Gresham Smith

FINAL

Basis of Design Report

SEA IWTP Expansion

June 23, 2023

Port of Seattle

Seattle-Tacoma International Airport

Seattle, Washington

Version 2.0

Gresham Smith Project No. 44846.10

Port Contract No. P-00320039

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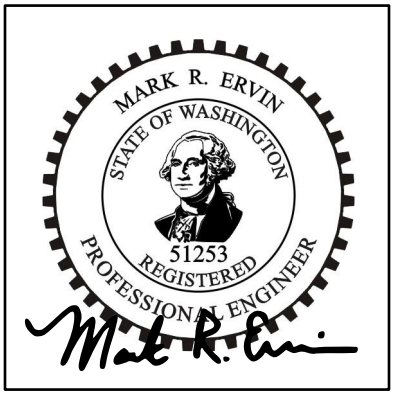
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Port Maintainability Notes

Acronyms/Abbreviations

AFFF	Aqueous film forming foam
AGB	Aerated gravel bed
API	American Petroleum Institute
AVE	Average
BOD	Biochemical Oxygen Demand
BTT	Blend to Temperature
CAD	Computer aided design
CAVFS	Compost-amended vegetated filter strip
CCCS	Concrete cellular confinement system
COD	Chemical Oxygen Demand
CSR	Comprehensive Stormwater Report (July 2019)
DAF	Dissolved air flotation
FAA	Federal Aviation Administration
FOG	Fats, oils, and greases
GCL	Geosynthetic clay liner
H&H	Hydrologic and hydraulic
IWD	Industrial Waste Discharge
IWS	Industrial Wastewater System
IWTP	Industrial Wastewater Treatment Plant
KCIW	King County Industrial Waste Program
LTV	Long-Term Vision
MSD	Midway Sewer District
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NSB	North Service Basin
NTP	Near Term Projects development milestone from the SAMP
OWS	Oil/water separator
PFAS	Per- and polyfluoroalkyl substances
PLC	Programmable Logic Controller
P&ID	Process and Instrumentation Diagram
RPZ	Runway Protection Zone
RSA	Runway Safety Area
SAMP	Sustainable Airport Master Plan
SCADA	Supervisory Control and Data Acquisition
SDS	Stormwater Drainage System
SEA	Seattle-Tacoma International Airport
SEPA	State Environmental Policy Act

SOP	Standard Operating Procedures
SSB	South Service Basin
SWMM	Seattle-Tacoma International Airport Stormwater Management Manual for Port Aviation Division
TDH	Total Dynamic Head
TKN	Total Kjeldahl Nitrogen
TOC	Total Organic Carbon
TSS	Total Suspended Solids
VFD	Variable-frequency drive
VVSD	Valley View Sewer District
WAC	Washington Administrative Code
WSDOT	Washington State Department of Transportation
WWTP	Wastewater Treatment Plant

Glossary of Standard Terms

Aerobic Biological Deicer Treatment	Biological treatment processes utilizing aerobic (oxygen consuming) microorganisms (primarily bacteria) for degrading the primary deicer constituents into smaller molecules. The purpose of aerobic treatment to reduce the mass loads and concentrations of the primary deicer constituents in stormwater discharged to surface waters, groundwater, or the sanitary sewer. Byproducts from aerobic deicer treatment systems include “wasted” biomass and carbon dioxide.
Aircraft Deicing and Anti-Icing Fluids	Deicers and anti-icers applied to aircraft with propylene glycol acting as freezing point depressant and primary source of BOD.
Attached Biological Growth Treatment	Treatment system where bacterial films form on inert media, such as activated carbon or plastic contained in a reactor.
Aerated Gravel Bed	An aerated gravel bed (AGB) is a biological wastewater treatment system consisting of a number of lined cells filled with gravel treatment beds that provide a stable environment for the bacterial degradation of glycols and other deicing compounds. It can be categorized as a lightly loaded, aerobic, submerged, attached-growth system.
Biochemical Oxygen Demand	The amount of oxygen consumed by bacteria to decompose a measured amount of organic matter in a solution.
Chemical Oxygen Demand	The amount of oxygen consumed by chemical reactions in a measured wastewater sample in solution.
Deicer	Liquid or crystalized chemical applied to airport or pavement surfaces to melt or prevent formation of frozen precipitation, inclusive of both deicer and anti-icing chemical formulations.
Dosing Structure	Unit process for mixing of influent wastewater with nutrients and metering of the mixture to treatment cells
Ecology	Washington State Department of Ecology
Fuel	For purposes of this report “fuel” is representative of any petroleum product that may act as a contaminant in industrial wastewater, inclusive of jet fuel, diesel, avgas, gasoline, lubricants, and other oil products.
High BOD	Term used to refer to industrial wastewater or infrastructure that handles industrial wastewater with BOD_5 concentration exceeding the SEA NPDES permit limit of 25 mg/L in the summer and 45 mg/L in the winter for Outfall 001.

Industrial wastewater	Mixture of stormwater and pollutant runoff from industrial activities at SEA, including storm water contaminated with fuel, lubricants, firefighting foam, cleaning agents, and aircraft and ground deicing agents; contaminated construction dewatering drainage; excess water from groundwater well construction and monitoring; and water used for industrial processes such as pipe pressure testing and vehicle or aircraft wash water.[1] For purposes of this report, "industrial wastewater" refers to water that will be or has been collected into the Industrial Wastewater System (IWS).
Low BOD	Term used to refer to industrial wastewater or infrastructure that handles industrial wastewater with BOD_5 concentration less than the SEA NPDES permit limit of 25 mg/L in the summer and 45 mg/L in the winter for Outfall 001.
Oil/water separator	Treatment device or structure designed to separate low density petroleum products from stormwater or wastewater
Pavement Deicing and Anti-Icing Materials	Liquid or crystalized chemicals applied to paved surfaces to melt or prevent formation of frozen precipitation.
Port	Port of Seattle
Pretreatment	Treatment that occurs upstream of discharge to sanitary sewer to meet sanitary sewer discharge permit limits and support subsequent full treatment (for discharge to surface water) at the municipal WWTP.
Primary Deicer Constituent	The primary freezing point depressant constituents in deicers (propylene glycol, ethylene glycol, acetate, formate, urea) that most often drive the need for deicer treatment.
SEA	Seattle-Tacoma International Airport code
SEA IWTP Expansion	Name of project that is the focus of this draft Basis of Design Report. Includes modifications to existing Lagoon 3, addition of Lagoon 4 and AGB Tank, modifications to the existing DAF system, and addition of new AGB biological treatment system.
South Plant	King County South Treatment Plant
Spent Aircraft Deicing Fluid	Aircraft deicing or anti-icing fluid that has been applied to aircraft and subsequently mixed with stormwater runoff.
Surrogate	Analytical parameters related to each other with a demonstrated statistical relationship, potentially for a given set of conditions.
Treatment	Process for removing pollutants of concern from industrial wastewater in order to meet NPDES permit limits for discharge to surface water.

[1] Port of Seattle. Seattle-Tacoma International Airport Stormwater Pollution Prevention Plan (SWPPP), February 2019. Industrial Wastewater System Policy, 2018.

Definition of Units

ft or ‘	feet
gal	gallons
gpd	gallons per day
gph	gallons per hour
gpm	gallons per minute
hp	horsepower
in or ”	inch
lbs	pounds
mg/L	milligrams per liter
Mgal	Million gallons
MGD	Million gallons per day
SCFM	standard cubic feet per minute
sf	square feet

1. Project Overview

1.1 Introduction

The Port of Seattle (Port) is developing plans to implement an expansion of the Industrial Wastewater Treatment Plant (IWTP) at the Seattle-Tacoma International Airport (SEA). The IWTP Expansion is primarily driven by significant reductions in the allowable mass loading of deicing chemicals, characterized as Biochemical Oxygen Demand (BOD), that can be discharged to the sanitary sewer system in stormwater runoff collected from SEA's Industrial Wastewater System (IWS). The reduced allowable loadings are identified in the Port's Industrial Waste Discharge (IWD) Permit issued by the King County Industrial Waste Program (KCIW). Secondary factors in the IWTP Expansion include future increases in flight operations and future changes in the IWS drainage configuration associated with planned SEA redevelopment.

To adapt to the moderate increases in industrial wastewater runoff volume and deicer from future SEA development, plus the significant reductions in allowable discharges of BOD mass load to the sanitary sewer, the Port is planning to increase storage capacity for high concentration BOD industrial wastewater and add a deicer treatment system to reduce BOD content through the IWTP Expansion project. Without the added storage and BOD treatment capacity, the Port's risk of non-compliance with either its National Pollutant Discharge Elimination Permit (NPDES) conditions or its IWD Permit conditions would reach unacceptable levels.

The IWTP Expansion will provide significant increases in capacity and operational flexibility to adapt to changing weather and deicing conditions and allow IWD and NPDES permit conditions to be met. The expansion will also require extensive changes to both the infrastructure and operations of the IWTP. Those changes are described in this Draft Basis of Design Report.

1.2 Engineering Report Submittal

The IWD permit requires the Port to submit an engineering report to KCIW describing the preferred onsite storage and treatment alternative for the IWTP Expansion, as described in Section S3. Special Conditions and Compliance Schedule:

> *The engineering report shall describe the preferred onsite storage and treatment alternative sufficient to develop design documents (plans and specifications). The engineering report's onsite storage and treatment alternative shall include the measures necessary to achieve the following BOD limitations. An engineering report meeting the requirements of WAC 173-240-130 shall be submitted for review and approval to KCIW by the compliance schedule due date specified in S3.D.*

A draft engineering report was prepared and submitted to KCIW in fulfillment of the IWD Permit requirement S3.B on February 28, 2023. The report was also submitted to the Washington State Department of Ecology (Ecology) for review of impacts associated with the Port's NPDES Permit.

The draft engineering report submittal included the following primary elements:

- Summary of existing IWS and IWTP Systems;
- Proposed IWTP expansion concept and design basis;
- Proposed site description;
- Proposed operational modifications; and
- Preliminary drawings, including site plans and process flow drawings.

Each of the applicable requirements in Washington Administrative Code (WAC) 173-240-130 were met within the engineering report submittal. **Table 1** provides a summary of the requirements and the corresponding section or sections where the content is addressed.

Table 1 – Engineering Report Requirements and Corresponding Sections of this Report

WAC Reference[1]	Requirement[1]	Relevant Report Section(s)
2.a	*Type of industry or business*	2
2.b	*The kind and quantity of finished product*	6
2.c	*The quantity and quality of water used by the industry and a description of how it is consumed or disposed of, including: (i) The quantity and quality of all process wastewater and method of disposal; (ii) The quantity of domestic wastewater and how it is disposed of; (iii) The quantity and quality of noncontact cooling water (including air conditioning) and how it is disposed of; and (iv) the quantity of water consumed or lost to evaporation*	3,6
2.d	*The amount and kind of chemicals used in the treatment process, if any*	6
2.e	*The basic design data and sizing calculations of the treatment units*	5,6,7
2.f	*A discussion of the suitability of the proposed site for the facility*	4,9
2.g	*A description of the treatment process and operation, including a flow diagram*	3,5,6,7,8
2.h	*All necessary maps and layout sketches*	Att. A
2.i	*Provisions for bypass, if any*	8
2.j	*Physical provision for oil and hazardous material spill control or accidental discharge prevention or both*	5,6,7
2.k	*Results to be expected from the treatment process including the predicted wastewater characteristics, as shown in the waste discharge permit, where applicable*	3,6
2.l	*A description of the receiving water, location of the point of discharge, applicable water quality standards, and how water quality standards will be met outside of any applicable dilution zone*	3
2.m	*Detailed outfall analysis*	6
2.n	*The relationship to existing treatment facilities, if any*	2,4,5,6,7,8
2.o	*Where discharge is to a municipal sewerage system, a discussion of that system's ability to transport and treat the proposed industrial waste discharge without exceeding the municipality's allocated industrial capacity. Also, a discussion on the effects of the proposed industrial discharge on the use or disposal of municipal sludge*	3,6,7

WAC Reference[1]	Requirement[1]	Relevant Report Section(s)
2.p	*Where discharge is through land application, including seepage lagoons, irrigation, and subsurface disposal, a geohydrologic evaluation of factors such as: (i) Depth to groundwater and groundwater movement during different times of the year; (ii) Water balance analysis of the proposed discharge area; (iii) Overall effects of the proposed facility upon the groundwater in conjunction with any other land application facilities that may be present*	Not applicable
2.q	*A statement expressing sound engineering justification through the use of pilot plant data, results from other similar installations, or scientific evidence from the literature, or both, that the effluent from the proposed facility will meet applicable permit effluent limitations or pretreatment standards or both*	3,6
2.r	*A discussion of the method of final sludge disposal selected and any alternatives considered with reasons for rejection*	6
2.s	*A statement regarding who will own, operate, and maintain the system after construction*	3
2.t	*A statement regarding compliance with any state or local water quality management plan or any plan adopted under the Federal Water Pollution Control Act as amended*	3,10
2.u	*Provisions for any committed future plans*	3,10
2.v	*A discussion of the various alternatives evaluated, if any, and reasons they are unacceptable*	3
2.w	*A timetable for final design and construction*	10
2.x	*A statement regarding compliance with the State Environmental Policy Act (SEPA) and the National Environmental Policy Act (NEPA), if applicable*	10
2.y	*Additional items to be included in an engineering report for a solid waste leachate treatment system are: (i) A vicinity map and also a site map that shows topography, location of utilities, and location of the leachate collection network, treatment systems, and disposal; (ii) Discussion of the solid waste site, working areas, soil profile, rainfall data, and groundwater movement and usage; (iii) A statement of the capital costs and the annual operation and maintenance costs; (iv) A description of all sources of water supply within two thousand feet of the proposed disposal site. Particular attention should be given to showing impact on usable or potentially usable aquifers*	Not applicable

Notes:
1. Requirements are quoted directly from indicated sections under WAC 173-240-130 “Engineering Report”.

1.3 Basis of Design Report

Following the submittal of the draft engineering report, that report was revised and expanded to provide additional information relevant to the project design and fulfill Port requirements for the project design notebook. **Table 2** lists the sections of this Basis of Design Report (this document), including some additions that were not in the engineering report:

Table 2 – Basis of Design Report Overview

Section No.	Section Name	Summary of Section	Changes from Engineering Report
1	Project Overview	Project scope and list of applicable requirements for the engineering report under WAC 173-240-130	
2	Background on the Existing IWS	Existing IWS structures, components, and processes, as well as wastewater characteristics, discharge entities, and limits of discharge.	
3	Proposed IWTP Expansion Concept and Overall Design Basis	Drivers and constraints for the IWTP expansion project, the tools and basis of design used during the concept development, and an overview of the proposed concept.	
4	Site Selection and Layout	Outlines the site selection criteria for the IWTP expansion project, the characterization and data collection for the selected sites, constraints for site development, and the proposed site concept.	
5	Proposed Industrial Wastewater Storage Modifications	Modifications to existing wastewater storage infrastructure and concepts and design basis for additional wastewater storage infrastructure.	
6	Proposed Treatment Processes	Physical and biological treatment processes proposed for the IWTP expansion project.	
7	Proposed Flow Routing	Proposed flow routing between all proposed and existing structures under the IWTP expansion project.	
8	Operational Modes for Expanded IWTP	Introduces different operational scenarios for routing and treatment of industrial wastewater for the expanded IWTP.	Added discussion on phasing of the IWTP expansion; Added staffing recommendations
9	Support Systems	Support systems associated with the IWTP expansion, including utilities, stormwater management, buildings, roads, and parking.	Added description of stormwater management concept
10	Next Steps	Presents the anticipated timeline for the IWTP expansion, regulatory requirements, and identifies future tasks.	Added guidance on phasing, schedule, and implementation of the IWTP expansion; Added outline of anticipated permits, approvals, and regulatory requirements; Added coordination steps for detailed design

Section No.	Section Name	Summary of Section	Changes from Engineering Report
Att. A	Drawing Sheets	List of all drawings associated with the IWTP expansion project.	Added additional drawings, including process piping, grading, stormwater, electrical, and architectural plans
Att. B	NPDES Permit	Regulatory permit associated with discharges to Puget Sound.	
Att. C	IWD Permit	Regulatory permit associated with discharges to the sanitary sewer.	
Att. D	Land Use Alternatives Analysis for Runway 34L RPZ	Required technical memo provided to FAA outlining an alternatives analysis for all siting options for the IWTP expansion project and justification as to why the AGB site within the Runway 34L RPZ was selected.	Not included in Engineering Report
Att. E	AGB Background Information	Additional information on the AGB treatment technology and sources on previous implementation for spent deicer treatment.	
Att. F	Implementation Considerations	Technical memo that provides guidance on the phased implementation of the IWTP expansion project.	Not included in Engineering Report
Att. G	Stormwater Management Concept	Overview of stormwater management concept for the AGB site under the IWTP expansion project.	Not included in Engineering Report
Att. H	Permits, Approvals, and Regulatory Requirements Matrix	Describes anticipated permits, approvals, and regulatory requirements associated with the IWTP expansion project.	Not included in Engineering Report
Att. I	Preliminary List of Construction Specifications	Preliminary list of specifications to be utilized during the IWTP expansion project.	Not included in Engineering Report

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2. Background on the Existing IWS

2.1 Introduction

Section 2 provides background information on the existing IWS, including SEA industrial wastewater characteristics, as well as existing functions and components of the existing IWS drainage and IWTP subsystems. It also identifies existing limitations of the IWTP, which in part drive the need for the SEA IWTP Expansion project.

The following Drawing Sheets in **Attachment A** are relevant to this section:

- C2 – C4: Existing Site Plans

2.2 Existing SEA IWS Overview

The SEA IWS encompasses the infrastructure used to convey, manage, and treat industrial wastewater for the purposes of complying with applicable regulations and permits, including the Port's NPDES permit and IWD permit.

The IWS includes two major subsystems:

- IWS drainage, including North Service Basin (NSB) and South Service Basin (SSB), and
- IWTP, including Lagoons 1, 2, and 3, the DAF system and solids handling system.

The functions of the existing IWS include:

- segregation of industrial wastewater flows into separate streams based on BOD_5 concentrations relative to NPDES permit limits;
- attenuation of peak stormwater flow rates to meet discharge flow limits;
- removal of suspended solids, insoluble metals, and petroleum contaminants from industrial wastewater; and
- discharge of industrial wastewater to either the surface water or sanitary sewer under the terms of applicable discharge permits.

2.3 Industrial Wastewater Characteristics

Flows within the IWS at SEA are considered "industrial wastewater" per the SEA NPDES and IWD permits. For purposes of this report "industrial wastewater" is the term used to refer to water that is going to be or has been collected into the SEA IWS. Industrial wastewater primarily consists of stormwater runoff that may be contaminated from any process or activity of industry in the NSB and SSB drainage basins.

Virtually the entire IWS flow volume is associated with stormwater runoff. Stormwater runoff volume can be comprised of direct rainfall runoff as well as snowmelt from deicing and designated

snow storage areas. Industrial wastewater flow rates and volumes, as well as the timing of IWS discharges, varies widely based on precipitation and snowmelt conditions.

Contaminants from industrial activities may include the constituents listed in **Table 3**. For the purposes of this report, the generic terms defined in **Table 3** are used to represent a broader set of related constituents. The quantities of various contaminants present in industrial wastewater vary widely and are dependent upon whether the industrial activity associated with the contaminants is occurring at given time, as well as the extent and location of the activity. In general, deicers are present only in the winter period, although deicers may be present in industrial wastewater well after seasonal deicing activity has ended due to ongoing snowmelt and washout of surfaces and pipes. The remainder of the contaminants shown in **Table 3** can potentially be found year-round.

Table 3 – Contaminants Potentially Found in SEA Industrial Water

Contaminant Name	Sources	Description
Deicers	• Aircraft deicing fluids (propylene glycol primary constituent) • Aircraft anti-icing fluids (propylene glycol primary constituent) • Pavement deicing materials (sodium formate primary constituent, sodium acetate less frequently) • Pavement anti-icing materials (potassium acetate primary constituent)	Analytical parameters used to quantify deicer content in industrial wastewater may include: • Biochemical Oxygen Demand (BOD_5) • Chemical Oxygen Demand (COD) • Total Organic Carbon (TOC) • Propylene Glycol (aircraft deicers only) Since deicers are the primary source of organics in the industrial wastewater, "BOD" is the term used in this report to refer to deicer quantities unless references to other specific parameters are required.
Fuel	• Jet fuel spills • Avgas spills • Diesel fuel spills • Gasoline spills • Lubricant leaks • Motor oil leaks	For purposes of this report "fuel" is used as the generic term to represent all petroleum products that may be spilled or leaked in the IWS and mixed with industrial wastewater. Analytical parameters used to quantify solids in IWS runoff may include: • Oil and Grease • Nonpolar fats, oils, and grease (FOG)
Solids	• Dirt, grit, gravel • Detritus from pervious areas • Metals • Construction sediment and dewatering waters • Solids from biofilm growth in IWS infrastructure • Biological solids from BOD treatment process	Analytical parameters used to quantify solids in industrial wastewater may include: • Total Suspended Solids (TSS) • Various Metals[1] Note that biological solids from a BOD treatment process are not present in the existing IWTP but may be present in the expanded IWTP.
AFFF	• Aqueous film forming foam from aircraft rescue and firefighting activities • Other firefighting foams	
Cleaning Agents	• Chemical agents that may be used to wash, clean, and test vehicles, equipment, surfaces, and pipes	

Notes:

1. Wastewater Discharge Permit 7810-05 (eff. July 21, 2021), S4.A.1: Effluent Limitations and Self-Monitoring Requirements.

2.4 Existing IWS Drainage Subsystem

The IWS drainage subsystem is a dedicated network of drainage infrastructure that collects industrial wastewater from industrial activity areas at SEA and conveys it to the IWTP for storage, treatment, and discharge. The subsystem includes inlets, trench drains, gravity sewers, pump stations, force mains, and associated infrastructure used to collect and convey runoff from the existing 339-acre IWS collection area, as shown on **Figure 1**. Areas outside of the IWS collection area drain to separate infrastructure associated with the "Storm Drainage System" or SDS.

The IWS Drainage subsystem is roughly split in half, north to south, into two separate drainage networks: the NSB and SSB. The dividing break line between the NSB and SSB is located near the North Satellite Building. The NSB serves 165 acres of industrial activity areas in the northern portion of SEA, including areas between Taxiways A and B and Air Cargo Road, in addition to the PACCAR hangar and general aviation area in the western airfield. The SSB serves 174 acres of industrial activity areas in the southern portion of SEA, including the fuel farm, passenger gate ramp areas, and aircraft hangars.

Industrial wastewater that is collected within each service basin drains to a separate gravity trunk line that conveys flow to the west and south toward the IWTP. As shown on **Figure 1**, the NSB trunk line crosses west across the airfield north of Taxiway N, turns south on the west side of Taxiway T, and southeast along the north side of Lagoons 1 and 2. The SSB trunk line crosses west across the airfield south of Taxiway Q and combines with the NSB trunk line just east of Lagoon 1. The combined IWS trunk line continues south across S. 188th Street toward existing Lagoon 3.

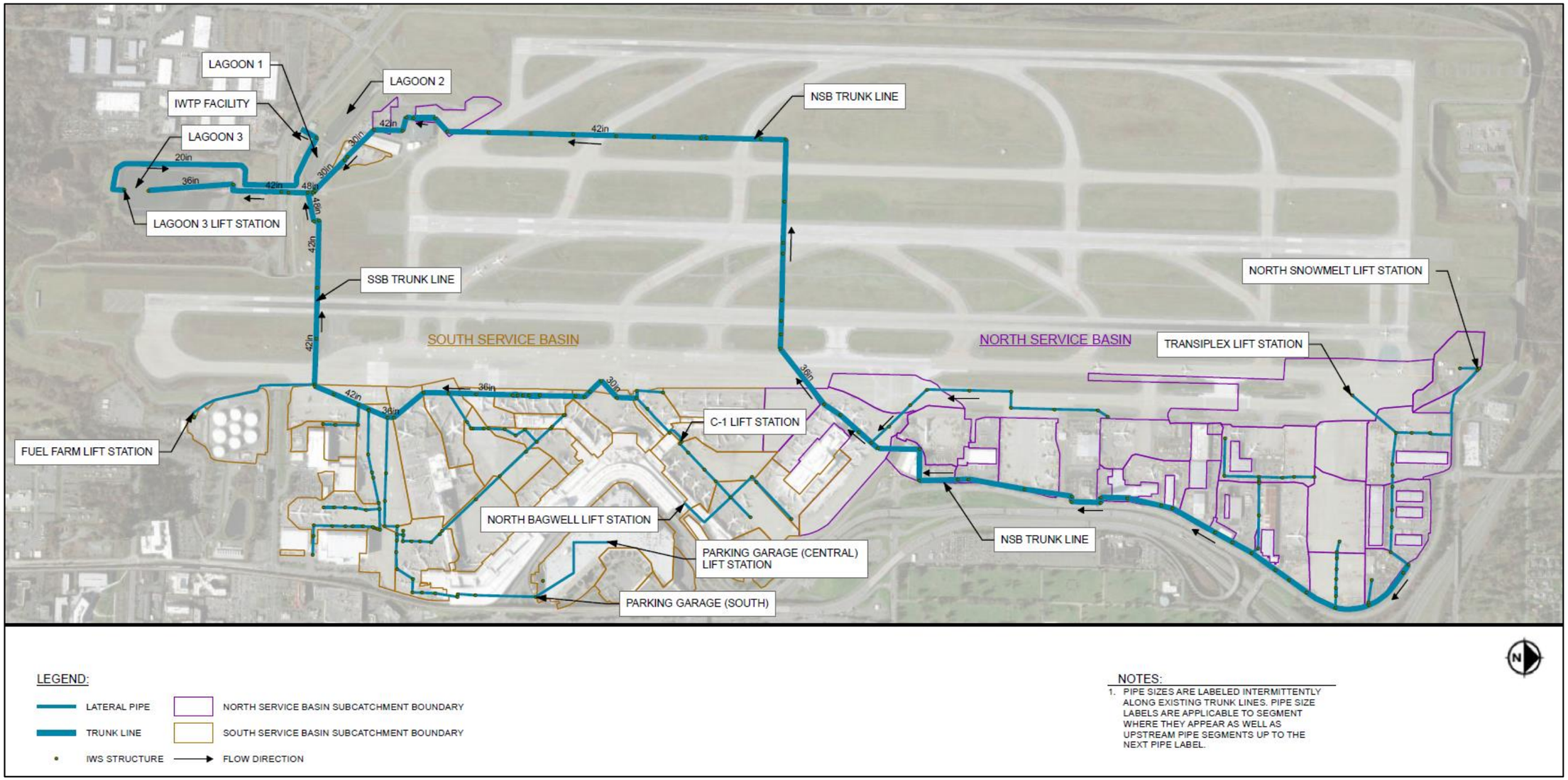


Figure 1: Existing IWS Drainage Infrastructure

2.5 Existing Industrial Wastewater Treatment Plant Subsystem

The existing IWTP is the IWS subsystem used to manage flows and contaminants in SEA industrial wastewater as needed to comply with applicable discharge permits for discharges to Puget Sound or the sanitary sewer. All IWS components and processes downstream of the NSB and SSB trunk lines are considered to be part of the IWTP.

The existing IWTP includes the following unit processes:

- Flow Segregation and Storage Process;
- Dissolved Air Flotation Treatment (DAF) Process;
- Industrial Wastewater Discharge to Puget Sound; and
- Industrial Wastewater Discharge to sanitary sewer.

2.5.1 Existing IWTP Flow Segregation and Storage Process

2.5.1.1 Flow Segregation Process

At the influent to the IWTP, industrial wastewater from the IWS NSB and SSB drainage areas is segregated to facilitate compliance with the NPDES permit BOD_5 concentration limits for Outfall 001 discharges. Because of the long turn-around time to receive BOD_5 laboratory results, the Port uses TOC as a surrogate parameter to represent BOD_5 concentrations. The numeric relationship between BOD_5 and TOC (2.1:1) has been documented by the Port through statistical analysis of laboratory data from IWS samples collected since 2014. The Port uses a series of online TOC meters that monitor TOC concentrations based on continuous sampling of the IWS NSB and SSB trunk lines. Flow segregation into low and high BOD concentration streams (as defined in **Table 4** below) occurs primarily when deicers are present in industrial wastewater.

Table 4 – IWS Flow Segregation Streams and Thresholds Influent to IWTP

Segregated IWS Stream	Description	Summer Segregation Threshold Concentration[1]	Winter Segregation Threshold Concentration[1]
Low BOD	Flows with equivalent BOD_5 concentrations less than the applicable threshold concentration	< 25 mg/L BOD_5	< 45 mg/L BOD_5
High BOD	Flows with equivalent BOD_5 concentrations greater than applicable threshold concentration	> 25 mg/L BOD_5	> 45 mg/L BOD_5

Notes:
1. NPDES Permit WA0024651, Table S1-1: IWS Flow Effluent Limits.

For purposes of this report, all references to “low BOD” and “high BOD” refer to the flow segregation-based definitions summarized in **Table 4**.

2.5.1.2 Storage Lagoons

The IWTP currently includes three open, lined lagoons for storage of segregated IWS low BOD and high BOD wastewater.

Lagoons 1 and 2 (**Figure 2)** are located near the confluence of the IWS Drainage subsystem trunk lines, just north of the IWTP DAF system. These lagoons are primarily used to temporarily store high BOD industrial wastewater that will be pretreated and discharged to the sanitary sewer (see **Section 2.5.5**). Lagoons 1 and 2 can also be used to isolate and temporarily detain industrial wastewater that contains slugs of fuel, AFFF, or sediment from the remainder of industrial wastewater for removal of the contaminants via external means such as skimming and vacuum trucks.



Figure 2: Lagoon 2

Lagoon 3 (**Figure 3**) is located at the downstream end of the combined IWS trunk line, south of S. 188th Street. Due to its downstream location, Lagoon 3 receives all industrial wastewater that is not routed into Lagoon 1 or 2. During summer and many winter periods, Lagoon 3 provides storage for only low BOD industrial wastewater that will be treated in the IWTP DAF system to remove fuel, metals, and solids and routed to Outfall 001 for discharge to Puget Sound.

Lagoon 3 also can be used to store high BOD industrial wastewater when Lagoons 1 and 2 and/or various IWTP structures (e.g., IWS Pump Station and Lagoon 3 Headbox) reach their volumetric capacity. High BOD industrial wastewater stored within Lagoon 3 is routed for pretreatment

through the DAF system to remove fuel, metals, and solids prior to discharge to the sanitary sewer.



Figure 3: Lagoon 3

Existing lagoon storage capacities in the IWTP are provided in **Table 5**.

Table 5 – Existing IWS Storage Unit Capacities and Functions

Storage Unit	Existing High BOD Concentration Storage Capacity (Mgal)[1,2]	Existing Low BOD Concentration Storage Capacity (Mgal)[1,2]
Lagoon 1	2.0	-
Lagoon 2	3.6	-
Lagoon 3	-	76.2
Total Capacity	**5.6**	**76.2**

Notes:

1. Port lagoon survey performed in 2018. Storage capacity at overflow elevations.
2. "High BOD" and "low BOD" storage capacity reflects primary function of each lagoon, although any lagoon may be used for low or high BOD storage when a capacity shortfall occurs.

2.5.2 Existing DAF Treatment Process

The existing DAF treatment process in the IWTP is operated to separate solids, metals, and fats, oils, and greases (FOG), including fuel, from both low BOD and high BOD industrial wastewater streams prior to discharge.

Typically, segregated high BOD industrial wastewater is routed by gravity from Lagoons 1 and 2 into the high BOD header. Typically, low BOD industrial wastewater is pumped from Lagoon 3 to a headbox outside the IWTP Treatment Building from which it flows by gravity into the low BOD treatment header.

The DAF treatment process begins with addition of chemical coagulants (typically aluminum sulfate or “alum” at the IWTP) to the influent wastewater in a rapid mix chamber. A subsequent slow speed mixing chamber (flocculation tank) is used to coagulate the chemical agents and suspended or colloidal fuel, metal, or other solid particulates.

The existing IWTP houses six DAF units (**Figure 4**). Low and high BOD wastewater streams can be processed simultaneously (i.e., “dual streaming”) by splitting low and high BOD stream amongst the units in various combinations.

Each DAF unit consists of a flotation tank, a means of introducing dissolved air in the wastewater column in the flotation tank, and a means of removing solids that have separated from the wastewater in the flotation tank. The existing DAF process introduces air into the wastewater using two methods, compressed air (2 units) and induced air (4 units). Fine air bubbles are released in the water column and subsequently attach to the coagulated chemical floc and solids particulates. The flocs and coagulated particulates rise to the top of the flotation tank based on density differences created by the attached air bubbles, forming a solids layer known as a “float” on top of the water column.

A rake mechanism moves the float to the north end of the DAF. The float is scraped up a scum beach and discharged into a trough that runs the length of the building. This trough leads to a small sump and pump station located outside of the east end of the Treatment Building. Refer to **Section 2.5.3** for the solids handling description.

The DAF effluent flows by gravity to either the high BOD or low BOD wet wells in the IWS Pump Station for discharge.



Figure 4: Existing DAF Units #1 and #2 with Alum Tank

2.5.3 Existing DAF Solids Handling System

Solids discharged from the DAF units' scum trough flows into a small sump and pump station located outside of the east end of the Treatment Building (**Figure 5**). The sump contents are pumped into a system of two 21,000 gallon decant tanks (i.e., "Baker Tanks"), which are piped together to allow sedimentation of the solids. The supernatant water is manually decanted back to Lagoon 3. Settled solids in the decant tanks are periodically removed by pump to a portable tanker for transport to a permitted disposal facility. Collected fuel is periodically pumped and hauled offsite for recycling.



Figure 5: Existing DAF Solids Handling System

2.5.4 Existing Industrial Wastewater Discharge to Puget Sound

Treated low BOD industrial wastewater meeting NPDES permit limitations for BOD_5 and TSS is discharged to Puget Sound. Under existing conditions, all lagoon discharges to Puget Sound are routed through the IWTP DAF system (see **Section 2.5.2**) and then discharged to the low BOD compartment at the IWS Pump Station. IWS Pump Station flows are released into a gravity outfall pipe, designated as Outfall 001 in the NPDES permit, that is shared with the Midway Sewer District (MSD). The outfall pipe drains southeast under S. 188th Street and Lagoon 3, where it then leaves Port property, and then receives discharges from MSD's Des Moines Creek Wastewater Treatment Plant (WWTP) near Des Moines Creek Park. From there it continues southwest in the Des Moines Creek Outfall Pipe through Des Moines Creek Beach Park to a submarine outfall diffuser at Puget Sound.

MSD limits the flow rate that the Port can discharge to the shared outfall pipe to a maximum flow rate of 3,200 gpm. This flow rate limitation accounts for an existing constriction in a portion of the pipe under the Tyee Valley Golf Course and preserves capacity in the outfall pipe for discharges

from the Des Moines Creek WWTP and authorized flow rate per the Port and Midway Sewer District Interlocal Agreement 461183.[2]

Discharges to Puget Sound are regulated under the NPDES and Washington State Waste Discharge Permit No. WA0024651 (effective September 1, 2021) issued by the Department of Ecology (Ecology). The NPDES permit is provided in **Attachment B.** Key requirements of the NPDES permit that are relevant to this design are summarized in **Table 6.** Samples are collected at the discharge monitoring point for Outfall 001 at the low BOD compartment of the IWS Pump Station wet well.

Table 6 – Summary of NPDES Permit Limits for IWS Discharges to Puget Sound

Parameter[1]	Monthly Average[1]	Maximum Daily[1]
BOD_5 (Nov – Mar)	45 mg/L	2,665 lbs/day
BOD_5 (Apr – Oct)	25 mg/L	1,480 lbs/day
TSS	21 mg/L	33 mg/L
Oil and Grease	8 mg/L	15 mg/L
pH	-	Min: 6 Max: 9

Notes:
1. NPDES Permit WA0024651, Table S1-1: IWS Flow Effluent Limits – Outfall 001 Discharge to Puget Sound.

2.5.5 Existing Industrial Wastewater Discharge to Sanitary Sewer

High BOD industrial wastewater is discharged to the sanitary sewer. Under existing conditions, all lagoon discharges to the sanitary sewer are routed from the lagoons through the IWTP DAF system (see **Section 2.5.2**) for pretreatment and then discharged to the high BOD compartment at the IWS Pump Station. From there the pretreated wastewater is pumped through a force main across SEA, discharged into the Valley View Sewer District (VVSD) sanitary sewer system, and conveyed to the King County South Wastewater Treatment Plant ("South Plant").

Industrial wastewater discharges to the sanitary sewer are regulated under Waste Discharge Permit No. 7810-05 (effective July 21, 2021 and expires July 20, 2026) ("Industrial Waste Discharge Permit" or "IWD Permit") issued to the Port by KCIW. The IWD permit is provided in **Attachment C**. Key requirements of the IWD Permit are summarized in **Table 7**, as applicable at Sample Site No. A70101.

[2] BHC Consultants. Industrial Wastewater Treatment Plant Discharge Conveyance Pipe Capacity Analysis. March 29, 2019.

For purposes of this report, discharges to the sanitary sewer refer only to industrial wastewater discharges and not domestic sewage. All references to sanitary sewer discharge limits refer to IWD Permit limits for industrial wastewater only. Samples are collected at the discharge monitoring point at the high BOD compartment of the IWS Pump Station wet well, except for flow which is monitored at the discharge flow meter.

Table 7 – Summary of Relevant IWD Permit Limits for IWS Discharges to Sanitary Sewer

Parameter	Current Limits (Oct. 2022 – Jul. 2026)[1,2]
Max. Daily Discharge Volume (MGal)	4.0 [1]
Max. Instantaneous Discharge Rate (gpm)	2,828 [1]
Max. Daily Flow Rate (gpm)	2,778 [1]
Daily Max. BOD_5 (lbs/day)	45,000 [2]
Monthly Average BOD_5 (lbs/day)	27,500 [2]
Daily Max. Hourly BOD_5 Load (lbs/hr)	2,500 [2]
Max. Daily Average Nonpolar FOG Concentration (mg/L)	100 [2]
Daily Average and Instantaneous Max. Concentrations and Maximum Daily Mass Loadings for Nine Metals and Cyanide	Varies by Parameter [3]
Minimum Instantaneous pH	5.0 [3]
Daily Maximum pH	12.0 [3]
Daily Minimum pH	5.5 [3]

Notes:

1. IWD Permit, Effluent Limitations and Self-Monitoring Requirements, S.4.A.3.
2. IWD Permit, Effluent Limitations and Self-Monitoring Requirements, S.4.A.2. Limits effective October 1, 2022 – July 20, 2026.
3. IWD Permit, Effluent Limitations and Self-Monitoring Requirements, S.4.A.1. Nine metals include arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc.

2.5.6 Existing IWTP System Limitations

The existing IWTP includes processes and procedures to separate fuels, foam, and solids, including particulate metals, from the industrial wastewater. When low BOD wastewater is discharged to Puget Sound these processes are considered as “treatment” needed to meet NPDES permit limits. When high BOD wastewater is discharged to the sanitary sewer, these processes are considered as “pretreatment” to support subsequent full treatment at the South Plant.

While high concentrations and mass loads of BOD from deicers can be present in the high BOD industrial wastewater stream, to-date the IWTP has not included any form of BOD or deicer treatment. Treatment for BOD has not been necessary to-date because the BOD_5 mass loading limits in IWD permits prior to the current IWD permit were sufficiently high to allow the Port to

route all high BOD wastewater discharges to the sanitary sewer without exceeding the existing total IWTP storage capacity.

The limitations in dedicated high BOD storage capacity in Lagoons 1 and 2 (5.6 Mgal total), however, have required the Port to utilize Lagoon 3 (76.2 Mgal total capacity) for additional storage capacity to temporarily detain high BOD wastewater prior to pretreatment in the DAF system and subsequent discharge to the sanitary sewer. However, the limitations in dedicated high BOD storage capacity and occasional use of Lagoon 3 for additional high BOD storage create a cascading flow management issue because when Lagoon 3 receives high BOD wastewater, the high BOD concentrations raise the BOD concentrations in existing or newly received low BOD industrial wastewater in Lagoon 3, thereby increasing the total volume of high BOD wastewater to pretreat and discharge to the sanitary sewer. As discussed in **Section 3**, the combination of significantly lower future BOD mass loading allowances to the sanitary sewer from SEA and increasing deicer use at SEA will result in insufficient IWTP storage capacity in future years without onsite BOD treatment.

Other aspects of existing IWTP capabilities and capacity that may be limiting for current and future operations include:

- Lack of oil/water separation directly upstream of the IWTP, which may be necessary to protect future onsite BOD treatment
- Limitations in DAF flow capacity for peak IWTP flow conditions
- Suboptimal performance of some of the existing DAF units
- Suboptimal performance of the DAF solids decant process

3. Proposed IWTP Expansion Concept and Overall Design Basis

3.1 Introduction

Section 3 provides an overview of primary factors driving the need to expand the IWTP, previous studies supporting the development of the IWTP expansion, descriptions of the tools used in the preliminary design, and an overview of the concept for the expanded IWTP.

The following Drawing Sheets in **Attachment A** are relevant to this section:

- C5 – C8: Proposed Site Plans
- C11-C17: IWS Piping Plans
- M3: DAF and Building Modifications
- M5: Solids Handling Modifications
- M7 – M9: Process and Instrumentation Diagrams

3.2 IWTP Expansion Project Drivers

The SEA IWTP Expansion project is primarily driven by the following factors:

- Anticipated reduction in allowable BOD mass loading in future IWD Permit for discharges from the IWTP to the sanitary sewer;
- Forecasted increases in flight operations at SEA and associated changes in deicer application quantities;
- Projected changes in IWS drainage basins associated with anticipated SEA redevelopment;
- Desire for performance improvements in some existing IWTP treatment processes and the need to replace some existing aging IWTP infrastructure; and
- Limitations in existing IWTP high BOD storage capacity.

Summary descriptions of these drivers are provided below, with additional detail provided in subsequent sections.

3.2.1 Anticipated Reduction in Allowable BOD Mass Loading to Sanitary Sewer

The existing IWD permit includes several conditions that act as primary drivers for triggering the IWTP Expansion and provide a basis for defining the expanded IWTP concepts, technologies, capacities, and performance. These are detailed below.

3.2.1.1 *Anticipated BOD Mass Loading Limits in 2026 IWD Permit*

The anticipated reduction in allowable BOD mass loading limits to 15,000 lbs/day (daily maximum) and 10,000 lbs/day (monthly average) is the primary driver for the IWTP Expansion. The reduction

in BOD load limits affects both the needed BOD treatment capacity and the minimum required high BOD storage capacity.

For all practical purposes, the 10,000 lb/day monthly average limit serves as the maximum allowable discharge to the sanitary sewer under any conditions and was assumed to be the maximum allowable discharge to the sanitary sewer in the IWTP Expansion design basis.

The 10,000 lbs BOD/day cap is a six-fold reduction from a 60,000 lb/day limitation in IWD permits prior to 2021 and a 2.75-fold reduction from the effective maximum of 27,500 lbs BOD/day in the current IWD Permit.

The onsite BOD treatment system described in subsequent sections replaces a portion of the lost BOD treatment capacity for sanitary sewer discharges. The ability to treat high BOD stormwater onsite to concentrations less than the NPDES BOD_5 limits effectively increases the IWTP flow throughput capacity. Additional high BOD industrial wastewater storage capacity provides the remainder of the overall IWTP capacity needed to counterbalance the reduction BOD mass loading for discharges to the sanitary sewer.

See **Table 8** for anticipated 2026 future limits identified in the IWD permit. It is assumed that the 2026 IWD Permit will include a condition indicating these limitations are applicable after all elements in the expanded IWTP have been constructed and fully commissioned.

Table 8 – Anticipated Future Limits for IWS Discharges to Sanitary Sewer

Parameter	Anticipated Future Limits (Jul. 2026 – Jul. 2031)[3]
Daily Max. BOD_5 (lbs/day)	15,000
Monthly Average BOD_5 (lbs/day)	10,000
Daily Max Hourly BOD_5 Load (lbs/hr)	625

Notes:
1. IWD Permit, S3.B: Engineering Report.

3.2.1.2 Risk of Temporary Cessation of Allowable Discharges to the Sanitary Sewer

The IWD permit includes a condition providing KCIW or VVSD with the authority to temporarily cease or stop discharges from the SEA IWTP to the sanitary sewer. These restrictions can be applied during periods of peak flows in the sanitary sewer (VVSD) and periods of peak flows and organic loads at the South Plant. KCIW can also impose a cessation or reduction in allowable discharges if there is a risk of violating South Plant NPDES limits or a risk of a South Plant bypass. The Port has experienced several instances of zero discharge or reduced allowable limits for discharges to the sanitary sewer in recent years.

The risk of temporary cessation or reductions in allowable discharges to the sanitary sewer triggers the need for the IWTP Expansion to include onsite BOD treatment that is able to discharge BOD-treated effluent to Puget Sound at Outfall 001.

3.2.2 Projected Future Changes in SEA Flight Operations and Deicer Application

The Port has been developing the SEA Sustainable Airport Master Plan (SAMP) since the late 2010s to identify changes in airport infrastructure and operations needed to address increases in passenger and cargo demands. Increases in flight operations corresponds to increases in the number of aircraft requiring deicing in a given winter event, which has the potential to trigger larger BOD mass loads and concentrations routed to the IWTP. The increase in projected future deicing activity in conjunction with the reduced permit limits is therefore a driving factor taken into account in sizing storage and treatment needs for the IWTP Expansion.

The aircraft operations and deicing activity used in the IWTP Expansion planning and regulatory process are based on projections for aircraft departures developed in 2017 for the year 2027. The year 2027 aligns with the original implementation horizon for the “Near Term Projects” (NTP) milestone in the SAMP. The disruptions to the aviation industry resulting from the pandemic have shifted the projections timeline for flight operations, such that the original (2017) projection for flights operations in 2027 may be reached in different year. However, to maintain continuity with previous planning and regulatory submittals, the aircraft operations levels used in the IWTP Expansion design development will remain the same and be referenced as “2027 projections” in this report.

The use of 2027 as the basis for aircraft departures and deicer application quantities was documented in the “Comprehensive Stormwater Report (CSR), submitted by the Port to KCIW in July 2019. As documented in the CSR, the flight operations were projected to increase 39% (2017 to 2027) and be accompanied by a shift to larger aircraft, resulting in a 51% increase in yearly deicer application quantities without implementing additional deicer source reduction controls.

As documented in the IWD permit, the basis for IWTP Expansion assumes implementation of two deicer source reduction measures by the time the expansion is construction and commissioned, including:

- 100% of the applied Type I deicer at SEA will be provided through Blend-to-Temperature (BTT) processes to optimize the propylene glycol/water ratios in applied deicer; and
- 50% of the deicing trucks in use at SEA will have hybrid deicing chemical/forced air deicing capabilities.

With the implementation of the above source controls, the projected increase in annual deicer usage between 2017 and 2027 flight operations was reduced to less than 25%. The forecasted increases in flight operations for 2027, plus the BTT and hybrid deicing truck usage above, have been incorporated to the modeling of IWS deicer runoff quantities used in part to establish required expanded IWTP capacities.

3.2.3 Expansion of the IWS Collection Area and Development Extents

The Port is in the process of planning changes at SEA to support growth and improve efficiency through the SEA SAMP. Some of those planned projects, particularly those in the NSB, will result in expansion of the total IWS collection area and impervious surfaces. In the near term, the total IWS collection area is expected to increase in size by 10% from 339 acres to 372 acres, and the vast majority of the collection area is expected to be impervious[3]. The increase in impervious collection area will result in increases in total industrial wastewater runoff volume and peak flows. While these changes will be implemented incrementally with each development project, the IWTP Expansion concept assumed a single future development milestone reflecting the full extent of anticipated changes to industrial wastewater volumes and flows.

The sizing of the expanded IWTP is based on the changes to IWS areas documented in the NTP milestone of the SAMP.. Potential modifications to SEA infrastructure and operations beyond the NTP milestone are considered to be “Long-Term Vision” (LTV) projects within the SAMP. Any changes beyond the NTP milestone to IWS drainage areas, industrial activities including deicing, and the relative pervious/impervious fractions of IWS surfaces are not incorporated into the sizing of the IWTP Expansion.

3.2.4 Limitations in Existing IWTP Treatment Performance and Useful Life

The existing IWTP includes a DAF system that provides the ability to treat industrial wastewater to separate spilled petroleum products from the wastewater as well as the ability to remove solids, including coagulated metals. Several of the DAF units have limitations in flow capacity and performance that limit system throughput to Puget Sound and the sanitary sewer. In addition, the DAF units are over 50 years old and have reached or exceeded their useful life.

3.2.5 Limitations in High BOD Storage Capacity

The 5.6 Mgal of available high BOD storage capacity in Lagoons 1 and 2 is insufficient to meet current or future high BOD storage needs during multiple projected deicing seasons, resulting in the need to route high BOD wastewater to Lagoon 3, which is intended for storage of low BOD industrial wastewater. The need to provide sufficient high BOD storage capacity to avoid use of low BOD storage capacity is an important driver in the IWTP Expansion. In establishing the design basis, sufficient dedicated high BOD storage will be provided to use only high BOD storage units in 95% of deicing seasons. In the remaining 5% of the seasons, low BOD storage units may need to be used to temporarily supplement high BOD wastewater storage prior to treatment.

[3] The IWS collection area was assumed to be 100% impervious in analyses supporting the SEA IWTP Expansion, although actual impervious area may be slightly less.

3.3 Constraints Affecting IWTP Expansion Design Basis

The SEA IWTP Expansion design basis is limited by the following constraints:

- Anticipated future conditions of IWD Permit for discharges to sanitary sewer
- Anticipated future conditions of NPDES Permit for discharges to Puget Sound
- Maximum allowable flow rate to MSD gravity outfall to Puget Sound
- Need to integrate components of IWTP Expansion project with existing IWTP infrastructure and operations
- Available sites for locating expanded IWTP infrastructure
- Airspace boundaries affecting maximum heights of various structures

These constraints are further described below, with additional detail provided in subsequent sections.

3.3.1 Anticipated Future Conditions in SEA IWD Permit (Industrial Wastewater to Sanitary Sewer)

The design basis for the expanded IWTP is based on existing IWD permit limitations for the following parameters (as specified in **Table 7**):

- Flow;
- Metals;
- Nonpolar FOG; and
- pH.

While none of the above limitations directly affect the design of the BOD treatment system in the expanded IWTP, limitations for metals and FOG may at times trigger the need for effluent from BOD treatment to be routed to the DAF system prior to discharge to the sanitary sewer. The flow rate limitation may affect flow routing of BOD treated effluent under some conditions.

The IWTP Expansion design basis also does not consider parameters that are not currently included in the permit, including per- and polyfluoroalkyl substances (PFAS) compounds, Total Kjeldahl Nitrogen (TKN), NH3-N, Total Phosphorus, Ortho-Phosphate, TSS, 6PPD-quinone, and Total Dissolved Solids (TDS).

Although the Port recognizes that the IWD permit is subject to potential future modifications by KCIW, the specific parameters, permit conditions, and numeric limitations to be included in future permits are unknown at this time. It is not feasible, nor cost-effective, to design a system for hypothetical future permit conditions. The approach to addressing future permit limits, and the siting requirements for any new infrastructure (if needed) may vary significantly depending on the specific parameter and permit conditions, as well as the concentrations of such parameters in IWS runoff.

As such, when IWD permit modifications occur in the future, the Port will evaluate at that time whether any system modifications are needed, and if necessary, develop an approach to comply

with new permit conditions. If any permit modifications occur prior to completion of design, construction, and commissioning for the current IWTP Expansion project, any modifications that are determined to be required would be addressed under a separate project to avoid impacts to the current project schedule.

3.3.2 Anticipated Future Conditions in SEA NPDES Permit (Outfall 001)

For the purposes of developing a design basis for the expanded IWTP, the following conditions and constraints in the current NPDES Permit for discharges to Outfall 001 are assumed to remain applicable in future NPDES permit renewals issued to the Port:

- BOD_5 Monthly Ave. Concentration: 45 mg/L (Nov – Mar), 25 mg/L (Apr – Oct) Daily composite samples;
- TSS Maximum: 21 mg/L (monthly ave.), 33 mg/L (daily max) Weekly composite samples; and
- Oil and Grease Max Concentration: 8 mg/L (monthly ave.), 15 mg/L (daily max) Weekly grab samples.

The BOD_5 and TSS effluent limitations for discharges to Puget Sound are important conditions in selection of the BOD treatment technology, sizing of the BOD treatment system, and design of process options for additional reductions in BOD_5 and TSS. The lower BOD_5 limit for the first month of the deicing season (October) has minimal impact on the IWTP Expansion design, but the lower limit in the spring (April) may have an impact if extensive stored volumes of high concentration industrial wastewater remains after March. The TSS limitations may affect whether BOD treated effluent must past through the DAF system prior to discharge to Puget Sound.

It is also assumed for the purposes of the IWTP Expansion design basis that permit limitations for PFAS compounds, TKN, NH3-N, Total Phosphorus, Ortho-Phosphate, and Total Dissolved Solids (TDS) will not be integrated into future NPDES permits for discharges from Outfall 001. Should limitations for these or other parameters be included in future NPDES permits for Outfall 001 discharges, the available treatment and storage capacity for the expanded IWTP may be affected.

3.3.3 Maximum Flow Rate Discharge to Puget Sound (Outfall 001)

The maximum flow rate that can be discharged to Puget Sound at Outfall 001 (3,200 gpm), based on the agreement with MSD, may limit the expanded IWTP in two ways:

- Under the lowest range of BOD concentrations to be treated in the BOD treatment system, the peak flows could be higher than 3,200 gpm. This is expected to be a highly infrequent condition. When this occurs, excess flows from the treatment system will need to be attenuated by routing flow back to one of the existing lagoons, as discussed in **Section 7**.

- When both low BOD industrial wastewater and treated effluent from an onsite BOD treatment system for high BOD industrial wastewater are discharged to Puget Sound, low BOD flow rates will need to be managed to avoid exceeding the flow limit. If an overflow occurs, excess flow will be routed back to Lagoon 3 as it does under existing conditions, as described in **Section 7**.

3.3.4 Integration of Existing and New IWTP Infrastructure and Operations

The IWTP Expansion will require the addition of onsite BOD treatment and expanded high BOD storage to address the drivers and limitations described in **Section 3.2**. However, much of the existing IWTP system functions are intended to remain operational under future conditions, including the DAF system, IWS Pump Station, Lagoons 1, 2, and 3, and associated infrastructure. Modifications will be necessary to select existing infrastructure to address existing performance limitations, and changes to overall system flow routing and controls will be required to fully integrate system operations between new and existing IWTP infrastructure. A key constraint affecting the design basis was the need to minimize construction and operational impacts to existing system functions as the new infrastructure and proposed modifications are incorporated. For further details on proposed modifications to existing system features, please refer to **Sections 5 through 8**.

3.3.5 Siting and Runway Protection Zone Constraints

The existing IWTP is situated between the Runway Protection Zones (RPZs) for Runway 34L and Runway 34C, with significant portions of all three lagoons falling within the RPZs. New infrastructure for the IWTP Expansion will need to be sited in the vicinity of the existing IWTP to allow infrastructure connections and integration as previously described. As such, it was necessary to consider siting new infrastructure on Port property within the RPZs surrounding the IWTP. Siting new infrastructure within the RPZs requires close coordination with the Federal Aviation Administration (FAA), as well as compliance with height and occupancy constraints to meet the intent of FAA RPZ requirements. For further details on how sites were selected for IWTP Expansion infrastructure, as well as compliance with RPZ constraints, please refer to **Section 4**.

3.4 Tools Used to Develop the Design Basis

3.4.1 Deicer Mass Balance Model Analysis

A model simulating IWS spent deicer quantities and runoff volumes was developed to support sizing of expanded IWTP infrastructure and process flow routing options. The deicing model uses historical hourly weather data from 52 winter seasons in the SEA area to represent the range of anticipated future conditions. Model inputs, calculations, outputs, modeled discharge constraints, and components sized using the model are summarized in **Table 9**.

Table 9 – Primary Deicing Model Parameters

Category	Parameters
Model Inputs	• Historical hourly precipitation, temperature, and associated weather data from 52 seasons • 2027 projected SEA flight schedule and fleet mix • 2027 projected deicer application locations • 2027 IWS projected drainage areas
Model Calculations	• Deicer applied per aircraft per hourly weather condition • Deicer applied to IWS pavement per hourly weather condition • Deicer available for capture after losses (evaporation, trackout, drip and shear from aircraft surfaces) • Industrial wastewater runoff by IWS drainage subarea per hourly weather condition based on rainfall and snowmelt • Reductions in applied Type I aircraft deicing fluid from use of Blend-to-Temperature and hybrid deicing trucks
Modeled Discharge Constraints	• NPDES BOD_5 concentration limits • MSD flow limitations • IWD anticipated 2026 BOD mass loading limits • IWD anticipated 2026 flow discharge limitations
Model Outputs	• Hourly flow rates at IWTP influent, effluent, and intervening locations • Hourly BOD mass loads at IWTP influent, effluent, and intervening locations • Hourly BOD concentrations IWTP influent, IWTP effluent, and intervening IWTP locations
Components Sized[1]	• BOD treatment capacity (lbs/day) • High BOD storage capacity (Mgal) • IWTP Expansion pumps

Notes:
1. Sizing information using the deicing model was supplemented by non-model hydraulic and process calculations.

The deicing model was calibrated using historical deicing application data and historical IWTP discharge flows and BOD concentrations. The model was used to evaluate various alternative component types, configurations, flow routes, and component sizes.

3.4.2 Hydrologic and Hydraulic Model Analysis

A hydrologic and hydraulic (H&H) analysis was performed to support the design of select IWTP modifications. This analysis was performed using the Port's existing IWS H&H model, which uses XPSWMM stormwater modeling software. The model includes a representation of IWS collection areas, IWS conveyance (gravity and pumped), Lagoon 3, and the outfall to Puget Sound. It was originally developed in 2020 based on IWS utility base mapping supplied by the Port and select

record drawings to address data gaps. Key assumptions and data sources used for the development of the IWS H&H model in 2020 are summarized in **Table 10**.

Table 10 – Key Assumptions and Data Sources for IWS H&H Model

Category	Description
Rainfall	24-hour duration storms based on rainfall depths defined in the City of Seattle Stormwater Manual (2021),[1] applied to Soil Conservation Service Type IA synthetic hyetographs.
IWS Collection Area	The existing IWS collection area boundary and drainage subbasins were reviewed and updated based on topography and infrastructure locations in Port base maps. Collection area was adjusted to reflect anticipated changes for NTP milestone, including expansion of industrial activity areas and conversion of select areas without industrial activities (e.g., building roofs) from IWS to SDS.
Development	Reflected development conditions for the NTP development milestone. All IWS drainage areas assumed to be 100% impervious.
IWS Drainage Infrastructure	Existing IWS drainage infrastructure was represented based on Port base maps and supplemented with record drawings to address data gaps. Infrastructure reflected updates to conveyance to address capacity deficiencies and NTP capacity demands.
Lagoons	The model includes a representation of Lagoon 3 only, and Lagoons 1 and 2 are not included. The storage curve for Lagoon 3 is based on a survey of Lagoon 3 performed by the Port in 2018, reflecting a total storage capacity of 76.2 Mgal at the overflow elevation (280 ft).
IWTP	The IWTP is not represented explicitly in the model, but the net discharge rate from Lagoon 3 to Puget Sound was limited to 3,200 gpm based on the outfall agreement with MSD.

Notes:

1. City of Seattle. *City of Seattle Stormwater Manual*. July 2021. Appendix F: Hydrologic Analysis and Design, Table 22: Precipitation-Magnitude-Frequency Estimates for Seatac.

The existing IWS H&H model described above was used to perform the following evaluations in support of establishing the design basis for the SEA IWTP Expansion:

- Quantify the minimum low BOD storage capacity needed at Lagoon 3 to meet the low BOD storage design basis, as summarized in **Section 3.4**. Quantify excess storage at Lagoon 3 that is able to be converted to high BOD storage (by splitting existing Lagoon 3) in an effort to address the high BOD storage capacity shortfall.
- Determine the minimum flow capacity needed for modifications to the IWS gravity trunk line upstream of Lagoon 3, in order to meet the IWS trunk design basis.

The model was not used to simulate any flows through Lagoons 1 or 2, IWTP, new treatment, or new storage units, nor was it used in support of the design basis for proposed modifications other than those described above.

3.5 Overall IWTP Expansion Design Basis

Parameters and assumptions relevant to the overall IWTP Expansion design basis determination are summarized in **Table 11** and **Table 12.**

Table 11 – Design Criteria Applicable to Overall IWTP Expansion

Item	Value / Description
IWS NSB Drainage Area	Source: SAMP NTP Development Plan Values: 177 acres, 100% impervious
IWS SSB Drainage Area	Source: SAMP NTP Development Plan Values: 195 acres, 100% impervious
Flight Operations (Daily departures by Airplane Design Group (ADG))	Source: Original SAMP projections for the year 2027 Values: ADG II(51)/ADG III(1,283)/ADG IV(77)/ADG V(56)
Aircraft Deicing Locations	NSB and SSB
IWS Pavement Deicing Locations	NSB and SSB
Snow Storage Locations	North Snow Dump: Concrete pad north of North Holding Apron and west of Cargo 1 South Snow Dump: Grassy area at Fuel Farm & Taxiway B
% of Type I deicer applied after using Blend-to-Temperature process	100%
% of deicing trucks with hybrid deicer (forced air/chemical) options	50%
BOD concentration threshold for high/low BOD industrial wastewater segregation	45 mg/L BOD winter (Nov – March) 25 mg/L BOD summer (April – October)
Maximum industrial wastewater flow rate discharged to sanitary sewer	2,777 gpm (4 MGD)
Maximum industrial wastewater BOD mass load discharged to sanitary sewer	10,000 lbs BOD per day
Maximum flow rate discharged to Outfall 001 (Puget Sound)	3,200 gpm (4.6 MGD)
Maximum industrial wastewater BOD_5 concentrations discharged to sanitary sewer	No maximum
Maximum BOD_5 concentrations discharged to Outfall 001 (Puget Sound)	45 mg/L BOD winter (Nov – March) 25 mg/L BOD summer (April – October)
Maximum TSS concentrations discharged to sanitary sewer	No maximum
Maximum TSS concentrations discharged to Outfall 001	21 mg/L TSS
Design season for sizing high BOD storage volume	Sufficient high BOD storage capacity for 95th percentile deicing season and below (1 in 20 yearly chance of using low BOD storage for high BOD wastewater)

Table 12 – Assumptions Applied in Developed IWTP Expansion Design Basis

Category	Assumption
Future NPDES Permit Limits	IWTP Expansion does not account for potential changes to current NPDES numeric limitations or addition of other parameters (e.g., PFAS compounds, nitrogen compounds, phosphorus compounds, TDS)
Future IWD Permit Limits	Other than anticipated reduction in allowable BOD mass loadings for 2026, IWTP Expansion does not account for potential changes to current IWD numeric limitations or addition of other parameters (e.g., PFAS compounds, nitrogen compounds, phosphorus compounds, TDS)
IWD Permit Cessation or Reduction of BOD mass loads	IWTP Expansion does not account for specific reductions in allowable BOD mass loading beyond the assumed 10,000 lbs/day limit including permanent cessation of IWD permit discharges.
Future Flight Schedule	IWTP Expansion does not account for potential flight schedule changes (increased departures or fleet mix) beyond that stated values for 2027
IWS Drainage Area	IWTP Expansion accounts for changes to IWS associated with SAMP NTP projects but does not account for SAMP LTV projects.
Siting	IWTP Expansion conceptual siting assumes no further constraints in ability to site infrastructure at proposed locations, including the RPZ of Runways 34L and 34C, beyond those identified by FAA in 2022.

3.6 Overview of IWTP Expansion Concept

The significant reduction in allowable BOD mass load limits for the industrial wastewater discharge to the sanitary sewer, in combination with projected increases in deicer application and the existing shortfall in high BOD storage capacity, results in the need for a new onsite BOD treatment system and an expansion in total high BOD storage capacity.

In early regulatory assessment and planning stages of the IWTP Expansion project, a variety of alternatives for meeting the changing conditions were explored and eventually eliminated based on them being infeasible, incompatible with site constraints, inappropriate for the industrial wastewater characteristics, or insufficient to meet effluent permit limits. Eliminated options included:

- Collecting and recycling glycol from a portion of the applied aircraft deicer at current deicing locations (not economically viable due to insufficient collected glycol concentrations and insufficient recovered glycol volumes)
- Adding enough deicing pad locations to increase the viability of recycling glycol (insufficient space for deicing pads with unacceptable impacts to ground operations and departure times)

- Providing enough high BOD storage for discharge of all high BOD wastewater to the sanitary sewer without adding onsite BOD treatment (insufficient space in acceptable areas for storage plus inability to discharge all collected flows in some seasons)
- Use of anaerobic fluidized bed reactors for BOD removal (insufficiently high influent concentrations and flow-through rates)
- Use of activated sludge or other aerobic treatment systems for BOD removal (less than optimal ability to operate in a stable and consistent manner in response to years with intermittent deicing plus generation of large amounts of sludge to process and dispose).

The selected IWTP concept is based on adding both onsite aerobic BOD treatment using an aerated gravel bed (AGB) technology with additional onsite high BOD storage. The addition of these elements will be supplemented by:

- Addition of oil/water separators (OWS) upstream of the storage lagoons
- Rightsizing of the low BOD industrial wastewater storage capacity
- Replacement of all existing DAF units to improve performance and throughput
- Replacement of the existing DAF solids decanting system with a sludge thickener

The principal means of siting the additional high BOD industrial wastewater storage is the splitting and expansion of the existing Lagoon 3 into high BOD and low BOD components. The high BOD storage from the Lagoon 3 division will be supplemented by a mostly underground high BOD storage tank located in the Runway 34L RPZ. The AGB treatment system and its supporting processes will be located in the Runway 34L RPZ.

Several preliminary process and instrumentation diagrams (P&IDs) are included as Sheets M7 to M9 in **Attachment A** to illustrate the flow routing and components associated with the integrated system. Proposed site plans are included as Sheets C5 to C8 to illustrate the siting of proposed structures, and proposed pipe routes are illustrated on Sheets C11 to C17.

An overview of the design basis for treatment and storage system elements is provided below.

3.6.1 Treatment Design Basis

The subsections below describe the design basis for each of the following treatment processes in the IWTP Expansion:

- OWS flow capacity
- BOD treatment mass load rates and flow rates
- DAF unit flow rates and number of units
- DAF solids thickening flow rates

3.6.1.1 Oil/Water Separators

OWS units are proposed for both the NSB and SSB trunk lines upstream of the IWTP. The OWS units will provide both a means of protecting the future BOD treatment process as well as further

reducing the risk on non-compliance with NPDES Oil & Grease limits and IWD FOG limits. The existing DAF system provides a similar function at the downstream end of the system for reducing risk of non-compliance with FOG permit limits, but flows that are routed to a future BOD treatment system will not pass through the DAF system first, so supplementary FOG control is required to protect the BOD treatment system. The proposed flow capacity for the OWS units is 10,000 gpm for each trunk line. That flow capacity will allow industrial wastewater to fully pass through the OWS units for dry weather and light rain or snowmelt conditions, and a portion of all flows that are routed to the IWTP (up to 10,000 gpm) will pass through the OWS units under all weather conditions. These units were not sized to meet any particular design storm, as there is not a mandatory design storm criteria that would be applicable. The maximum capacity of the OWS was limited in part by available space for installation of the units. For further information on the OWS concept, please refer to **Section 6.3**.

3.6.1.2 BOD Treatment Using AGB Technology

A treatment capacity of 10,000 lbs-BOD/day is proposed for the AGB treatment system. The treatment capacity will be equally divided amongst six individual AGB cells. The BOD treatment capacity was limited in part by available space in the Runway 34L RPZ area. The selection of 10,000 lbs-BOD/day was also impacted by a balancing AGB flow throughput capacity, high BOD storage capacity, and the balancing of treatment and storage capacity needed to fit both storage and treatment on the available area while meeting FAA criteria for protecting people and property in the RPZ. The AGB treatment system will operate on a constant mass load basis, with flow rates through the AGB system varied in response to measured TOC concentrations (acting as a surrogate for BOD concentration). For further information on why the AGB was selected as the BOD treatment technology, as well as key design assumptions, please refer to **Section 6.5**.

3.6.1.3 DAF Units

The six existing aging DAF units will be replaced with six new DAF units with a higher capacity of 1,067 gpm each. The proposed total capacity of 6,400 gpm (7.2 MGD) for the new DAF units will enable the overall IWTP system flow capacity to not be constrained by the DAF capacity. Operating simultaneously, three units can meet the flow limitations for industrial wastewater discharges to Puget Sound and the other three can meet or exceed the flow limitations to the sanitary sewer. For further information on how the DAF modification concept was developed, as well as key design assumptions, please refer to **Section 6.6**.

3.6.1.4 DAF Solids Handling

The existing decant tanks used for solids settling will be replaced with a gravity thickener unit, similar to a clarifier. A separate solids storage tank will be added to temporarily store thickened sludge prior to being transported for disposal. The proposed system can accommodate a continuous flow of 500 gpm with up to 1.5% solids, which improves the existing system performance. For further information on how the DAF solids handling process, including key design assumptions, please refer to **Section 6.7**.

3.6.2 Storage Design Basis

The overall design basis used for total IWS storage capacity (including both high and low BOD storage units) was focused on avoiding an overflow or bypass to surface water for the full range of deicing and weather conditions evaluated in the deicer mass balance model (as described in **Section 3.4.1)** for future development and flight operations. The model was used to simulate an on-site BOD treatment system consistent with the daily loading rate assumptions described in **Section 6.5**, as well as existing IWS high BOD and low BOD storage unit capacities. Treatment and storage were simulated together for the full range of 52 hypothetical deicing seasons (as described in **Section 3.4.1**) and the total storage capacity was iterated on until no overflow to surface water occurred.

It was also necessary to determine the minimum high BOD storage capacity that would minimize overflows between high BOD storage to low BOD storage, in an effort to minimize the volume of industrial wastewater that require on-site treatment for BOD prior to discharging to Puget Sound. The volume of high BOD runoff is more dependent on future deicer application volumes than it is on wet weather conditions. As such, it was necessary to define the minimum high BOD storage capacity using the deicer mass balance model rather that apply a typical design storm basis. In the model, high BOD storage was allowed to overflow to low BOD storage each time it ran out of storage capacity. Results were reviewed to determine how many of the seasons resulted in at least one overflow from high BOD storage to low BOD storage. The high BOD storage capacity was then adjusted in an iterative fashion until overflows from high BOD storage to low BOD storage were avoided for 95% of evaluated deicing seasons. The analysis determined that a minimum total high BOD storage capacity of 35 Mgal (including existing high BOD storage at Lagoons 1 and 2) would be sufficient to meet this design basis and maintain compliance with the future permit limits.

As larger, more dilute precipitation events will typically be routed to low BOD storage, a design storm basis was used to confirm the minimum low BOD storage capacity. An evaluation was performed to determine the minimum storage volume that would allow industrial wastewater runoff from a 100-year 24-hour storm event to be contained in Lagoon 3 while discharging to the DAF System and Puget Sound but without overflowing to surface water. This analysis was performed using the IWS H&H model described in **Section 3.4.2**. The analysis determined that a minimum low BOD storage capacity of 39 Mgal would be sufficient to meet this criteria.

Total minimum low BOD and high BOD storage capacities are summarized in **Table 13**, in comparison to existing IWS storage capacities. As shown in the table, there is an existing capacity high BOD storage shortfall of approximately 30 Mgal based on future NTP demand. Meanwhile, the existing low BOD storage capacity at Lagoon 3 exceeds future NTP demand by over 33 Mgal, which exceeds the high BOD capacity shortfall. This suggests that it would be beneficial to reallocate excess low BOD storage capacity to address the high BOD storage capacity shortfall.

Table 13 – Existing IWS Storage Unit Capacities and Functions

Storage Function	Total Existing Storage Capacity (Mgal)[1]	Total Required Storage Capacity (Mgal)[2]	Additional Storage Capacity Required (Mgal)	Excess Storage Capacity (Mgal)
High BOD Storage	5.6	35.0	29.4	-
Low BOD Storage	76.2	39.0	-	33.7
Total Capacity	**81.8**	**74.0**	-	-

Notes:

1. Source: Port lagoon survey performed in 2018. Storage capacity at overflow elevations. Existing high BOD storage capacity includes Lagoons 1 and 2. Existing low BOD storage capacity includes Lagoon 3 only.
2. Total required storage capacity includes existing capacity plus any additional new storage capacity required to address future NTP capacity demand, based on the deicing and H&H analysis.

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4. Site Selection and Layout

4.1 Introduction

The Port conducted a detailed siting analysis to identify candidate locations to accommodate the proposed IWTP Expansion components. This section summarizes the criteria that characterize an adequate site, the selected siting locations, and the constraints associated with the selected locations.

The following Drawing Sheets in **Attachment A** are relevant to this section:

- C1 – C4: Existing Site Plans
- C5 – C8: Proposed Site Plans

4.2 Site Selection Criteria

Many constraints exist at and surrounding SEA which limit opportunities for siting and construction of the IWTP expansion, including SEA operations areas, existing urban development and protected natural resources. Given the selected process configuration and deicer treatment technology, the following considerations were incorporated into the siting evaluation:

- Proximity to existing IWTP infrastructure
- Proximity to the NSB and SSB discharge points
- Sufficient available land area for new storage and treatment infrastructure (minimum 14 acres)
- Compliance with FAA siting restrictions (e.g., Part 77 airspace surfaces, safety areas, object free areas, RPZ)
- Surface topography
- Constructability, including impacts to existing infrastructure

During the preliminary planning process, potential sites for the required new storage structures and treatment operations were identified. In an attempt to avoid siting within the RPZ of Runways 34L and 34C, the Port conducted an alternatives analysis which evaluated properties within a one-mile radius of the IWTP for adequacy. The results were documented in *Land Use Alternatives Analysis for Runway 34L RPZ For Construction and Operation of Expanded IWTP* (July 2022) submitted to FAA (**Attachment D**). FAA reviewed the memo and concluded the Port had conducted a sufficient analysis and took no exception to it, allowing the Port to proceed with the siting alternative which minimizes impacts within the RPZ. This alternative was the starting point for the development of the proposed modifications contained in this Basis of Design Report.

4.3 Site Characterization and Data Collection

Existing computer aided design (CAD) base maps, existing record drawings, and new land survey data were the primary data sources used to develop the existing site plans (Sheets C1 to C4 in

Attachment A) as well as to support the development of the proposed design concept illustrated on the proposed site plans and piping plan (Sheets C5 to C8 and C11 to C17 in **Attachment A**). While the Port-provided information is accurate to the best of the Notebook team's knowledge, existing site information should be field-verified during or prior to the detailed design phase.

Due to the siting constraints and the need for connections to existing IWTP infrastructure, the overall concept is divided into three sites—"AGB Site," "IWTP Site," and "Lagoon 3 Site."

4.3.1 Existing CAD Base Maps

The Port maintains CAD base maps of SEA property, including a variety of data on infrastructure, building, and land characteristics, which are updated periodically with current information. Existing information on the IWS and IWTP infrastructure was essential for designing the IWTP Expansion, including proposed connection points and system configuration. Other existing utilities, pavement, structures, and natural resource features were also utilized to inform the siting and layout.

4.3.2 Existing Record Drawings

The Port maintains a database of record drawings from past design and construction projects. Of particular use were the drawings related to the IWTP construction and upgrades, Lagoon 3 construction and upgrades, the demolition of the properties previously acquired by the Port south of S. 188th Street, and the construction of the Runway 34L approach lighting system.

4.3.3 Topographic, Utility, and Land Survey

The Port surveyors conducted a detailed land survey in March 2022 to help fill data gaps in the base map, primarily at the properties south of S. 188th Street where the AGB treatment is proposed. The Port surveyor scope included topography, aboveground utilities, pavement extents, fencing, and property boundaries.

4.4 Siting Constraints

Due to the need for over 20 acres of land for the IWTP Expansion, and the limited availability of land near the existing IWTP, the proposed components are located in three different sites. The sites' characteristics and associated constraints are described in the following subsections. Refer to Sheets C1 to C4: Existing Site Plans in **Attachment A**.

4.4.1 AGB Site

The AGB site is approximately 14 acres owned by the Port just south of the IWTP DAF Building. The site is land-locked by S. 188th Street on the north, Des Moines Memorial Drive to the west, and industrial businesses to the east and south. The property has some variable topography, but generally slopes from north to south. Some historical soil borings were reviewed that showed groundwater at the time of the borings varied from 8-16 feet. Additional groundwater

characterization is recommended to determine the seasonal high groundwater table, as described in **Section 10**.

The site exists within the RPZ of Runway 34L. FAA guidance describes acceptable land uses and activities within the RPZ to minimize the risks to people and property. The Port has followed that guidance and coordinated with FAA to gain acceptance of the proposed design approach, which does not increase risks to the public, minimizes the number and height of aboveground structures, and minimizes the time that Port staff are required to be present onsite.

The approach lighting system for Runway 34L operated by FAA bisects the property. These lighting towers and the associated electrical duct bank are immovable and must not be impacted by the proposed IWTP Expansion. Coordination will be required with FAA Planning and Engineering during the detailed design phase to determine requirements for construction in the vicinity of the lights and duct bank, including buffers to be maintained as well as access requirements. Coordination will also be necessary with FAA during the construction phase prior to construction of pipes or utilities crossing the duct bank.

During construction of the lighting system, much of the previous infrastructure was demolished, but the building foundations remain along with some other existing utilities that terminate on the site or continue across the site. Coordination with the local utility agencies will be necessary to facilitate construction of the IWTP Expansion, including confirmation of existing utilities that can be demolished or require relocation (if active), as well as establishment of new utility service connections.

4.4.2 IWTP Site

The IWTP DAF Building, IWS Pump Station Building, and Lagoons 1 and 2 generally define the extents of the IWTP Site, with S. 188th Street to the south. The site generally slopes from north to south. Significant amounts of existing infrastructure are located throughout the site, including existing SDS sewers and a treatment vault, IWS sewers, IWTP process pipes, and electrical and communications utilities. Two roads provide access to the Lagoons and the airfield, one to the east of Lagoon 1 and one to the west of Lagoon 2.

4.4.3 Lagoon 3 Site

The existing Lagoon 3 is surrounded by an access road on the top of the berm. Most of the site is located within the RPZ of Runway 34C, except for the southernmost portion including the Lagoon 3 Pump Station. As described at the AGB Site, the Port has gained FAA acceptance of the proposed design approach within the RPZ. The associated 34C runway approach lighting towers, which must not be impacted, are featured on the east side of the lagoon. On the north side of the lagoon, a variety of utilities exist including IWS pipes, SDS pipes and vaults, electrical lines, and communications lines.

The lagoon’s earthen berm is a permitted dam regulated by Ecology due to its overall height and function. Modifications to the eastern berm would likely require a permit.

There are three jurisdictional wetlands adjacent to the site, identified by the Port as IWS-A, IWS-B, and Wetland 28 (**Figure 6**). Wetland 28 is a "high performing" Category I wetland which is not proposed to be disturbed, although the buffer may be impacted. Wetlands IWS-A and IWS-B are Category III wetlands which have a moderate level of ecological functions. Any proposed impacts to these wetlands will be avoided if possible and otherwise follow appropriate Section 404 and Ecology 401 permitting as needed.

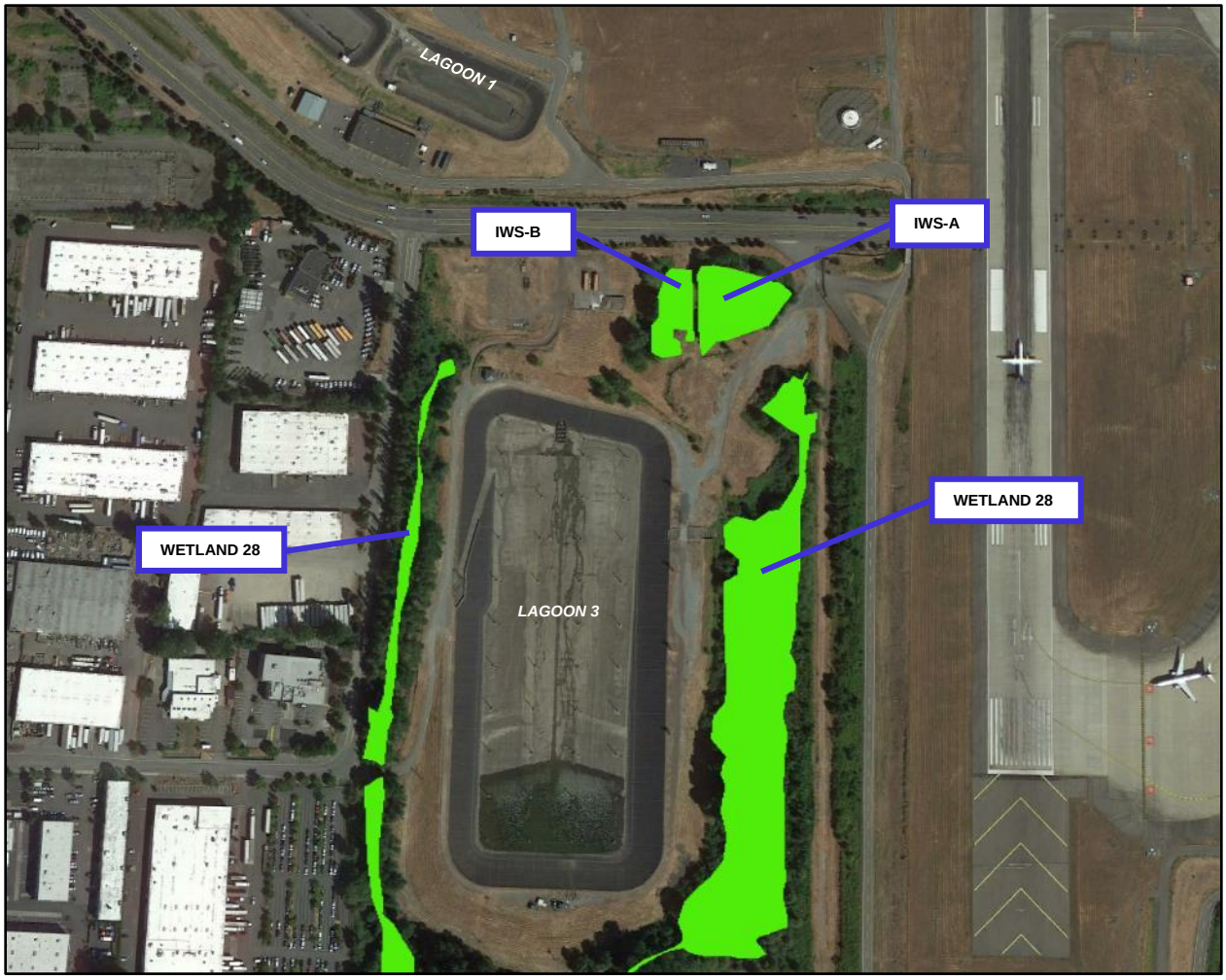


Figure 6: Wetlands around Lagoon 3 Site

4.5 Proposed Site Concept

4.5.1 AGB Site

The AGB Site is the location of the BOD treatment process as well as a portion of high BOD storage. Proposed components are summarized in this subsection and shown on Sheets C5 and C6 in **Attachment A**. More details are provided on the proposed storage components in **Section**

5, proposed treatment components in **Section 6**, and proposed conveyance components in **Section 7.**

The primary industrial wastewater storage element at this site is:

- AGB Tank, with side walls completely buried and dome roof aboveground

The primary BOD treatment system structures will be installed to be near or below grade.

- AGB biological treatment cells
- Pump stations
- Hydraulic control structures and vaults
- IWS conveyance piping

The BOD treatment system requires the following supporting components:

- Control and utility building, constructed aboveground with the lowest building height that can house the blower system
- Control hardware
- Electrical hardware

Additional site features include:

- Site stormwater runoff controls
- Utility lines (e.g., electric, telecommunications, water, sewer)
- Access roads
- Road vehicle parking

4.5.2 IWTP Site

The IWTP Site is the location of existing and proposed IWTP treatment and storage components. The components are summarized in this subsection and shown on Sheets C5 and C7 in **Attachment A**. More details are provided on the proposed treatment components in **Section 6** and proposed conveyance components in **Section 7**.

The IWTP Site will continue to include the following elements of the existing IWTP system:

- IWS conveyance piping
- IWS diversion structures
- Lagoon 1 and Lagoon 2
- IWTP DAF Building
- IWS Pump Station Building

Proposed modifications at the IWTP Site include:

- IWS conveyance piping
- Flow control structures
- New DAF units and associated tanks and equipment

- New solids handling and storage equipment

4.5.3 Lagoon 3 Site

The Lagoon 3 Site is the location of over 30 Mgal of the additional high BOD storage, accomplished by expanding northward the footprint of existing Lagoon 3 and constructing a berm to create two separate storage units for low BOD and for high BOD industrial wastewater. The components are summarized in this subsection and shown on Sheets C5 and C8 in **Attachment A**. More details are provided on the proposed storage components in **Section 5** and proposed conveyance components in **Section 7**.

The Lagoon 3 Site will continue to include the following elements of the existing Lagoon 3 system:

- Lagoon 3 (partial)
- Lagoon 3 Pump Station, associated vaults, and force main
- Lagoon 3 mechanical screen
- Lagoon 3 emergency generator
- Existing road (partial) and access ramp
- Lagoon 3 emergency spillway and emergency drain pipe
- Lagoon 3 Underdrain Pump Station and force main
- Lagoon 3 effluent structure
- Lagoon 3 underdrain system (partial)
- IWS trunk line (partial)

Proposed modifications at the Lagoon 3 Site include:

- Lagoon influent piping
- New diversion structure
- New TOC monitoring shelter
- New mechanical screen
- Berm to divide lagoon into two separate lagoons
- New discharge pump station and associated vaults
- Partial replacement of underdrain system
- New underdrain pump station and force main
- New leak detection system and pump station
- Partial replacement and extension of existing access road
- New access ramp
- Expansion and replacement of liner system and concrete floor
- Expansion and replacement of bird deterrent netting system
- Realignment of existing gravity pipe to Puget Sound outfall

5. Proposed Industrial Wastewater Storage Modifications

5.1 Introduction

As described in **Section 2**, the IWS includes three existing lagoons that store and attenuate flows from the IWS until they can be treated and discharged in accordance with applicable discharge limits. As described in **Section 3**, the existing IWTP has a high BOD storage capacity deficiency which would be exacerbated when accounting for future demands for NTP conditions and future IWD permit BOD mass load limit reductions. This section provides an overview of the design concept for proposed modifications to existing storage units and proposed new storage units to reduce the risk of non-compliance with applicable discharge permits under future conditions.

The following Drawing Sheets in **Attachment A** are relevant to this section:

- C5 – C8: Proposed Site Plans
- C11 – C17: IWS Piping Plans
- M1: AGB Tank and Elevation
- M7 – M9: Process and Instrumentation Diagrams

5.2 Overview of Proposed Storage Modifications

As described in **Section 2**, the existing IWS includes three lagoons: Lagoons 1 and 2 used for high BOD storage, and Lagoon 3 used for low BOD storage. Under proposed conditions, the three existing lagoons will continue to serve similar functions, but Lagoon 3 will be modified significantly, and two new storage units will be added. The proposed storage system will consist of the following storage units:

- **Lagoons 1 and 2**, unchanged from existing conditions, which will continue to be used for high BOD storage;
- **Lagoon 3**, reduced in size but continuing to be used for low BOD storage;
- **Lagoon 4**, new high BOD storage lagoon adjacent to Lagoon 3; and
- **AGB Tank**, new high BOD storage tank at the AGB site.

During the development of the design concept for proposed storage modifications, the goal was to maximize the storage capacity to the extent possible with consideration for siting constraints, even if it went beyond the minimum required total storage capacity. This “excess” capacity in the storage concepts provides a buffer for design changes that may occur during the detailed design phase as a result of site characterization findings, detailed siting analyses, or changes to design assumptions. Any excess storage capacity that is constructed will increase system resiliency for conditions that vary from the design basis, such as extreme weather conditions, expanded development in the IWS collection area upstream, and unforeseen changes to discharge requirements. Storage unit capacities under existing and proposed conditions are summarized in **Table 14**.

Table 14 – Overview of Storage Capacity Modifications

Storage Unit	Storage Function	Existing Capacity (Mgal)	Proposed Capacity (Mgal)
Lagoon 1	High BOD Storage	2.0	2.0
Lagoon 2	High BOD Storage	3.6	3.6
Lagoon 3	Low BOD Storage	76.2	41.9[1]
Lagoon 4	High BOD Storage	-	29.7[1]
AGB Tank	High BOD Storage	-	5.0

Notes:

1. Volumes listed for Lagoons 3 and 4 represent independent storage capacity below the elevation of the new dividing berm emergency spillway between Lagoons 3 and 4. There is an additional 4.0 Mgal of combined storage capacity above the new dividing berm emergency spillway and below the existing emergency spillway to surface waters, for a total combined storage capacity of 75.6 Mgal within Lagoons 3 and 4.

Table 15 provides a summary of overall low BOD and high BOD storage capacity under proposed conditions, in comparison to existing conditions (see **Section 2**) and design basis requirements (see **Section 3**). As shown in the table, the current IWTP Expansion concept reflects 3 Mgal of excess low BOD storage capacity, and 5 Mgal of excess high BOD storage capacity, with a total excess capacity of 12 Mgal.

Table 15 – Proposed versus Required Storage Capacity

Storage Function	Total Existing Storage Capacity[1] (Mgal)	Total Required Storage Capacity[2] (Mgal)	Total Proposed Storage Capacity (Mgal)
High BOD Storage	5.6	35.0	40.3[3]
Low BOD Storage	76.2	39.0	41.9[4]
Total Storage Capacity	**81.8**	**74.0**	**86.2**[5]

Notes:

1. Source: Port lagoon survey performed in 2018. Storage capacity at overflow elevations. Existing high BOD storage capacity includes Lagoons 1 and 2. Existing low BOD storage capacity includes Lagoon 3 only.
2. Total required storage capacity includes existing capacity plus any additional new storage capacity required to address future conditions capacity demand.
3. Total proposed high BOD storage includes Lagoons 1, 2, and 4, and AGB Tank.
4. Total proposed low BOD storage includes Lagoon 3 only.
5. Total capacity includes distinct high BOD storage and low BOD storage capacities, as well as shared storage capacity of 4 Mgal above the dividing berm emergency spillway between Lagoon 3 and 4 that is below the elevation of the existing emergency spillway to surface waters.

Storage unit modifications and new storage units included in the IWTP Expansion are detailed in the subsections below.

5.3 Lagoon 3 Modifications and New Lagoon 4

5.3.1 Lagoons 3 and 4: Concept Overview

As existing Lagoon 3 (**Figure 7**) has excess low BOD storage capacity, it can be significantly reduced in size and still meet the design basis described in **Section 3**. This would allow the excess storage capacity to be reallocated as a high BOD storage unit ("Lagoon 4") to address the high BOD storage capacity shortfall.

This storage concept involves splitting Lagoon 3 into two separate lagoons using a dividing berm, as well as expanding the overall lagoon footprint to the north. The southern lagoon would maintain the same low BOD storage function as existing Lagoon 3 and would retain the name "Lagoon 3". The northern lagoon, "Lagoon 4", would be used for the storage of high BOD industrial wastewater that is segregated from the IWS trunk line. A new flow segregation system (with diversion structure and TOC monitor) will be installed along the IWS trunk line just upstream of the lagoons to segregate flow to Lagoons 3 and 4 based on BOD_5 concentration limits in the NPDES permit (based on surrogate TOC monitoring results) as described in **Section 7.4**.

Both lagoons will be designed as lined detention basins with characteristics that are similar to existing Lagoon 3. **Table 16** provides an overview of modifications proposed at Lagoons 3 and 4. These modifications are also illustrated on the proposed site plans on Sheets C5-C8.

Table 16 – Overview of Modifications at Lagoons 3 and 4

Lagoon 3 Modifications	Lagoon 4 Modifications
• New dividing berm • New access ramp • New influent system • New connector pipe across dividing berm • New emergency spillway across dividing berm • Liner system and concrete replacement • New leak detection system • Replacement of bird netting system	• Expanded footprint to the north • New access road surrounding Lagoon 4 • New influent system • New discharge system • Re-graded floor with new liner system and concrete replacement • New leak detection system • New underdrain system with pump station • Recirculation system • Level sensor • Replacement of bird netting system

5.3.2 Lagoons 3 and 4: Concept Selection Basis

This split lagoon concept was selected to take advantage of the existing excess low BOD storage capacity, which can be reallocated to address the high BOD storage capacity shortfall. As this concept makes use of existing excavated storage capacity and existing infrastructure, it offers reduced costs compared to an alternative that involves constructing a new high BOD storage tank with a similar volume.



Figure 7: Lagoon 3

5.3.3 Lagoon 3 and 4: Design Basis

Lagoons 3 and 4 will serve as the primary storage destinations for industrial wastewater, with Lagoon 3 serving as the primary low BOD storage structure and Lagoon 4 serving as the primary high BOD storage structure feeding the AGB system storage tank. If needed, Lagoons 1 and 2 could be used for storage of either low BOD or high BOD wastewater.

Lagoon 3 is required to have a minimum storage capacity of 39 Mgal, which correlates with the maximum storage volume in existing Lagoon 3 during a 100-year storm. Lagoon 4 is required to have a minimum storage capacity of 30 Mgal to address the high BOD storage shortfall. As described in **Section 5.2**, the sizes of both lagoons are currently maximized on the site beyond these minimum requirements. Proposed design characteristics for Lagoons 3 and 4 are summarized in **Table 17**.

Table 17 – Lagoons 3 and 4 Design Characteristics

Characteristic	Lagoon 3	Lagoon 4
Storage Unit Type	Lined Detention Basin	Lined Detention Basin
Intended Use	Low BOD Industrial Wastewater	High BOD Industrial Wastewater
Total Active Storage Capacity (Mgal)[1]	41.9	29.7
Storage Unit Dimensions[2] (ft)	630 x 490	580 x 480
Storage Unit Active Storage Depth[3] (ft)	24	22

Notes:

1. Volumes represent independent high BOD or low BOD storage capacity below the elevation of the emergency spillway across the dividing berm between Lagoons 3 and 4. There is an additional 4.0 Mgal of combined storage capacity above the dividing berm emergency spillway and below the existing emergency spillway to surface water, for a total combined storage capacity of 75.6 Mgal within Lagoons 3 and 4.
2. Numbers represent average width and length (actual width and length varies).
3. Approximate depth between emergency spillway on dividing berm and lowest elevation in lagoon floor.

5.3.4 Lagoons 3 and 4: Key Components

Key components of Lagoon 3 and 4 modifications are summarized in **Table 18**. In general, Lagoon 4 will include similar liner layers and infrastructure as what is currently included in Lagoon 3, with the exception that Lagoon 4 will also incorporate a new leak detection system. See **Section 7** for further details on conveyance systems and flow routing.

Table 18 – Lagoons 3 and 4 Components

Component	Description
Flow Segregation and Influent System	A new TOC monitor and a diversion structure with motorized slide gates will be constructed along the IWS trunk line upstream of Lagoons 3 and 4 to segregate flows based on BOD.
Influent System	New gravity influent lines will be installed between the diversion structure and each lagoon (see **Section 7**), and new influent structures will be constructed in each lagoon consistent with the existing influent structure at Lagoon 3.
Discharge System	The existing Lagoon 3 discharge system will remain. A new discharge system will be required for Lagoon 4, including effluent structure, Lagoon 4 Discharge Pump Station, valve vault, flow vault, and force main. This system will also incorporate a mechanical screening unit, as described in **Section 6.4**.
Access	A new access ramp is needed for Lagoon 3. Both Lagoon 3 and 4 will include a concrete cellular confinement system (CCCS) that is drivable for maintenance access, similar to existing Lagoon 3. A new gravel perimeter road will be constructed around Lagoon 4, continuing across the dividing berm.
Mixing	A recirculation and mixing function will be provided at Lagoon 4 by using the Lagoon 4 Discharge Pump Station and Force Main to pump effluent from Lagoon 4 back to the IWS trunk line upstream of the diversion structure (which will then be routed back into Lagoon 4) via the Lagoon 4 Recirculation Valve Vault.

Component	Description
Overflow	The existing emergency spillway falls within the footprint of Lagoon 4. A new emergency spillway will be constructed across the dividing berm to allow overflows from Lagoon 3 to Lagoon 4 and vice versa. This new spillway will allow any overflows from Lagoon 3 to discharge through the existing emergency spillway that discharges to surface water (at Lagoon 4) if required. Additionally, the existing emergency drain pipe, which falls within the footprint of Lagoon 3, will be retained.
Connector Pipe	A new connector pipe with a manual valve will be installed through the dividing berm between Lagoon 3 and 4 at the bottoms of the lagoons. When the valve is opened, flow will be able to be transferred between lagoons as needed for overflow, storage capacity relief, or flow routing flexibility.
Underdrain System	The existing underdrain system will be reconstructed and expanded under the floor of Lagoon 4. This new system will drain by gravity to the new Lagoon 4 Underdrain Pump Station west of the lagoon (to be sized based on results of geotechnical investigation), which will pump groundwater to the existing Lagoon 3 Underdrain Pump station for discharge to the ravine.
Liner System	Both Lagoon 3 and 4 will need to be fully re-lined with a geomembrane liner, in order to cover the expanded footprint and integrate modified lagoon features.
Leak Detection System	A new leak detection system will be incorporated into Lagoons 3 and 4 below the liner system and above the underdrain system, to capture leaks through the geomembrane liner. It will include a geocomposite drainage layer directly under the liner to collect and convey leaks to a Leak Detection Pump Station on the west side of Lagoon 4. It will also include a geosynthetic clay liner (GCL) below the geocomposite to act as a secondary liner and prevent leaks from draining into the underdrain system. Should leaks occur, a level sensor at the Leak Detection Pump Station will trigger an alarm and flows will be pumped to the Lagoon 4 Discharge Pump Station for storage and treatment at the AGB.
Instrumentation	The following instruments will be installed at Lagoons 3 and 4: • Level sensor in Lagoon 4 Discharge Pump Station • Level sensor at Leak Detection Pump Station to track presence of leaks that have occurred through Lagoon 4 liner system • TOC meter at diversion structure

5.4 New AGB Tank

5.4.1 AGB Tank: Concept Overview

This storage concept involves constructing a high BOD storage tank local to the AGB site to meet storage capacity needs for future aircraft development and flight operations. Additionally, this tank may provide equalization of concentrations in the tank to minimize fluctuations in the flow rate through the AGB, which is fed on a constant BOD mass load basis. On a less frequent basis, it can also be used to provide flexibility for flow routing within the AGB system, such as storing effluent from the AGB that is not ready to be discharged. The AGB tank side wall is required to be fully buried to comply with FAA guidance for construction within the RPZ.

The selected storage unit type is an AWWA D110 Type III prestressed wire-wound concrete tank. This tank type features a concrete slab foundation, 4-inch thick pre-cast tip-up wall panels, a steel diaphragm for watertightness, wire wrapping to prestress the walls, and a concrete dome roof. It will require an elastomeric coating for corrosion protection on inside concrete walls and floor due to the potential for high BOD deicing runoff to develop a low pH if deicer wastewater is stored in the tank for long periods of time, especially during warmer conditions. The tank concept is illustrated on Sheets C6 and M1.

5.4.2 AGB Tank: Concept Selection Basis

The AWWA D110 Type III prestressed wire-wound concrete tank type has a demonstrated record of watertight performance at airport deicer management systems in the Pacific Northwest and across the U.S., including PDX, PVD, CMH, CAK (**Figure 8**), and CVG. This type of tank offers large storage capacities that meet the design basis, as well as a relatively economical footprint compared to detention basins or subsurface vaults. It also presents a lower risk of odors compared to an open basin. These tanks are low-maintenance, requiring only annual inspections, annual sediment removal, and coating repair as needed to prevent corrosion.



Figure 8: Buried AWWA D110 Type III Tank at Akron-Canton Airport

5.4.3 AGB Tank: Design Basis

The design basis goals used to size the AGB Tank were as follows:

- Maximize the storage capacity that could fit within available space constraints, with consideration for AGB footprint as well as excavation required for full bury of tank; and
- Provide sufficient storage capacity to feed the AGB system for at least a full day, in order to minimize interruptions to the treatment process.

Based on the above criteria, a design tank capacity of 5 Mgal was selected, and a corresponding tank diameter and depth were selected as summarized in **Table 19**. The tank volume and dimensions are the largest that fit within available site constraints, with consideration for the AGB

layout as well as the extent of excavation required to fully bury the tank and comply with FAA guidance in the RPZ. Additionally, the storage capacity allows continues treatment system operations for just over a day when operating at a rate equivalent to the maximum discharge rate to Puget Sound. The tank design should address local seismic requirements in the Seattle region.

Proposed design characteristics for the AGB Tank are summarized in **Table 19**.

Table 19 – AGB Tank Design Characteristics

Characteristic	Value
Storage Unit Type	Prestressed Wirewound Concrete Storage Tank
Total Active Storage Capacity (Mgal)	5.0
Storage Unit Dimensions (ft)	200 ft inside diameter
Storage Unit Active Storage Depth (ft)	22.5 ft (wet storage depth)

5.4.4 AGB Tank: Key Components

Key components of the AGB Tank are summarized in **Table 20**.

Table 20 – AGB Tank Components

Component	Description
Influent System	AGB Tank Influent Valve Vault controls flows from the AGB Effluent Force Main and Lagoon 4 Force Main into the tank (see **Section 7**). Inside the tank, each force main has a vertical riser to discharge at the top of the tank.
Discharge System	Primary discharge is a gravity drain to the AGB Tank Pump Station for pumping into or around the AGB system. A separate solids drain can be used to drain collected solids at the end of the season.
Access	Tank will include stairs to top of tank, handrail and access hatch on dome with fall protection system, and ladder into tank below access hatch.
Odor Control and Venting	A passive vent on the dome will prevent pressure from building up. The dome will include a spare sleeve for future odor control system as required.
Overflow	Tank includes overflow weir for emergency to prevent overfilling tank and damaging dome. Overflow drains through a buried pipe connected to the stormwater system.
Underdrain System	A perforated underdrain system will be installed below the tank foundation to drain groundwater from below the tank. An underdrain pump station will have ability to pump groundwater to stormwater system or AGB Tank Pump Station.
Coating System	The tank will be lined with an elastomeric coating on the interior concrete walls and floor to protect the concrete from corrosion due to low pH.
Instrumentation	The AGB Tank will include the following instruments: • Level floats • Ultrasonic level meter • Atmospheric pressure sensor (to check that tank vent is operational)

6. Proposed Treatment Processes

6.1 Introduction

Meeting the anticipated BOD mass load limitations in the future IWD permit while maintaining compliance with NPDES permit criteria for BOD_5, requires the addition of a treatment process that reduces BOD mass loads and concentrations for discharges to the surface water and sanitary sewer. Several other unit treatment process will also be added or upgraded in the IWTP to support the biological treatment process to meet IWD permit and NPDES permit limitations for BOD_5, TSS, metals, and oil & grease.

Section 6 describes the various treatment proposed treatment processes to be incorporated in the IWTP Expansion project.

The following Drawing Sheets in **Attachment A** are relevant to this section:

- C5 – C8: Proposed Site Plans
- C11 – C17: IWS Piping Plans
- M2: DAF and Building Modifications – Demolition Plan
- M3: DAF and Building Modifications – Proposed Plan
- M4: Solids Handling Modifications – Demolition Plan
- M5: Solids Handling Modifications – Proposed Plan
- M6: AGB Details
- M7 – M9: Process and Instrumentation Diagrams

6.2 Overview of Treatment Processes

6.2.1 Pollutant Sources and Drivers for Treatment

Treatment for the following pollutants in the expanded IWTP is required to meet IWD and NPDES permit conditions for BOD, trash, TSS, metals and fuels/oils.

- BOD is found in SEA industrial wastewater in winter primarily due to the presence of aircraft deicers applied in the IWS or melting from snow storage areas in the IWS. Pavement deicers applied in the IWS will also contribute BOD in lesser proportions in winter. Small quantities of BOD may be created year-round from detritus and microbial growths year-round. The quantities of BOD in industrial wastewater runoff will widely vary from day-to-day and season-to-season.
- A variety of items categorized as trash may be present in the industrial wastewater from materials used in the IWS area.
- TSS in SEA industrial wastewater may be derived from sand, grit, and sediment, including sediment from construction activities that may not be fully contained by Best

Management Practices in construction areas. Additional TSS may be generated by bacteria sloughing off of gravel media in the AGB, especially at the end of the treatment season.

- Metals may be present in small quantities, primarily from metal vehicles and equipment used on the airfield.
- The primary petroleum product of concern is jet fuel that may be spilled during aircraft fueling operations or at the SEA fuel farm. Fuel spills from gasoline vehicles and spilled oils may also be present.

The following treatment processes will be added or modified in the expanded IWTP to manage the above pollutants in industrial wastewater runoff. The individual processes are described in subsequent sections.

- Oil/water separation with OWS and DAF
- Screening with mechanical screen
- BOD removal with AGB technology
- Solids management processes with DAF and gravity thickener

6.3 Oil/Water Separators

6.3.1 Drivers for Oil/Water Separation

Spills and leaks of fuel and other petroleum products can occur at multiple places in the IWS, including the fuel farm containment system, which discharges to the IWS SSB. The DAF system allows for the capture and separation of oil and fuels in runoff that is routed through the DAF system prior to discharge, and this system will provide the means for complying with permit limits for nonpolar FOG (IWD Permit) and oil and grease (NPDES permit) in the event of a fuel spill. However, influent to the AGB system is not routed through the DAF system, and an additional means for capturing oil and fuels is needed upstream of the AGB system to protect it from potential impacts.

While the AGB treatment system microorganisms are not significantly affected by fuel that may be entrained with the influent stormwater, the presence of significant quantities of fuel as a “free product” in the treatment cells could inhibit bacterial growth and development. A key benefit of adding standalone oil/water separator units upstream of the lagoons is that they would reduce the risk of fuel getting into the lagoons, which would simplify clean up efforts and reduce impacts to IWTP operations. The units also settle out solids and can reduce the frequency of sediment removal from the downstream lagoons.

Downstream of the oil/water separators, the lagoons and tank will provide a secondary downstream means for capture of oil/fuel that is not able to be captured by the oil/water separators. Additionally, AGB effluent will be monitored for the presence of oils or fuel, and if necessary, will be routed to the DAF system for final oil/fuel capture to meet permit limits prior to discharge.

6.3.2 Technology Overview

In industries, “oil/water separation” is the generic term used for any method the takes advantage of the density differences between water and fuel. Oil/water separator (OWS) systems create a contained space to reduce velocities and turbulence to provide the time necessary the density differences to take hold and create distinct layers of fuel and water. Two OWS system technology options were considered for the IWS:

- American Petroleum Institute (API) Baffle Wall OWS systems
- Coalescing Plate OWS systems.

API OWS systems are open chambers designed to reduce velocities of incoming flows, allowing fuels to rise to the surface and be retained behind baffles. Coalescing OWS systems use coalescing plates to increase the efficiency of removal of fuel. As water passes through coalescing plates, oil droplets rise and attach to the plates, where they combine and coalesce into larger droplets and eventually films of fuel. The film migrates to the surface through density differences from the water. API OWS units are easier to clean and maintain. Coalescing systems require less space and are more efficient but may require more maintenance to occasionally remove and clean/replace the plates.

Because quiescent conditions are needed for oil removal, these units also act as solids settling basins. Therefore, solids also typically settle out and need to be removed from OWS units.

Lagoons can also function as oil/water separators if operated appropriately, without adding standalone OWS units upstream. This would require that the lagoons are not drained completely, to allow a pool of standing water for oil to float above the lagoon effluent structure and not be entrained into the pump station discharge. Once the water contained within the lagoon has been inspected to verify there is no sheen or other evidence of free product in the stored water, the lagoon would be able to be fully drained as needed. Due to large surface area of the lagoon, oils or fuel captured within the lagoon may be dispersed across the lagoon footprint, requiring more extensive cleanup efforts. Oil residues would also need to be cleaned from the lagoon floor and sidewalls periodically. During cleanup of spills or of the lagoon itself, the lagoon discharge would need to be shut down, potentially hindering IWTP operations and effectively reducing storage capacity and flows to the AGB system or DAF system.

6.3.3 Oil/Water Separation Technology Selection Basis for SEA

In the expanded IWTP, coalescing type OWS systems are currently proposed for the NSB and SSB conveyance lines upstream of the lagoons. Coalescing systems will maximize the flow capacity within the available footprint in these locations.

Although periodic maintenance is inherent to OWS, they provide controlled conditions for the maintenance which minimizes cleanup efforts and minimizes impact to IWTP operations in comparison to using lagoons. The secondary benefit of solids accumulation in the OWS systems is that it may reduce the frequency of sediment removal in the lagoons. Finally, retaining a standing pool in the lagoons to perform oil/water separation may increase the risk of attracting hazardous wildlife.

The Port will evaluate the overall risks and benefits of the oil/water separation technology and confirm its selection during detailed design of this project.

6.3.4 OWS Process Design Basis and Sizing

The NSB and SSB OWS systems will be used to separate fuel spills during dry weather, snowmelt, and smaller rainfall events. OWS system capacities of 10,000 gpm are proposed for each of the two trunk lines, with each system consisting of two 5,000 gpm units. 5,000 gpm units are the largest available manufactured coalescing units. The proposed system therefore provides a total of 20,000 gpm capacity for IWS flows into the IWTP from the four total OWS units.

An example of a two-bay OWS system configuration is illustrated in **Figure 9**.

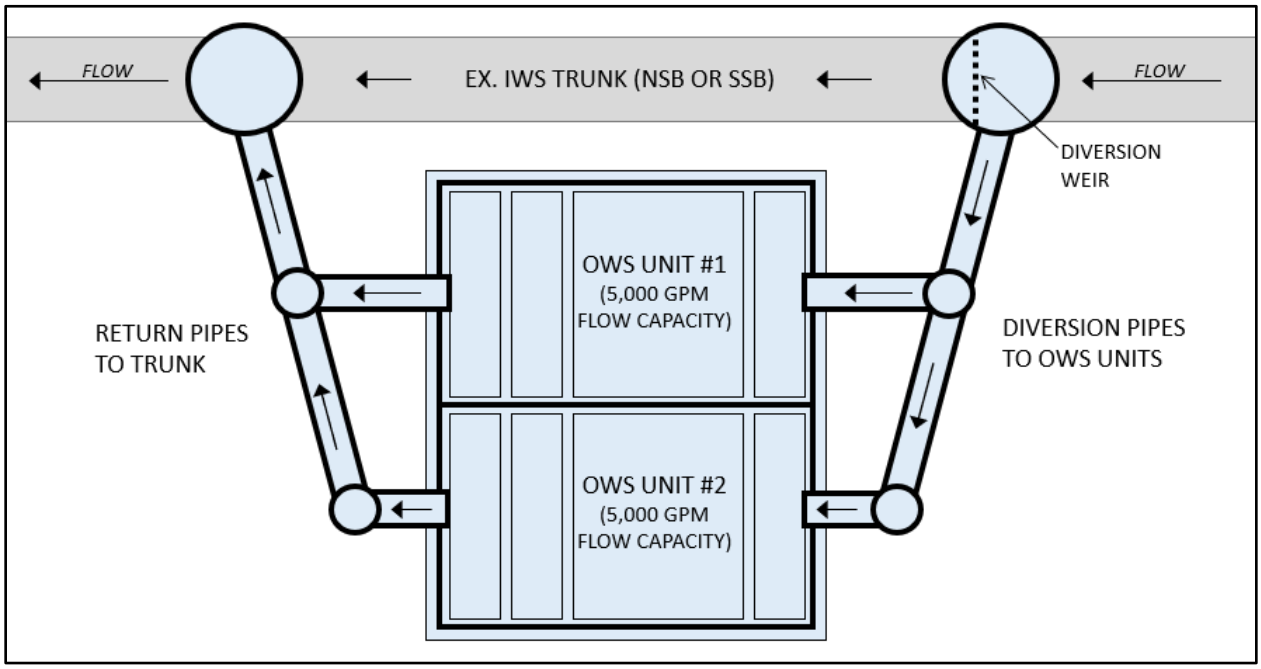


Figure 9: Example of Two-Bay OWS Configuration

The OWS systems would be installed to the side of the NSB and SSB lines with interconnecting piping to convey the flows. Flows conveyed into the OWS systems would be treated to fuel concentrations of approximately 12 mg/l. Any flows in excess of 10,000 gpm in each line would pass through the main line and be untreated.

6.3.5 OWS Process Configuration and Components

A two-bay OWS system is proposed to be installed along the NSB trunk just upstream of the flow segregation point to Lagoon 2, under the existing parking lot west of the snow shed and south of the corporate hangar parking lot. This location is outside of the AOA fence and was selected for ease of access for maintenance.

Another two-bay OWS system is proposed to be installed along the SSB trunk west of Runway 34R and south of Taxiway Q, within the RPZ for Runway 34C, and in between the Runway Safety Areas (RSAs) for Runways 34C and 34R. This location was selected to avoid construction and operational impacts to aircraft aprons and taxiways, as well as avoid restrictions associated with the RSAs.

The proposed locations for NSB and SSB OWS concepts are illustrated in **Figure 10**. Vehicle access will be needed to each OWS location for inspection and maintenance (i.e., removal of fuel and solids).

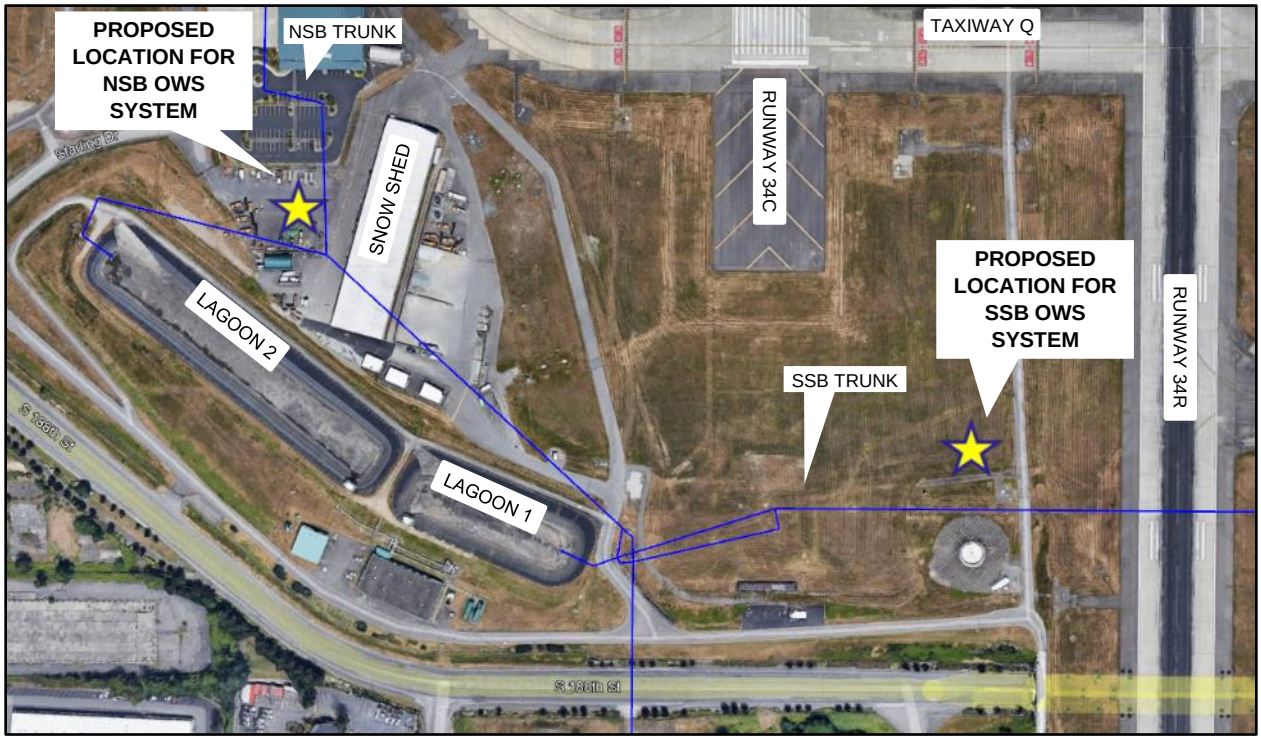


Figure 10: Proposed OWS Locations for NSB and SSB Trunk Lines

6.4 Lagoon 4 Mechanical Screen

6.4.1 Drivers for Trash Removal

A mechanical screening unit will be installed upstream of the Lagoon 4 Discharge Pump Station to remove collected trash and debris that would have the potential to clog the pumps and downstream processes. The primary purpose of this screen is to minimize the risks of potential damage or operational interruptions to pumps and equipment downstream, including the AGB, rather than water quality benefits for permit compliance.

6.4.2 Technology Overview

The mechanical screening unit will be similar in design and construction to the mechanical screen installed upstream of the Lagoon 3 Pump Station (TS-3000). The unit will be self-cleaning with a travelling rake that routinely travels from the bottom of the screen to the top to deposit screenings into an adjacent dewatering bin. Photos of the TS-3000 unit are as **Figure 11**.



Figure 11: Photos of TS-3000 (left) and Dewatering Bin (right)

6.4.3 Technology Selection Basis for SEA

The screen will be designed to remove all solids greater than ½" diameter and can be physically removed by a bar rack. The unit is required to protect the performance of the lift station pumps installed downstream. This technology was selected based on successful performance of the similar system upstream of the Lagoon 3 Pump Station, as well as compatibility with lagoon depth and space constraints.

6.4.4 Process Design Basis and Sizing

The Lagoon 4 screen will have design characteristics consistent with the existing bar screen at the Lagoon 3 Pump Station. The bar spacing will be ½" with a 5-degree incline (85 degrees from horizontal). The rated capacity will be 7.20 MGD. The motor will be 5 hp (60 hz/480v).

6.4.5 System Configuration and Components

The screen will have a 3’ width with approximate length of 40’. The length of the unit will be finalized during detailed design. The unit will be installed in a 6’ diameter wet well with structural bracing and stainless-steel isolation panels. Local controls for the screen will be located adjacent to the unit. The wet well will be connected to the adjacent Lagoon 4 Discharge Pump Station by ductile iron pipe. Raked screenings will be deposited into an adjacent 4’ x 4’ dewatering bin.

The configuration of the screen will be similar to TS-3000 installed on the south side of Lagoon 3 (see **Figure 12**).

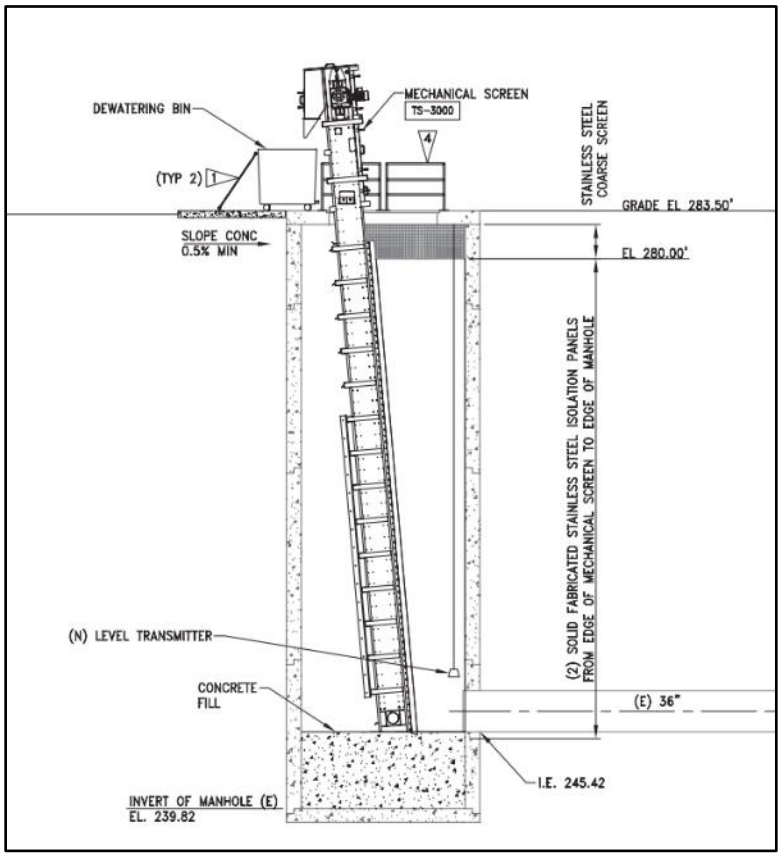


Figure 12: Section of Mechanical Screen TS-3000 (STIA-2404 Record Drawing C-5)

6.5 Aerated Gravel Bed for BOD Treatment

6.5.1 Drivers for BOD Treatment

Removal of BOD from deicers contained in the industrial wastewater stream is necessary to meet IWD permit BOD mass load limitations, NPDES permit BOD_5 concentration limits, and avoid exceeding capacity of IWTP storage.

6.5.2 BOD Treatment Alternatives Evaluation

In the IWTP Expansion preliminary planning stages, various methods for reducing BOD were evaluated. These include deicer source reduction measures, collection of deicer near application source, and various biological treatment technologies. Measures for reducing the deicer application amounts per aircraft (blending-to-temperature, use of hybrid deicing trucks) are being separately implemented.

Biological treatment technologies evaluated included activated sludge, AGBs, anaerobic fluidized bed reactors, and moving bed biofilm reactors. As described in **Section 3.6**, the AGB technology was selected because its capabilities align more closely with the Port's needs for the following:

- Flow processing capacity to align with available storage
- Influent BOD concentration ranges
- NPDES permit limitations for BOD_5
- Height profile
- Hazardous wildlife attractant risk
- Post BOD treatment processing and material disposal
- Ease and pace of seasonal startup
- Operational complexity
- Maintenance requirements
- Ability to integrate with existing IWTP operations

Details on the treatment technology alternative analysis were previously presented to KCIW in the CSR and the Preliminary Planning Report.

6.5.3 Technology Overview

The AGB is a biological wastewater treatment system consisting of a number of lined cells filled with gravel treatment beds. It is engineered to provide a stable environment for the bacterial degradation of glycols and other deicing compounds. Technically, it can be categorized as a lightly loaded, aerobic, submerged, attached-growth system. AGBs are unique compared to traditional biological processes in that they are designed to operate seasonally and accept highly variable flows and concentrations while in operation. The system is engineered to be simple in design with minimal operator oversight. The large size balances the need for mechanical complexity required for smaller systems.

A typical cross section of an AGB cell is provided as **Figure 13**. Flow to the AGB is pump in and gravity out. Influent is pumped uniformly over the top of the beds through dosing lines and travels downward through gravel to drain lines on the floor. The drain lines are connected to an effluent hydraulic control structure that controls the elevation of the water in the bed. The water level is maintained to keep the gravel submerged and prevent exposed water on the surface. Aeration lines cover the bed floor and supply air bubbles to the gravel that maintain aerobic conditions for the bacteria. The treatment bed is lined with an impermeable, synthetic liner.

The treatment process depends on a resident, attached, bacterial population for treatment. Influent organic loading into the AGB (measured as lbs/day of BOD) is automatically controlled and matched to the aeration and nutrient dosing levels. This creates a stable treatment environment and supports optimum removal of organics (glycols) from the influent. At the end of the deicing season, when the deicer, oxygen, and/or nutrients are shutoff, the bacterial activity declines, however aeration of the bed continues for a period to support digestion of accumulated bacterial solids. After a period of dormancy during summer months, the AGB system is normally ramped up to full capacity in two to four weeks after introduction of flows containing deicer. Due to the readily degradable nature of deicing chemicals, the retained presence of some bacteria in the cells, and the configuration of the system, annual re-seeding with bacteria is not necessary to support seasonal start up.

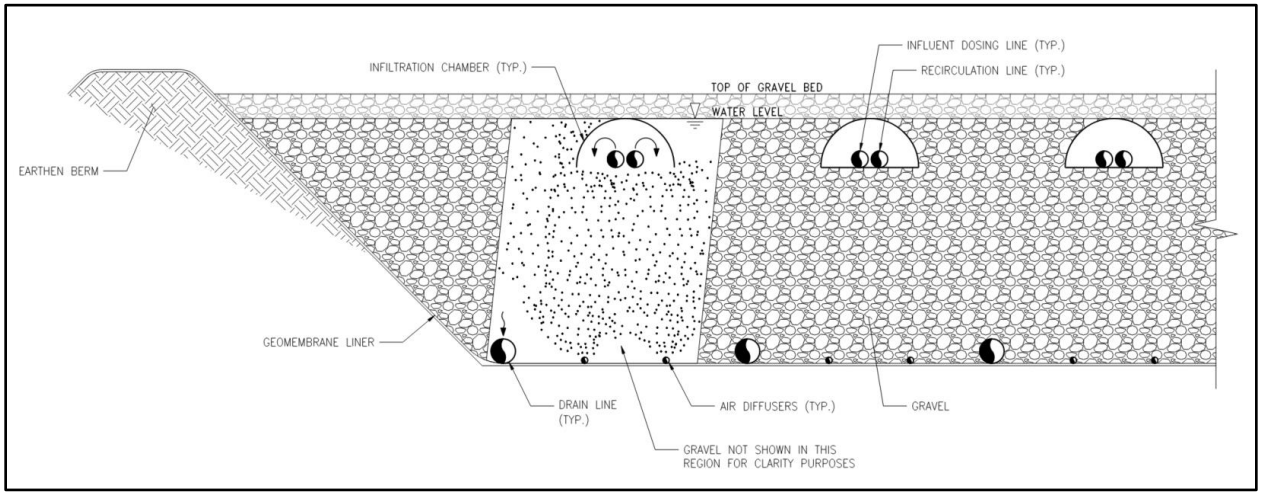


Figure 13: Typical Cross Section of AGB Cell

6.5.4 Technology Selection Basis for SEA

The AGB system is a demonstrated biological treatment technology that was initially applied to deicer treatment in the 2000s based on pilot studies. The AGB has been the focus of research by the aviation industry as part of the Airport Cooperative Research Program under the National Academies Transportation Research Board. The technology has been applied at full scale for deicer treatment at numerous airports, including Buffalo, NY (BUF); Long Island, NY (ISP); Wilmington, OH (ILN); Edmonton, Alberta, Canada (YEG); Calgary, Alberta, Canada (YYC); and a confidential airport. Each system design was tailored for site-specific influent characteristics to meet applicable permit limitations The existing installations have demonstrated the ability of this technology to achieve BOD reductions consistent with that required for SEA. Please refer to **Attachment E** for additional background information on this technology, including information from select existing installations. Using sound engineering judgement based on established aerobic, attached growth treatment processes and evidence from existing installations, the AGB system, when implemented in conjunction with the associated existing and proposed flow routing, storage, discharge, monitoring, and controls infrastructure described in this report, is capable of meeting the applicable permit limits described in **Section 3.3**.

Following the evaluation of various treatment technology alternatives, the AGB was selected for application at the SEA IWTP based on the following:

- Relatively straight-forward operation, including automatic operation of pumps and manual operation of blowers;
- Aerated, attached growth bacteria are suitable for achieving biological treatment during cold temperatures;
- Ability to achieve low propylene glycol and BOD effluent concentrations;
- Consistent and predictable performance over a wide range of influent concentrations, if loading into the treatment system is controlled;
- Low height profile compatible with FAA requirements for RPZ; and
- No open water surfaces, compatible with FAA Advisory Circular guidance to limit attraction of wildlife that is hazardous to aircraft.

6.5.5 AGB Process Design Basis

Industrial wastewater flow rates and BOD concentrations collected into the IWS are highly variable, and extensive modeling was conducted to support the sizing of storage and AGB treatment capacities. A treatment system with capacity of 10,000 lbs-BOD/day treatment was sized through balancing of onsite treatment capacity, sanitary sewer BOD discharge load capacity, and storage capacity. This BOD mass loading rate is the primary design basis for the AGB, and accommodates a large range of influent BOD concentrations that will require treatment prior to discharge from SEA.

The AGB system provides treatment for cold industrial wastewater runoff that contains deicing chemicals, including propylene glycol from aircraft deicers as well as potassium acetate and formate products from pavement deicers. The industrial wastewater runoff and deicing chemicals from the IWS are deficient in the macro- and micro-nutrients needed for bacterial growth in treatment systems. Supplemental addition of nutrients containing nitrogen and phosphorus is necessary to support the bacterial degradation of the deicers.

The AGB performance will vary over the treatment period as conditions change from day-to-day and month-to-month. Normally, removal of propylene glycol is 100% as it is readily transformed to bacterial biomass. The BOD load removed by the AGBs is expected to range from 85 to 95% of the influent loading. The bacterial population will constantly be in various stage of growth, maintenance, and dying off. Most of the dead bacteria are digested in the AGB. Undigested or partially digested bacteria will be measured as TSS and BOD in the treated effluent. Most of the BOD content in the effluent is expected to be from bacteria and their degradation byproducts and not from deicers. During periods of extensive aerobic digestion, such as the end of the deicing season, there may be isolated periods with elevated TSS concentrations.

The capacity and effectiveness of the AGB system is largely linked to the capacity of the aeration system in terms of lbs-oxygen/day transferred from air bubbles to the water in the AGB. The aeration system includes positive displacement blowers that supply air to the cells via air transfer lines (see Sheets C12 and C13). Once in the cells, air flows through laterals with slits that create

coarse bubbles in the cells. The pipe diameter is sized to minimize air velocity and related friction losses. The aeration system is sized to match the treatment capacity loading of 10,000 lb-BOD/day while providing uniform distribution of the air through each cell. This supports a wide range of concentrations but limits the treatment flow rate to maintain a constant design loading rate to the extent possible.

Table 21 illustrates flow rates required to achieve the design loading rate for a range of concentrations. Low concentrations can be treated at a high flow rate, but, to meet the constant loading rate, high concentrations require lower flow rates. For this reason, there are practical flow feeding limits to treatment of higher concentrations. At lower concentrations, the ability to meet the constant loading rate will be limited by the design flow capacity of the pump stations feeding the AGB system (see **Section 7.6**). The flows, concentrations, and loading rates in **Table 21** are provided for reference only and represent optimal operational conditions. There may be operational circumstances periodically that require a reduced loading rate due to AGB system performance.

Table 21 – Range of Influent Flows and BOD Concentrations to Achieve Design Loading

Design Loading Rate (Concentration x Flow) (lbs BOD/day)	Concentration (mg-BOD/L)	Flow (MGD)
10,000	217	5.53[1]
10,000	500	2.40
10,000	1,000	1.20
10,000	1,500	0.80
10,000	2,000	0.60
10,000	3,000	0.40
10,000	4,000	0.30
10,000	5,000	0.24
10,000	6,000	0.20
10,000	7,000	0.17
10,000	8,000	0.15
10,000	9,000	0.13
10,000	10,000	0.12

Notes:

1. At low concentrations, the flow rate through the AGB system is limited by the design flow capacity of the pump stations feeding the AGB system. As described in Section 7.6, this maximum design flow rate is 3,840 gpm, or 5.53 MGD.

The preliminary design of the AGB treatment system is based on the following assumptions:

- The system will be designed by professional engineers familiar with the process design;
- The system will be constructed per contract documents (plans and specifications);
- The system will be operated per an operation and maintenance manual to be prepared for the IWTP system inclusive of the proposed expansion components;

- The system is diligently monitored and controlled by qualified operations staff;
- No toxic or other inhibitory compounds are introduced to the AGB that would impact the growth of bacteria;
- Plastics and other debris are removed upstream of the AGB;
- Free floating fuels are removed upstream of the AGB; and
- AGB loading is maintained at or below 10,000 lb-BOD/day.

Treated effluent BOD concentrations will vary based on a number of factors, including:

- Influent BOD loading changes
- Influent BOD concentrations
- Air supply into the cells and distribution of air transferred into the water over the volume of the gravel bed
- Temperatures
- Whether system is in a startup period, steady state period, or shutdown period
- Whether AGB cells are operating in parallel or series mode (refer to **Section 6.5.5.1**)

Assuming that sufficient air and nutrients are provided per the design basis, effluent propylene glycol concentrations are expected to range between non-detect and 10 mg/L, with effluent BOD_5 concentrations generally ranging from 5 to 100 mg/L. Treated effluent TSS concentrations are generally expected to range between 5 and 50 mg/L, with potential spikes encountered during periods of bacterial sloughing after shutdowns when influent flows have stopped for long periods (typically end of season). Concentrations outside of these ranges may be encountered depending upon the combination of conditions encountered as well as system operational protocols in use and operator decisions. The DAF system may be used to reduce TSS in these instances, but sludge typical of a municipal wastewater treatment process is not produced by an AGB.

The proposed AGB system is illustrated on Sheets C6, C12, C13, and M6.

6.5.5.1 Parallel and Series Modes

The AGB system is typically run in “parallel” mode, which means that all active cells are being fed simultaneously from the dosing structure and all cells discharge directly to the AGB effluent pump station. Each cell functions as a primary treatment unit. Under certain conditions it may be advantageous to run the AGBs in “series” mode, which means that the cells are operated in treatment pairs. In series mode, up to three cells (e.g., Cells 1, 3, and 5) are fed from the dosing structure and their effluent is routed to one of the other three cells (e.g., Cells 2, 4, and 6) for additional treatment before being routed to the AGB effluent pump station. For example, Cell 1 acts as primary treatment and discharges to Cell 2 for secondary treatment, which helps further reduce BOD concentrations in the treated effluent. Flow routing within the AGB system is illustrated separately for parallel mode in Sheet M8 and for series mode in Sheet M9.

6.5.6 AGB Process Configuration and Components

The AGB include the following subsystems:

- Influent Dosing
- Treatment Cells
- Drain Lines
- Recirculation System
- Aeration System
- Nutrient Dosing System

Each of the subsystems is individually designed with information that stems from the governing design basis. A summary of design information is provided in **Table 22**.

Photos of the subsystems are provided in **Figures 14-17**.



Figure 14: Influent Dosing Lines and Infiltration Chambers During Construction



Figure 15: Drain Lines and Air Diffusers During Construction



Figure 16: Recirculation Lines and Sumps During Construction



Figure 17: Aeration Blowers

Table 22 – AGB Design Summary

Characteristic	Value
Treatment Cells	
Number of Cells	6
Total AGB Area	144,000 ft^2 (24,000 ft^2 per cell)
Max Mass Loading Rate – Total, All Cells	10,000 lbs-BOD/day
Max. Mass Loading Rate Per Unit Volume	0.015 lbs-BOD/ft^3-day
Total Peak Flow Capacity (All Cells)	5.5 MGD
Peak Flow Capacity Per Cell	0.9 MGD
Max. Flux Rate (Peak Flow Per Unit Area)	38.4 gal/ft^2-day (Flow rate varies with concentration)
Min. Residence Time Per Cell	8.0 hr (Flow rate varies with concentration)
Influent Dosing Structure	
Number of Dosing Pumps	6
Dosing Pump Power	7.5 hp
Dosing Pump Maximum Flow Rate	533 gpm
Dosing Lateral Diameter	4”
AGB Cell Internal Drain Line	
Drain Pipe Diameter	6”
AGB In-Cell Recirculation System	
Recirculation Pipe Diameter	4”
Number of Recirculation Pumps	6
Recirculation Pump Power	2 hp
AGB Aeration System	
System Type	Coarse bubble system with positive displacement blowers
Number of Blowers	4
Blower Motor Power	250 hp
Blower Airflow	20,000 SCFM
Oxygen Transfer Efficiency	10%
Oxygen Requirement Rate	1.5 lbs-O_2/lb-BOD at average temperature of 50°F
Nutrient Dosing System	
Chemicals Added	Liquid Urea Ammonium Nitrate (UAN 32%) Liquid Ammonium Phosphate
Nutrient Storage Tank Volume	5,500 gal
Number of Pumps	2
Pump Flowrate	Variable (0 – 7.6 gph)
Pump Motor Power	< 1 hp
Typical Dosing Ratio (BOD:Nitrogen:Phosphorus)	100:10:1

The primary design criteria used for sizing the AGB are the total BOD mass loading rate and the mass loading rate per cell volume. These parameters are used to establish the maximum treatment capacity that will meet minimum performance requirements without resulting in excessive bacterial growth. The selected maximum values are based on values applied in similar AGB installations that have achieved low effluent TSS values, while minimizing the need to

remove solids from the effluent and minimizing the risk of cell clogging. Each AGB cell has more available BOD load reduction capacity, but the load rates are intentionally limited to avoid excessive growth. As a result, the maximum mass loading rate is the limiting factor in performance, not the hydraulic capacity, residence time, nutrient loading rates or oxygen supply.

Other parameters summarized in **Table 22** have been provided in response to a request from KCIW, although they are not necessarily indicative of minimum design or performance criteria for the AGB. For example, flow rates through the system are variable with concentration to meet the design mass loading rate, and peak flow capacity will only be experienced under infrequent conditions at the low end of the anticipated BOD concentration range (see **Table 21**). The values in the table were calculated based on current design assumptions that are consistent with the design basis.

6.6 DAF System Modifications

6.6.1 Drivers for DAF Modifications

The existing IWTP has utilized DAF units for many years to remove solids, metals, and fuel prior to discharge of treated water to the sanitary sewer or surface water. While removal of these pollutants will continue to be needed in the expanded IWTP, it is necessary to increase DAF capacity, improve DAF removal efficiency, and replace aging DAF equipment. As a result, the six existing DAF units will be removed and replaced with six new DAF units.

6.6.2 DAF Technology Overview

Influent to the proposed IWTP DAF system will continue to be segregated as either high or low BOD. Low BOD wastewater will continue to be pumped from Lagoon 3 to the headbox outside the IWTP Treatment Building from which it will flow by gravity into the low BOD treatment header. Typically, high BOD wastewater will continue to flow by gravity from Lagoons 1 or 2. In abnormal conditions, the proposed Lagoon 4 Discharge Pump Station will also be able to route flows into the headbox outside the IWTP Treatment Building to allow high BOD wastewater into the high BOD header. The DAF treatment process will continue to add coagulation chemicals (normally aluminum sulfate or “alum”) to the influent wastewater in a flash mix tank with motorized mixer, gently mixing the chemicals in a flocculation tank to coagulate particulates and oil droplets, and removing the resultant floc and other oil particles in a DAF tank (**Figure 18**). Waste streams of high and low BOD will continue to be able to be processed simultaneously.

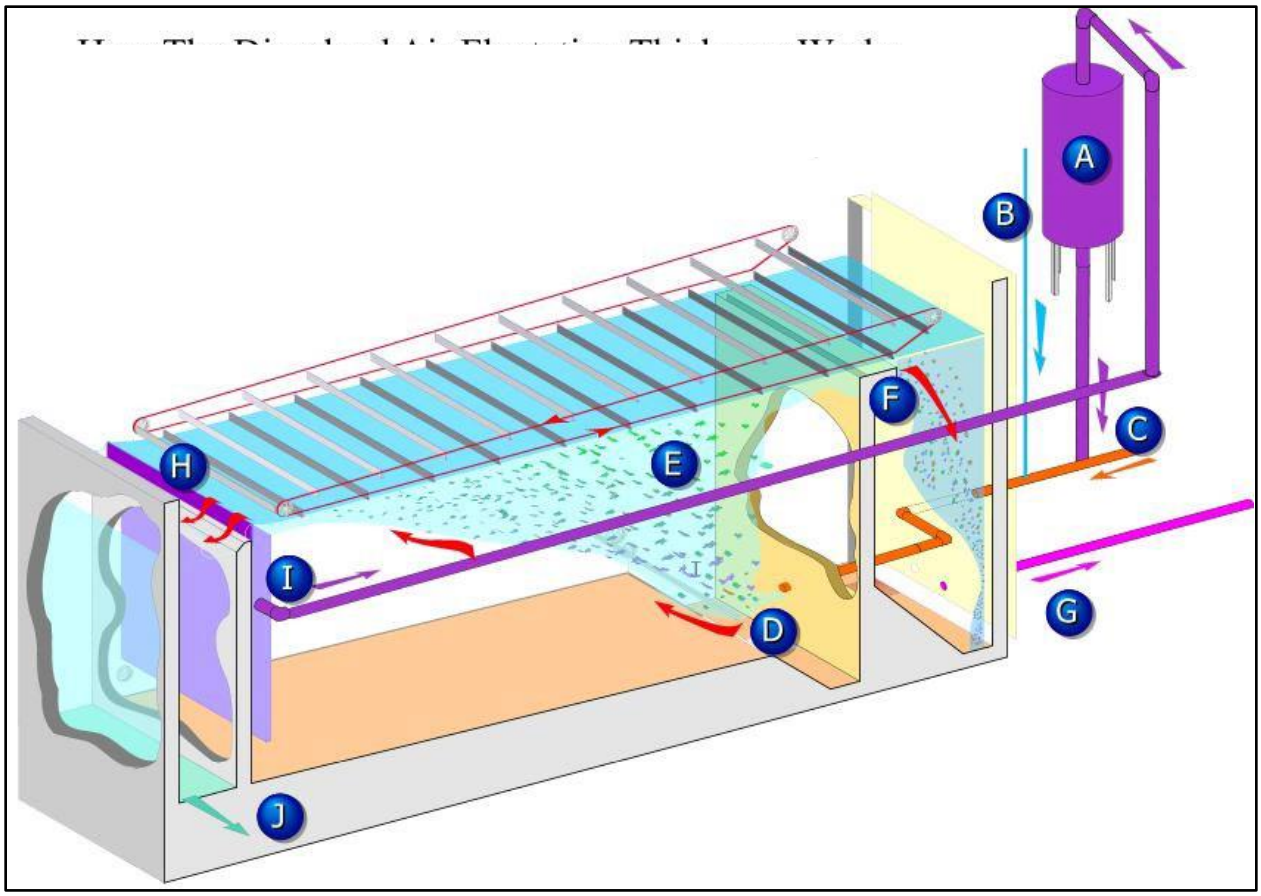


Figure 18: DAF Components and Functionality (source: IWTP O&M Manual, 2019)

Key to Figure:

A. Recycled liquid is combined with compressed air in a pressurized retention tank. The pressurized stream will be released into the DAF tank.
B. To aid in the floatation process, a chemical coagulant such as Aluminum Sulfate, is added to the influent flow stream.
C. The chemical coagulant and incoming flow are mixed in a rapid mix chamber and flocculation tank (not shown) for approximately 10 minutes prior to combining with the pressurized air.
D. As the solution of pressurized air, influent flow, and chemical coagulant is released in the DAF, the decrease in pressure causes the air to come out of solution in the form of tiny air bubbles.
E. The air bubbles attach to the suspended solids and oily matter causing them to float to the surface of the tank. A continuous supply of air bubbles produces a compacting effect.
F. The concentrated solids are skimmed from the surface of the tank and discharged at the north end of the tank into a trough running the length of the building.

G. The thickened solids drain by gravity to a small sump and pump station located outside of the east end of the Treatment Building.
H. Remaining liquid exits the tank over a weir located at the south end of the tank and flows by gravity to the plant effluent.
I. A portion of the effluent is returned to the air retention tank where it is mixed with pressurized air.
J. The remaining effluent flows by gravity and is combined with the plant effluent pipes.

There are a total of six DAFs units proposed to replace the six existing DAF units. The proposed DAF process dissolves air into the wastewater using compressed air. All six DAF units use compressed air where a portion of the DAF effluent wastewater is recirculated through an air dissolution tank. When the recirculated portion from the dissolved air tanks is mixed into the influent, very fine air bubbles are released and attach to the coagulated chemicals and other particles. These constituents float to the top of the tank with the air bubbles and form a “float” on top of the tank. A rake mechanism moves the float to the north end of the DAF. The float is scraped up a scum beach and discharged into a trough that runs the length of the building. The proposed DAF units will also feature a screw pump to discharge settled solids through an outlet connected to the solids trough. This trough leads to a small sump and pump station located outside of the east end of the Treatment Building discussed in **Section 6.7**. The DAF effluent flows by gravity to either the high BOD or low BOD wet wells in the Pump Station.

6.6.3 DAF Technology Selection Basis for SEA

DAF technology will continue to provide the existing treatment functions, based on demonstrated performance at the IWTP, as the future influent characteristics are not expected to change substantially from existing conditions. The modifications are proposed to increase DAF capacity, improve DAF removal efficiency, and replace aging DAF equipment.

6.6.4 DAF Process Design Basis

The NPDES permitted discharge of low BOD flows from the IWTP to Puget Sound is 3,200 gpm. The IWD permitted discharge of high BOD flows from the IWTP to sanitary sewer has recently increased to 2,778 gpm. Three units are currently used to treat low BOD discharges to Puget Sound, with a combined flow rate (3,075 gpm), which is less than the MSD flow limit for discharges to Puget Sound (3,200 gpm, see **Section 2.5.4**). To target the combined total flow capacity of 5,978 gpm (sum of MSD flow limit to Puget Sound and IWD Permit flow limit to sanitary sewer), six DAF units with equally sized capacity using compressed air are proposed, each with maximum per-unit throughput of 1,067 gpm. The sizing approach allows for the Port the following benefits:

- Maximizes the Puget Sound low BOD discharge permitted flow capacity with three units (3,200 gpm)
- Provides flexibility to achieve potential future flow increases in permitted IWD discharges
- Provides redundancy of equipment to allow any of the DAF units to be used for either discharge location

- Provides ease of maintenance due to interchangeability of parts

6.6.5 DAF Process Configuration and Components

The proposed modifications to the DAF system (see Sheets M2 and M3) maintain the same general configuration, with upsized DAF units of equal capacity for all six units. The existing size of the flash mix tanks and flocculation tanks for DAF units #2, 3, 4, and 5 are appropriate for the proposed DAF units (see **Figure 19**). Flash mix tanks and flocculation tanks for DAF units #1 and 6 must be replaced with larger sizes, equivalent to units #2, 3, 4 and 5. **Table 23** summarizes the design basis details for the proposed DAF process components.



Figure 19: Existing Flash Mix Tank and Flocculation Tank

Table 23 – DAF Modifications Design Summary

Characteristic	Value
Flash Mix Tank	
Number of Tanks	2
Tank Material	Steel (3/16”) with coating
Capacity	1,000 gallons
Dimensions (Diameter x Height)	5’-3” x 6’-5”
Flocculation Tank	
Number of Tanks	2
Tank Material	Steel (3/16”) with coating
Capacity	6,600 gallons
Dimensions (Diameter x Height)	13’ x 6’9”
DAF Unit	
Number of DAFs	6
Design Flow Rate	1,067 gpm
Surface Area	300 sf
Dimensions (Length x Width x Height)	34’-5’’ x 13’ x 11’-7’’
Power Requirement (max)	30 HP

6.7 DAF Solids Handling Process Modifications

6.7.1 Drivers for Solids Handling Modifications

The existing infrastructure for DAF solids handling is inefficient for three primary reasons. First, when new solids are pumped into the decant tanks, the solids already settled within the tanks tends to get resuspended in the water. Second, the manual selection of the outlet pipes is imprecise, based on operator’s observations of the decant quality. Third, the decanting capacity does not allow for more than one DAF unit to be emptied for maintenance simultaneously.

6.7.2 DAF Solids Handling Process Technology Overview

Proposed modifications to the solids handling system are illustrated on Sheets M4 and M5. Solids removed from the proposed DAF units will continue to be discharged to the existing sump and pump station located outside of the east end of the existing Treatment Building. The sump contents will be pumped into a proposed gravity thickener (**Figure 20**) to facilitate sedimentation of the solids like a clarifier. The sludge will enter the center of the thickener through an influent pipe. Once the influent sludge is evenly distributed throughout the tank, solids will settle via gravity to the bottom of the tank. The supernatant water separated from the sludge will flow up over the weir and flow by gravity back to the existing pipe connections to Lagoon 3 in the sump pit. There will be a slow-moving scraper that pushes the sludge to a hopper located at the bottom of the tank. The thickened sludge will be pumped from the hopper to a separate tank for temporary

storage. The sludge can then be collected and transported to a permitted disposal facility. Collected oil will be periodically pumped and hauled offsite for recycling.

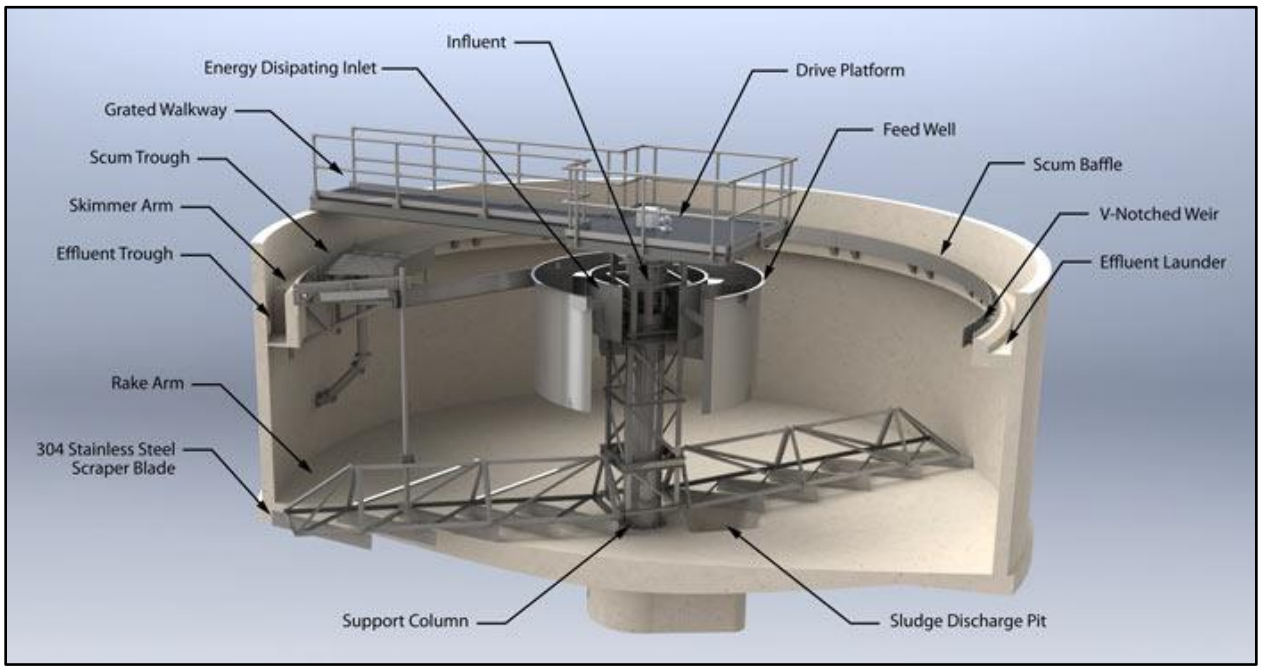


Figure 20: Typical Cross Section of a Gravity Thickener (source: Monroe Environmental)

6.7.3 DAF Solids Handling Process Technology Selection Basis for SEA

The gravity thickener was selected for DAF solids handling because the technology facilitates solids loading, decanting and settling with the same unit at the same time. The system design allows constant loading while minimizing the disturbance of the solids settled at the bottom. A separate solids storage tank was selected for temporary collection of solids from the sludge discharge pit to minimize accumulation on the floor of the gravity thickener. This avoids excessive solids build up which can compact over time and become an impediment to the sludge scraper blade.

6.7.4 DAF Solids Handling Process Design Basis

The gravity thickener is sized for a hydraulic loading rate of 100 gpd/sf at a maximum 1.5% solids concentration. The solids concentration is assumed to be similar to municipal waste activated sludge which is difficult to settle and therefore represents a relatively conservative design basis. The design flow is based on effluent from the DAF units under the conservative condition when up to two DAF units are being decanted in one day or approximately 32 gpm. Under typical conditions the flow rate will be much lower (~10% of design flow). Based on the design flow, the required surface area is 460 sf which results in a nominal diameter of 25 ft. Existing sludge characterization regarding TSS concentration, settling properties, etc. are pending confirmation; therefore, the gravity thickener size shall be confirmed during detailed design.

6.7.5 DAF Solids Handling Process Configuration and Components

The proposed solids handling entails demolition of the existing decant tanks and replacement with one gravity thickener unit and a solids storage tank. These components will be connected with piping to each other and to the existing sludge sump and pump station as shown on Sheet M5 in **Attachment A**.

Table 24 summarizes the design basis details for the proposed solids handling components.

Table 24 – Solids Handling Modifications Design Summary

Characteristic	Value
Gravity Thickener	
Number of Units	1
Tank Material	Concrete
Settling Area	460 sf
Hydraulic Loading Rate	100 gpd/sf
Solids Loading Rate	3 - 20 lb/day
Design Flow Rate	32 gpm (46,000 gpd, volume of 2 DAF units)
Overflow Rate of Thickened Sludge	450 - 500 gpm
Influent Solids Concentration (max)	1.5%
Desired Solids Concentration	2.0%
Dimensions (Diameter x Height)	25’ x 12’
Scraper Power	1 HP
Sludge Pump Power	5 HP
Underflow Pumps Rate	50 gpm
Solids Storage Tank	
Number of Tanks	1
Tank Material	High Density Polyethylene
Capacity	10,000 gal
Dimensions (Diameter x Height)	12’ x 14’

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7. Proposed Flow Routing

7.1 Introduction

Modifications are necessary to existing IWS & IWTP flow routing operations to integrate existing and proposed storage, treatment, and discharge infrastructure. This section summarizes proposed changes to system flow routing infrastructure, as well as how these flow routes are recommended to be applied under normal and adaptive operational modes.

The following Drawing Sheets in **Attachment A** are relevant to this section:

- C5 – C8: Proposed Site Plans
- C11 – C17: IWS Piping Plans
- M7 – M9: Process and Instrumentation Diagrams

7.2 Compliance with Port Conveyance Design Standards

The conveyance infrastructure in this design concept is intended to comply with Port requirements for IWS infrastructure defined in *Civil Systems Standards*[4], as appropriate and feasible. The standards include requirements for pipe material, minimum diameter, minimum depth of cover, trench construction, fittings, valves, and slide gates. Pipe and utility clearance requirements will be met wherever possible, but there are numerous locations at the AGB and Lagoon 3 sites where the required minimum 10-foot horizontal clearance between IWS pipes is infeasible due to space constraints and the number of pipes needed within a narrow corridor. In these areas, the pipes will be spaced sufficiently for construction.

7.3 Overview of Proposed Flow Routing Modifications

Under existing conditions, flow in the IWS trunk line is segregated to either high BOD storage (Lagoons 1 and 2) at the IWTP site or low BOD storage at the Lagoon 3 site. From there all flows from the lagoons are routed to the IWTP site for treatment at the DAF system and subsequent discharge to Puget Sound or sanitary sewer based on BOD concentration. The existing flow routing scheme is described further in **Section 2** as well as illustrated on the IWTP Block Diagram included as **Figure 20**.

[4] Port of Seattle Facilities and Infrastructure, *Civil Systems Standards*, 2020.

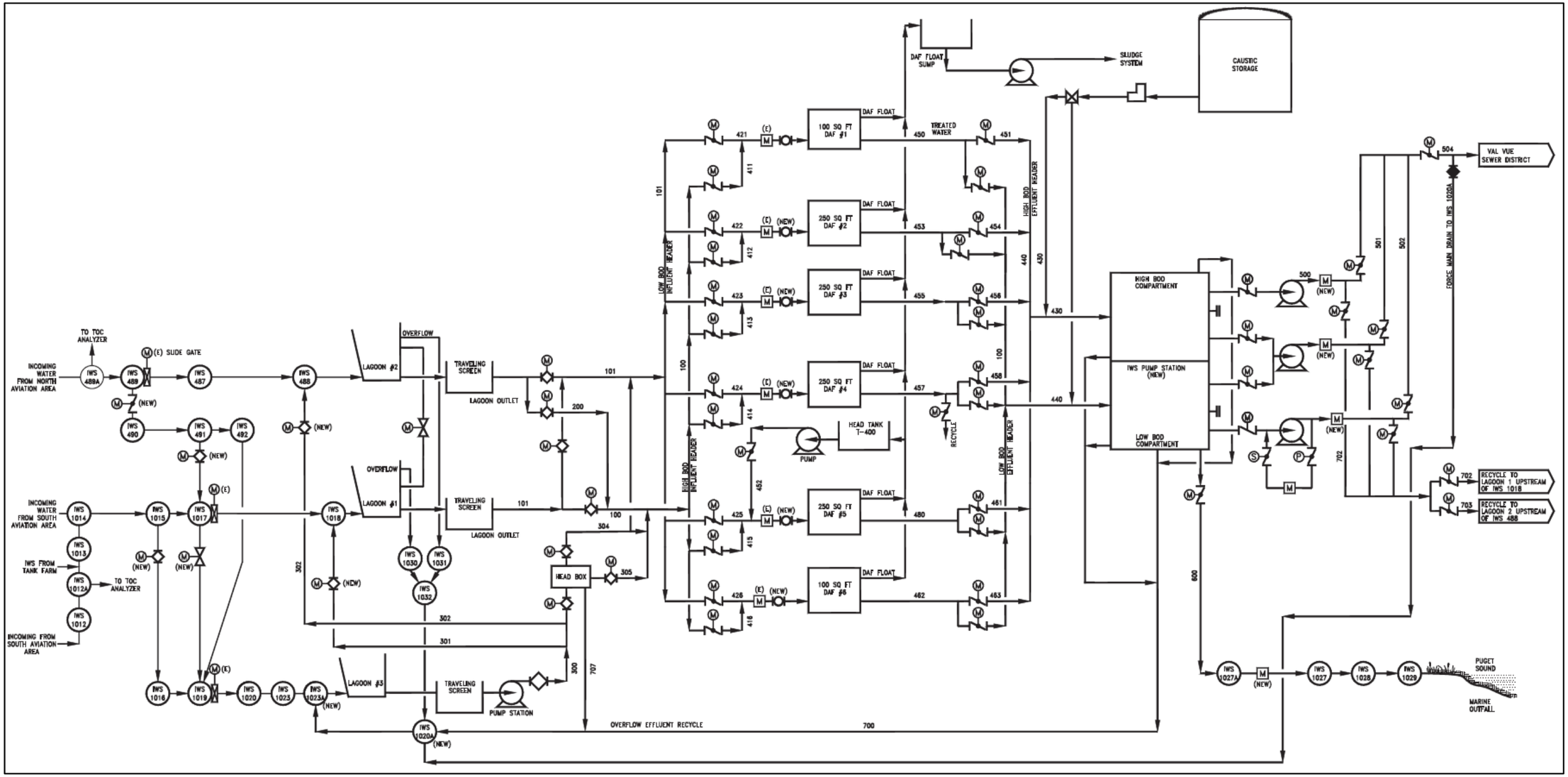


Figure 21: Existing IWTP Flow Routing Block Diagram (STIA-0312 Record Drawing P1)

The proposed flow routing scheme is illustrated on the overall P&IDs included as Sheets M7 through M9 in **Attachment A**. As shown on the P&IDs, the following new flow routing functions are proposed to be established with the IWTP Expansion:

- Flow segregation changes to incorporate new diversion point at Lagoons 3 and 4
- Lagoon 4 high BOD flow routing to AGB for treatment
- AGB effluent routing for discharges to Puget Sound or sanitary sewer
- High BOD flow routing from AGB Tank and Lagoon 4 to sanitary sewer (AGB direct discharge)

The following existing major flow routes will remain functional, although control mechanisms and flow prioritization will be adjusted to accommodate the new flow routing functions:

- Existing high BOD flow segregation from IWS trunk lines to Lagoons 1 and 2
- Existing high BOD flow routing from Lagoons 1 and 2 to DAF and sanitary sewer
- Existing low BOD flow routing from Lagoon 3 to DAF and Puget Sound

The subsections below describe new and modified flow routing schemes within the IWTP, as well as infrastructure that is proposed to accomplish these functions. **Figure 22** below provides a key for how the flow routing schemes in the subsections below relate to one another. **Section 8** also describes flow routing schemes that will be employed under normal operating conditions as well as less frequent adaptive operating conditions.

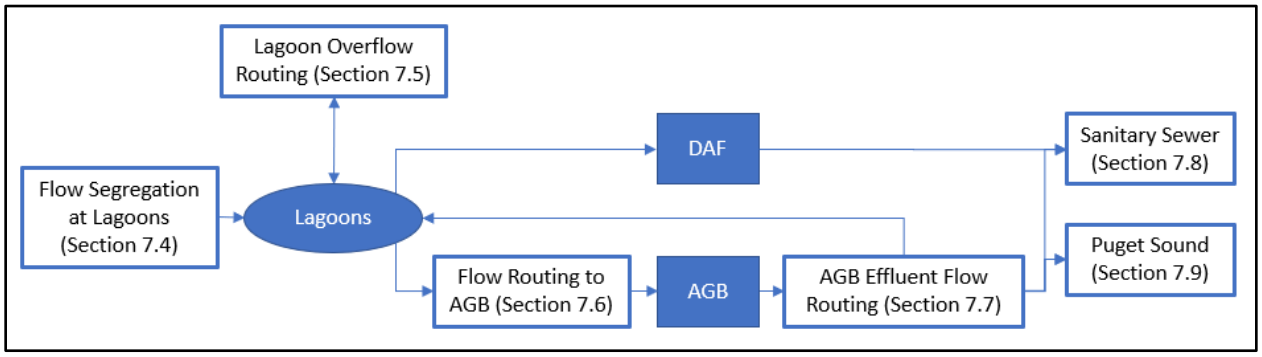


Figure 22: Overview of Proposed IWTP Flow Routing Schemes

7.4 Flow Segregation at Lagoons

In the expanded IWTP, a new primary flow segregation process will be located just upstream of Lagoons 3 and 4. It will consist of a sample pump system in the IWS trunk line, TOC monitor to provide data to evaluate if flow is above or below the low/high BOD threshold, and a diversion structure with motorized slide gates that will actuate to direct flow to Lagoon 3 or Lagoon 4 based on concentration. All low BOD flow is to be routed to Lagoon 3, unless Lagoon 3 has reached capacity. All high BOD flow to be treated in the AGB will be routed to Lagoon 4 and on to the AGB Tank. The diversion threshold is assumed to be at or just below the current NPDES limits for BOD_5.

Table 25 summarizes proposed infrastructure for flow segregation at Lagoons 3 and 4.

Table 25 – Proposed Infrastructure for Flow Segregation at Lagoons 3 and 4

Infrastructure	Description
Diversion Structure	• Subsurface concrete structure north of Lagoon 4 • Two motorized slide gates controlling release of trunk line flows to Lagoon 3 or Lagoon 4 gravity influent pipes
TOC Monitoring Shelter	• IWS trunk line sample pump system • New TOC monitoring shelter adjacent to diversion structure • Single TOC monitor calibrated to low BOD range
Lagoon 3 and 4 Influent Pipes	• New gravity influent lines from diversion structure to Lagoon 3 (60-inch pipe) and Lagoon 4 (42-inch pipe) influent structures

The existing flow segregation points at Lagoons 1 and 2 will remain functional, but will be used only when operators decide to use Lagoons 1 and 2 for the following functions:

- **Direct discharges to the sanitary sewer without treatment at the AGB**: Lagoons 1 and 2 will be used as the feed source for high BOD industrial wastewater to be routed directly to the sanitary sewer (after passing through the DAF system). In this scenario, high BOD flow will be routed direct from the NSB and SSB to Lagoons 1 and 2.
- **Spill control or containment**: Lagoons 1 and 2 will maintain their existing spill control functions that are described in **Section 2**.
- **Secondary high BOD storage capacity**: Lagoons 1 and 2 may be used for high BOD storage if Lagoon 4 is full.
- **Secondary low BOD storage capacity**: Lagoons 1 and 2 may be used for low BOD storage if Lagoon 3 is full.

7.5 Lagoon Overflow Routing

In the event that Lagoon 1 and/or 2 exceeds capacity, the overflow currently drains to an existing gravity pipe that drains to the IWS trunk line upstream of Lagoon 3. This same pipe also receives any overflows that occur at the IWTP influent head box or the IWS Pump Station. These existing overflow functions will be maintained under proposed conditions, but the downstream end of the overflow pipe north of Lagoon 4 will be realigned to tie directly into the proposed diversion structure instead of IWS 1023A. All overflows draining to the diversion structure will be monitored for TOC and segregated to Lagoon 3 or 4 based on concentration.

In the event that Lagoon 3 or 4 fills up, the new emergency spillway across the dividing berm will allow either lagoon to overflow to the other. The new dividing berm emergency spillway elevation will be set one foot below the existing emergency spillway elevation on the east berm, to make use of all available storage capacity before the water level rises to the level where an overflow to

surface water would occur. Additionally, the Lagoon 3 and 4 Connector Pipe will be installed across the dividing berm between the two lagoons, with a valve that can be opened to allow flow to be routed between lagoons before the water level rises to the level of the emergency spillway at the dividing berm. Existing Lagoon 3 overflow infrastructure will remain, and will continue to be used for both lagoons, including the existing 20-inch emergency drain pipe, and the existing emergency spillway to surface water.

Table 26 summarizes proposed infrastructure for IWTP overflow flow routing.

Table 26 – Proposed Infrastructure for Lagoon Overflows

Infrastructure	Description
Realigned IWTP Overflow Pipe	Relocate downstream portion of 24” gravity overflow pipe to tie into Diversion Structure
Lagoon 3 & 4 Connector Pipe	New approximately 24” pipe connecting Lagoon 3 and 4 to allow shared capacity, overflow, or alternate flow routing

7.6 Flow Routing to the AGB

The preferred means for managing high BOD industrial wastewater in the expanded IWTP is treatment at the AGB system with discharge of treated effluent to Puget Sound. High BOD flow in the IWS trunk line will primarily be segregated to Lagoon 4 and then pumped by the new Lagoon 4 Discharge Pump Station through a force main running along the south side of S. 188th Street to the AGB Tank. Lagoons 1 and 2 will not be able to discharge to the AGB Tank except via overflow to Lagoon 4 (see **Section 7.5**) (the primary flow destination for Lagoons 1 and 2 is the sanitary sewer).

In between the Lagoon 3 site and AGB site, the Lagoon 4 Force Main leaves Port property. Coordination is necessary with the City of SeaTac during the detailed design phase to determine if the force main can be constructed within the right-of-way of S. 188th Street If that is infeasible, it may be possible to pursue an easement to cross private property south of the right-of-way.

The portion of the Lagoon 4 Force Main that crosses 16th Ave S (approximately 300 ft) is recommended to be constructed using trenchless methods to reduce potential construction impacts. Feasible trenchless methods may include microtunneling or jack-and-bore, but final determination should be made based on the results of a geotechnical investigation.

The AGB Tank will store flow until it can be pumped by the AGB Tank Pump Station to the Dosing Structure and from there into the AGB system. As noted in **Section 7.6**, the AGB system is designed for a constant BOD loading rate, and flow rates into the system are varied to maintain a constant loading based on variable concentrations entering the Dosing Structure. The AGB system was designed for a maximum flow rate of 3,840 gpm, which is 20% higher than the flow limit for discharges to Puget Sound (3,200 gpm). This maximum flow rate was selected to provide flexibility for flows to exceed the discharge limit if needed to achieve the design loading rate at very low concentrations (as described in **Section 6.5.5**).

Table 27 summarizes proposed infrastructure for flow routing to the AGB.

Table 27 – Proposed Infrastructure for Flow Routing to AGB

Infrastructure	Description
Lagoon 4 Discharge Pump Station	• Pump station, valve vault, and flow vault with magmeter • Duplex with duty pump and standby / in-place spare • Duty point: 4,487 gpm @ 98.6' TDH • Variable-frequency drive (VFDs) • 140 hp pump motors • 18" Lagoon 4 Force Main to AGB Tank Influent Valve Vault and optional tie-in to Lagoon 3 Force Main. Trenchless construction for approximately 300 feet across 16th Ave S.
Lagoon 3 Force Main Partial Realignment	• Existing 20" Force Main requires partial realignment northwest of Lagoon 4 to accommodate construction of Lagoon 4 Force Main
AGB Tank Influent Valve Vault	• Subsurface valve vault that controls inflow to AGB Tank • Two 18" plug valves on effluent force main (see AGB Effluent Flow Routing)
AGB Tank Pump Station	• Pump station, valve vault, and flow vault with magmeter • Duplex with duty pump and standby / in-place spare • Duty point: 3,840 gpm @ 31.9' TDH • VFDs • 45 hp pump motors • 18" force main to AGB Dosing Structure

7.7 AGB Effluent Flow Routing

Treated effluent from the AGB system will be conveyed to the new AGB Effluent Pump Station. This pump station was designed to keep up with variable flow rates through the AGB system, assuming variable speed pumps (with VFDs) that are capable of achieving a maximum flow rate of 3,840 gpm (see **Section 7.6** for further info on the basis for this flow rate).

The AGB Effluent Pump Station will route effluent to one of several destinations:

- **Puget Sound:** Treated AGB effluent will typically be routed to Puget Sound when BOD is less than NPDES permit limits, as long as Lagoon 3 is not prioritized to Puget Sound.
    - If TSS concentrations exceed NPDES limits, the AGB effluent should be discharged to Lagoon 2 for routing through the DAF prior to the Puget Sound discharge.
    - Otherwise, it can be discharged directly to the IWS Pump Station low BOD compartment.
- **Sanitary Sewer:** Treated AGB effluent may be routed to the sanitary sewer when Lagoon 3 is prioritized to Puget Sound. It may also be routed to the sanitary sewer if

BOD_5 in the effluent exceeds NPDES permit limits (when not routing flow to the AGB Tank as described below), provided that the load limit to the sanitary sewer has not been exceeded.

  - If metals concentrations exceed IWD Permit limits, the AGB effluent should be discharged to Lagoon 2 for routing through the DAF prior to the sanitary sewer discharge.
  - Otherwise, it can be discharged directly to the IWS Pump Station high BOD compartment.

- **AGB Tank**: The AGB "effluent return" function allows flow to be routed back to the AGB Tank if it is not able to be discharged due to effluent quality issues or restrictions at the Puget Sound or sanitary sewer discharge locations.

The above flow routing functions will be accomplished by operating valves in a series of valve vaults along the AGB Effluent Force Main. The above flow routing functions will be accomplished using valve vaults along the AGB Effluent Force Main. The AGB Tank Influent Valve Vault controls whether flow is returned to the AGB Tank. The AGB Effluent Routing Valve Vault at the IWTP Site controls flow routing to the low or high BOD compartments of the IWS Pump Station or to Lagoon 2 for routing through the DAF.

The portion of the AGB Effluent Force Main that crosses S. 188th Street (approximately 290 ft) is recommended to be constructed using trenchless methods to reduce potential construction impacts. Feasible trenchless methods may include microtunneling or jack-and-bore, but final determination should be made based on the results of a geotechnical investigation.

Table 28 summarizes proposed infrastructure for AGB effluent flow routing.

Table 28 – Proposed Infrastructure for AGB Effluent Flow Routing

Infrastructure	Description
Effluent Gravity System	• Gravity drainage system (pipe diameters 12” to 24”) between AGB cell hydraulic control structures and AGB Effluent Pump Station
AGB Effluent Pump Station	• Pump station, valve vault, and flow vault with magmeter • Duplex systems with duty pump and standby / in-place spare • Duty point: 4,162 gpm @ 72.7’ Total Dynamic Head (TDH) • VFD • 18” force main to AGB Tank, IWS Pump Station (low and high BOD compartments) and existing pipe south of Lagoon 2. Trenchless construction for approximately 300 feet across S. 188th St.
AGB Effluent Force Main Valves	• Two 18” plug valves inside AGB Tank Influent Valve Vault to control whether effluent force main returns to AGB Tank (Effluent Return) or continues on to AGB Effluent Routing Valve Vault at IWTP site.
AGB Effluent Routing Valve Vault	• Subsurface valve vault that directs effluent to one of three destinations • Three 18” plug valves on Effluent Force Main to direct effluent to low BOD compartment at IWS Pump Station for discharge to Puget Sound, high BOD compartment at IWS Pump Station for discharge to sanitary sewer, or to existing 24” force main that returns to Lagoon 2 for routing to IWTP.
AGB Effluent to Lagoon 2 Valve Vault	• Subsurface valve vault that allows flow from the AGB Effluent Force Main to pump into the existing Lagoon 3 Force Main to Lagoon 2 • Two isolation plug valves (18” for Lagoon 4 Force Main and 24” for Lagoon 3 Force Main)

7.8 Discharges to Sanitary Sewer

The AGB Effluent Force Main will be connected to the high BOD compartment of the IWS Pump Station to allow discharge of treated AGB effluent directly to the sanitary sewer. Flows from the DAF system and AGB to the high BOD compartment will need to be staggered to avoid an overflow at the IWS Pump Station using the PLC system and level sensors. Should an overflow occur at the high BOD compartment, flows will be routed through the realigned IWTP overflow pipe (see **Section 7.5**).

Flows from Lagoons 1 and 2 that are routed through the DAF system will normally take priority for discharges to the sanitary sewer. However, AGB effluent may take priority when Lagoon 3 is actively discharging to Puget Sound (see **Section 7.9)**.

Although the stored contents at Lagoon 4 and the AGB Tank will typically be routed to the AGB system, both storage units also have the ability to route flow directly to the DAF system and

sanitary sewer without treatment at the AGB. These flow routes are not typical but are included solely for operational flexibility and may be employed at the operators' discretion. The contents of Lagoon 4 may be pumped by the Lagoon 4 Discharge Pump Station into the existing Lagoon 3 Force Main (when the Lagoon 3 Pump Station is not actively pumping) and conveyed to the DAF and sanitary sewer. The contents of the AGB Tank may be pumped by the AGB Tank Pump Station to the AGB Effluent Pump Station (when it is not actively pumping AGB effluent) and then to Lagoon 2 for routing to the DAF and sanitary sewer. All flow that is not routed to the AGB system will be routed through the DAF system prior to discharge.

Table 29 summarizes proposed infrastructure required for direct discharges to the sanitary sewer from the AGB Tank and Lagoon 4.

Table 29 – Proposed Infrastructure for AGB and Lagoon 4 Direct Discharges to Sanitary

Infrastructure	Description
AGB Direct Discharge Valve Vault	• Subsurface valve vault that directs flow from AGB Tank around AGB to AGB Effluent Pump Station for routing to DAF system • Two 18" plug valves
Lagoons 3 & 4 Force Main Connection Valve Vault	• Subsurface valve vault that allows flow from the Lagoon 4 Force Main to pump into the existing Lagoon 3 Force Main • Two isolation plug valves (18" for Lagoon 4 Force Main and 20" for Lagoon 3 Force Main)

7.9 Discharges to Puget Sound

All discharges to Puget Sound will either be treated by the AGB system or the DAF system. The AGB Effluent Force Main will be connected to the low BOD compartment at the IWS Pump Station to allow discharge of treated AGB effluent to Puget Sound. Discharges of AGB effluent and DAF system effluent to this low BOD compartment will need to be coordinated using level sensors and PLC controls to avoid an overflow. Should an overflow occur at the low BOD compartment, flows will be routed back to Lagoon 3 or 4 through the realigned IWTP overflow pipe (see **Section 7.5**).

When the AGB system is operating, AGB effluent will take priority for discharges to Puget Sound. However, flow from Lagoon 3 through the DAF system can frequently supplement AGB effluent discharges to Puget Sound, as AGB effluent flow rates will typically be less than the outfall flow limit. New variable speed pumps with VFDs are proposed at the Lagoon 3 Pump Station to allow the flow rate from Lagoon 3 to the DAF system to be optimized based on AGB effluent flow rates.

To minimize the risk of an overflow at Lagoon 3, Lagoon 3 can take priority for discharge to Puget Sound when it reaches a defined threshold capacity or water level. In this scenario, AGB effluent would be routed to the sanitary sewer, and Lagoon 3 can maximize discharges to Puget Sound to quickly free up low BOD storage capacity. Lagoon 3 will also take priority when the AGB system is not currently discharging.

Downstream of the IWS Pump Station, the existing gravity outfall pipe to Puget Sound crosses under existing Lagoon 3. The pipe will be realigned along the north and east sides of Lagoon 4 to minimize potential construction conflicts. The realignment will be designed to maintain the existing flow capacity of the outfall pipe. The portion of the realignment along the east side of Lagoons 3 and 4 is proposed to be constructed using trenchless methods to reduce potential construction impacts to the permitted dam and wetlands east of the lagoons.

Table 30 summarizes new infrastructure that is proposed to be implemented to accomplish flow routing to the AGB.

Table 30 – Proposed Infrastructure for Discharges to Puget Sound

Infrastructure	Description
New VFD at Lagoon 3 Pump Station	• Replace pumps at Lagoon 3 Pump Station with variable speed pumps with VFDs to allow discharges from Lagoon 3 to DAF system and Puget Sound to be optimized based on AGB effluent flow rates, as well as minimize frequency of overflows at the IWTP influent head box.
Realigned Puget Sound Outfall Pipe	• 24” gravity outfall pipe, with trenchless construction for approximately 650 ft along east berm of Lagoon 3 and 4

8. Operational Modes for Expanded IWTP

8.1 Introduction

This section provides an overview of conditions and considerations associated with typical and less frequent operating modes for the expanded IWTP. Operation of the expanded IWTP facility will be governed by more detailed Standard Operating Procedures (SOPs) to be developed as part of an updated IWTP Operations and Maintenance Manual. The following general operational modes are expected:

- Normal Operational Mode
- Adaptive Management Operational Mode
- Emergency Bypass Mode

The following Drawing Sheets in Attachment A are relevant to this section:

- C5 – C8: Proposed Site Plans
- C11 – C17: IWS Piping Plans
- M7 – M9: Process and Instrumentation Diagrams

8.2 Normal Operational Mode

Normal Operational Mode represents typical operating conditions that are expected to occur on a frequent basis. Normal Operational Mode conditions include:

- Sufficient remaining storage capacity in Lagoons 3 and 4 and water level not approaching an overflow condition;
- Weather/deicing forecast indicates no events in next two weeks that pose risk of Lagoon 4 exceeding capacity;
- Sufficient remaining BOD load in Lagoon 4 to ensure AGB system can operate for at least a week running at 50% load capacity or greater;
- AGB has gone through startup phase and is operating at a steady mass loading rate;
- No AGB operational or maintenance issues being experienced that are significant enough to compromise performance;
- Treated AGB TSS and BOD_5 concentrations are less than NPDES permit limits as measured at AGB Effluent Pump Station;
- No current need to segregate flows to Lagoons 1 or 2 because of fuel spills or other upstream industrial wastewater conditions; and
- No current restrictions for discharges to Puget Sound or sanitary sewer beyond limitations and conditions specified in respective permits.

The principal operating considerations in Normal Operational Mode are summarized in **Table 31**.

Table 31 – Principal Operating Protocols Under Normal Operational Mode

System Component	Action
Oil/Water Separation for NSB and SSB Runoff	Flows routed through OWSs from NSB and SSB trunk lines
Flow Segregation from NSB and SSB Runoff	Route runoff to Lagoon 3 if TOC < NPDES Limit
	Route runoff to Lagoon 4 if TOC > NPDES Limit
Flow Routing From Lagoon 4 to AGB Tank	Route to AGB Tank if available tank capacity is > ~5% (250,000 gal). Maximize use of AGB storage capacity to preserve capacity in Lagoon 4.
Flow Routing from Lagoon 4 to DAF and Sanitary Sewer	Under Normal Operational Mode, Lagoon 4 contents not routed to DAF or sanitary sewer
Flow Routing from AGB Tank To Dosing Structure	Route to AGB Tank flows to Dosing Structure based on dosing structure water level
Flow Routing from Dosing Structure to AGB Cells	Split flow to all six AGB cells in parallel mode
AGB Mass Loading Dosing Rates to AGB Cells	Dose at system capacity (10,000 lbs BOD/day) Influent flow rates continually vary based on Dosing Structure TOC concentrations
AGB Treated Effluent Flow Routing	Prioritize routing to low BOD compartment at IWS Pump Station for discharge to Puget Sound if below NPDES limits
Lagoon 3 Flow Routing	Route to low BOD compartment at IWS Pump Station at a flow rate that supplements AGB discharges without exceeding flow limits

As indicated in **Table 31**, under normal operating conditions, high BOD runoff will primarily be routed to Lagoon 4 for storage, then routed to the AGB for treatment, prior to being discharged to Puget Sound. This flow route is illustrated with bold linework on Sheet M7 and labeled as “Primary Flow Route for High BOD Runoff.” This standard operational approach aligns with the Port’s strategy for reducing discharges to the sanitary sewer to comply with reduced limits in the IWD Permit.

Although Lagoons 1 and 2 are available for storing high BOD runoff, these storage units will be used less frequently, because they are not able to route flows to the AGB system and are only able to discharge high BOD runoff to the sanitary sewer (after treatment at the DAF system). These lagoons will typically only be used under conditions where the flow rate through the AGB system to Puget Sound is not keeping up with the rate that high BOD runoff is being collected and high BOD runoff is building up in Lagoon 4. When this occurs, operators may decide to route incoming high BOD runoff to Lagoons 1 and 2 for subsequent treatment at the DAF system and discharge to the sanitary sewer. This can occur simultaneously while the AGB system is continuing to treat down high BOD runoff stored in Lagoon 4 and discharging treated runoff to Puget Sound. Routing high BOD runoff to Lagoons 1 and 2 for treatment at the DAF and discharge to the sanitary sewer is considered to be an “adaptive” operations mode for a risk of overflow at Lagoon 4, as discussed in **Section 8.3**.

8.3 Adaptive Management Operations Mode

Adaptive Management Operations Mode represents less frequent conditions that may require adjustments to default operations and flow routing to maintain compliance with permit limits or optimize system performance. The following represent examples of conditions under which operators may depart from Normal Operations Mode and adapt system operations to situational needs:

- Risk of overflow at Lagoon 4
- Risk of overflow at Lagoon 3
- Treated AGB effluent concentrations greater than NPDES permit limits
- Significant fuel spills in industrial wastewater

8.3.1 Adaptations for Risk of Overflow at Lagoon 4

During winters generating large volumes of high BOD industrial wastewater, Lagoon 4 may hold high volumes for certain periods. Those high volumes may be a result of some combination of heavy deicing, significant volumes of industrial wastewater from rainfall following deicing and snowmelt, and high BOD concentrations in Lagoon 4 or AGB Tank slowing AGB treatment flow rates.

Operators will evaluate weather/deicing forecasts, Lagoon 4 capacities, and AGB treatment flow rates to determine if adaptations to the Normal Operational Mode are necessary to avoid the risk of Lagoon 4 reaching capacity. Adaptive management steps that operators may take to avoid a bypass to surface water (Emergency Bypass Mode, as described in **Section 8.3**) include:

- Maximize flow rates through the AGB system and maximize pumping from Lagoon 4 to AGB Tank to draw down levels in Lagoon 4.
- Route high BOD industrial wastewater in IWS trunk line to Lagoons 1 and 2 for subsequent routing to the DAF units and sanitary sewer
- Use connector pipe between Lagoons 3 and 4 when needed to take advantage of available capacity at Lagoon 3 before an overflow to surface water occurs.
- Allow Lagoon 4 to spill over into Lagoon 3 using the new emergency spillway on top of the dividing berm.

8.3.2 Adaptations for Risk of Overflow at Lagoon 3

Under normal circumstances when the AGB system is operating, AGB effluent will take priority for discharges to the low BOD compartment at IWS Pump Station and discharges to Puget Sound. Lagoon 3 discharges will be able to supplement AGB effluent flows to the low BOD compartment up to the Puget Sound outfall flow limit, through the use of a new VFD at the Lagoon 3 Pump Station. However, Lagoon 3 will not have full use of the Puget Sound outfall flow limit and will ultimately draw down more slowly than it does under existing conditions. As the overall IWTP storage capacity is increasing, and storage capacity can be shared between low and high BOD storage units in an emergency, the overall risk of an overflow from Lagoon 3 to surface water will

be reduced under future conditions. However, there are adaptive management steps that operators should take to minimize the risk of an overflow to surface water and preserve some capacity in Lagoon 3 for low BOD storage.

To minimize the risk of an overflow at Lagoon 3, the operators will have the option decide to when to prioritize discharges from Lagoon 3 to Puget Sound. This decision may be made based on capacity remaining in Lagoon 3 and forecasted weather conditions. When Lagoon 3 is prioritized, AGB effluent will be routed to the sanitary sewer so that Lagoon 3 can make full use of the flow limit to Puget Sound and free up storage capacity more rapidly.

Adaptive management steps that operators may take to avoid a bypass to surface water (Emergency Bypass Mode, as described in **Section 8.3**) include:

- Prioritize discharges from Lagoon 3 to Puget Sound at the low BOD compartment at the IWS Pump Station.
- Segregate low BOD industrial wastewater in IWS trunk line to Lagoon 4 if capacity allows, or else Lagoon 1 or 2.
- During the deicing season, route AGB effluent to the sanitary sewer via the high BOD compartment of the IWS Pump Station as long as Lagoon 3 is discharging to Puget Sound, so that AGB treatment operations can continue uninterrupted.
- Use connector pipe between Lagoons 3 and 4 when needed to take advantage of available capacity at Lagoon 3 before an overflow to surface water occurs.
- Allow Lagoon 3 to spill over into Lagoon 4 using the new emergency spillway on top of the dividing berm.

8.3.3 Adaptations for AGB Effluent Concentrations Greater than NPDES Permit Limits

Should treated AGB effluent BOD_5 concentrations be higher than NPDES permit limits, operators will first consider adjustments to the following within the AGB system to determine if effluent BOD concentrations can be reduced.

- Verify nutrient loading levels and residual concentrations are appropriate and adjust if necessary
- Verify air supply is sufficient and adjust if necessary
- Temporarily adjust influent BOD loadings
- Convert AGB operation from parallel to series mode in one or more cells

If operators make the above adjustments and AGB BOD_5 and/or TSS concentrations in the treated AGB effluent still exceed NPDES permit limits, operators may choose to route flow to the DAF system for additional treatment. The solids removal capabilities of the DAF system may help to reduce elevated TSS as well as insoluble BOD_5 associated with bacterial solids from the AGB system (see **Section 6.5.5**). If the DAF system reduces these concentrations to below NPDES limits, the effluent may be able to be discharged to Puget Sound. If not, the flow can be discharged

to the sanitary sewer. These adaptive management protocols for AGB effluent flow routing, as summarized in **Table 32**.

Table 32 – Treated AGB Effluent Routing Adaptive Management Options

Case	AGB Effluent Characteristics	Treated AGB Effluent Flow Route	DAF Effluent Characteristics	Discharge Point
1	BOD_5 and TSS > NPDES limit ➡	Return to AGB Tank	N/A	N/A
2	BOD_5 and/or TSS > NPDES limit ➡	Route to DAF system ➡	BOD_5 and/or TSS <NPDES limit ➡	Route to Puget Sound
3	BOD_5 and/or TSS > NPDES limit ➡	Route to DAF system ➡	BOD_5 and/or TSS >NPDES limit ➡	Route to sanitary sewer

8.3.4 Adaptations for Fuel Spills in Industrial Wastewater

The expanded IWTP will include OWS units that will serve to separate spilled fuels prior to Lagoons 1-4 under most conditions. If fuel is observed in collected runoff downstream of the OWS units, operators may choose to route flows from Lagoons 1, 2, 3 or 4 through the DAF units for additional removal of fuel. At high flow rates or in situations with high spilled fuel volumes, operators may also route flows containing fuels to Lagoon 1 and 2 for temporary segregation and holding to allow time for remaining fuel to separate from collected industrial wastewater.

8.4 Emergency Bypass Mode

As described in the previous section, a variety of adaptive management steps will be available to operators to allow them to share storage capacity between IWS storage units and avoid an overflow to surface water. Under extreme circumstances, the water level may continue to rise to a point where an emergency overflow or a controlled release from one of the lagoons to surface water is unavoidable. Under these conditions, the Port will operate in Emergency Bypass Mode.

From an NPDES permit perspective, any release of untreated industrial wastewater to surface water (i.e., IWS runoff that is not treated by the expanded IWTP) is considered a “bypass.” Bypasses are generally prohibited by the NPDES permit, except under specific conditions authorized by the permit. Under Emergency Bypass Mode, the Port will follow permit requirements to avoid potential enforcement actions. Prior to entering into Bypass mode Port operators will have exhausted the adaptive management operations to the extent feasible, and will notify Ecology in advance in accordance with permit requirements.

The Port has defined detailed procedures for operations during a bypass or overflow condition as summarized in the Operations and Maintenance (O&M) Manual. These include using the emergency drain pipe to route flow from existing Lagoon 3 to Des Moines Creek once a threshold

elevation has been reached. This is preferable to making use of the existing Lagoon 3 emergency spillway, in order to minimize the potential for erosion or other issues at Des Moines Creek. However the emergency spillway may ultimately be used if water levels continue to rise after the drain has been opened. Although Lagoons 3 and 4 are being modified with this project, both the existing emergency drain pipe and emergency spillway will remain in place, and similar operating procedures can continue to be used in the future when a bypass is unavoidable.

8.5 Phasing of Changes to System Operations

The IWTP Expansion will be implemented in a phased manner, with the goal of maintaining continuity in IWTP operations and maintaining compliance with applicable discharge permits. Operations and controls may need to be modified on a temporary basis during construction activities to account for infrastructure being taken offline temporarily as well as temporary changes to flow routing, storage, and discharge destinations. Permanent changes to operations and controls will need to be implemented in a phased manner as new and modified infrastructure is brought online, such as the AGB Tank. Phasing considerations are further detailed in **Attachment F**.

8.6 Staffing Recommendations

8.6.1 Operator / Staffing Needs

Based on experience with three similarly sized AGB systems, we anticipate that AGB system operational staffing at SEA would require two full-time operators. These two full-time staff would be in addition to existing IWTP operational staff, which would need to be retained to meet ongoing operational needs for the lagoons and DAF treatment system. Additionally, existing AGB systems have sometimes required a third operator for redundancy during critical operational periods. With proper training, the existing IWTP staff should be able to fulfill this redundancy need. The AGB system is designed to operate automatically for short periods of time with operator adjustments on a daily basis. Operators work either in tandem on one shift or individually over two shifts with the system operating autonomously during off-shifts. The AGB system will have alarms to alert the operators if monitored parameters go outside of acceptable levels and will shut the system down if the condition is critical.

The desired skill set for potential operators is similar to that of typical wastewater treatment operators. This will cover the pump and monitoring operations for the treatment system. Since the AGB is not a commonly used treatment process, additional training on the specific operational requirements will be needed and performed by the process engineers. This training is recommended to occur during the startup and commissioning process in the first year of operation.

Typically, system monitoring and laboratory analysis can be accomplished by one operator and the second performs maintenance and housekeeping activities, such as the following:

- Collect water samples from various points in the AGB system

- Conduct lab analyses for specific parameters
- Review on-line readings from SCADA
- Review treatment parameters and adjust loading rates
- Adjust nutrient dosing pumps
- Review dissolved oxygen levels and adjust blowers
- Visual check storage tanks water levels
- Review stock amounts and reorder supplies
- Repair out of service equipment

When heavier maintenance or a staff leave of absence occurs, the third operator is called in to assist in operations. The first year typically requires additional attention from the operators as they get familiar with the system. Predictably, the actual workload varies seasonally according to the deicing operations and weather. A typical schedule of tasks and estimated level of effort is summarized in Table 33.

Table 33 – Summary of Typical Operator Tasks, Schedule and Level of Effort

Task	Schedule	Estimated Level of Effort
Attend commissioning/training	July 1 - Sept 30	2 days classroom training, 2 days field training, 6 days commissioning
Winter Operations	Oct 1 - May 1	7 days per week, 16 hours per day split among two operators, 1 day per week coordination
Summer Operations	May 1 - Sept 30	2 days per week for two operators, 2 days per month coordination
Coordination & Management	ongoing	24 hours per month
Reporting	ongoing	0.5 hours per daily report 1 hour per weekly report 2 hours per monthly report 32 hours for end of season report 48 hours per year for maintenance reports

8.6.2 Operations Needs

Normal operations and maintenance do not require specialized equipment or additional personnel. There are several periodic events that do either require additional personnel or contracting with outside vendors. These activities include:

- Annual cleaning of the storage tank. This is a summer activity and typically performed by a waste contractor while the AGB system is shutdown.

- Semi-annual calibration and cleaning of the analytical TOC monitors. This is a specialized task and requires technical knowledge of the units. The Port can coordinate this activity with the maintenance of its existing TOC monitors in operation.
- Annual maintenance of the analytical instruments, including on-line pH, dissolved oxygen, level and pressure instruments. It is recommended that Port maintenance or an outside instrument vendor maintain the instruments and performs annual maintenance.
- Annual maintenance of the pumps. It is recommended that Port maintenance or an outside pump vendor perform the annual maintenance of the pumps. The maintenance includes:
    - Removing the pumps and inspecting the impeller.
    - Checking the amp draw of the pumps.
    - Cleaning the wet well and removing solids.
- Periodic flushing or cleaning of lines and sumps. It is recommended to have Port maintenance or a plumbing contractor available to perform jetting of pipes and cleaning of pump stations. The maintenance includes:
    - Monthly flushing of sample lines to remove biological growth.
    - Monthly flushing of AGB dosing lines to remove biological growth and trash (from the airfield).
    - Cleaning of the oil/water separators when the solids exceed 12 inches of depth accumulation in the units.
    - Emergency flushing of lines when solids accumulate reducing the flow capacity or completely blocking the line.

8.6.3 Other Requirements

The AGB requires that spare parts be available for replacement of failed equipment. The Control Building was sized to house some of the large spare parts for more critical equipment listed below. Additional space may be required for some of the other spare parts. Large spare parts include:

- Spare high-flow submersible pumps
- Spare blower air filters
- Packs of spare coalescing plates for the oil/water separators

9. Support Systems

9.1 Introduction

Beyond the main storage, conveyance, and treatment systems, there are a number of support systems required for the IWTP Expansion project. These “support systems” cover an array of elements necessary for the proper operation of the expanded IWTP.

The following Drawing Sheets in **Attachment A** are relevant to this section:

- A1 – A2: Control Building Plan and Elevations
- C11 – C17: IWS Piping Plans
- C18: Stormwater Control and Drainage – AGB Site
- E1 – E3: Electrical Site Plans
- M7: P&ID – Overall Process

9.2 Overview of Support Systems

The primary support systems include:

- Monitoring and Controls
- Utilities
- Buildings
- Roads and Parking

Monitoring and controls covers the systemwide collection of electronic data from instruments and equipment for the purpose of controlling process components (e.g., screens, pumps, and blowers) and identifying alarm conditions. Utility services required for the expanded IWTP include potable water, sewer, electric, telecommunications, and possible natural gas. For buildings, the primary structure envisioned is the “Control Building” that houses the chemical feed system, blowers, and electrical equipment. The Control Building will be located at the AGB site. Finally, roads and parking covers vehicular access required by personnel to support facility operations.

9.3 Monitoring and Controls

The SCADA system for control of the system will be a network of Programmable Logic Controllers (PLCs). Satellite PLCs will be located at strategic points in the system and will be connected to the main PLC located at the AGB treatment system. The satellite PLCs will be the connection points for equipment and instruments and will be programmed to perform control of local processes. The satellite PLCs will be connected to the main PLC through fiber optic connections and will communicate status. The main PLC will control system-wide processes and will have the main operator interface. The data historian, which saves the system data, will be attached to the main PLC.

The stormwater flows from the NSB and the SSB will be monitored using TOC monitors to determine which lagoon the flows will be routed. The locations of these monitors are shown in Sheet M9 in **Attachment A**. Once the flows are in the lagoons, operator grab samples will be used to determine the loadings of BOD in the lagoons. These results will be used to determine flow rates that will be allowed into the DAF treatment and AGB treatment. Effluent monitoring of the treatment units will determine compliance with the regulated discharges.

Proposed instruments included in the IWTP Expansion are summarized in **Table 34**.

Table 34 – Proposed Monitoring Instruments

Structure Name	Instrument Type	Instrument Details	Site
L3/L4 Diversion Structure	TOC Monitor [1]	TOC sampling for influent trunk line	Lagoon 3
Lagoon 4	Level Sensor	Submersible level transducer	Lagoon 3
Lagoon 4 Discharge Pump Station	Level Sensor	Submersible level transducer	Lagoon 3
Lagoon 4 Discharge Pump Station	Pressure Sensor	Pressure indicating transmitter	Lagoon 3
Lagoon 4 Discharge Pump Station	Flow Sensor	Magnetic flow meter	Lagoon 3
AGB Tank	Level Sensor	Radar	AGB
AGB Tank	Pressure Sensor	Pressure indicating transmitter	AGB
AGB Tank Pump Station	Level Sensor	Submersible level transducer	AGB
AGB Tank Pump Station	Pressure Sensor	Pressure indicating transmitter	AGB
AGB Tank Pump Station	Flow Sensor	Magnetic flow meter	AGB
Dosing Structure	Level Sensor	Submersible level transducer	AGB
Dosing Structure	Pressure Sensor	Pressure indicating transmitter (6 total)	AGB
Dosing Structure	Flow Sensor	Magnetic flow meter (6 total)	AGB
Control Building	Level Sensor	Ultrasonic, for chemical tank	AGB
Control Building	pH Probe	For samples from the Dosing Structure	AGB
Control Building	Temperature Probe	For samples from the Dosing Structure	AGB
Control Building	TOC Monitor [1]	For samples from the Dosing Structure	AGB
Control Building	Flow Sensor	Thermal mass flow meters for blowers (6 total)	AGB
Control Building	Pressure Sensor	Pressure indicating transmitter for blower manifold	AGB
AGB Cells	Level Sensor	Submersible level transducer within cell (6 total)	AGB
AGB Cells	Level Sensor	Ultrasonic, in hydraulic control structure (6 total)	AGB
AGB Cells	Dissolved Oxygen Probe	One for each cell and each cell's hydraulic control structure (12 total)	AGB
AGB Cells	Temperature Probe	One for each cell and each cell's hydraulic control structure (12 total)	AGB
AGB Effluent Pump Station	Level Sensor	Submersible level transducer	AGB
AGB Effluent Pump Station	Pressure Sensor	Pressure indicating transmitter	AGB
AGB Effluent Pump Station	Flow Sensor	Magnetic flow meter	AGB
AGB Effluent Pump Station	TOC Monitor [1]	For AGB effluent samples	AGB

Notes:

1. Two of the three proposed TOC monitors may be relocated from existing installations serving the NSB and SSB trunk lines (each line will retain one existing TOC monitor). The third TOC monitor will be a new purchase.

9.4 Utilities

Utilities for the project are primarily related to electrical supply and telecommunications for project equipment and instruments. Additionally, new utility service lines are required at the AGB Site to serve the Control Building and treatment operations. These utility needs are detailed in the subsections below.

9.4.1 Electrical and Telecommunications Needs

9.4.1.1 Power Supply

A new electrical connection and significant electrical demand is anticipated at the AGB site for the operation of project equipment and instruments. The power requirement for the blowers and pump stations is sizeable and significant electrical infrastructure will be required to support the power demands adjacent to the motor loads. Coordination will be required with the local electric utility (Puget Sound Energy) to verify that sufficient power supply is available locally and confirm connection point.

At the IWTP and Lagoon 3 site, existing power will need to be extended to serve new and modified equipment and instruments located at proposed treatment units, lift stations, valve vaults, diversion structure, solids handling system, and DAF system. Existing power supplies at these sites will need to be compared to proposed equipment and instrument power demands to determine the extent of infrastructure modifications required and confirm tie-in point.

A table of the estimated electrical requirements for project equipment and instruments is provided in **Table 35**. The routing and size of electrical supply will be determined during detailed design. Electrical site plans are provided as Sheets E1 through E3.

Table 35 – Electrical Requirements

Equipment Location	Equipment Type	Brief Description	Quantity	Motor Power (HP)
Control Building	Blower	Rotary Lobe Blower Package	4	250
AGB Tank Pump Station	Pump	AGB Tank to Dosing Structure	2	45
Dosing Structure	Pump	Pumps for AGB Dosing	6	7.5
AGB Cells	Pump	Recirculation Pumps	12	2
AGB Effluent Pump Station	Pump	AGB Effluent Pump Station to IWS Pump Station	2	110
Lagoon 4 Discharge Pump Station	Pump	Lagoon 4 Effluent Pumps	2	140
L3/L4 Diversion Structure	Slide Gate	Slide Gate Actuators	2	0.5
Dosing Structure	Pump	AGB Dosing TOC Sample Pumps	2	2
Control Building	Pump	Nutrient Feed Pumps	2	0.25
Control Building	Pump	Chemical Mixing Pump	1	1.5
Dosing Structure	Instrument	Submerged Mechanical Mixer	1	2
Lagoon 4 Underdrain Pump Station	Pump	Underdrain Pump Station Pumps	2	3.8
Lagoon 4 Leak Detection Pump Station	Pump	Leak Detection Pump Station Pumps	2	1
AGB Tank Underdrain Pump Station	Pump	AGB Tank Underdrain Pump Station Pumps	2	3.3
AGB Effluent Pump Station	Pump	AGB Effluent TOC Sample Pumps	2	2
L3&L4 Diversion Structure	Pump	Lagoon 3 and 4 Influent TOC Sample Pumps	2	2

9.4.1.2 Backup Power

At the AGB site, a hookup for a portable generator is recommended at the Effluent Pump Station, to avoid flooding from upstream AGB cells in the event of a power loss. No other backup power is required for the AGB site.

At the Lagoon 3 site, there is an existing permanent emergency generator serving the Lagoon 3 Pump Station. No additional backup power is proposed at this time. In the event that the contents of Lagoon 4 need to be pumped out during a power outage, the valve on the proposed connector pipe between Lagoons 3 and 4 can be opened to allow flows from Lagoon 4 to drain to the Lagoon 3 Pump Station for pumping to the IWS Pump Station.

At the IWTP site, the existing IWS Pump Station already has a hookup for a portable generator. No additional backup power infrastructure is proposed at this time to serve the modified DAF system or solids handling system.

9.4.1.3 Telecommunications

For preliminary design, it is assumed that all powered equipment and instruments will be paired with telecommunications system to support monitoring and control. New telecommunications lines will need to be connected to the Port's existing system for integrated operations. The routing and definition of the communications infrastructure will be defined during detailed design.

9.4.2 Other Utility Needs at AGB Site

New utility connections and service lines are required for a variety of other utility types at the AGB site, including the following:

- Sanitary: A sanitary connection is required to support a single restroom and laboratory sink at the Control Building to support operations staff. It may also be extended to the Effluent Pump Station to provide an emergency overflow connection.
- Water and fire water: A potable water connection is required to support a single restroom and laboratory sink at the Control Building to support operations staff. A fire water connection, water main loop, and fire hydrants will also be required to meet building code requirements as well as requirements for emergency response in the RPZ by the Airport Fire Department.
- Natural gas: A natural gas connection could be used for heating the Control Building, but electric heating could be used if preferable.
- Stormwater: A storm sewer connection will be necessary for flow routing of site runoff downstream of required stormwater controls. This connection will not be used for any runoff associated with IWS areas, including runoff from designated industrial activity areas on-site or off-site.

In addition to new service line requirements, there are numerous existing utility lines crossing the AGB site that conflict with the proposed construction. Coordination will be necessary with utility agencies to confirm which lines terminate on-site and can be demolished, versus lines that are actively serving neighboring properties that require relocation. Additionally, coordination will be necessary with each utility agency during the detailed design phase regarding capacity demand, connection point, permitting requirements, and timeline for approval. Utility agencies requiring coordination include the following:

- Midway Sewer District: Sanitary sewer
- Highline Water District: Potable water and fire water
- Puget Sound Energy: Natural gas and electric
- City of SeaTac: Storm sewer drainage (excluding industrial wastewater)

9.5 Stormwater Management Concept

A preliminary concept for stormwater management has been developed to comply with the *Seattle-Tacoma International Airport Stormwater Management Manual for Port Aviation Division* (SWMM), as described in **Attachment G** and illustrated on Sheet C18. The applicability of SWMM requirements to each of the three project sites were evaluated, resulting in the following conclusions:

- Lagoon 3 site modifications are not subject to the SWMM. The grading work that is proposed for the construction of Lagoon 4 is expected to drain into the IWS, which is exempt from SWMM requirements. Other proposed modifications are focused on underground utility work, which is exempt from the SWMM.
- IWTP site modification are also not subject to the SWMM, due to a focus on underground utility work and drainage to the IWS.
- AGB site modifications are subject to the SWMM, and minimum requirements 1-10 are all applicable. Requirements include, but are not limited to, source control, onsite stormwater management and low impact development, runoff treatment, and flow control BMPs. Although flow control requirements are applicable, the preliminary analysis suggests that flow control BMPs will not be required due select areas being routed to the IWS and a reduction in site imperviousness.

A preliminary stormwater BMP concept was developed for the AGB site to comply with the applicable minimum requirements. Areas were defined where BMPs can be sited in the future, although BMP footprints have not been defined in detail. These “BMP areas” are illustrated on Sheet C18. Based on preliminary calculations, the total BMP area exceeded the minimum area needed to meet SWMM runoff treatment requirements.

BMPs were assumed to be a combination of compost-amended vegetated filter strips (CAVFS) (or extended CAVFS where applicable) and bioretention, which are both applicable toward runoff treatment and on-site stormwater management requirements. Additional recommended on-site stormwater management approaches include “post-construction soil quality and depth” (SWMM BMP T5.13) within restored pervious surface areas and downspout dispersion systems (SWMM BMP T5.10B). Additional details are provided in **Attachment F**.

9.6 Buildings

The Control Building is located on the AGB site. The building houses the blowers, nutrient storage and feed system, electrical and control equipment, and operator facilities (i.e., restroom and storage), as illustrated on Sheets A1 and A2. The building is located on SEA property and will be designed and constructed in accordance with the Port’s building code.

The building will be an industrial building with moderate-hazard classification similar to those used in water/sewer treatment facilities (International Building Code F-1). The building must comply with all State and local regulations. In addition, the Control Building must comply with FAA siting

restrictions (e.g., Part 77 airspace surfaces, safety areas, RPZ, etc.). As discussed in **Section 4**, the Port has gained acceptance from FAA for this building to be constructed within the RPZ with the understanding it will not be permanently occupied and will be designed to the shortest height that can accommodate the necessary equipment.

A preliminary layout of the Control Building is provided in **Figure 23**.

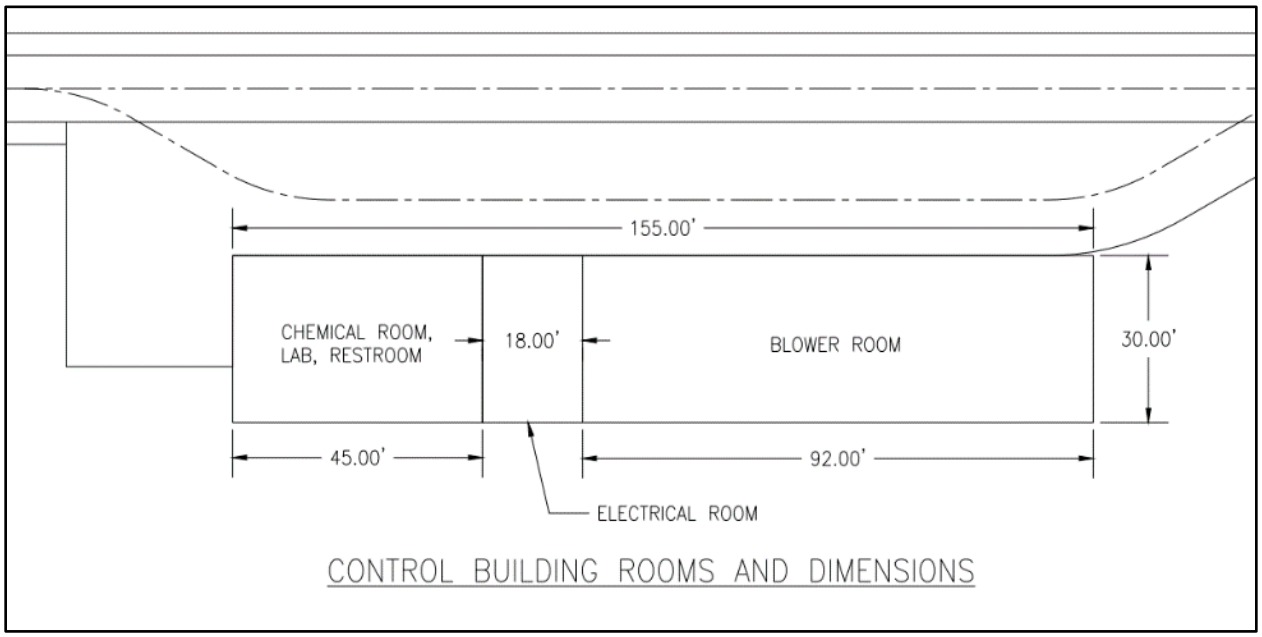


Figure 23: Control Building Layout

9.7 Roads and Parking

Facility access roads are provided for the AGB site with entrance gates and driveways on S. 188th Street and Des Moines Memorial Drive. Parking will be located at the Control Building for operations staff. The Control Building roads will be asphalt and designed with turn radii for chemical delivery and pump maintenance trucks. The roads will encircle the site to accommodate bidirectional traffic. A layout for the proposed roads is included in Appendix A on Sheet C6 – Proposed Site Plan AGB Site. Road work and parking design will be designed and constructed in accordance with Port standards.

A new gravel access road is proposed to be constructed around Lagoon 4 after it is expanded. This road will cross the dividing berm as well, and will tie into the existing gravel roads at Lagoon 3. The mechanical screen will require access for waste (screenings) removal. The pump stations and monitoring shelter will have roadwork and parking to accommodate regular operation and maintenance activity.

10. Next Steps

The final engineering report was submitted to KCIW in compliance with the IWD Permit requirement S3.B Engineering Report. This section outlines the next steps for the Port to proceed towards the design and construction of the SEA IWTP Expansion.

10.1 Anticipated Timeline

Once concurrence is received from KCIW as well as Ecology, the Port will proceed with its processes for procurement of detail design services, construction, commissioning, and start up. The anticipated timeline and milestones are outlined in **Table 36**, including anticipated submittals to KCIW required in the IWD Permit. Due to the inherent complexity of the IWTP Expansion while maintaining airport and IWTP operations, the proposed timeline does not totally align with the existing IWD compliance schedule in Schedule S3.D. Explanation and justification for the anticipated timeline is provided in the following paragraphs.

Table 36 – Anticipated Timeline for Final Design, Construction and Start Up

Item	Permit-Required Due Date[1]	Anticipated Start Date	Anticipated Completion Date
Engineering Report, Draft [2]	August 30, 2022	February 1, 2022	February 28, 2023
Engineering Report, Final [3]	December 31, 2022	March 28, 2023	June 14, 2023
Detailed Design Advertisement/Award	N/A	October 2023	June 2024
Plans and Specifications, 60% Design	July 31, 2023	Quarter 1, 2025	Quarter 3, 2025
Plans and Specifications, 100% Design	December 15, 2023	Quarter 4, 2025	Quarter 1, 2026
Construction Advertisement/Award [4]	July 1, 2024	Quarter 4, 2023	Quarter 2, 2024
Construction [5]	March 31, 2026	Quarter 1, 2026	Quarter 4, 2028
Commissioning and Start Up	N/A	Quarter 3, 2027	Quarter 4, 2028

Notes:

1. IWD Permit, Compliance Schedule—implementation of Measures, Milestones, and Due Dates, S3.D. Some line items not required and noted as “N/A”. Other line items are named slightly differently, per notes 4 and 5.
2. The Port requested and received written approval from KCIW for schedule modification on August 24, 2022.
3. The Port requested and received written approval from KCIW for schedule modification on May 26, 2023.
4. Milestone in the IWD Permit S3.D is “Start of Construction – Contract Award”
5. Milestone in the IWD Permit S3.D is “Substantial Completion”

The anticipated schedule reflects the project scope as represented in this Basis of Design Report. This scope has grown significantly since the initiation of the project, as the scale of the proposed pre-treatment facility has resulted in several downstream considerations and scope additions (e.g., modifications to Lagoon 3, staff capacity, operational impacts, existing conditions, etc.) which were unknown at project initiation. A preliminary phasing plan will be developed to define the schedule in significantly more detail during the design phase, with consideration for how the work elements will be combined into construction packages, as well as the sequencing required to minimize interruptions to current system operations and maintain compliance with discharge permits. While the Port must follow its processes for large capital projects, priority will be given to accelerate the delivery schedule as much as possible.

The following is an explanation of the primary project phases and estimated timelines:

10.1.1 Planning Phase

In the planning phase, the Port develops a 'Project Notebook' which contains a conceptual design and overall project cost estimate. This Basis of Design Report reflects the overall design concept to be used in the Project Notebook, which in this case contains a higher level of detail than usual due to the complexity of the project and the technical requirements of the Engineering Report. 4-5 months of this process were spent incorporating a re-design of the storage concept per comments from the FAA. Some design concepts such as PLC control architecture / phasing and IWTP building modifications are still being developed. Once the conceptual basis of design is complete, the Notebook process requires a series of meetings and approvals to confirm delivery method, maintenance requirements, operational impacts, permitting requirements, environmental assessment, asset management, and documentation requirements.

Once the Project Notebook is complete, the project scope and budget will be proposed to the Port's Investment Committee for approval. After this approval, the project must go through a series of additional reviews before going to the Port Commission for Design Authorization. The current target for Design Authorization is September 2023.

10.1.2 Design Phase

Once Commission Authorization is obtained, the procurement process for a designer can begin. The Port Central Procurement Office (CPO) typically reserves 10 months to complete a project-specific procurement process. The process includes development of the procurement documents, advertisement, public informational meetings, proposal review, interviews, negotiations related to the Service Agreement, and negotiations related to the initial Service Directive(s). The 10-month period also accounts for CPO workload, which in this case will be mitigated by project prioritization. The Port is developing procurement documents in advance and looking at any opportunities to accelerate the provided procurement schedule.

The detailed design for this project will follow the typical 30/60/90/100% design phasing. A project validation phase is included for the designer to review the conceptual design and field conditions. As discussed in Section 10.3.4, a phasing plan will be developed during 30% design which will

segregate subsequent design packages for early work (demolition, grading, etc.). The phasing plan developed during the detailed design phase will also establish a more detailed construction schedule with applicable milestone dates for major design elements. Opportunities to compress the schedule and minimize the risks of schedule delays will be incorporated into the phasing plan.

The total detailed design phase has a planned duration of 18 months, which is considered reasonable given the scale of the project scope.

10.1.3 Construction Phase

The project team plans to utilize a General Contractor / Construction Manager (GC/CM) delivery for this project. Procurement of the General Contractor will begin in early 2024 with the intent of using the GC/CM for design constructability reviews, phasing plan development, and other pre-construction activities. The phasing requirements for this project are complex, particularly due to the need to maintain operations of the IWS system to facilitate discharges while simultaneously modifying existing components and integrating into the proposed system. The GC/CM delivery method is expected to create efficiencies in the overall project schedule and provide great value for the Port. Specialty contractors for Mechanical and Electrical disciplines (MC/CM and EC/CM) will also be procured. This delivery method simplifies the ability to perform early work and procure long-lead materials early, helping minimize the risk of schedule delays.

Based on the current design concept, the overall construction duration has a planned duration of 30 months.

A memorandum of phasing and implementation considerations, included as **Attachment E**, provides guidance for the phased implementation of the project, with the goal of maintaining continuity in IWTP operations and maintaining compliance with applicable discharge permits.

10.2 Regulatory Requirements and Permitting

The Port is preparing a detailed plan for meeting all its regulatory obligations related to the design, construction, and implementation of the IWTP Expansion. Beyond the requirements of the IWD Permit that are outlined in the timeline in **Section 10.1**, the Port also expects to submit a permit modification request to Ecology to amend the SEA NPDES Permit, if necessary, to align with the proposed changes in the IWTP Expansion.

The construction of the IWTP Expansion is expected to trigger SEPA applicability because any proposal that requires a state or local agency decision to license, fund, or undertake a project, or the proposed adoption of a policy, plan, or program can trigger environmental review under SEPA. Furthermore, NEPA will likely be triggered as well because projects that require an FAA decision can trigger environmental review under NEPA. The Port will comply with the SEPA and NEPA requirements and has begun to prepare documentation for appropriate submittals.

A high-level summary of anticipated permitting and regulatory approvals related to the IWTP Expansion was developed for the draft engineering report, as summarized in **Table 37**. A more detailed permitting matrix has been developed for the Notebook, and is included as **Attachment**

H. The Port is also monitoring emerging contaminants, such as PFAS and 6PPD-quinone, and will incorporate associated considerations as needed.

Table 37 – Potentially Applicable Permits or Regulatory Approvals

Potentially Applicable Permit	Lead Agency
Wastewater Discharge Permit	King County Department of Natural Resources Industrial Waste Division
NPDES Permit No. WA0024651	Washington State Department of Ecology
Dam Safety Office Review	Washington State Department of Ecology
Grading Permit	Port
State Environmental Policy Act	Port
National Environmental Policy Act	Federal Aviation Administration
Section 404 Individual Permit	US Army Corps of Engineers
Ecology 401 Water Quality Certification	Washington State Department of Ecology
Coastal Zone Management Act Consistency Determination	Washington State Department of Ecology
Utility Connections/Demo Coordination	Applicable Local Utility/Agency
Updated Airport Layout Plan	FAA
Construction Safety and Phasing Plan	FAA
7460-1 Notice of Proposed Construction or Alteration	FAA

10.3 Additional Tasks

10.3.1 Subsurface Characterization

To inform the detailed design, it is recommended to begin planning for subsurface data collection in targeted areas of the IWTP Expansion concept. Geotechnical investigation is recommended at the AGB site and Lagoon 3 site but is not anticipated to be required at the IWTP site due to the limited scope of work at that site.

10.3.1.1 AGB Site

The AGB site requires geotechnical investigation to characterize existing soil and groundwater properties that will inform the detailed design. Considerations for this investigation include:

- Characterize seasonal high groundwater elevations through groundwater level monitoring at piezometers. This information should be coordinated with groundwater data that the Port may have previously collected at existing groundwater wells or piezometers. Groundwater data collection is especially influential on the schedule since it should be evaluated in the wet season (late fall to early spring).
- Perform pump tests to inform sizing of underdrains, groundwater pump station at the AGB Tank, and construction-phase dewatering systems.

- Perform soil borings across the site, with particular emphasis on the control building and AGB Tank.
- Perform soil testing and analyses to provide guidance on soil suitability for backfill, off-site hauling and disposal requirements, slope stability and shoring requirements for excavations, foundation design for structures, and compaction requirements.
- Provide guidance on feasibility of demolishing existing retaining walls on-site and guidance for re-grading and terracing the site.

10.3.1.2 Lagoon 3 Site

Geotechnical investigation was previously performed at the Lagoon 3 site as part of previous Lagoon 3 design modifications. Some additional investigation at the Lagoon 3 site is recommended, but with an emphasis on the expanded lagoon footprint to the north, the new dividing berm between Lagoon 3 and 4, and construction within the existing berm around Lagoon 3. New geotechnical work should be coordinated with findings from previous investigations. Considerations for this investigation include:

- Perform borings within expansion area north of lagoon, and at select additional locations within the limits of disturbance.
- Provide guidance on suitability of soil north of lagoon to be used as embankment material for dividing berm.
- Provide design guidance for construction of dividing berm, including keying embankment into existing berms and basin floor, slope stability, and berm height and width.
- Provide design guidance for open trench excavation as well as trenchless construction within the existing lagoon berm, with consideration for structural integrity and dam permit requirements.
- Provide design guidance related to anchor trenches and installation of geosynthetic materials, including geomembrane liner, geotextiles, and geosynthetic clay liner.
- Provide design guidance for pipes crossing between lagoons across dividing berm, including overflow spillway and lagoon connector pipe, as well as potential additional pipe crossings to be considered during detailed design, including underdrains, leak detection system, and influent / effluent pipes.

10.3.2 Additional Site Survey

Some additional survey data should be collected at the proposed sites of the IWTP Expansion to inform the detailed design. The following are known data gaps on existing utilities and topography:

- Some discrepancies remain between the recent site survey and the Port's existing base map at the AGB Site.
- Some utilities at IWTP site are shown on the base map from record drawings and have not been field verified.

- Some utilities along the southside of S. 188th Street between the Lagoon 3 Site and the AGB Site have not been field verified.
- Topographic information is incomplete at the Lagoon 3 Site, particularly along the southeastern side and western sides outside the lagoon.
- Trees larger than 4-inch diameter at breast height will need to be surveyed to identify species and size, likely only needed at the AGB site, to develop a tree replacement plan.

10.3.3 Coordination with Future South Snow Pad

The Port is separately designing a new south snow pad near existing Lagoon 3 to address the need for additional snow storage at SEA. The project is in the early design and permitting stage, but the drainage from the snow pad is intended to be piped to the future Lagoon 4. Continued coordination with the design and construction between these two projects is required for their successful implementation.

10.3.4 Detailed Design

Building upon this basis of design report and the additional data gathered from the tasks described above, the Port will proceed into detailed design phase. A draft list of specifications was developed to support and accompany the basis of design and drawings (**Attachment I)**.

The current design concept will continue to be refined and developed during the detailed design phase. Potential design optimization and coordination steps to be considered during the detailed design phase include the following:

- Develop detailed controls logic and standard operating procedures in coordination with the Port to facilitate compliance, streamline operations, and minimize the potential for overflows. Identify trigger points for shifting between normal and adaptive management operational modes. Optimize monitoring and controls to manage simultaneous discharges from different sources to IWS Pump Station wet well.
- Evaluate maintenance procedures for new equipment and structures, including maintenance vehicle and equipment heights and access needs. Cite Port's Maintainability Notes on design drawings where appropriate (**Attachment J**). Consider whether any siting or design modifications are needed to comply with FAA imaginary surfaces or safety requirements. Consider locations requiring a water connection for annual cleaning, pressure washing, or other maintenance. Monitoring, maintenance, and standard operating procedures to be incorporated into updated IWTP O&M Manual.
- Coordinate with City of Seatac to optimize the alignment of proposed pipes that run parallel to or cross the right-of-way of S. 188th Street, implementing trenchless technologies where feasible, and minimizing impacts to traffic and existing utilities and infrastructure.
- Continue to refine pipe alignments and structure siting to enhance constructability, minimize impacts to wetlands and permitted dam, minimize utility conflicts, and facilitate

access. Potential concepts to be evaluated at Lagoon 3 site include combination of Lagoon 3 and 4 underdrains, relocation of Lagoon 4 influent pipe under Lagoon 3, and shifting Lagoon 4 Pump Station and associated structures east of the west access road.

- Coordinate with Port on selected pipe and building materials to verify compliant with Port standards. Verify ability to use HDPE pipe material with Port Fire Department.
- Continue to refine electrical service requirements, including addition of electric charging station for an electric fleet vehicle outside the AGB Control Building and one for a potential electric forklift inside the overhead door inside the AGB Control Building.
- Lay out proposed utility service lines and relocated utility service lines based on coordination with utility agencies regarding utility capacity demands and tie-in locations, as described in Section 9.4.
- Coordinate with FAA on requirements for construction within close proximity to FAA runway lights and electrical ductbanks.
- Continue to refine conveyance and storage infrastructure sizing based on detailed design phase equipment selections, hydraulic calculations, and performance criteria.
- Refine proposed grading to minimize steep slopes and facilitate access, with consideration for elevations that need to be met to achieve required system hydraulics.
- Refine access road and parking layout based on emergency vehicle and maintenance access requirements, as well as operator staffing and fleet vehicle requirements, including electric vehicle charging stations. Evaluate whether it would be beneficial to relocate AGB site driveway connection from Des Moines Memorial Drive to S. 190th Street.
- Update stormwater analysis (see Section 9.5) based on updated assumptions for grading and imperviousness. Refine stormwater BMP sizing, selection, and siting based on updated infrastructure siting and sizing and pavement extents.
- Consider jar testing representative influent samples to confirm process modifications in the DAF and solids handling systems. This could help confirm proposed DAF and gravity thickener sizing, as well as determine the impact and efficacy of flocculant addition and optimize dosage, if necessary.

10.3.5 Construction Phasing Plan

The Port is developing a plan to phase various construction tasks over space and time in a logical fashion. The intent is to create packages of work that can be accomplished without negatively impacting the ongoing operations and functions of the IWTP. Demolition and construction at the AGB site can proceed without impacting the existing IWTP functionality. However, construction activities at the existing DAF system and Lagoon 3 will require careful coordination and sequencing to allow IWS flows to be stored, treated at the DAF system, and discharged in accordance with permit limits while construction activities are ongoing. Preliminary phasing

considerations are summarized in **Attachment E**. Examples of considerations include the following:

- It will be necessary for at least a portion of the DAF system to remain online and functional while other portions of the system are offline for replacement.
- Construction of the AGB tank prior to Lagoon 4 may help offset the impact of construction on the available storage capacity in Lagoon 3, although this may require a temporary pumping system to route flow from the trunk line to the AGB Tank.
- Construction and commissioning of the AGB treatment system ahead of the construction at the Lagoon 3 site may help offset the limitations in available storage encountered while Lagoon 3 is temporarily offline during construction of the dividing berm.

Attachment A

Drawing Sheets

Port of Seattle

SEA-TAC INTERNATIONAL AIRPORT

INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION

FINAL BASIS OF DESIGN REPORT

NOT FOR CONSTRUCTION

APPROVED AS-BUILT SET

THIS DRAWING SET REPRESENTS A RECORD OF HOW THE PROJECT WAS CONSTRUCTED AND DOES NOT REPRESENT DESIGN OR CHANGE APPROVAL

APPROVED BY

DATE

WORK PROJECT NO. **0000**

PORT OF SEATTLE NO. + SHEET NUMBER **STIA-2404 G0**

MAJOR CONTRACT

RECOMMENDED FOR APPROVAL

DATE

DATE

DATE

APPROVED BY

DATE

WORK PROJECT NO. **0000**

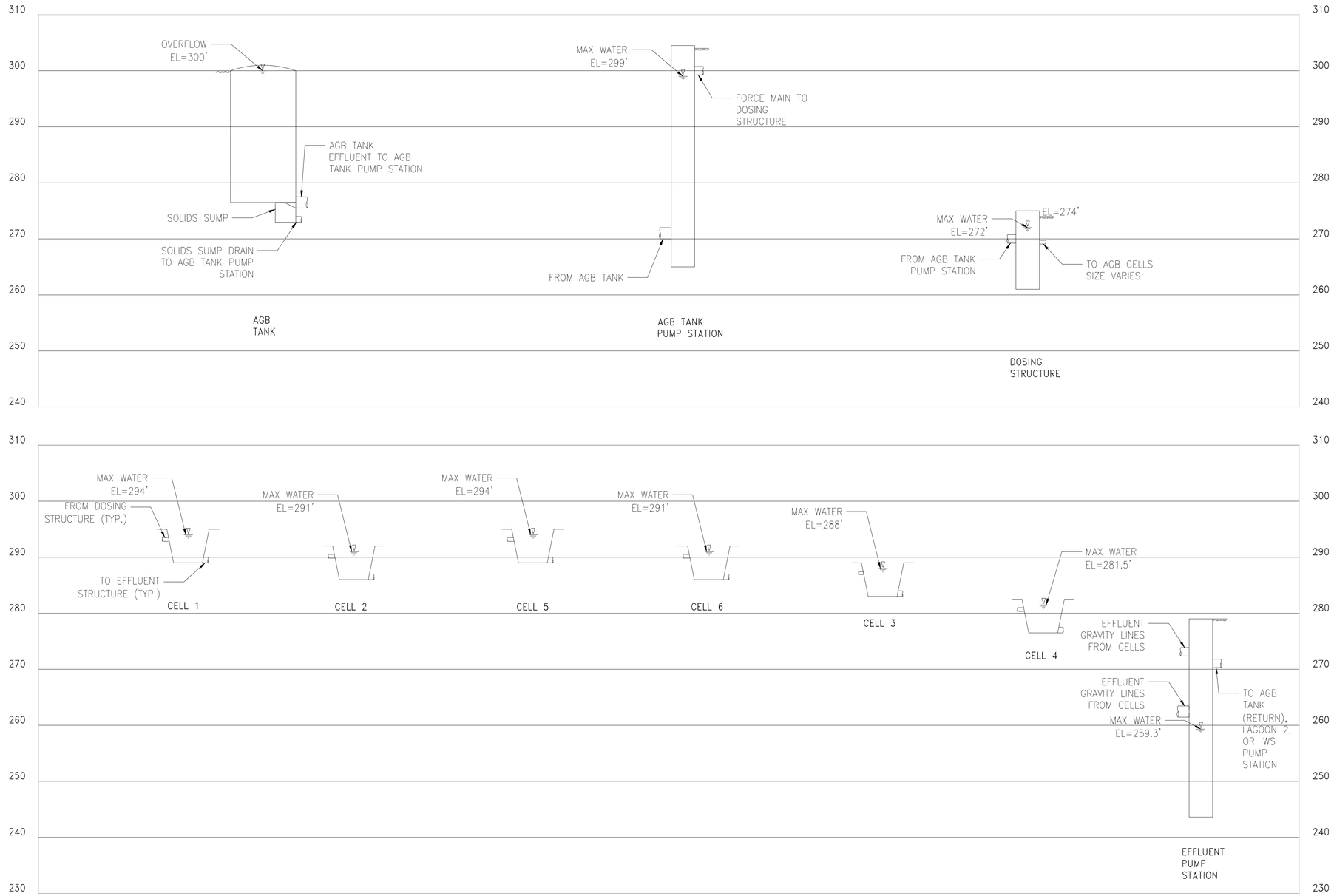
PORT OF SEATTLE NO. + SHEET NUMBER **STIA-2404 G0**

SHEET NO.	SHEET TITLE
	GENERAL PROJECT PLANS
G0	COVER AND SHEET INDEX
G1	HYDRAULIC PROFILE - AGB SITE
G2	HYDRAULIC PROFILE - IWTP AND LAGOON 3 SITES
	ARCHITECTURAL PROJECT PLANS
A1	CONTROL BUILDING PLAN
A2	CONTROL BUILDING ELEVATIONS

SHEET NO.	SHEET TITLE
	CIVIL PROJECT PLANS
C1	EXISTING SITE PLAN - OVERALL
C2	EXISTING SITE PLAN - AGB SITE
C3	EXISTING SITE PLAN - IWTP SITE
C4	EXISTING SITE PLAN - LAGOON 3 SITE
C5	PROPOSED SITE PLAN - OVERALL
C6	PROPOSED SITE PLAN - AGB SITE
C7	PROPOSED SITE PLAN - IWTP SITE
C8	PROPOSED SITE PLAN - LAGOON 3 SITE
C9	PROPOSED GRADING PLAN - AGB SITE
C10	PROPOSED GRADING PLAN - LAGOON 3 SITE
C11	IWS PIPING PLAN - OVERALL
C12	IWS PIPING PLAN - AGB SITE (1 OF 2)
C13	IWS PIPING PLAN - AGB SITE (2 OF 2)
C14	IWS PIPING PLAN - IWTP SITE
C15	IWS PIPING PLAN - LAGOON 3 SITE (1 OF 3)
C16	IWS PIPING PLAN - LAGOON 3 SITE (2 OF 3)
C17	IWS PIPING PLAN - LAGOON 3 SITE (3 OF 3)
C18	STORMWATER CONTROL AND DRAINAGE PLAN - AGB SITE

SHEET NO.	SHEET TITLE
	MECHANICAL PROJECT PLANS
M1	AGB TANK PLAN AND ELEVATION
M2	DAF AND BUILDING MODIFICATIONS - DEMOLITION PLAN
M3	DAF AND BUILDING MODIFICATIONS - PROPOSED PLAN
M4	SOLIDS HANDLING MODIFICATIONS - DEMOLITION PLAN
M5	SOLIDS HANDLING MODIFICATIONS - PROPOSED PLAN
M6	AGB DETAILS
M7	PROCESS AND INSTRUMENTATION DIAGRAM - OVERALL PROCESS
M8	PROCESS AND INSTRUMENTATION DIAGRAM - AGB PROCESS - PARALLEL FLOW
M9	PROCESS AND INSTRUMENTATION DIAGRAM - AGB PROCESS - SERIES FLOW
	ELECTRICAL PROJECT PLANS
E1	ELECTRICAL PLAN - AGB SITE
E2	ELECTRICAL PLAN - IWTP SITE
E3	ELECTRICAL PLAN - LAGOON 3 SITE

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GENERAL NOTES:

1. THE PURPOSE OF THE HYDRAULIC PROFILES IS TO REPRESENT MAXIMUM WATER OR OVERFLOW ELEVATIONS. DYNAMIC WATER ELEVATIONS ARE NOT REPRESENTED.

(#) KEYED NOTES:

1. NOT USED.

KEY PLAN

CALL 2 DAYS
BEFORE YOU DIG
1-800-424-5555

HYDRAULIC PROFILE

AGB SITE
VERTICAL SCALE: 1" = 10'

NOT FOR CONSTRUCTION

Gresham Smith
10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR./ARCH: MARK ERVIN
DESIGNER:
DRAWN BY:
SCALE: VERTICAL: 1" = 10'
DATE:
CHECKED BY:
CHECKED/APPROVED BY:

REVISIONS

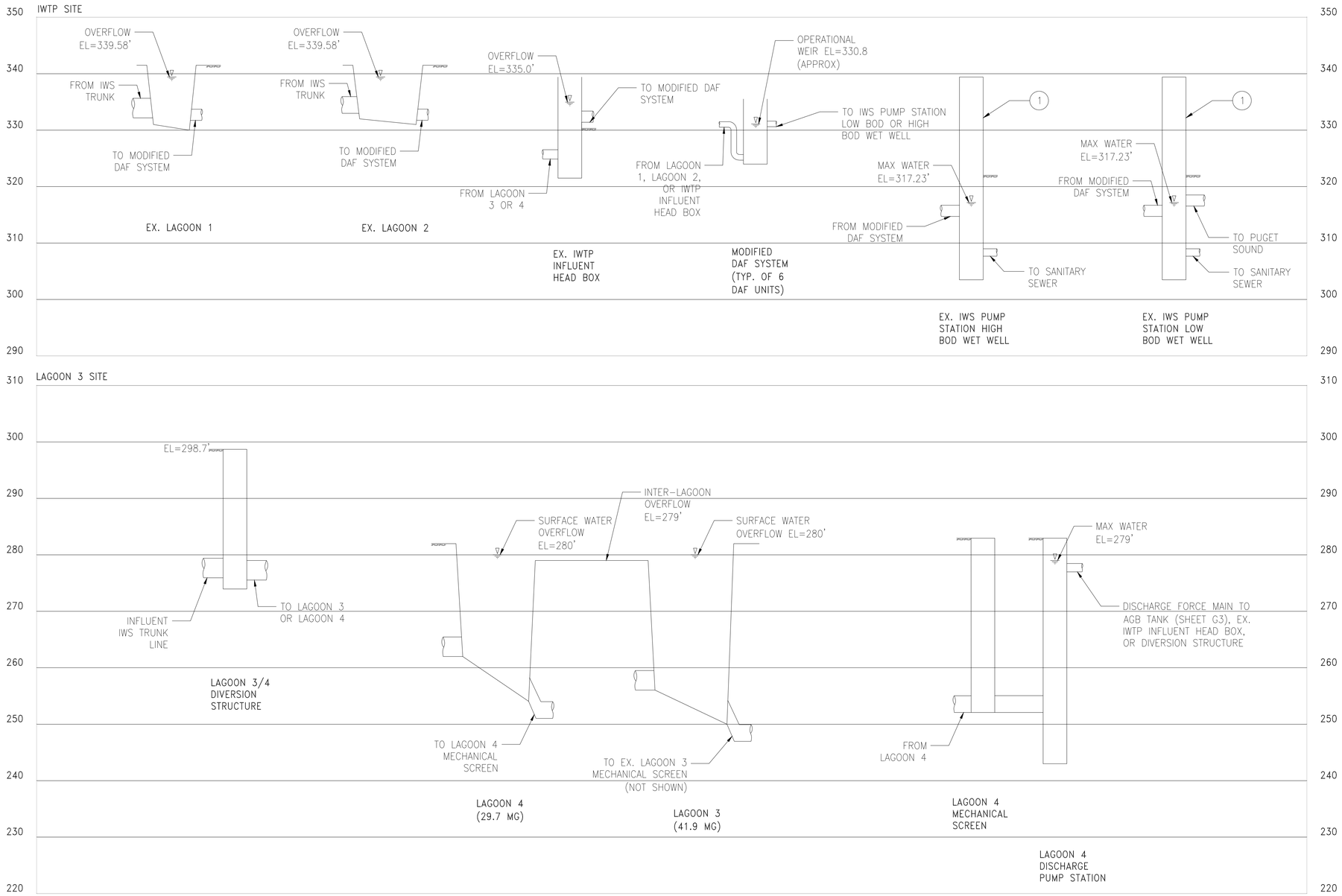
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2	06-23-23	.	FINAL BASIS OF DESIGN REPORT	.	.	.	.	.	.
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POS PROJECT MANAGER: ETHAN CONLEY
POS PROJECT ENGINEER:
POS DESIGN ENGINEER:
POS DRAFTER:
POS SCALE: VERTICAL: 1" = 10'
POS DATE:
POS CHECKED/APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION
SHEET TITLE: HYDAULIC PROFILE AGB SITE

POS WORK PROJECT NUMBER: 000000
CONSULTANT'S PROJECT NUMBER: 44846.10
POS PROJECT TRACKING NUMBER: STIA-2404 G1

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GENERAL NOTES:

1. THE PURPOSE OF THE HYDRAULIC PROFILES IS TO REPRESENT MAXIMUM WATER OR OVERFLOW ELEVATIONS. DYNAMIC WATER ELEVATIONS ARE NOT REPRESENTED.

(#) KEYED NOTES:

1. THE EXISTING IWS HIGH BOD AND LOW BOD WET WELLS ARE SEPARATE COMPARTMENTS WITHIN THE LOWER HALF OF THE EXISTING IWS PUMP STATION.

KEY PLAN

CALL 2 DAYS BEFORE YOU DIG 1-800-424-5555

HYDRAULIC PROFILE

IWTP AND LAGOON 3 SITES
VERTICAL SCALE: 1" = 10'

NOT FOR CONSTRUCTION

Gresham Smith
10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR./ARCH: MARK ERVIN
DESIGNER:
DRAWN BY:
SCALE: VERTICAL: 1" = 10'
DATE:
CHECKED BY:
CHECKED/APPROVED BY:

REVISIONS

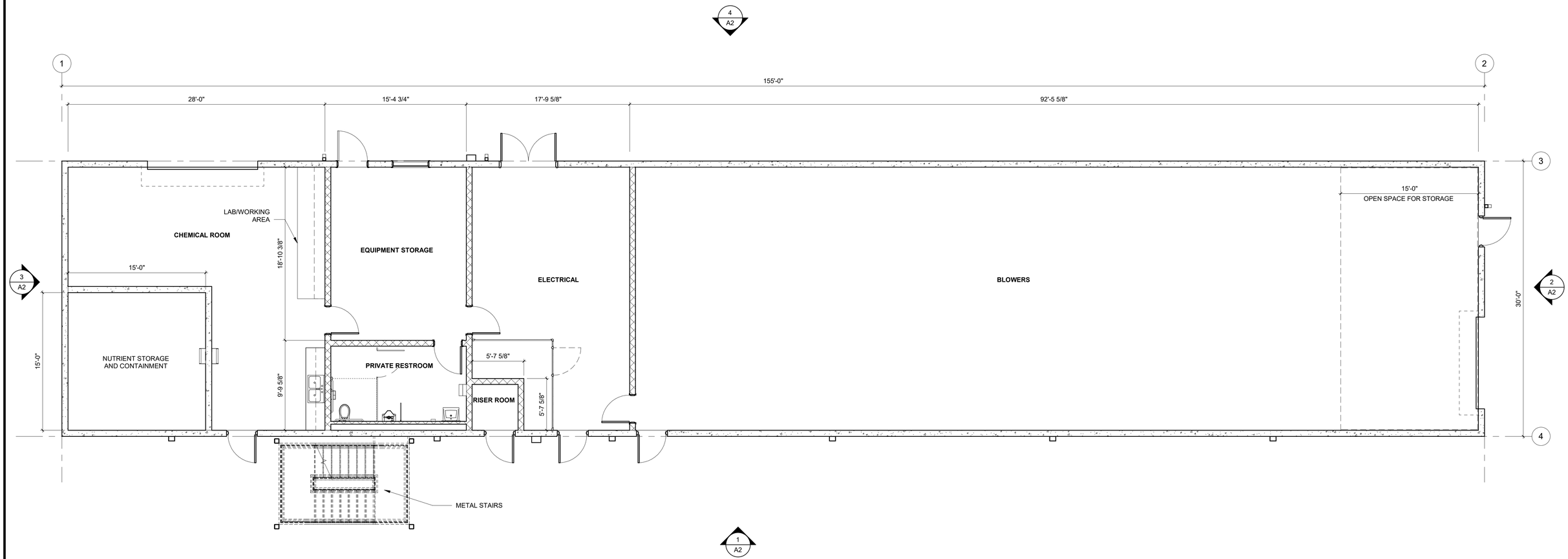
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POS PROJECT MANAGER: ETHAN CONLEY
POS PROJECT ENGINEER:
POS DESIGN ENGINEER:
POS DRAFTER:
POS SCALE: VERTICAL: 1" = 10'
POS DATE:
POS CHECKED/APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION
SHEET TITLE: HYDRAULIC PROFILE IWTP AND LAGOON 3 SITES

POS WORK PROJECT NUMBER: 000000
CONSULTANT'S PROJECT NUMBER: 44846.10
POS PROJECT TRACKING NUMBER: STIA-2404 G2

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1 FIRST FLOOR - OVERALL PLAN

3/16" = 1'-0"

0' 2' 4' 8' 12'

N

CALL 2 DAYS
BEFORE YOU DIG
1-800-424-5555

NOT FOR CONSTRUCTION

Gresham Smith

10 West Broad Street
Suite 1650
Columbus, OH 43215

614.221.0678

PROJECT ENGR./ARCH: MARK ERVIN
DESIGNER:
DRAWN BY:
SCALE: 3/16" = 1'-0"
DATE:
CHECKED BY:
CHECKED/APPROVED BY:

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D
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2	06-23-23		FINAL BASIS OF DESIGN REPORT						

POS PROJECT MANAGER: ETHAN CONLEY
POS PROJECT ENGINEER:
POS DESIGN ENGINEER:
POS DRAFTER:
POS SCALE: 3/16" = 1'-0"
POS DATE:
POS CHECKED/APPROVED BY:

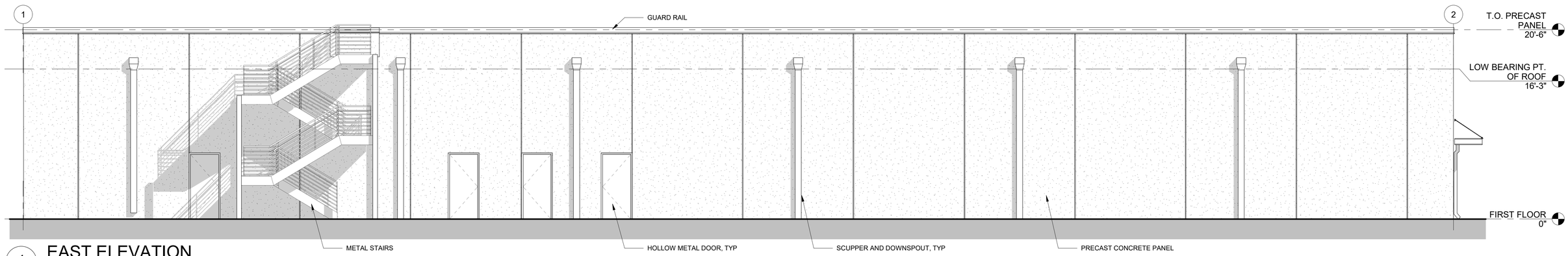
Port of Seattle

SEA-TAC INTERNATIONAL AIRPORT

PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION

SHEET TITLE: CONTROL BUILDING PLAN

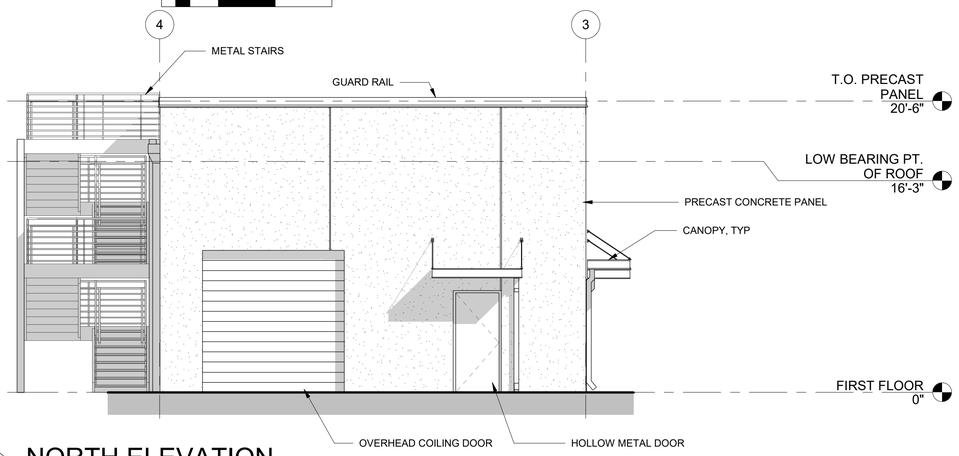
POS WORK PROJECT NUMBER: 000000
CONSULTANT'S PROJECT NUMBER: 44846.00
POS PROJECT TRACKING NUMBER: STIA-2404 A1



1 EAST ELEVATION

3/16" = 1'-0"

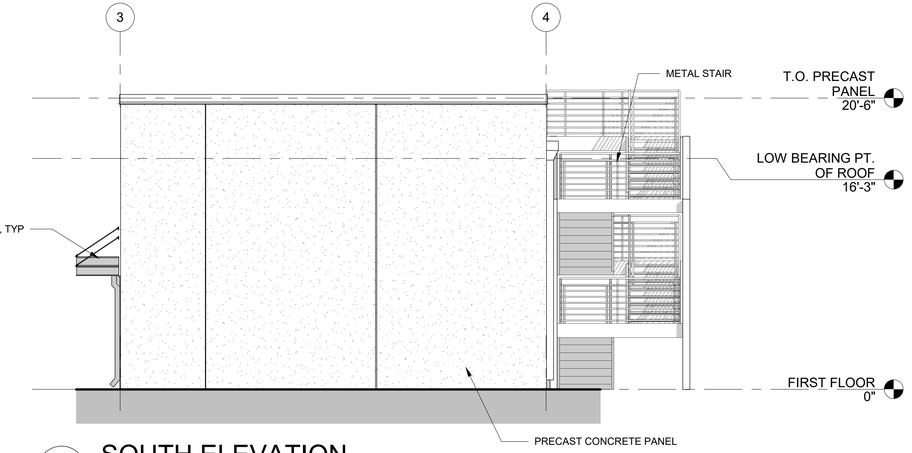
0' 2' 4' 8' 12'



2 NORTH ELEVATION

3/16" = 1'-0"

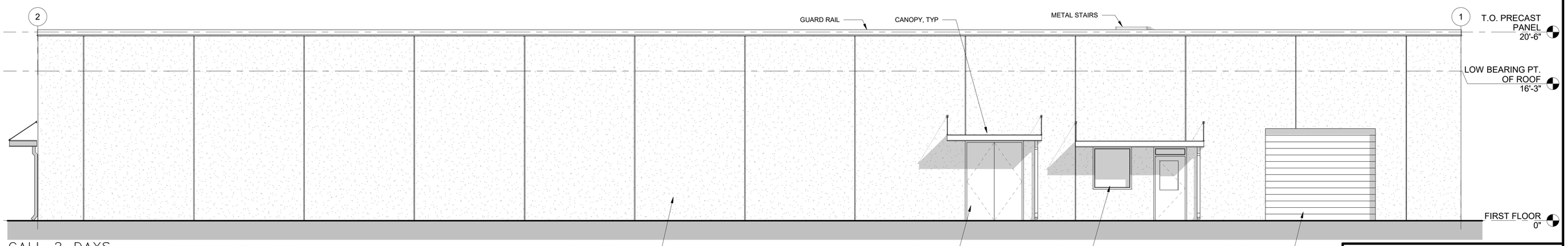
0' 2' 4' 8' 12'



3 SOUTH ELEVATION

3/16" = 1'-0"

0' 2' 4' 8' 12'



4 WEST ELEVATION

3/16" = 1'-0"

0' 2' 4' 8' 12'

CALL 2 DAYS BEFORE YOU DIG 1-800-424-5555

NOT FOR CONSTRUCTION

Gresham Smith

10 West Broad Street
Suite 1650
Columbus, OH 43215

614.221.0678

PROJECT ENGR./ARCH: MARK ERVIN
DESIGNER:
DRAWN BY:
SCALE: 3/16" = 1'-0"
DATE:
CHECKED BY:
CHECKED/APPROVED BY:

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D
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2	06-23-23		FINAL BASIS OF DESIGN REPORT						

POS PROJECT MANAGER: ETHAN CONLEY
POS PROJECT ENGINEER:
POS DESIGN ENGINEER:
POS DRAFTER:
POS SCALE: 3/16" = 1'-0"
POS DATE:
POS CHECKED/APPROVED BY:

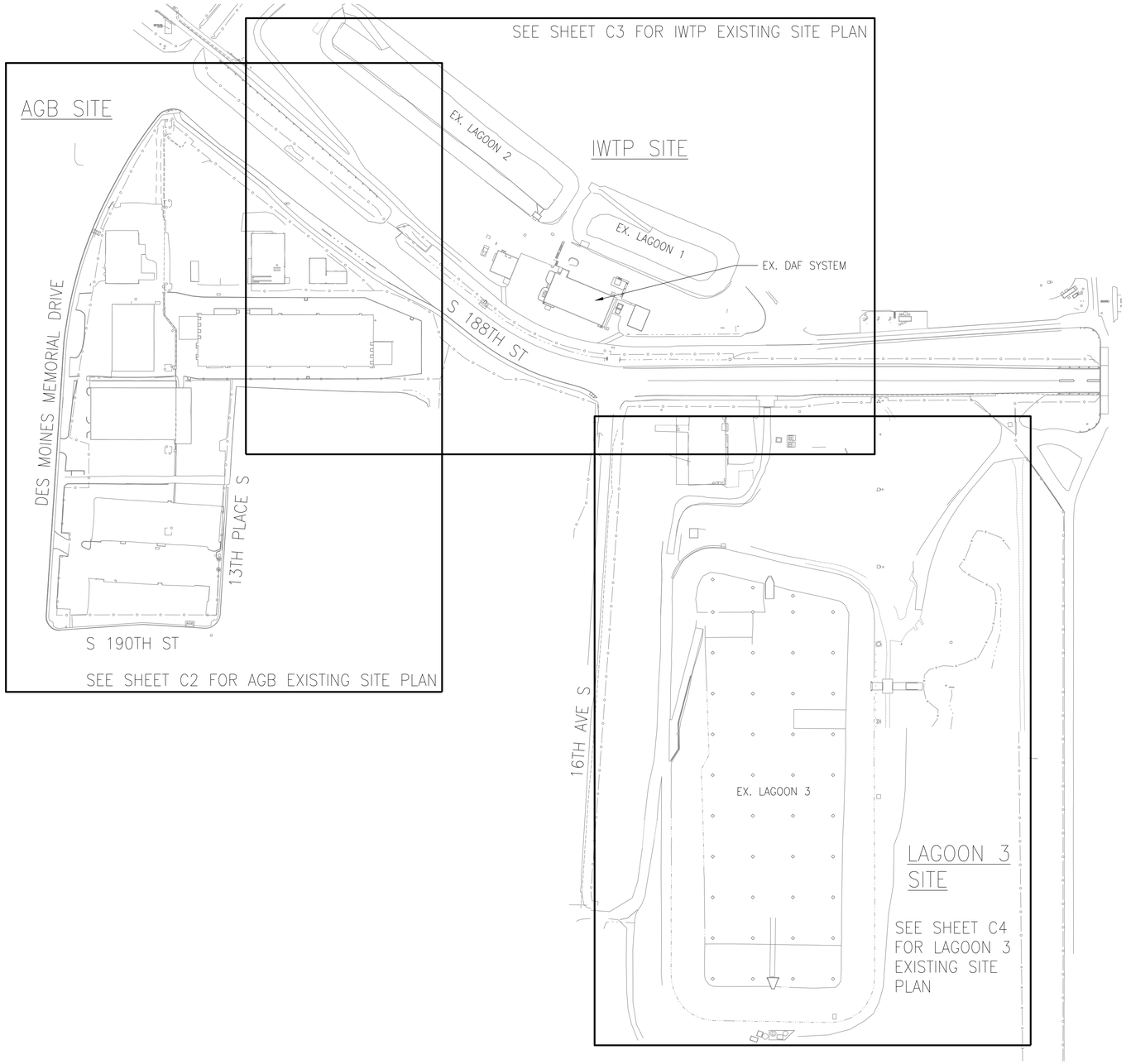
Port of Seattle

SEA-TAC INTERNATIONAL AIRPORT

PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION

SHEET TITLE: CONTROL BUILDING ELEVATIONS

POS WORK PROJECT NUMBER: 000000
CONSULTANT'S PROJECT NUMBER: 44846.00
POS PROJECT TRACKING NUMBER: STIA-2404 A2

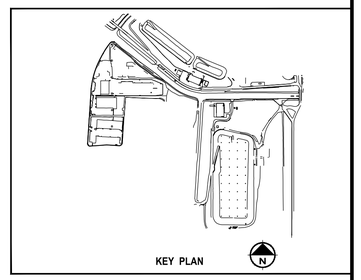


GENERAL NOTES:

1. NOT USED

(#) KEYED NOTES:

1. NOT USED



PLAN
EXISTING SITE PLAN
OVERALL
SCALE: 1" = 150'

N

1"=150'-0" 150 0 150 300
Scale Feet

CALL 2 DAYS
BEFORE YOU DIG
1-800-424-5555

NOT FOR CONSTRUCTION

Gresham Smith
10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR/ARCH: MARK ERVIN
DESIGNER:
DRAWN BY:
SCALE: 1" = 150'
DATE:
CHECKED BY:
CHECKED/APPROVED BY:

REVISIONS

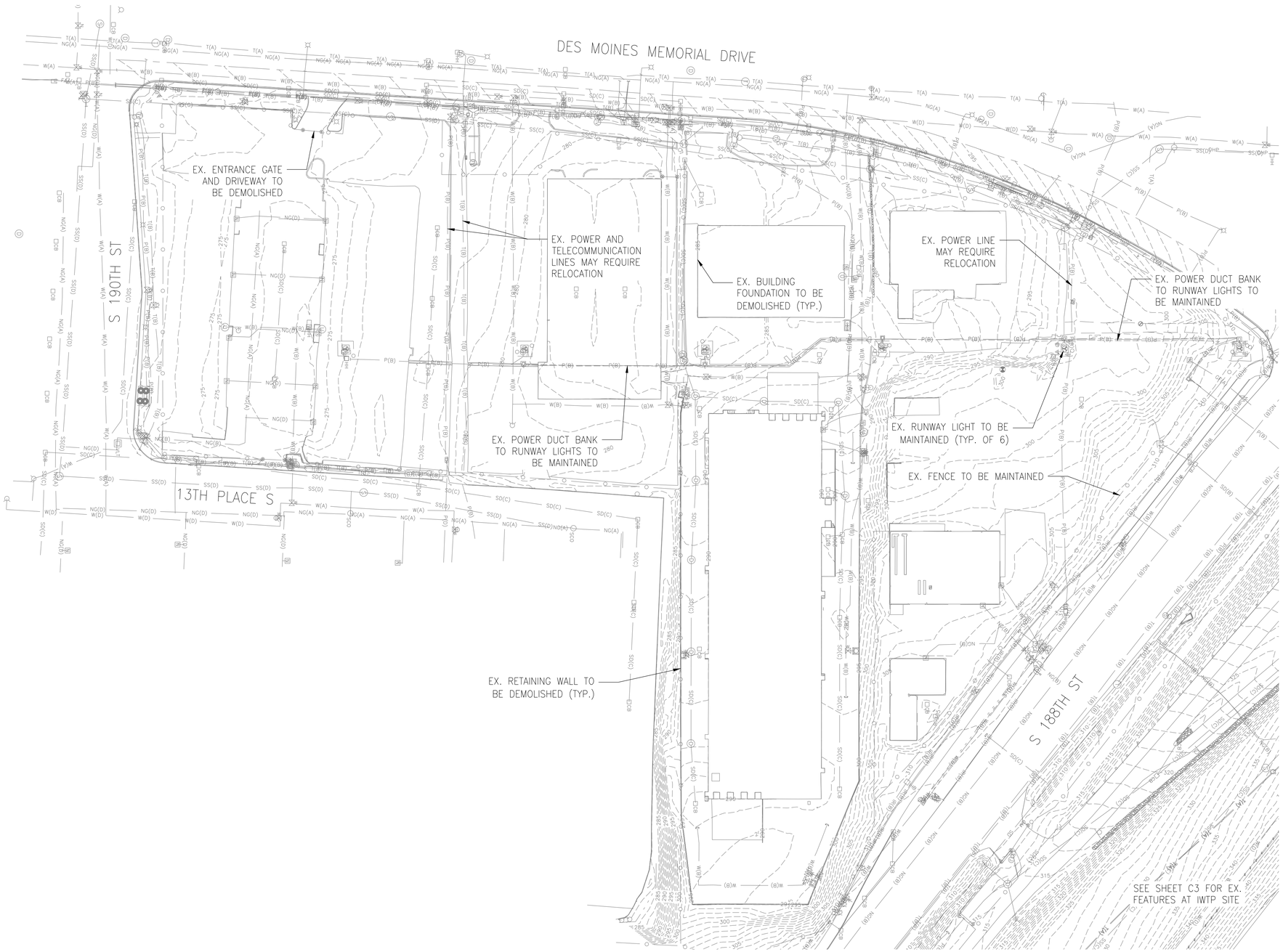
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POS PROJECT MANAGER: ETHAN CONLEY
POS PROJECT ENGINEER:
POS DESIGN ENGINEER:
POS DRAFTER:
POS SCALE: 1" = 150'
POS DATE:
POS CHECKED/APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION
SHEET TITLE: EXISTING SITE PLAN OVERALL

POS WORK PROJECT NUMBER: 000000
CONSULTANT'S PROJECT NUMBER: 44846.10
POS PROJECT TRACKING NUMBER: STIA-2404 C1

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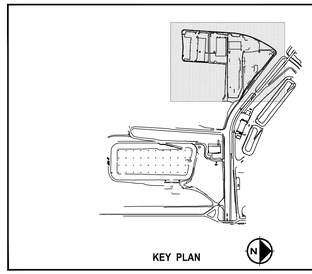


GENERAL NOTES:

1. SEE SHEET C6 FOR PROPOSED FEATURES AT THE AGB SITE.
2. COORDINATE WITH UTILITY AGENCIES TO CONFIRM ACTIVE UTILITIES CROSSING SITE THAT REQUIRE RELOCATION RATHER THAN DEMOLITION. ALL EXISTING UTILITIES WITHIN THE LIMITS OF CONSTRUCTION THAT ARE INACTIVE AND DO NOT REQUIRE RELOCATION SHALL BE DEMOLISHED.
3. NEW UTILITY CONNECTIONS ARE REQUIRED FOR: WATER AND FIRE WATER (HIGHLINE WATER DISTRICT), STORMWATER (CITY OF SEATAC), SANITARY (MIDWAY SEWER DISTRICT), ELECTRICAL AND NATURAL GAS (PUGET SOUND ENERGY), AND TELECOMMUNICATIONS (CENTURYLINK). COORDINATE ON NEW UTILITY CAPACITY REQUIREMENTS AND TIE-IN LOCATIONS (NOT SHOWN HERE).
4. SITE IS LOCATED WITHIN THE RPZ AND WILL REQUIRE FIRE WATER SYSTEM (HIGHLINE WATER DISTRICT) WITH FIRE HYDRANTS TO SUPPORT EMERGENCY RESPONSE FROM AIRPORT FIRE DEPARTMENT AT SITE.
5. EXISTING RUNWAY LIGHTS AND ASSOCIATED DUCT BANK SHALL BE PROTECTED FROM DISTURBANCE AND REMAIN OPERATIONAL AT ALL POINTS DURING CONSTRUCTION. COORDINATE WITH FAA DURING DETAILED DESIGN PHASE TO CONFIRM INFRASTRUCTURE LOCATIONS, MINIMUM OFFSETS, AND CONSTRUCTION REQUIREMENTS FOR UTILITY CROSSINGS AND GRADING IN THE VICINITY. NOTIFY FAA PRIOR TO CONSTRUCTION IN THESE AREAS.

(#) KEYED NOTES:

1. NOT USED



PLAN

EXISTING SITE PLAN
AGB SITE
SCALE: 1" = 60'

N

1"=60'-0" 60 0 60 120
Scale Feet

NOT FOR CONSTRUCTION

CALL 2 DAYS
BEFORE YOU DIG
1-800-424-5555

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Gresham Smith
10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR./ARCH: MARK ERVIN
DESIGNER:
DRAWN BY:
SCALE: 1" = 60'
DATE:
CHECKED BY:
CHECKED/APPROVED BY:

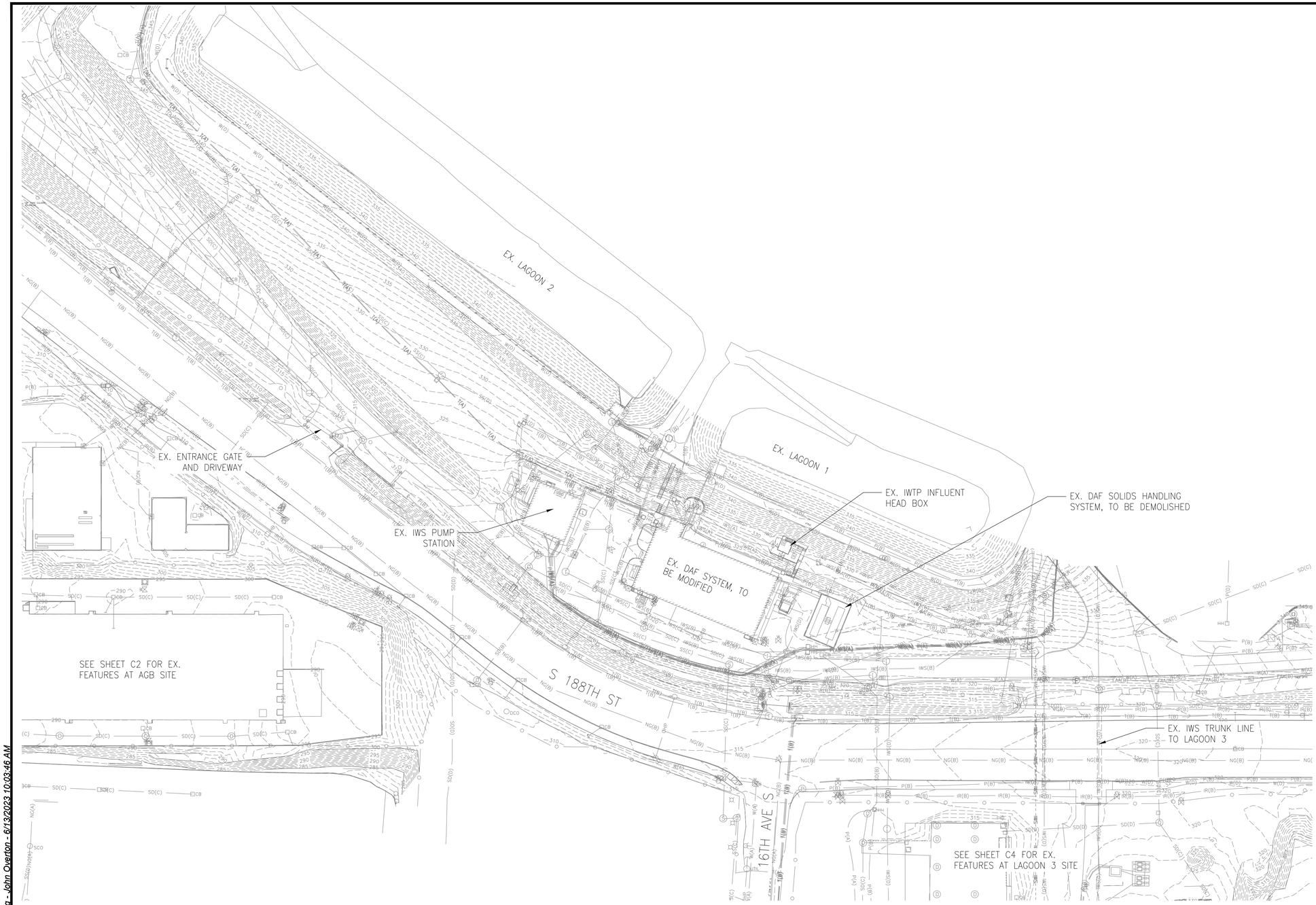
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3	06-07-23	.	FINAL ENGINEERING REPORT	.	.	.	.	.	.
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POS PROJECT MANAGER: ETHAN CONLEY
POS PROJECT ENGINEER:
POS DESIGN ENGINEER:
POS DRAFTER:
POS SCALE: 1" = 60'
POS DATE:
POS CHECKED/APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION
SHEET TITLE: EXISTING SITE PLAN AGB SITE

POS WORK PROJECT NUMBER: 000000
CONSULTANT'S PROJECT NUMBER: 44846.10
POS PROJECT TRACKING NUMBER: STIA-2404 C2



CALL 2 DAYS
BEFORE YOU DIG
1-800-424-5555

PLAN
EXISTING SITE PLAN
IWTP SITE
SCALE: 1"=60'

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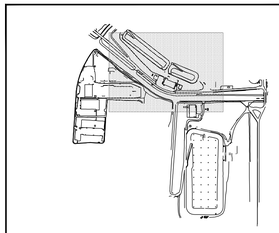
1"=60'-0" 60 0 60 120
Scale Feet

GENERAL NOTES:

1. SEE SHEET C7 FOR PROPOSED FEATURES AT THE IWTP SITE.

(#) KEYED NOTES:

1. NOT USED



KEY PLAN

NOT FOR CONSTRUCTION

Gresham Smith
10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR./ARCH: MARK ERVIN
DESIGNER:
DRAWN BY:
SCALE: 1" = 60'
DATE:
CHECKED BY:
CHECKED/APPROVED BY:

REVISIONS

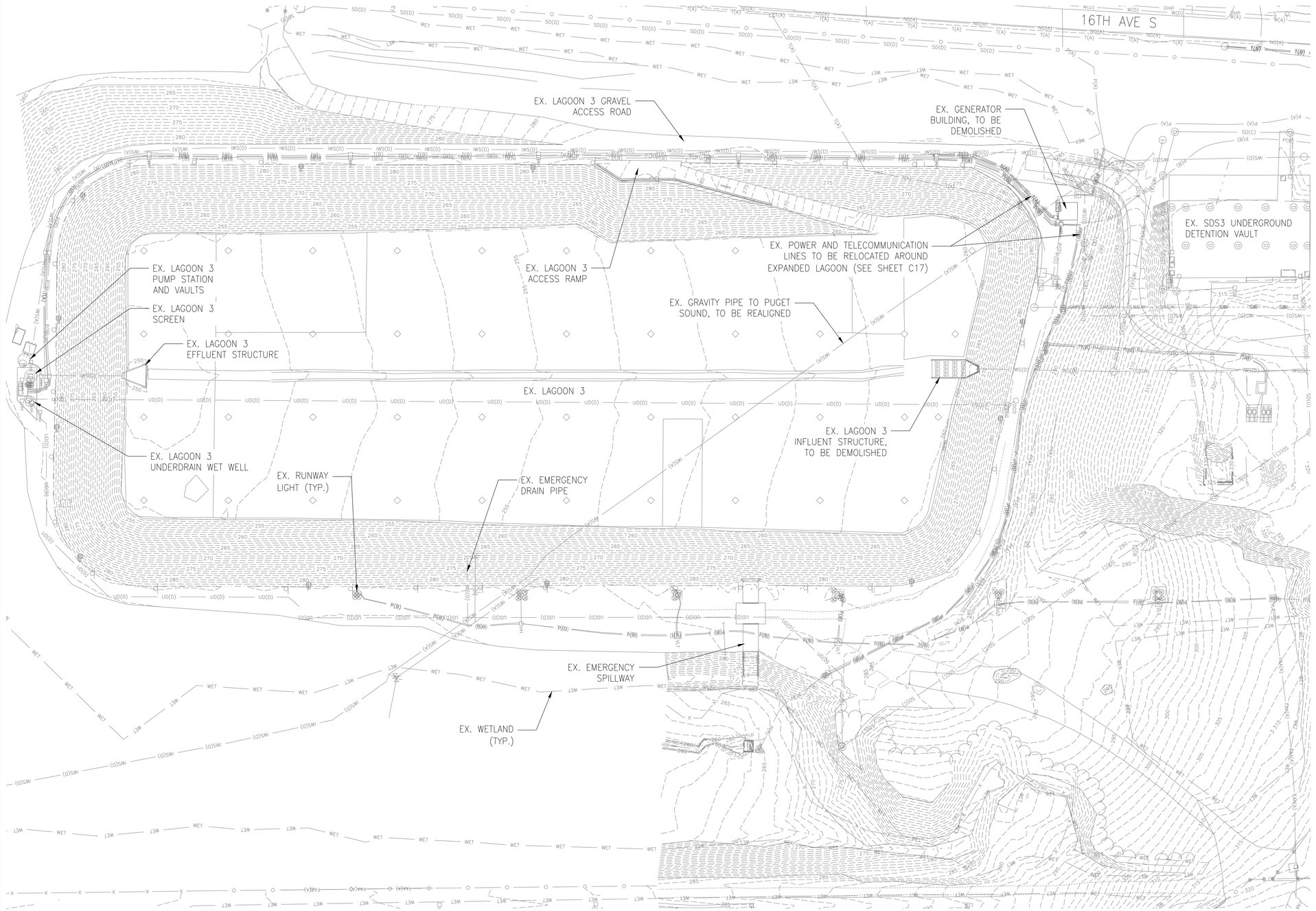
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POS PROJECT MANAGER: ETHAN CONLEY
POS PROJECT ENGINEER:
POS DESIGN ENGINEER:
POS DRAFTER:
POS SCALE: 1" = 60'
POS DATE:
POS CHECKED/APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION
SHEET TITLE: EXISTING SITE PLAN
IWTP SITE

POS WORK PROJECT NUMBER: 000000
CONSULTANT'S PROJECT NUMBER: 44846.10
POS PROJECT TRACKING NUMBER: STIA-2404 C3

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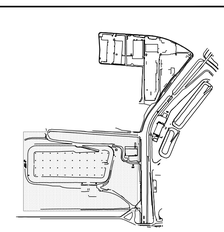


GENERAL NOTES:

1. SEE SHEET C8 FOR PROPOSED FEATURES AT THE LAGOON 3 SITE.
2. LAGOON 3 IS CLASSIFIED AS A DAM, AND ALL MODIFICATIONS MUST COMPLY WITH ECOLOGY DAM SAFETY REQUIREMENTS.

(#) KEYED NOTES:

1. NOT USED



KEY PLAN

CALL 2 DAYS
BEFORE YOU DIG
1-800-424-5555

PLAN

EXISTING SITE PLAN
LAGOON 3 SITE
SCALE: 1" = 60'

1"=60'-0" 60 0 60 120
Scale Feet

NOT FOR CONSTRUCTION

Gresham Smith
10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR./ARCH: MARK ERVIN
DESIGNER:
DRAWN BY:
SCALE: 1" = 60'
DATE:
CHECKED BY:
CHECKED/APPROVED BY:

REVISIONS

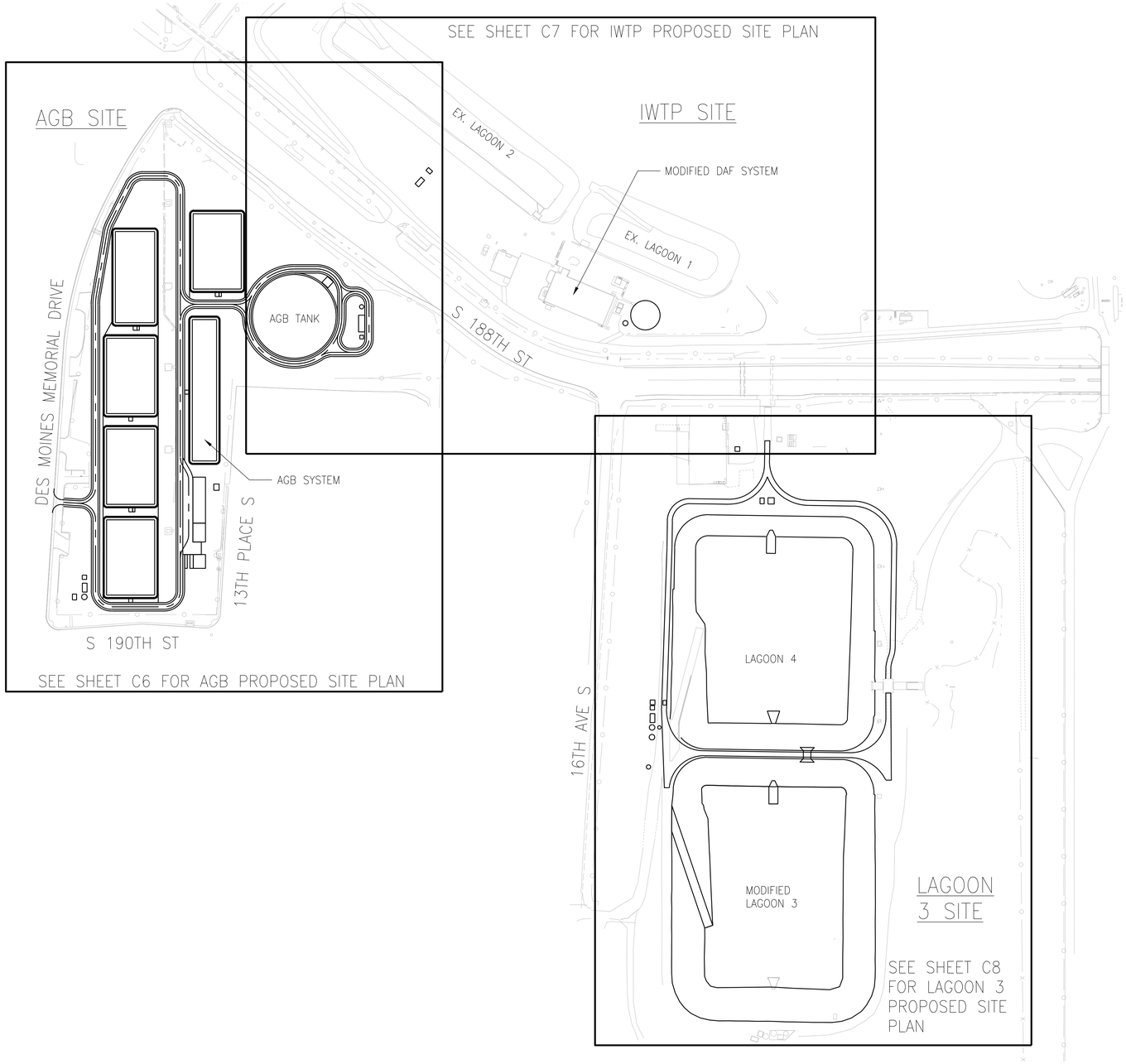
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POS PROJECT MANAGER: ETHAN CONLEY
POS PROJECT ENGINEER:
POS DESIGN ENGINEER:
POS DRAFTER:
POS SCALE: 1" = 60'
POS DATE:
POS CHECKED/APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION
SHEET TITLE: EXISTING SITE PLAN LAGOON 3 SITE

POS WORK PROJECT NUMBER: 000000
CONSULTANT'S PROJECT NUMBER: 44846.10
POS PROJECT TRACKING NUMBER: STIA-2404 C4

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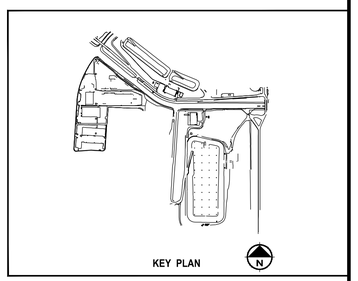


GENERAL NOTES:

1. NOT USED

(#) KEYED NOTES:

1. NOT USED



PLAN

PROPOSED SITE PLAN
OVERALL
SCALE: 1" = 150'

N

1"=150'-0" 150 0 150 300
Scale Feet

CALL 2 DAYS
BEFORE YOU DIG
1-800-424-5555

NOT FOR CONSTRUCTION

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Gresham Smith
10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR/ARCH:	MARK ERVIN
DESIGNER:	
DRAWN BY:	
SCALE:	1" = 150'
DATE:	
CHECKED BY:	
CHECKED/APPROVED BY:	

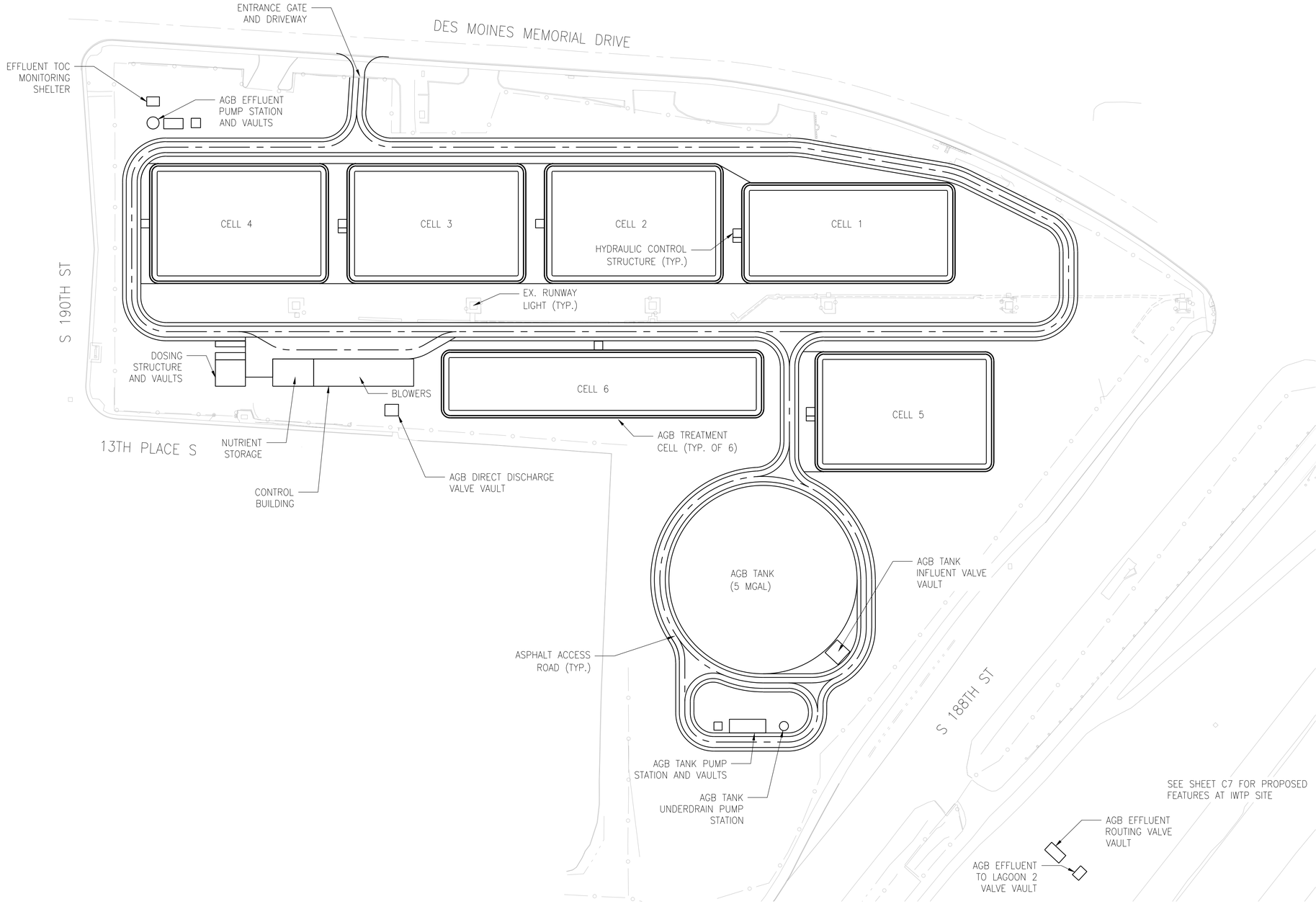
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NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D
1	02-28-23	.	DRAFT ENGINEERING REPORT	.	.	.	.	.	.
2	03-21-23	.	DRAFT BASIS OF DESIGN REPORT	.	.	.	.	.	.
3	06-07-23	.	FINAL ENGINEERING REPORT	.	.	.	.	.	.
4	6-23-23	.	FINAL BASIS OF DESIGN REPORT	.	.	.	.	.	.
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POS PROJECT MANAGER:	ETHAN CONLEY
POS PROJECT ENGINEER:	
POS DESIGN ENGINEER:	
POS DRAFTER:	
POS SCALE:	1" = 150'
POS DATE:	
POS CHECKED/APPROVED BY:	

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION
SHEET TITLE: PROPOSED SITE PLAN OVERALL

POS WORK PROJECT NUMBER	000000
CONSULTANT'S PROJECT NUMBER	44846.10
POS PROJECT TRACKING NUMBER	STIA-2404 C5



PLAN

PROPOSED SITE PLAN
AGB SITE
SCALE: 1" = 60'

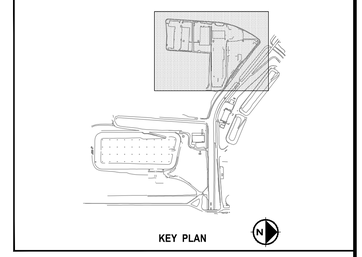
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Scale Feet

GENERAL NOTES:

1. SEE SHEET C2 FOR EXISTING FEATURES AT THE AGB SITE.
2. SEE SHEETS C12–C17 FOR PROPOSED IWS PIPING PLANS AND SHEET C18 FOR STORMWATER CONTROL AND DRAINAGE PLAN. PROPOSED UTILITY CONNECTION LOCATIONS AND SERVICE LINE LAYOUTS TO BE DEVELOPED DURING DETAILED DESIGN PHASE.
3. EXISTING RUNWAY LIGHTS AND ASSOCIATED DUCT BANK SHALL BE PROTECTED FROM DISTURBANCE AND REMAIN OPERATIONAL AT ALL POINTS DURING CONSTRUCTION. COORDINATE WITH FAA DURING DETAILED DESIGN PHASE TO CONFIRM INFRASTRUCTURE LOCATIONS, MINIMUM OFFSETS, AND CONSTRUCTION REQUIREMENTS FOR UTILITY CROSSINGS AND GRADING IN THE VICINITY. NOTIFY FAA PRIOR TO CONSTRUCTION IN THESE AREAS.

(#) KEYED NOTES:

1. NOT USED



CALL 2 DAYS
BEFORE YOU DIG
1-800-424-5555

NOT FOR CONSTRUCTION

Gresham Smith
10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR/ARCH:	MARK ERVIN
DESIGNER:	
DRAWN BY:	
SCALE:	1" = 60'
DATE:	
CHECKED BY:	
CHECKED/APPROVED BY:	

REVISIONS

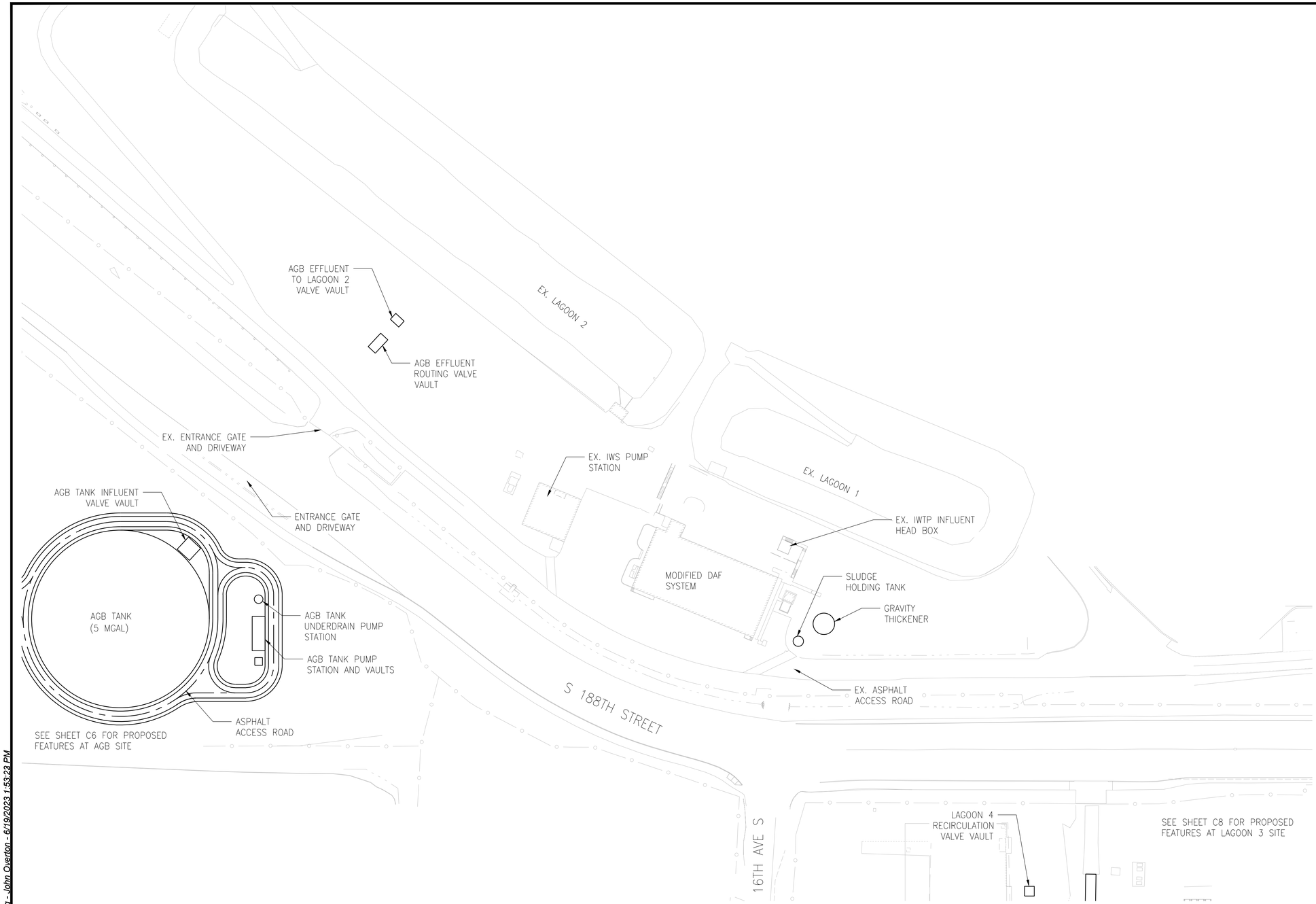
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3	06-07-23	.	FINAL ENGINEERING REPORT	.	.	.	.	.	.
4	06-23-23	.	FINAL BASIS OF DESIGN REPORT	.	.	.	.	.	.
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POS PROJECT MANAGER:	ETHAN CONLEY
POS PROJECT ENGINEER:	
POS DESIGN ENGINEER:	
POS DRAFTER:	
POS SCALE:	1" = 60'
POS DATE:	
POS CHECKED/APPROVED BY:	

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION
SHEET TITLE: PROPOSED SITE PLAN AGB SITE

POS WORK PROJECT NUMBER	000000
CONSULTANT'S PROJECT NUMBER	44846.10
POS PROJECT TRACKING NUMBER	STIA-2404 C6

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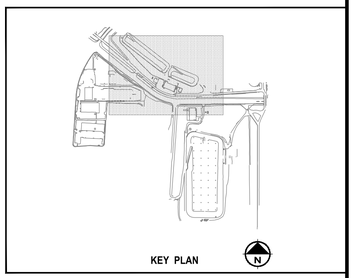


GENERAL NOTES:

1. SEE SHEET C3 FOR EXISTING FEATURES AT THE IWTP SITE.

(#) KEYED NOTES:

1. NOT USED



CALL 2 DAYS
BEFORE YOU DIG
1-800-424-5555

PLAN

PROPOSED SITE PLAN
IWTP SITE
SCALE: 1" = 60'

N

1"=60'-0" 60 0 60 120
Scale Feet

NOT FOR CONSTRUCTION

Gresham Smith
10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR./ARCH:	MARK ERVIN
DESIGNER:	
DRAWN BY:	
SCALE:	1" = 60'
DATE:	
CHECKED BY:	
CHECKED/APPROVED BY:	

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D
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3	06-07-23	.	FINAL ENGINEERING REPORT	.	.	.	.	.	.
4	06-23-23	.	FINAL BASIS OF DESIGN REPORT	.	.	.	.	.	.
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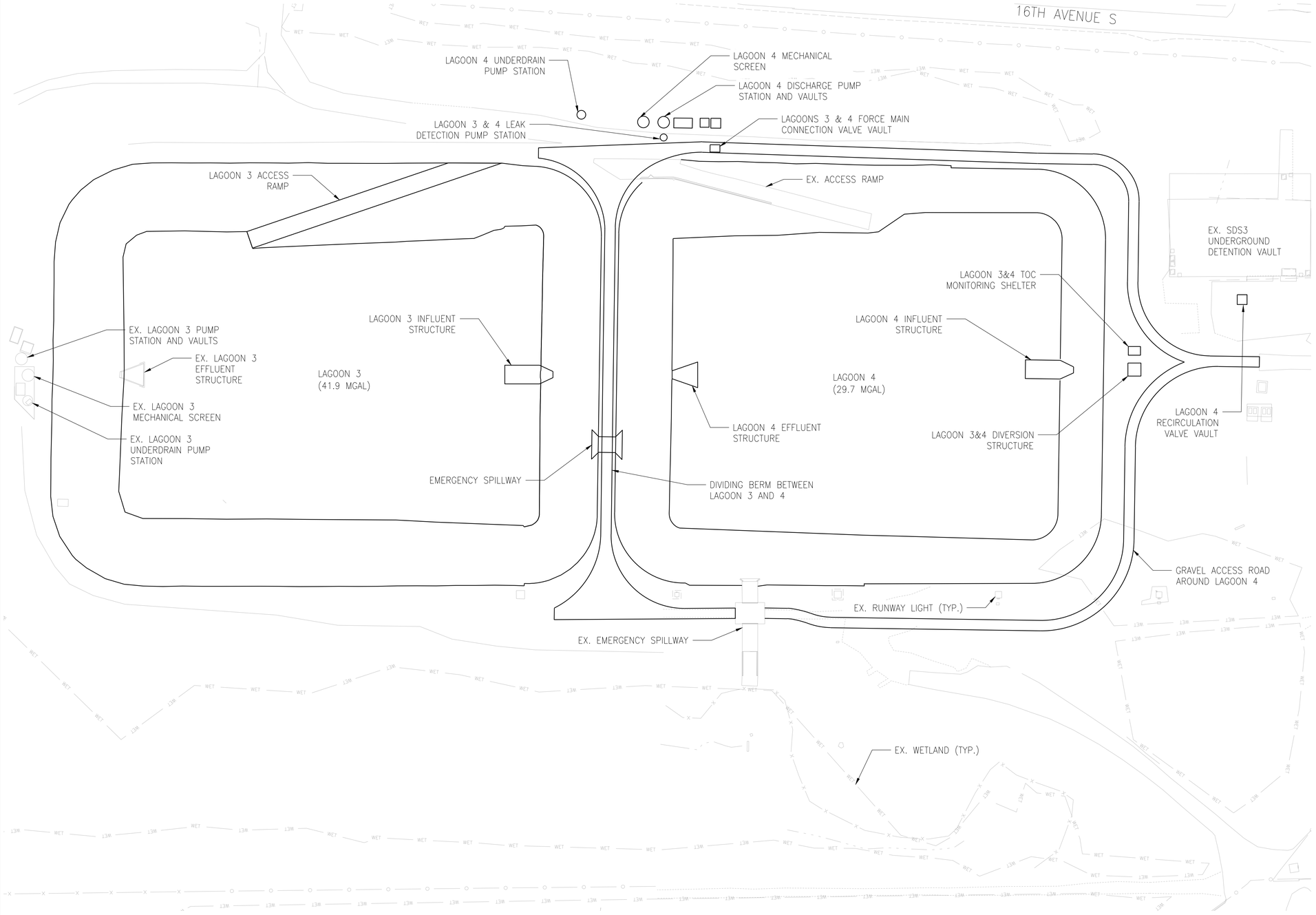
POS PROJECT MANAGER:	ETHAN CONLEY
POS PROJECT ENGINEER:	
POS DESIGN ENGINEER:	
POS DRAFTER:	
POS SCALE:	1" = 60'
POS DATE:	
POS CHECKED/APPROVED BY:	

Port of Seattle
PROJECT NAME: SEA-TAC INTERNATIONAL AIRPORT
INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION

SHEET TITLE: PROPOSED SITE PLAN
IWTP SITE

POS WORK PROJECT NUMBER	000000
CONSULTANT'S PROJECT NUMBER	44846.10
POS PROJECT TRACKING NUMBER	STIA-2404 C7

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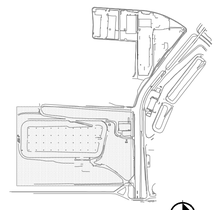


GENERAL NOTES:

1. SEE SHEET C4 FOR EXISTING FEATURES AT THE LAGOON 3 SITE.
2. LAGOON 3 IS CLASSIFIED AS A DAM, AND ALL MODIFICATIONS MUST COMPLY WITH ECOLOGY DAM SAFETY REQUIREMENTS.

(#) KEYED NOTES:

1. NOT USED



CALL 2 DAYS
BEFORE YOU DIG
1-800-424-5555

PLAN

PROPOSED SITE PLAN
LAGOON 3 SITE
SCALE: 1" = 60'

1"=60'-0" Scale: 60 0 60 120 Feet

NOT FOR CONSTRUCTION

Gresham Smith
10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR./ARCH: MARK ERVIN
DESIGNER:
DRAWN BY:
SCALE: 1" = 60'
DATE:
CHECKED BY:
CHECKED/APPROVED BY:

REVISIONS

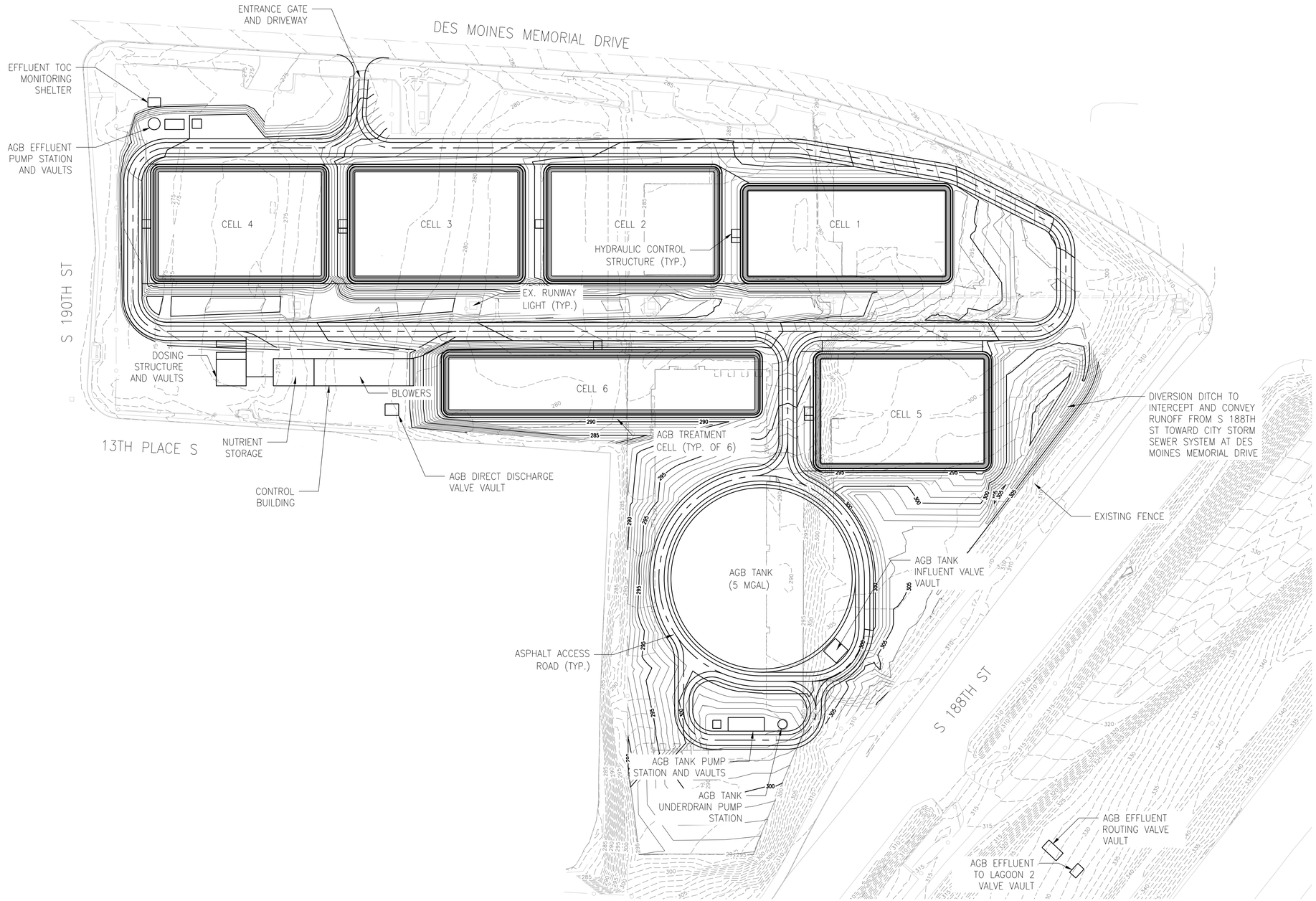
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POS PROJECT MANAGER: ETHAN CONLEY
POS PROJECT ENGINEER:
POS DESIGN ENGINEER:
POS DRAFTER:
POS SCALE: 1" = 60'
POS DATE:
POS CHECKED/APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION
SHEET TITLE: PROPOSED SITE PLAN LAGOON 3 SITE

POS WORK PROJECT NUMBER: 000000
CONSULTANT'S PROJECT NUMBER: 44846.10
POS PROJECT TRACKING NUMBER: STIA-2404 C8

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PLAN

PROPOSED GRADING PLAN
AGB SITE
SCALE: 1" = 60'

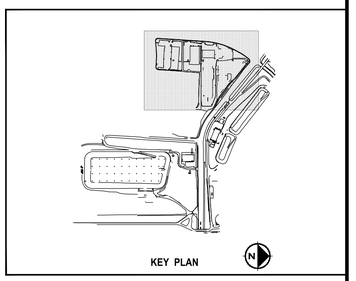
1"=60'-0" 60 0 60 120
Scale Feet

GENERAL NOTES:

1. GRADING SHOWN IS PRELIMINARY AND REQUIRES REFINEMENT DURING DETAILED DESIGN BASED ON GEOTECHNICAL INFORMATION, DRAINAGE REQUIREMENTS, SITE CONSTRAINTS, INFRASTRUCTURE FOOTPRINTS, AND ACCESS REQUIREMENTS.
2. PROPOSED CONTOURS ILLUSTRATE CHANGES TO EXISTING TOPOGRAPHY. EXTENTS OF PROPOSED CONTOURS DO NOT ACCOUNT FOR FULL LIMITS OF DISTURBANCE.
3. EXISTING RUNWAY LIGHTS AND ASSOCIATED DUCT BANK SHALL BE PROTECTED FROM DISTURBANCE AND REMAIN OPERATIONAL AT ALL POINTS DURING CONSTRUCTION. COORDINATE WITH FAA DURING DETAILED DESIGN PHASE TO CONFIRM INFRASTRUCTURE LOCATIONS, MINIMUM OFFSETS, AND CONSTRUCTION REQUIREMENTS FOR UTILITY CROSSINGS AND GRADING IN THE VICINITY. NOTIFY FAA PRIOR TO CONSTRUCTION IN THESE AREAS.

(#) KEYED NOTES:

1. NOT USED



CALL 2 DAYS
BEFORE YOU DIG
1-800-424-5555

NOT FOR CONSTRUCTION

Gresham Smith
10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR./ARCH: MARK ERVIN
DESIGNER:
DRAWN BY:
SCALE: 1" = 60'
DATE:
CHECKED BY:
CHECKED/APPROVED BY:

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D
1	03-21-23	.	DRAFT BASIS OF DESIGN REPORT	.	.	.	.	.	.
2	06-23-23	.	FINAL BASIS OF DESIGN REPORT	.	.	.	.	.	.
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POS PROJECT MANAGER: ETHAN CONLEY
POS PROJECT ENGINEER:
POS DESIGN ENGINEER:
POS DRAFTER:
POS SCALE: 1" = 60'
POS DATE:
POS CHECKED/APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION
SHEET TITLE: PROPOSED GRADING PLAN AGB SITE

POS WORK PROJECT NUMBER: 000000
CONSULTANT'S PROJECT NUMBER: 44846.10
POS PROJECT TRACKING NUMBER: STIA-2404 C9

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16TH AVENUE S

LAGOON 4 UNDERDRAIN PUMP STATION

LAGOON 4 MECHANICAL SCREEN

LAGOON 4 DISCHARGE PUMP STATION AND VAULTS

LAGOONS 3 & 4 FORCE MAIN CONNECTION VALVE VAULT

LAGOON 3 & 4 LEAK DETECTION PUMP STATION

LAGOON 3 ACCESS RAMP

EX. ACCESS RAMP

EX. SDS3 UNDERGROUND DETENTION VAULT

LAGOON 3&4 TOC MONITORING SHELTER

LAGOON 3 INFLUENT STRUCTURE

LAGOON 4 INFLUENT STRUCTURE

EX. LAGOON 3 PUMP STATION AND VAULTS

EX. LAGOON 3 EFFLUENT STRUCTURE

LAGOON 3

LAGOON 4

EX. LAGOON 3 MECHANICAL SCREEN

EX. LAGOON 3 UNDERDRAIN PUMP STATION

LAGOON 4 EFFLUENT STRUCTURE

LAGOON 4 RECIRCULATION VALVE VAULT

LAGOON 3&4 DIVERSION STRUCTURE

EMERGENCY SPILLWAY

DIVIDING BERM BETWEEN LAGOON 3 AND 4

GRAVEL ACCESS ROAD AROUND LAGOON 4

EX. RUNWAY LIGHT (TYP.)

EX. EMERGENCY SPILLWAY

EX. WETLAND (TYP.)

CALL 2 DAYS
BEFORE YOU DIG
1-800-424-5555

PLAN

PROPOSED GRADING PLAN
LAGOON 3 SITE
SCALE: 1" = 60'

1"=60'-0"

60 0 60 120
Scale Feet

GENERAL NOTES:

1. GRADING SHOWN IS PRELIMINARY AND REQUIRES REFINEMENT DURING DETAILED DESIGN BASED ON GEOTECHNICAL INFORMATION, DRAINAGE REQUIREMENTS, SITE CONSTRAINTS, INFRASTRUCTURE FOOTPRINTS, AND ACCESS REQUIREMENTS.
2. PROPOSED CONTOURS ILLUSTRATE CHANGES TO EXISTING TOPOGRAPHY. EXTENTS OF PROPOSED CONTOURS DO NOT ACCOUNT FOR FULL LIMITS OF DISTURBANCE.
3. LAGOON 3 IS CLASSIFIED AS A DAM, AND ALL MODIFICATIONS MUST COMPLY WITH ECOLOGY DAM SAFETY REQUIREMENTS.

(#) KEYED NOTES:

1. NOT USED

KEY PLAN

NOT FOR CONSTRUCTION

Gresham Smith
10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR./ARCH: MARK ERVIN
DESIGNER:
DRAWN BY:
SCALE: 1" = 60'
DATE:
CHECKED BY:
CHECKED/APPROVED BY:

REVISIONS

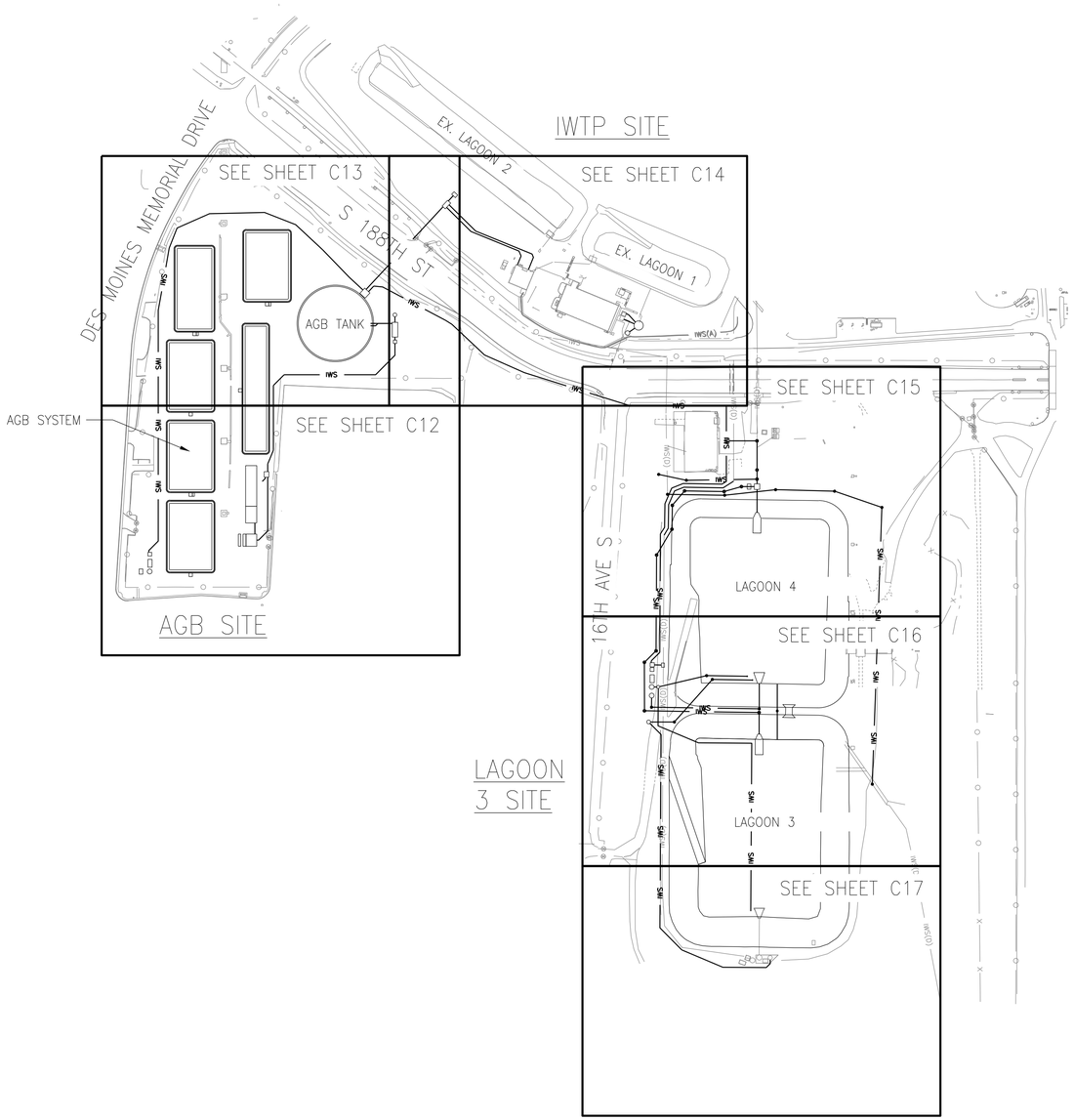
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POS PROJECT MANAGER: ETHAN CONLEY
POS PROJECT ENGINEER:
POS DESIGN ENGINEER:
POS DRAFTER:
POS SCALE: 1" = 60'
POS DATE:
POS CHECKED/APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION
SHEET TITLE: PROPOSED GRADING PLAN LAGOON 3 SITE

POS WORK PROJECT NUMBER: 000000
CONSULTANT'S PROJECT NUMBER: 44846.10
POS PROJECT TRACKING NUMBER: STIA-2404 C10

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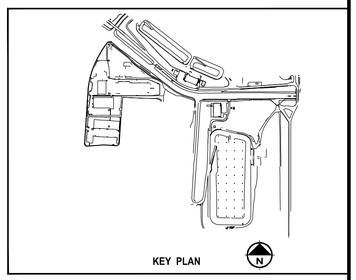


GENERAL NOTES:

1. SEE SHEETS C1 THROUGH C4 FOR EXISTING FEATURES AT THE AGB SITE, IWTP SITE, AND LAGOON 3 SITE.
2. SEE SHEETS C5 THROUGH C8 FOR PROPOSED FEATURES AT THE AGB SITE, IWTP SITE, AND LAGOON 3 SITE.
3. SEE SHEETS C12 THROUGH C17 FOR DETAILED IWS PIPING PLANS CORRESPONDING TO VIEW FRAMES ON THIS SHEET.
4. SEE SHEET C18 FOR PROPOSED STORM SEWER LAYOUT AT THE AGB SITE.

(#) KEYED NOTES:

1. NOT USED



CALL 2 DAYS
BEFORE YOU DIG
1-800-424-5555

PLAN

IWS PIPING PLAN
OVERALL
SCALE: 1" = 200'

N

1"=200'-0"

200 0 200 300

Scale Feet

NOT FOR CONSTRUCTION

Gresham Smith
10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR./ARCH:	MARK ERVIN
DESIGNER:	
DRAWN BY:	
SCALE:	1" = 200'
DATE:	
CHECKED BY:	
CHECKED/APPROVED BY:	

REVISIONS

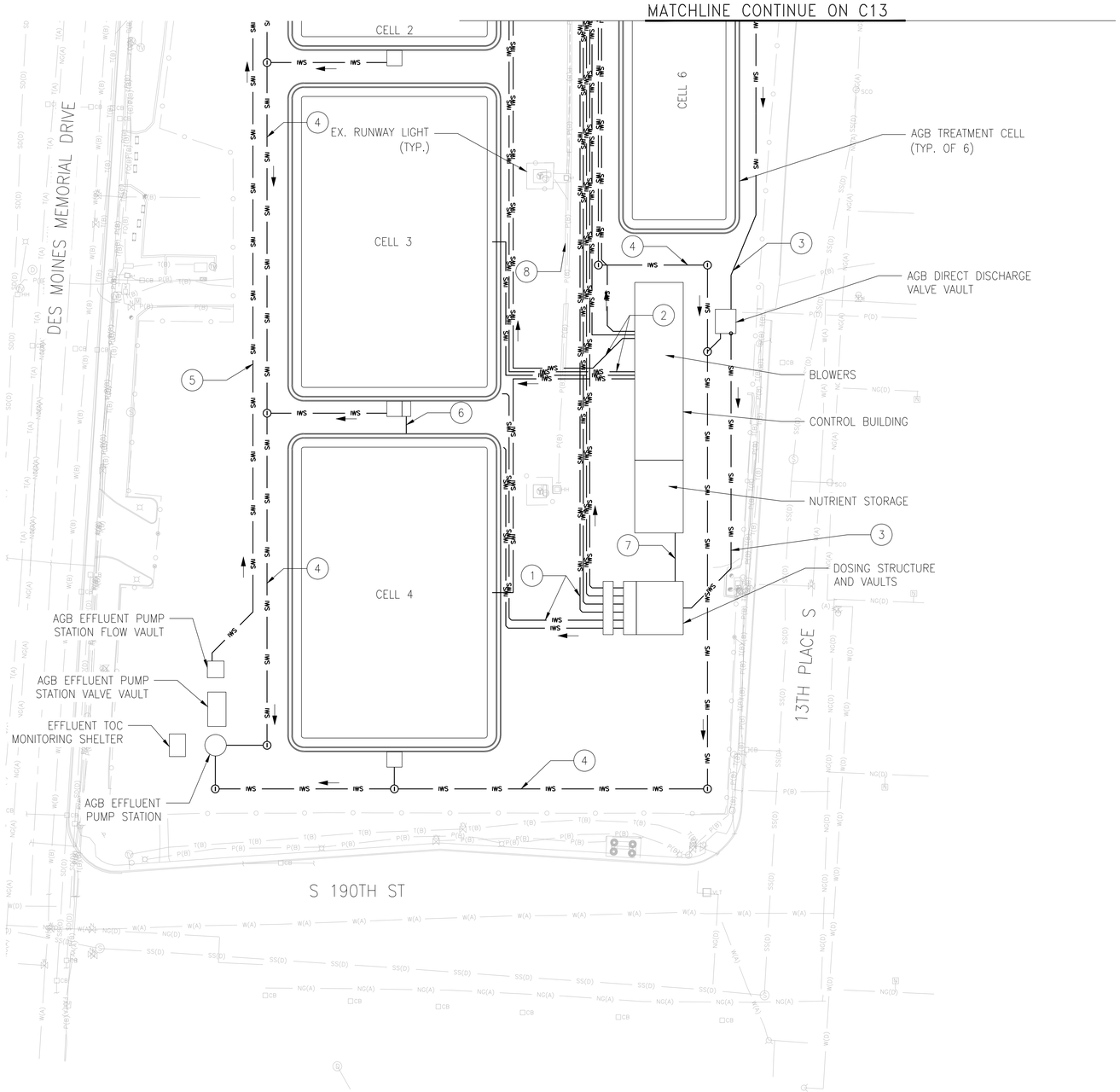
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3	06-07-23	.	FINAL ENGINEERING REPORT	.	.	.	.	.	.
4	06-23-23	.	FINAL BASIS OF DESIGN REPORT	.	.	.	.	.	.
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POS PROJECT MANAGER:	ETHAN CONLEY
POS PROJECT ENGINEER:	
POS DESIGN ENGINEER:	
POS DRAFTER:	
POS SCALE:	1" = 200'
POS DATE:	
POS CHECKED/APPROVED BY:	

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION
SHEET TITLE: IWS PIPING PLAN OVERALL

POS WORK PROJECT NUMBER	000000
CONSULTANT'S PROJECT NUMBER	44846.10
POS PROJECT TRACKING NUMBER	STIA-2404 C11

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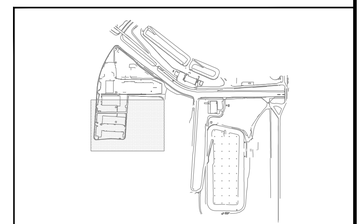


GENERAL NOTES:

1. EXISTING RUNWAY LIGHTS AND ASSOCIATED DUCT BANK SHALL BE PROTECTED FROM DISTURBANCE AND REMAIN OPERATIONAL AT ALL POINTS DURING CONSTRUCTION. COORDINATE WITH FAA DURING DETAILED DESIGN PHASE TO CONFIRM INFRASTRUCTURE LOCATIONS, MINIMUM OFFSETS, AND CONSTRUCTION REQUIREMENTS FOR UTILITY CROSSINGS AND GRADING IN THE VICINITY. NOTIFY FAA PRIOR TO CONSTRUCTION IN THESE AREAS.
2. COORDINATE WITH UTILITY AGENCIES TO CONFIRM ACTIVE UTILITIES CROSSING SITE THAT REQUIRE RELOCATION RATHER THAN DEMOLITION. ALL EXISTING UTILITIES WITHIN THE LIMITS OF CONSTRUCTION THAT ARE INACTIVE AND DO NOT REQUIRE RELOCATION SHALL BE DEMOLISHED.
3. NEW UTILITY CONNECTIONS ARE REQUIRED FOR: WATER AND FIRE WATER (HIGHLINE WATER DISTRICT), STORMWATER (CITY OF SEATAC), SANITARY (MIDWAY SEWER DISTRICT), ELECTRICAL AND NATURAL GAS (PUGET SOUND ENERGY), AND TELECOMMUNICATIONS (CENTURYLINK). COORDINATE ON NEW UTILITY CAPACITY REQUIREMENTS AND TIE-IN LOCATIONS (NOT SHOWN HERE).
4. SITE IS LOCATED WITHIN THE RPZ AND WILL REQUIRE FIRE WATER SYSTEM (HIGHLINE WATER DISTRICT) WITH FIRE HYDRANTS TO SUPPORT EMERGENCY RESPONSE FROM AIRPORT FIRE DEPARTMENT AT SITE.
5. SEE SHEET C18 FOR PROPOSED STORM SEWER LAYOUT (NOT SHOWN HERE FOR CLARITY).

(#) KEYED NOTES:

1. DOSING FORCE MAIN (TYP. OF 6) FROM DOSING STRUCTURE TO AGB TREATMENT CELLS
2. AERATION LINE FROM BLOWERS TO AGB TREATMENT CELLS (TYP. OF 6)
3. AGB TANK FORCE MAIN FROM AGB TANK PUMP STATION TO DOSING STRUCTURE
4. EFFLUENT GRAVITY LINE FROM AGB TREATMENT CELLS TO AGB EFFLUENT PUMP STATION
5. EFFLUENT FORCE MAIN FROM AGB EFFLUENT PUMP STATION TO AGB TANK AND IWTP SITE
6. TRANSFER LINE BETWEEN AGB TREATMENT CELLS FOR SERIES FLOW (TYP. OF 3)
7. NUTRIENT FEED LINE FROM CONTROL BUILDING TO DOSING STRUCTURE
8. EX. FAA ELECTRICAL LINES TO RUNWAY LIGHTS



CALL 2 DAYS BEFORE YOU DIG 1-800-424-5555

PLAN
IWS PIPING PLAN
AGB SITE (1 OF 2)
SCALE: 1" = 40'

N

1"=40'-0" 40 0 40 80
Scale Feet

NOT FOR CONSTRUCTION

Gresham Smith
10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR./ARCH:	MARK ERVIN
DESIGNER:	
DRAWN BY:	
SCALE:	1" = 40'
DATE:	
CHECKED BY:	
CHECKED/APPROVED BY:	

REVISIONS

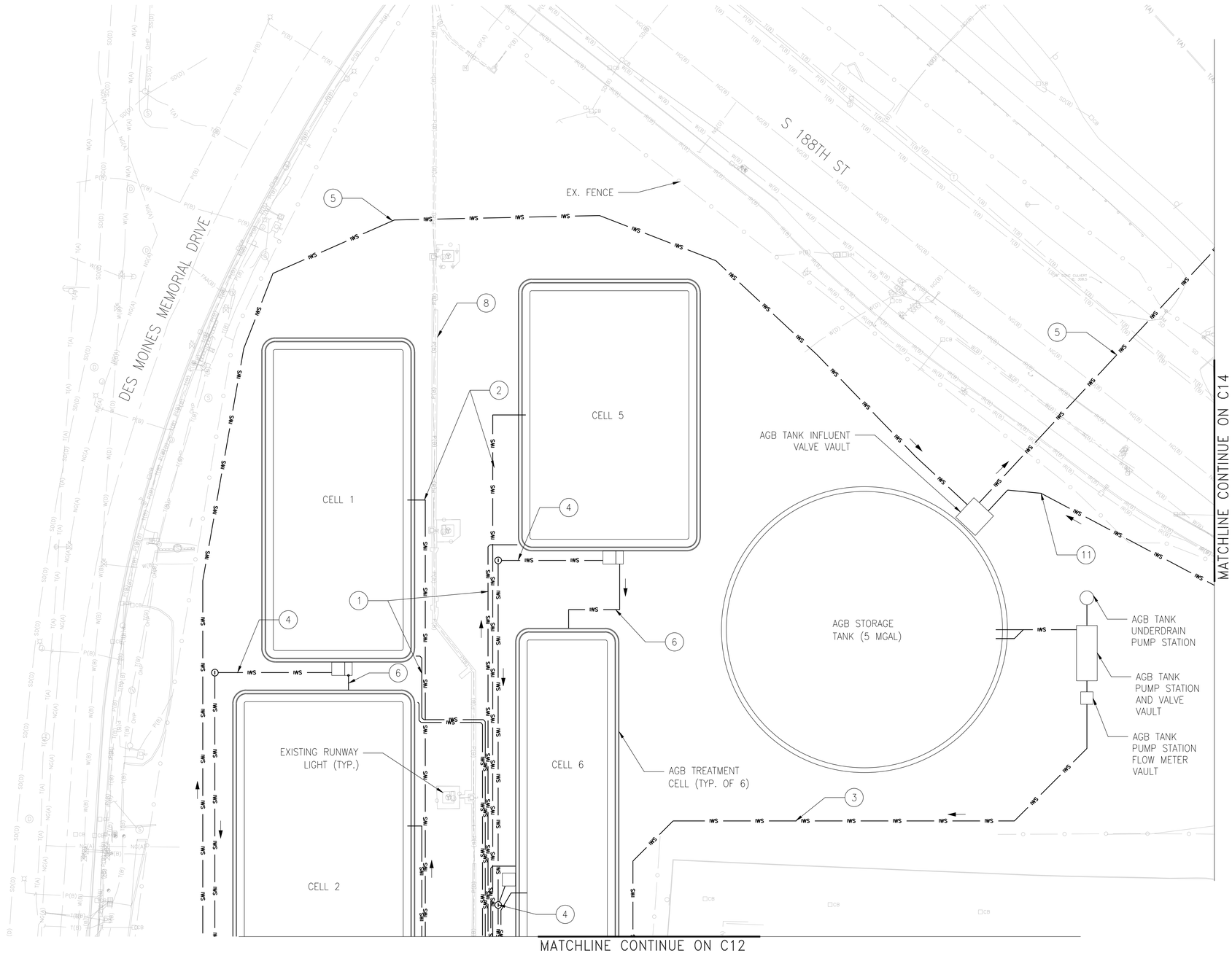
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2	06-07-23	.	FINAL ENGINEERING REPORT	.	.	.	.	.	.
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POS PROJECT MANAGER:	ETHAN CONLEY
POS PROJECT ENGINEER:	
POS DESIGN ENGINEER:	
POS DRAFTER:	
POS SCALE:	1" = 40'
POS DATE:	
POS CHECKED/APPROVED BY:	

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION
SHEET TITLE: IWS PIPING PLAN AGB SITE (1 OF 2)

POS WORK PROJECT NUMBER	000000
CONSULTANT'S PROJECT NUMBER	44846.10
POS PROJECT TRACKING NUMBER	STIA-2404 C12

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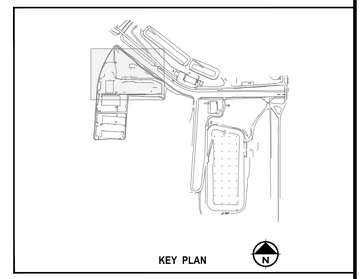


GENERAL NOTES:

1. EXISTING RUNWAY LIGHTS AND ASSOCIATED DUCT BANK SHALL BE PROTECTED FROM DISTURBANCE AND REMAIN OPERATIONAL AT ALL POINTS DURING CONSTRUCTION. COORDINATE WITH FAA DURING DETAILED DESIGN PHASE TO CONFIRM INFRASTRUCTURE LOCATIONS, MINIMUM OFFSETS, AND CONSTRUCTION REQUIREMENTS FOR UTILITY CROSSINGS AND GRADING IN THE VICINITY. NOTIFY FAA PRIOR TO CONSTRUCTION IN THESE AREAS.
2. COORDINATE WITH UTILITY AGENCIES TO CONFIRM ACTIVE UTILITIES CROSSING SITE THAT REQUIRE RELOCATION RATHER THAN DEMOLITION. ALL EXISTING UTILITIES WITHIN THE LIMITS OF CONSTRUCTION THAT ARE INACTIVE AND DO NOT REQUIRE RELOCATION SHALL BE DEMOLISHED.
3. NEW UTILITY CONNECTIONS ARE REQUIRED FOR: WATER AND FIRE WATER (HIGHLINE WATER DISTRICT), STORMWATER (CITY OF SEATAC), SANITARY (MIDWAY SEWER DISTRICT), ELECTRICAL AND NATURAL GAS (PUGET SOUND ENERGY), AND TELECOMMUNICATIONS (CENTURYLINK). COORDINATE ON NEW UTILITY CAPACITY REQUIREMENTS AND TIE-IN LOCATIONS (NOT SHOWN HERE).
4. SITE IS LOCATED WITHIN THE RPZ AND WILL REQUIRE FIRE WATER SYSTEM (HIGHLINE WATER DISTRICT) WITH FIRE HYDRANTS TO SUPPORT EMERGENCY RESPONSE FROM AIRPORT FIRE DEPARTMENT AT SITE.
5. SEE SHEET C18 FOR PROPOSED STORM SEWER LAYOUT (NOT SHOWN HERE FOR CLARITY).

(#) KEYED NOTES:

1. DOSING FORCE MAIN (TYP. OF 6) FROM DOSING STRUCTURE TO AGB TREATMENT CELLS
2. AERATION LINE FROM BLOWERS TO AGB TREATMENT CELLS (TYP. OF 6)
3. AGB TANK FORCE MAIN FROM AGB TANK PUMP STATION TO DOSING STRUCTURE
4. EFFLUENT GRAVITY LINE FROM AGB TREATMENT CELLS TO AGB EFFLUENT PUMP STATION
5. EFFLUENT FORCE MAIN FROM AGB EFFLUENT PUMP STATION TO AGB TANK AND IWTP SITE
6. TRANSFER LINE BETWEEN AGB TREATMENT CELLS FOR SERIES FLOW (TYP. OF 3)
8. EX. FAA ELECTRICAL LINES TO RUNWAY LIGHTS
11. LAGOON 4 FORCE MAIN TO AGB TANK



CALL 2 DAYS BEFORE YOU DIG 1-800-424-5555

PLAN

IWS PIPING PLAN
AGB SITE (2 OF 2)
SCALE: 1" = 40'

N

1"=40'-0" Scale: 40 0 40 80 Feet

NOT FOR CONSTRUCTION

Gresham Smith
10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR./ARCH: MARK ERVIN
DESIGNER:
DRAWN BY:
SCALE: 1" = 40'
DATE:
CHECKED BY:
CHECKED/APPROVED BY:

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D
1	03-21-23	.	DRAFT BASIS OF DESIGN REPORT	.	.	.	.	.	.
2	06-07-23	.	FINAL ENGINEERING REPORT	.	.	.	.	.	.
3	06-23-23	.	FINAL BASIS OF DESIGN REPORT	.	.	.	.	.	.
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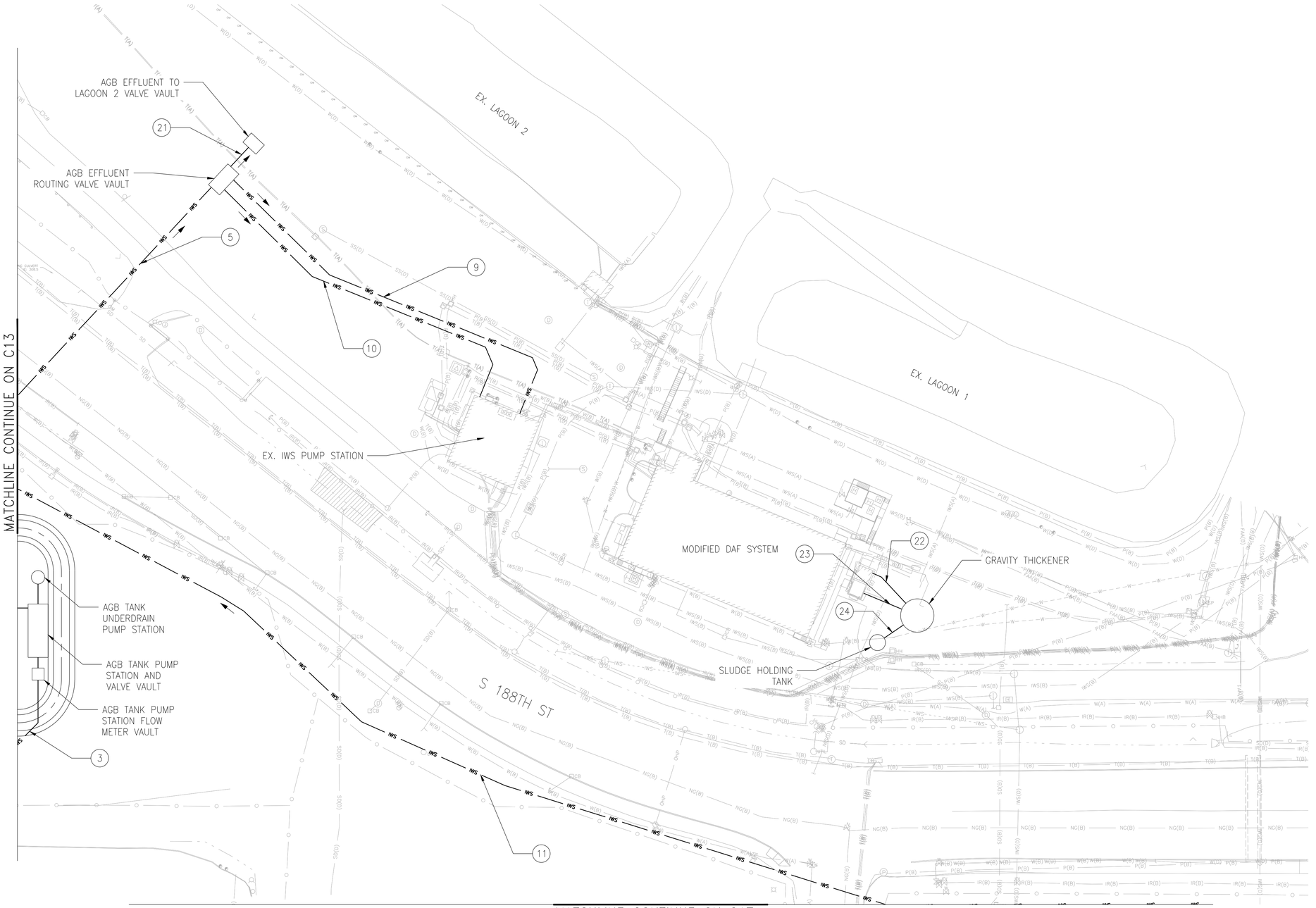
POS PROJECT MANAGER: ETHAN CONLEY
POS PROJECT ENGINEER:
POS DESIGN ENGINEER:
POS DRAFTER:
POS SCALE: 1" = 40'
POS DATE:
POS CHECKED/APPROVED BY:

Port of Seattle
PROJECT NAME: SEA-TAC INTERNATIONAL AIRPORT
INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION

SHEET TITLE: IWS PIPING PLAN AGB SITE (2 OF 2)

POS WORK PROJECT NUMBER: 000000
CONSULTANT'S PROJECT NUMBER: 44846.10
POS PROJECT TRACKING NUMBER: STIA-2404 C13

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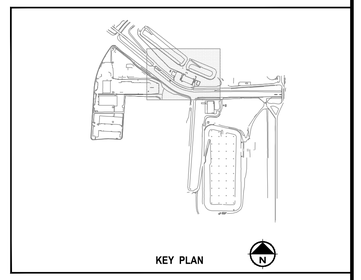


GENERAL NOTES:

1. NOT USED

(#) KEYED NOTES:

3. AGB TANK FORCE MAIN FROM AGB TANK PUMP STATION TO DOSING STRUCTURE
5. EFFLUENT FORCE MAIN FROM AGB EFFLUENT PUMP STATION TO IWTP SITE
9. AGB EFFLUENT FORCE MAIN TO LOW BOD COMPARTMENT OF IWS PUMP STATION FOR DISCHARGE TO PUGET SOUND
10. AGB EFFLUENT FORCE MAIN TO HIGH BOD COMPARTMENT OF IWS PUMP STATION FOR DISCHARGE TO SANITARY SEWER
11. LAGOON 4 FORCE MAIN TO AGB TANK
21. EFFLUENT FORCE MAIN FROM AGB EFFLUENT PUMP STATION TO LAGOON 2 AND DAF SYSTEM
22. GRAVITY THICKENER INFLUENT PIPING
23. GRAVITY THICKENER EFFLUENT PIPING
24. SLUDGE PIPING



CALL 2 DAYS BEFORE YOU DIG 1-800-424-5555

PLAN

IWS PIPING PLAN
IWTP SITE
SCALE: 1" = 40'

N

1"=40'-0" Scale: 40 0 40 80 Feet

NOT FOR CONSTRUCTION

Gresham Smith
10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR./ARCH:	MARK ERVIN
DESIGNER:	
DRAWN BY:	
SCALE:	1" = 40'
DATE:	
CHECKED BY:	
CHECKED/APPROVED BY:	

REVISIONS

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POS PROJECT MANAGER:	ETHAN CONLEY
POS PROJECT ENGINEER:	
POS DESIGN ENGINEER:	
POS DRAFTER:	
POS SCALE:	1" = 40'
POS DATE:	
POS CHECKED/APPROVED BY:	

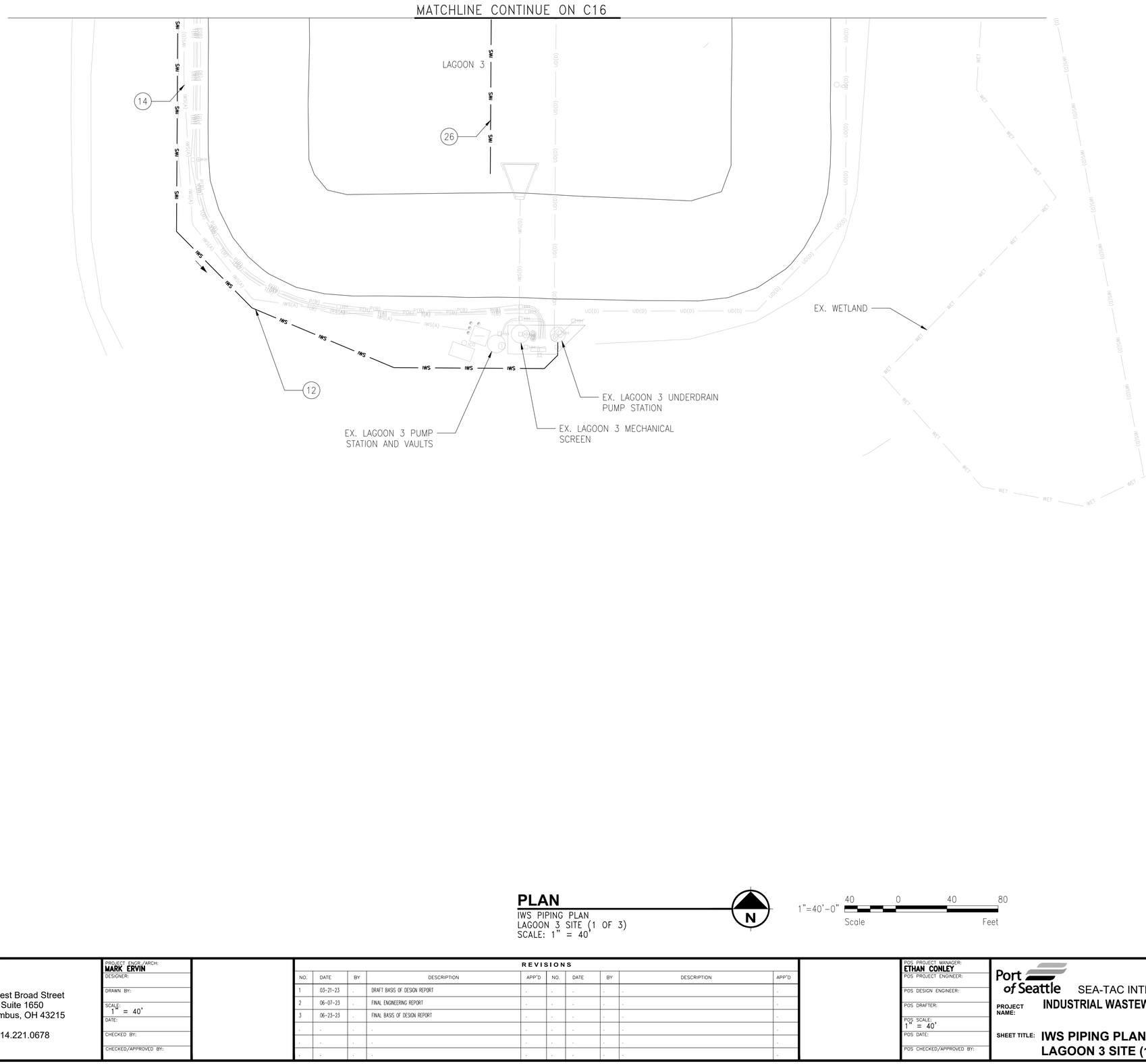
Port of Seattle — SEA-TAC INTERNATIONAL AIRPORT

PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION

SHEET TITLE: IWS PIPING PLAN
IWTP SITE

POS WORK PROJECT NUMBER	000000
CONSULTANT'S PROJECT NUMBER	44846.10
POS PROJECT TRACKING NUMBER	STIA-2404 C14

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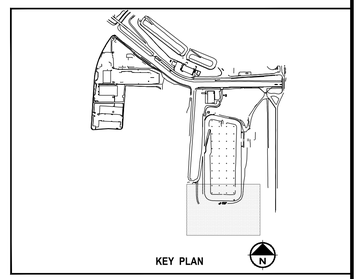


GENERAL NOTES:

1. EXISTING RUNWAY LIGHTS AND ASSOCIATED DUCT BANK SHALL BE PROTECTED FROM DISTURBANCE AND REMAIN OPERATIONAL AT ALL POINTS DURING CONSTRUCTION. COORDINATE WITH FAA DURING DETAILED DESIGN PHASE TO CONFIRM INFRASTRUCTURE LOCATIONS, MINIMUM OFFSETS, AND CONSTRUCTION REQUIREMENTS FOR UTILITY CROSSINGS AND GRADING IN THE VICINITY. NOTIFY FAA PRIOR TO CONSTRUCTION IN THESE AREAS.
2. LAGOON 3 IS CLASSIFIED AS A DAM, AND ALL MODIFICATIONS MUST COMPLY WITH ECOLOGY DAM SAFETY REQUIREMENTS.

(#) KEYED NOTES:

12. LAGOON 4 UNDERDRAIN PUMP STATION FORCE MAIN TO EX. LAGOON 3 UNDERDRAIN PUMP STATION
14. EX. LAGOON 3 FORCE MAIN
26. LAGOON 3 LEAK DETECTION SYSTEM DRAIN



CALL 2 DAYS
BEFORE YOU DIG
1-800-424-5555

PLAN

IWS PIPING PLAN
LAGOON 3 SITE (1 OF 3)
SCALE: 1" = 40'

N

1"=40'-0"
40 0 40 80
Scale Feet

NOT FOR CONSTRUCTION

Gresham Smith
10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR./ARCH: MARK ERVIN
DESIGNER:
DRAWN BY:
SCALE: 1" = 40'
DATE:
CHECKED BY:
CHECKED/APPROVED BY:

REVISIONS

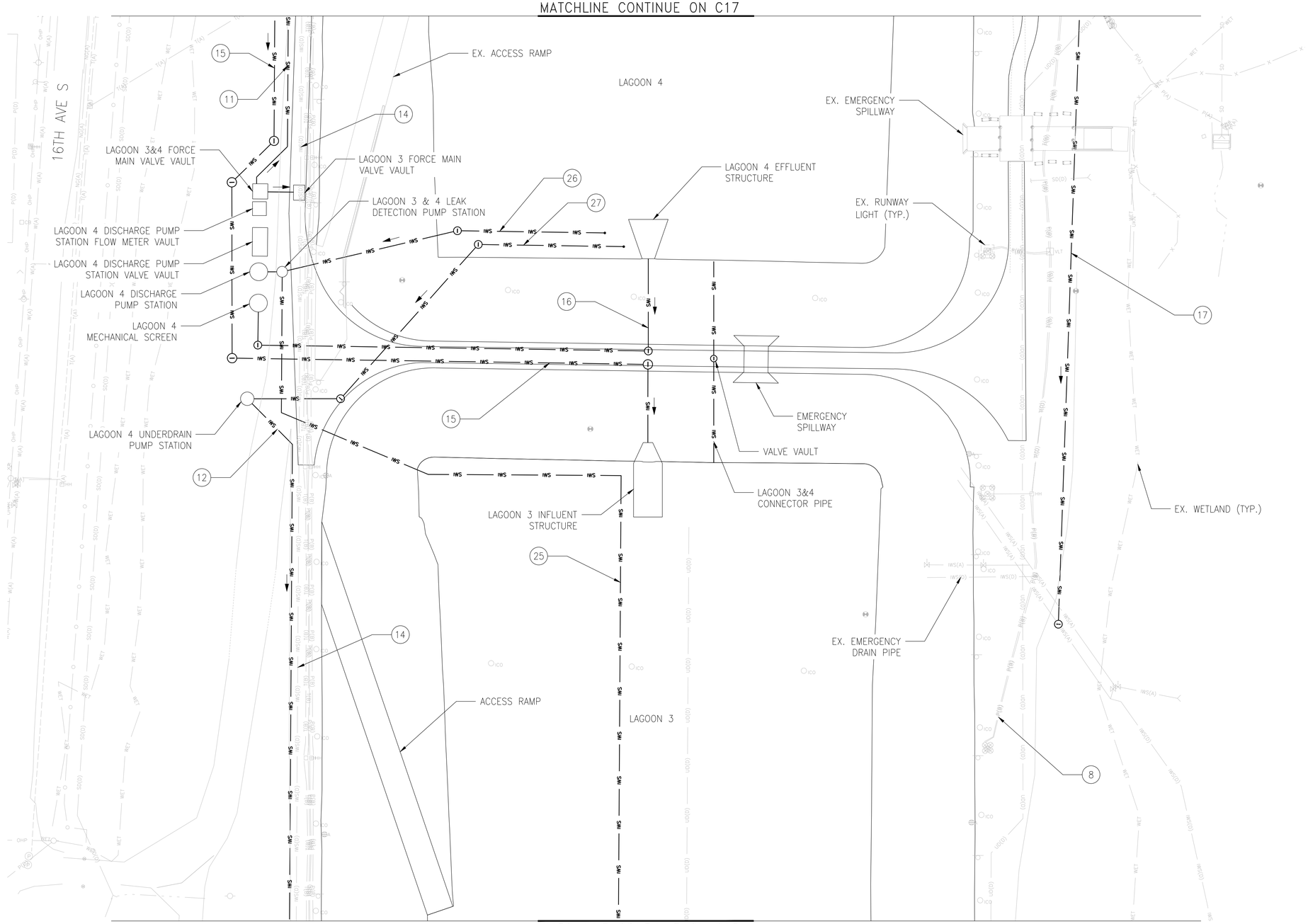
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POS PROJECT MANAGER: ETHAN CONLEY
POS PROJECT ENGINEER:
POS DESIGN ENGINEER:
POS DRAFTER:
POS SCALE: 1" = 40'
POS DATE:
POS CHECKED/APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION
SHEET TITLE: IWS PIPING PLAN
LAGOON 3 SITE (1 OF 3)

POS WORK PROJECT NUMBER: 000000
CONSULTANT'S PROJECT NUMBER: 44846.10
POS PROJECT TRACKING NUMBER: STIA-2404 C15

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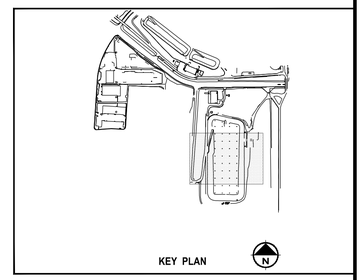


GENERAL NOTES:

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2. LAGOON 3 IS CLASSIFIED AS A DAM, AND ALL MODIFICATIONS MUST COMPLY WITH ECOLOGY DAM SAFETY REQUIREMENTS.

(#) KEYED NOTES:

8. EX. FAA ELECTRICAL LINES TO RUNWAY LIGHTS
11. LAGOON 4 FORCE MAIN TO AGB TANK
12. LAGOON 4 UNDERDRAIN PUMP STATION FORCE MAIN TO EX. LAGOON 3 UNDERDRAIN PUMP STATION
14. EX. LAGOON 3 FORCE MAIN
15. LAGOON 3 GRAVITY INFLUENT
16. LAGOON 4 GRAVITY EFFLUENT
17. REALIGNMENT OF GRAVITY PIPE TO PUGET SOUND OUTFALL
25. LAGOON 3 LEAK DETECTION SYSTEM DRAIN
26. LAGOON 4 LEAK DETECTION SYSTEM DRAIN
27. LAGOON 4 UNDERDRAIN COLLECTION PIPE



CALL 2 DAYS BEFORE YOU DIG 1-800-424-5555

PLAN
IWS PIPING PLAN
LAGOON 3 SITE (2 OF 3)
SCALE: 1" = 40'

N

1"=40'-0" 40 0 40 80
Scale Feet

NOT FOR CONSTRUCTION

Gresham Smith
10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR./ARCH: MARK ERVIN
DESIGNER:
DRAWN BY:
SCALE: 1" = 40'
DATE:
CHECKED BY:
CHECKED/APPROVED BY:

REVISIONS

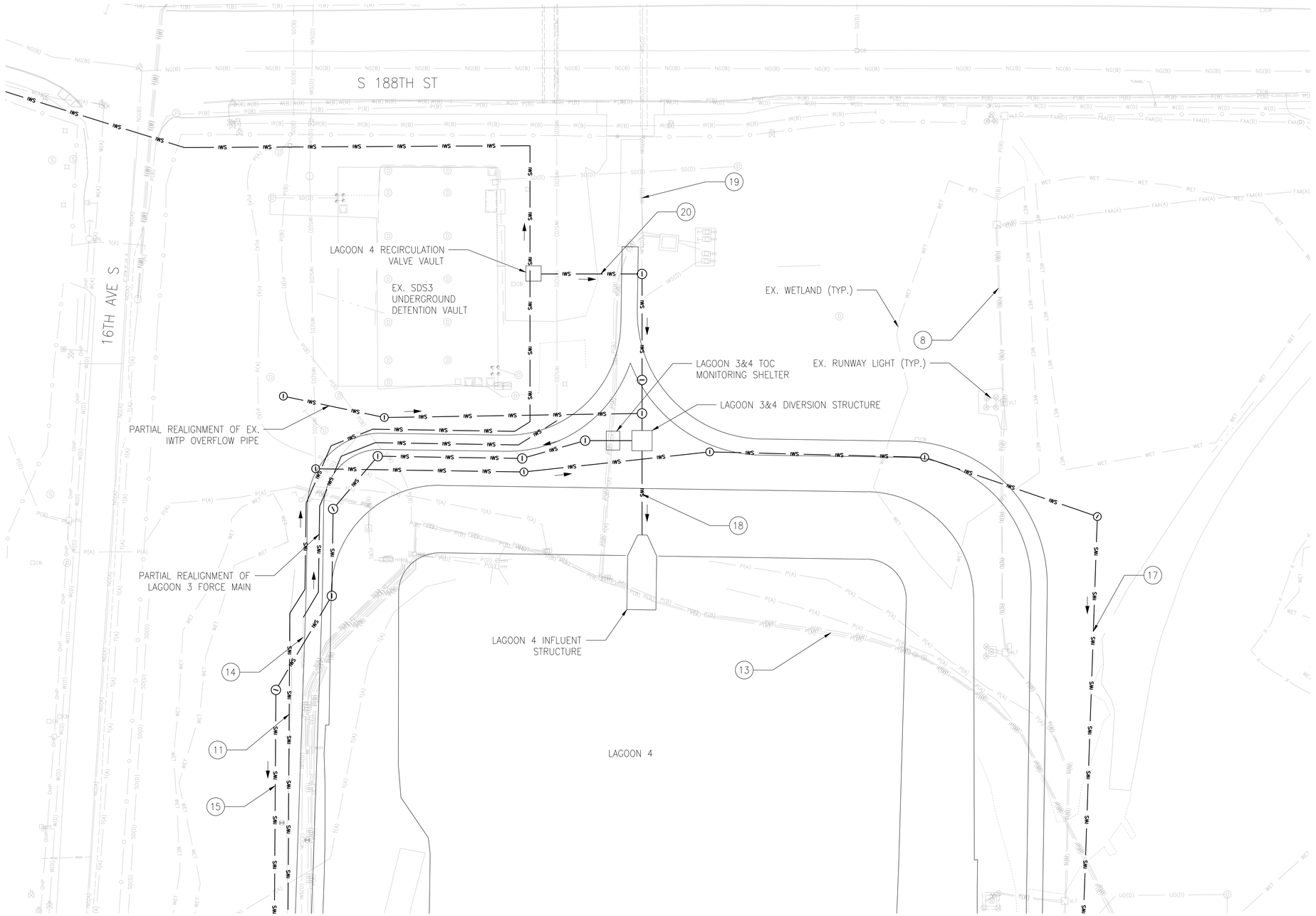
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POS PROJECT MANAGER: ETHAN CONLEY
POS PROJECT ENGINEER:
POS DESIGN ENGINEER:
POS DRAFTER:
POS SCALE: 1" = 40'
POS DATE:
POS CHECKED/APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION
SHEET TITLE: IWS PIPING PLAN LAGOON 3 SITE (2 OF 3)

POS WORK PROJECT NUMBER: 000000
CONSULTANT'S PROJECT NUMBER: 44846.10
POS PROJECT TRACKING NUMBER: STIA-2404 C16

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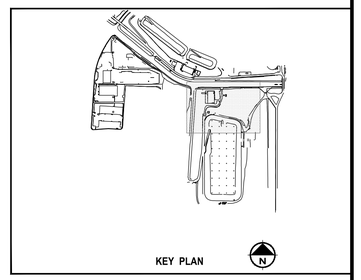


GENERAL NOTES:

1. EXISTING RUNWAY LIGHTS AND ASSOCIATED DUCT BANK SHALL BE PROTECTED FROM DISTURBANCE AND REMAIN OPERATIONAL AT ALL POINTS DURING CONSTRUCTION. COORDINATE WITH FAA DURING DETAILED DESIGN PHASE TO CONFIRM INFRASTRUCTURE LOCATIONS, MINIMUM OFFSETS, AND CONSTRUCTION REQUIREMENTS FOR UTILITY CROSSINGS AND GRADING IN THE VICINITY. NOTIFY FAA PRIOR TO CONSTRUCTION IN THESE AREAS.
2. LAGOON 3 IS CLASSIFIED AS A DAM, AND ALL MODIFICATIONS MUST COMPLY WITH ECOLOGY DAM SAFETY REQUIREMENTS.

(#) KEYED NOTES:

8. EX. FAA ELECTRICAL LINES TO RUNWAY LIGHTS
11. LAGOON 4 FORCE MAIN TO AGB TANK
13. EX. POWER AND TELECOMMUNICATION LINES WITHIN THE FOOTPRINT OF EXPANDED LAGOON 4 TO BE RELOCATED NORTH OF EXPANSION
14. EX. LAGOON 3 FORCE MAIN
15. LAGOON 3 GRAVITY INFLUENT
17. REALIGNMENT OF GRAVITY PIPE TO PUGET SOUND OUTFALL
18. LAGOON 4 GRAVITY INFLUENT
19. EX. IWS TRUNK LINE
20. LAGOON 4 RECIRCULATON LINE



CALL 2 DAYS
BEFORE YOU DIG
1-800-424-5555

PLAN
IWS PIPING PLAN
LAGOON 3 SITE (3 OF 3)
SCALE: 1" = 40'

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1"=40'-0" 40 0 40 80
Scale Feet

NOT FOR CONSTRUCTION

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Gresham Smith
10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR./ARCH:	MARK ERVIN
DESIGNER:	
DRAWN BY:	
SCALE:	1" = 40'
DATE:	
CHECKED BY:	
CHECKED/APPROVED BY:	

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D
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2	06-07-23	.	FINAL ENGINEERING REPORT	.	.	.	.	.	.
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POS PROJECT MANAGER:	ETHAN CONLEY
POS PROJECT ENGINEER:	
POS DESIGN ENGINEER:	
POS DRAFTER:	
POS SCALE:	1" = 40'
POS DATE:	
POS CHECKED/APPROVED BY:	

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION
SHEET TITLE: IWS PIPING PLAN
LAGOON 3 SITE (3 OF 3)

POS WORK PROJECT NUMBER	000000
CONSULTANT'S PROJECT NUMBER	44846.10
POS PROJECT TRACKING NUMBER	STIA-2404 C17

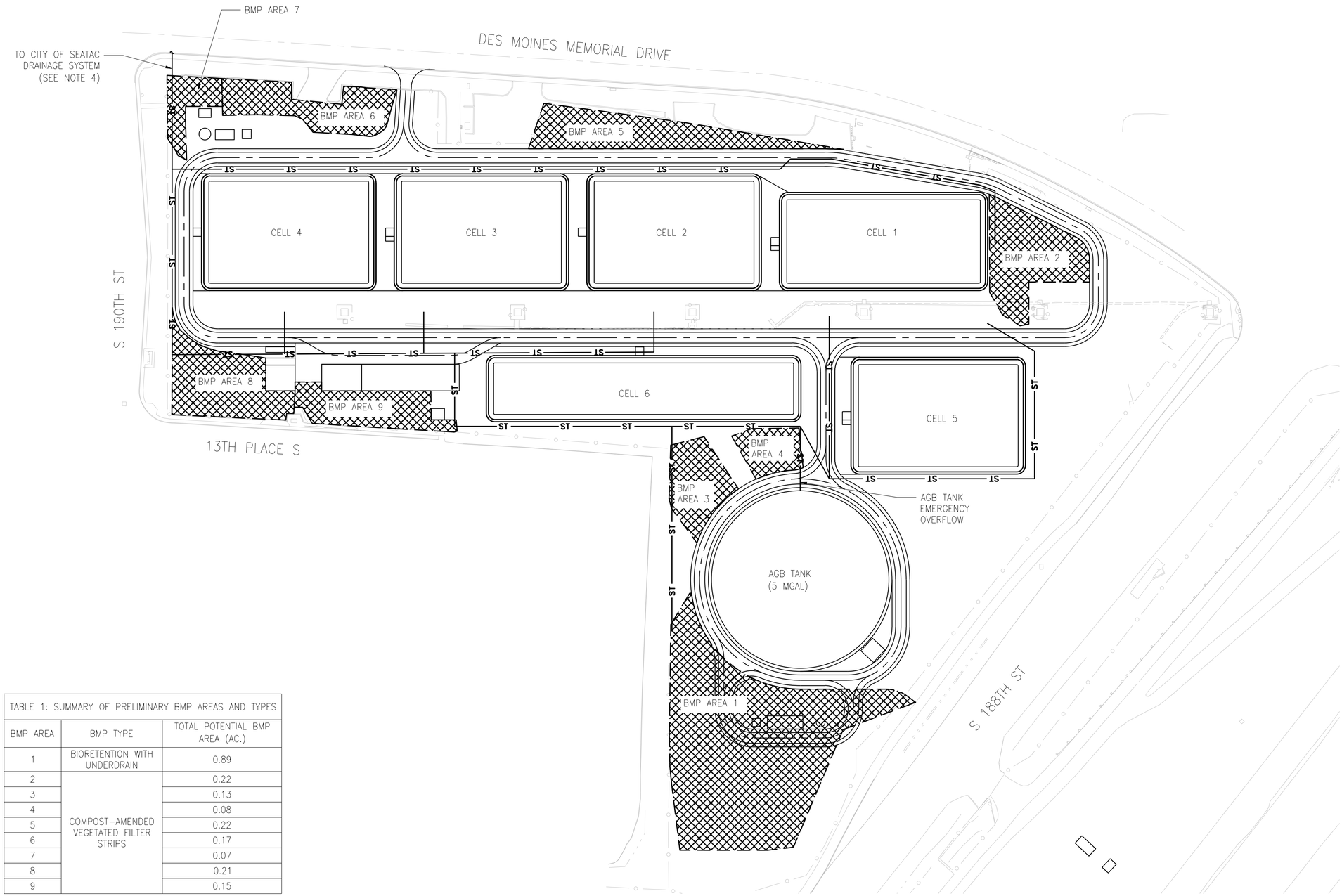


TABLE 1: SUMMARY OF PRELIMINARY BMP AREAS AND TYPES		
BMP AREA	BMP TYPE	TOTAL POTENTIAL BMP AREA (AC.)
1	BIORETENTION WITH UNDERDRAIN	0.89
2	COMPOST-AMENDED VEGETATED FILTER STRIPS	0.22
3		0.13
4		0.08
5		0.22
6		0.17
7		0.07
8		0.21
9		0.15

CALL 2 DAYS BEFORE YOU DIG 1-800-424-5555

PLAN

STORMWATER CONTROL AND DRAINAGE PLAN
AGB SITE
SCALE: 1" = 60'

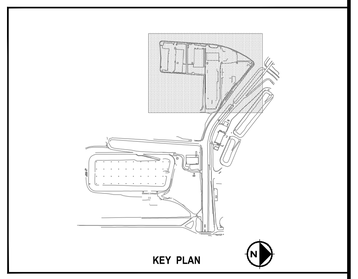
1"=60'-0" Scale: 60 0 60 120 Feet

GENERAL NOTES:

1. THIS PROJECT IS REQUIRED TO COMPLY WITH PORT REQUIREMENTS DEFINED IN THE SEATTLE TACOMA INTERNATIONAL AIRPORT STORMWATER MANAGEMENT MANUAL FOR PORT AVIATION DIVISION.
2. THIS SHEET ILLUSTRATES POTENTIAL SITES OR "BMP AREAS" WHERE STORMWATER BEST MANAGEMENT PRACTICES (BMPS) MAY BE INSTALLED TO COMPLY WITH PORT REQUIREMENTS. ACTUAL BMP FOOTPRINTS WILL NEED TO BE DEFINED WITHIN THESE AREAS DURING THE DETAILED DESIGN PHASE, AND WILL NEED TO ACCOUNT FOR MINIMUM OFFSETS FROM SITE INFRASTRUCTURE, POTENTIAL UTILITY CONFLICTS, AND DETAILED GRADING DESIGN.
3. BMP TYPES AND AREAS ARE BASED ON A PRELIMINARY SITE STORMWATER ANALYSIS, AS DESCRIBED WITHIN THE BASIS OF DESIGN REPORT. ANALYSIS WILL NEED TO BE REFINED DURING DETAILED DESIGN TO ACCOUNT FOR CHANCES TO IMPERVIOUS AREA EXTENTS, INFRASTRUCTURE, AND GRADING AS THE DESIGN EVOLVES.
4. A CONCEPTUAL STORM SEWER LAYOUT IS SHOWN BASED ON IDENTIFIED BMP AREAS AND PRELIMINARY GRADING. LOCATION OF CONNECTION POINT TO CITY OF SEATAC DRAINAGE SYSTEM SHALL BE DETERMINED THROUGH COORDINATION WITH CITY OF SEATAC.
5. DRAINAGE INFRASTRUCTURE SHALL BE REFINED DURING DETAILED DESIGN PHASE BASED ON DETAILED DESIGN ASSUMPTIONS, GRADING, CONSTRUCTABILITY, AND SITE CONSTRAINTS.
6. EXISTING RUNWAY LIGHTS AND ASSOCIATED DUCT BANK SHALL BE PROTECTED FROM DISTURBANCE AND REMAIN OPERATIONAL AT ALL POINTS DURING CONSTRUCTION. COORDINATE WITH FAA DURING DETAILED DESIGN PHASE TO CONFIRM INFRASTRUCTURE LOCATIONS, MINIMUM OFFSETS, AND CONSTRUCTION REQUIREMENTS FOR UTILITY CROSSINGS AND GRADING IN THE VICINITY. NOTIFY FAA PRIOR TO CONSTRUCTION IN THESE AREAS.
7. REFER TO SHEET C6 FOR DEFINITION OF PROPOSED FEATURES AT THE AGB SITE.

(#) KEYED NOTES:

1. NOT USED



NOT FOR CONSTRUCTION

Gresham Smith
10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR./ARCH: MARK ERVIN
DESIGNER:
DRAWN BY:
SCALE: 1" = 60'
DATE:
CHECKED BY:
CHECKED/APPROVED BY:

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D
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POS PROJECT MANAGER: ETHAN CONLEY
POS PROJECT ENGINEER:
POS DESIGN ENGINEER:
POS DRAFTER:
POS SCALE: 1" = 60'
POS DATE:
POS CHECKED/APPROVED BY:

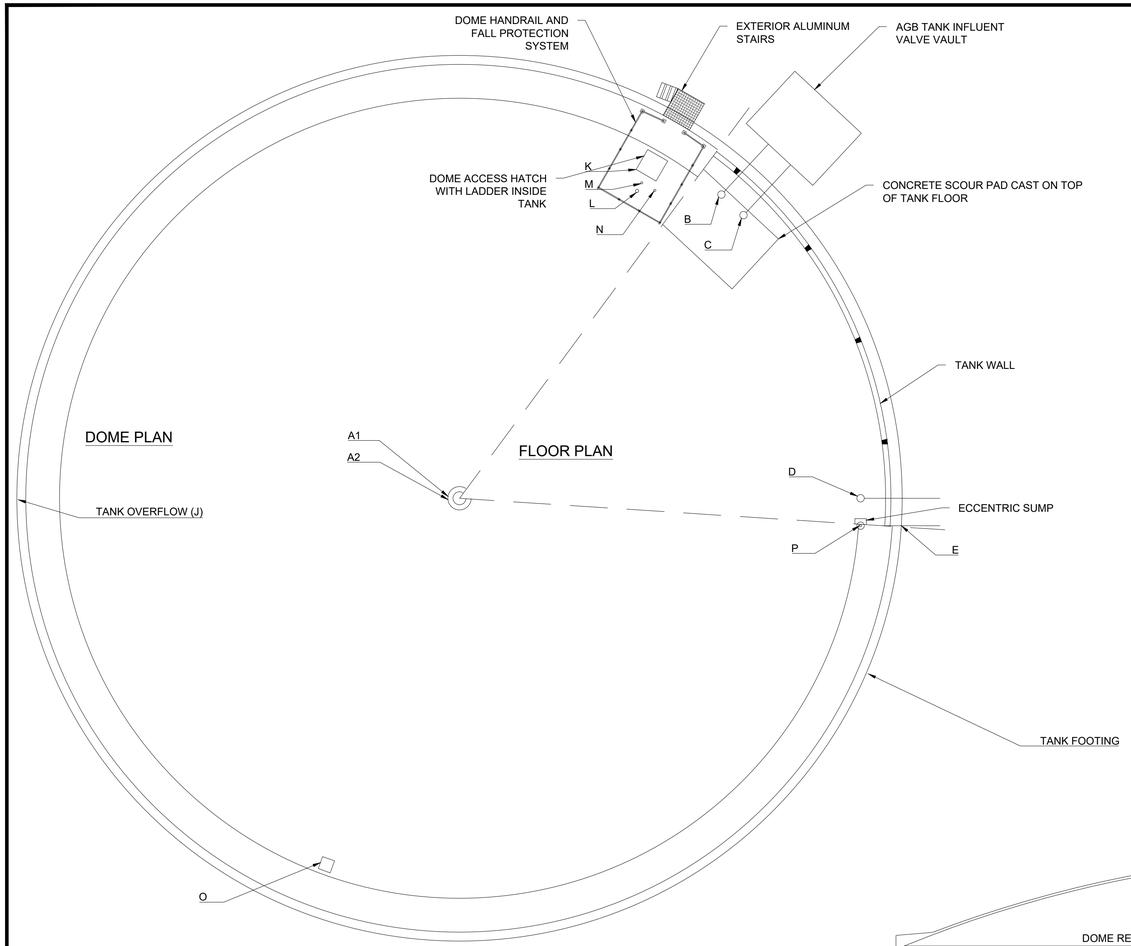
Port of Seattle — SEA-TAC INTERNATIONAL AIRPORT

PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION

SHEET TITLE: STORMWATER CONTROL AND DRAINAGE PLAN AGB SITE

POS WORK PROJECT NUMBER: 000000
CONSULTANT'S PROJECT NUMBER: 44846.10
POS PROJECT TRACKING NUMBER: STIA-2404 C18

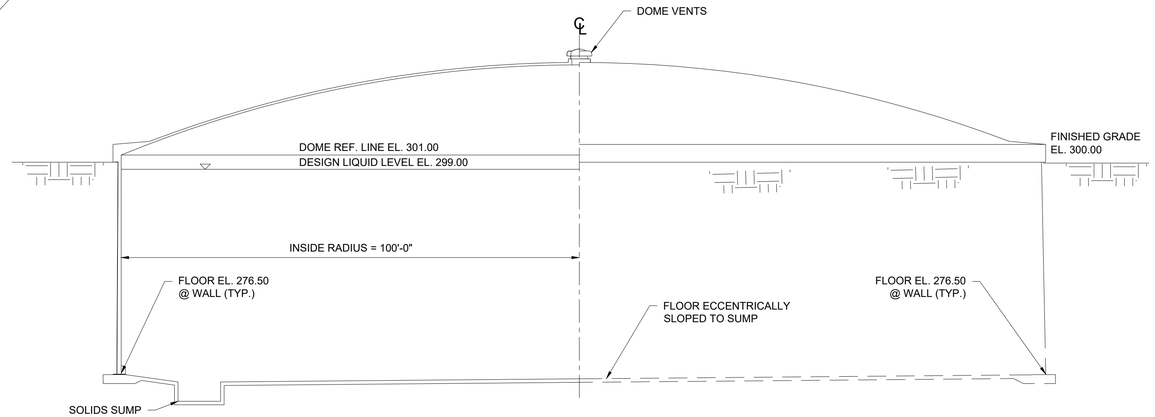
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PLAN

AGB TANK
PLAN VIEW

NOT TO SCALE



ELEVATION

AGB TANK
ELEVATION VIEW

NOT TO SCALE

NOZZLE SCHEDULE		
NOZZLE ID	SERVICE	AZIMUTH
A1	DOME VENT	0°
A2	DOME VENT	0°
B	INLET PIPE: AGB EFFLUENT RETURN	43°
C	INLET PIPE: LAGOON 4 FORCE MAIN	43°
D	GRAVITY OUTLET PIPE	90°
E	SOLIDS DRAIN	94°
J	OVERFLOW	270°
K	SQUARE DOME HATCH	30°
L	LEVEL INSTRUMENTATION	30°
M	FLOAT VALVE CONDUIT CHASE	30°
N	PRESSURE INSTRUMENTATION	30°
O	ODOR CONTROL CONNECTION	200°
P	VALVE NUT ACTUATOR	94°

GENERAL NOTES:

1. THE EXTERIOR DOME CONCRETE SURFACES SHALL RECEIVE ONE COAT OF TAMOSEAL AND ONE COAT OF TAMMSCOAT SMOOTH OR PREBID APPROVED EQUAL. THE EXPOSED EXTERIOR WALL CONCRETE SURFACES TO ONE FOOT BELOW GRADE SHALL RECEIVE TWO COATS OF TAMMSCOAT SMOOTH OR PREBID APPROVED EQUAL. COLOR SHALL BE SELECTED BY OWNER.
2. THE INTERIOR FLOOR AND WALLS OF THE TANK SHALL RECEIVE A CIM 1000 ELASTOMERIC COATING TO RESIST ACIDIC CORROSION.

(#) KEYED NOTES:

1. NOT USED

CALL 2 DAYS
BEFORE YOU DIG
1-800-424-5555

NOT FOR CONSTRUCTION

Gresham Smith
10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR./ARCH: MARK ERVIN
DESIGNER:
DRAWN BY:
SCALE: NOT TO SCALE
DATE:
CHECKED BY:
CHECKED/APPROVED BY:

REVISIONS

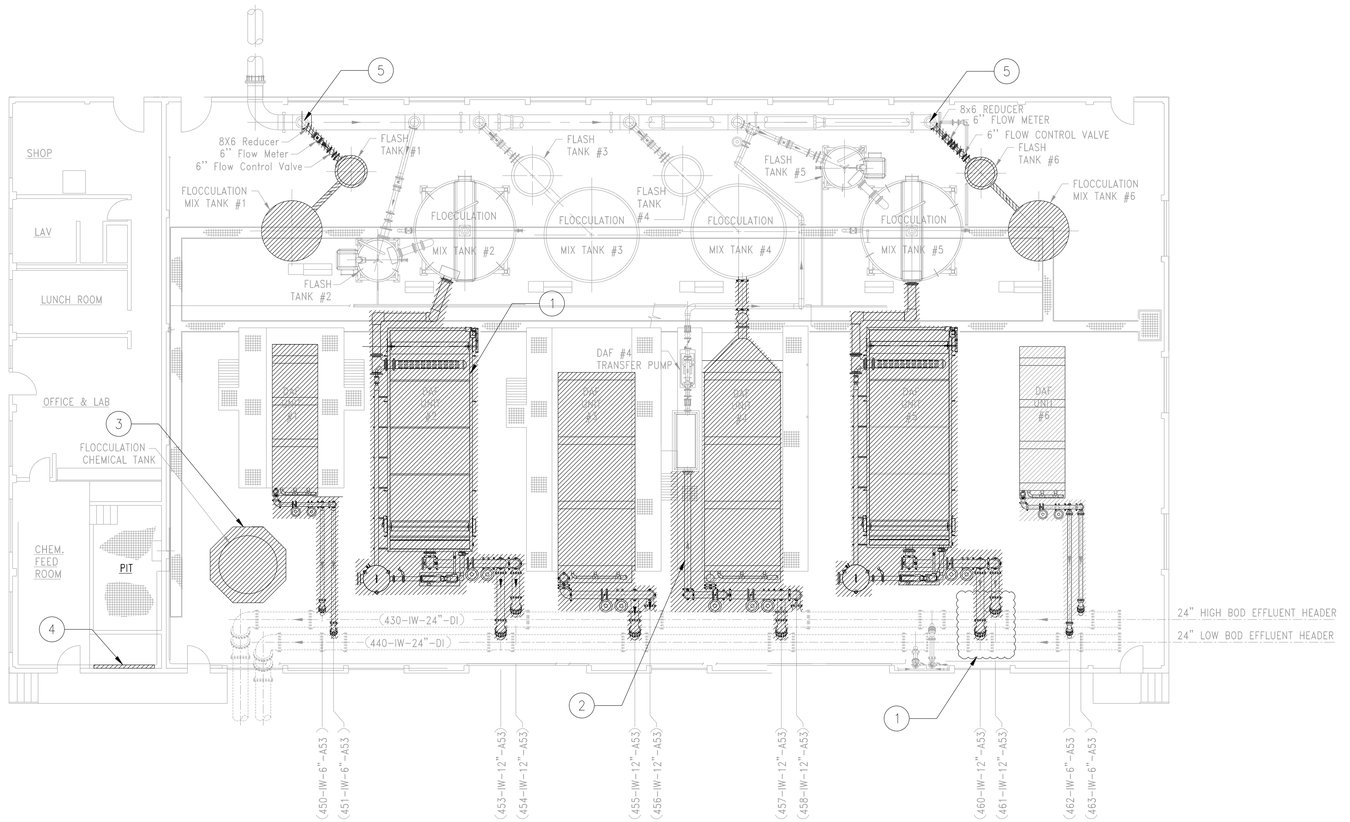
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POS PROJECT MANAGER: ETHAN CONLEY
POS PROJECT ENGINEER:
POS DESIGN ENGINEER:
POS DRAFTER:
POS SCALE: NOT TO SCALE
POS DATE:
POS CHECKED/APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION
SHEET TITLE: AGB TANK PLAN AND ELEVATION

POS WORK PROJECT NUMBER: 000000
CONSULTANT'S PROJECT NUMBER: 44846.10
POS PROJECT TRACKING NUMBER: STIA-2404 M1

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GENERAL NOTES:

1. DEMOLISH EXISTING 6 DAF UNITS WITH THEIR FOUNDATIONS AND PLATFORMS.
2. DEMOLISH FLASH MIX AND FLOCCULATION MIX TANKS #1 AND #6 WITH THEIR INFLUENT AND EFFLUENT PIPING.
3. DEMOLISH RECYCLE PIPING AND RECYCLE PUMP FOR EACH DAF UNIT.
4. DEMOLISH DISCHARGE PIPING FOR EACH DAF UNIT.

(#) KEYED NOTES:

1. EXPOSE LOW AND HIGH BOD EFFLUENT HEADERS TO CONNECT NEW UPSIZED DISCHARGE PIPING (TYP.).
2. DEMOLISH EFFLUENT PIPING CONNECTED TO DAF #4 AND TRANSFER PUMP
3. DEMOLISH CONCRETE PAD FOR FLOCCULATION CHEMICAL TANK. REMOVE AND RELOCATE FLOCCULATION CHEMICAL TANK.
4. DEMOLISH EXTERIOR WALL TO ACCOMMODATE INSTALLATION OF ROLL-UP DOOR.
5. COORDINATE WITH PORT AUTHORITY FOR SHUTDOWN PROCEDURES.

CALL 2 DAYS
BEFORE YOU DIG
1-800-424-5555

PLAN

DAF AND BUILDING MODIFICATIONS
DEMOLITION PLAN
SCALE: 1" = 10'

N

1"=10'-0" 10 0 10 20
Scale Feet

NOT FOR CONSTRUCTION

Gresham Smith
10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR./ARCH: MARK ERVIN
DESIGNER:
DRAWN BY:
SCALE: 1" = 10"
DATE:
CHECKED BY:
CHECKED/APPROVED BY:

REVISIONS

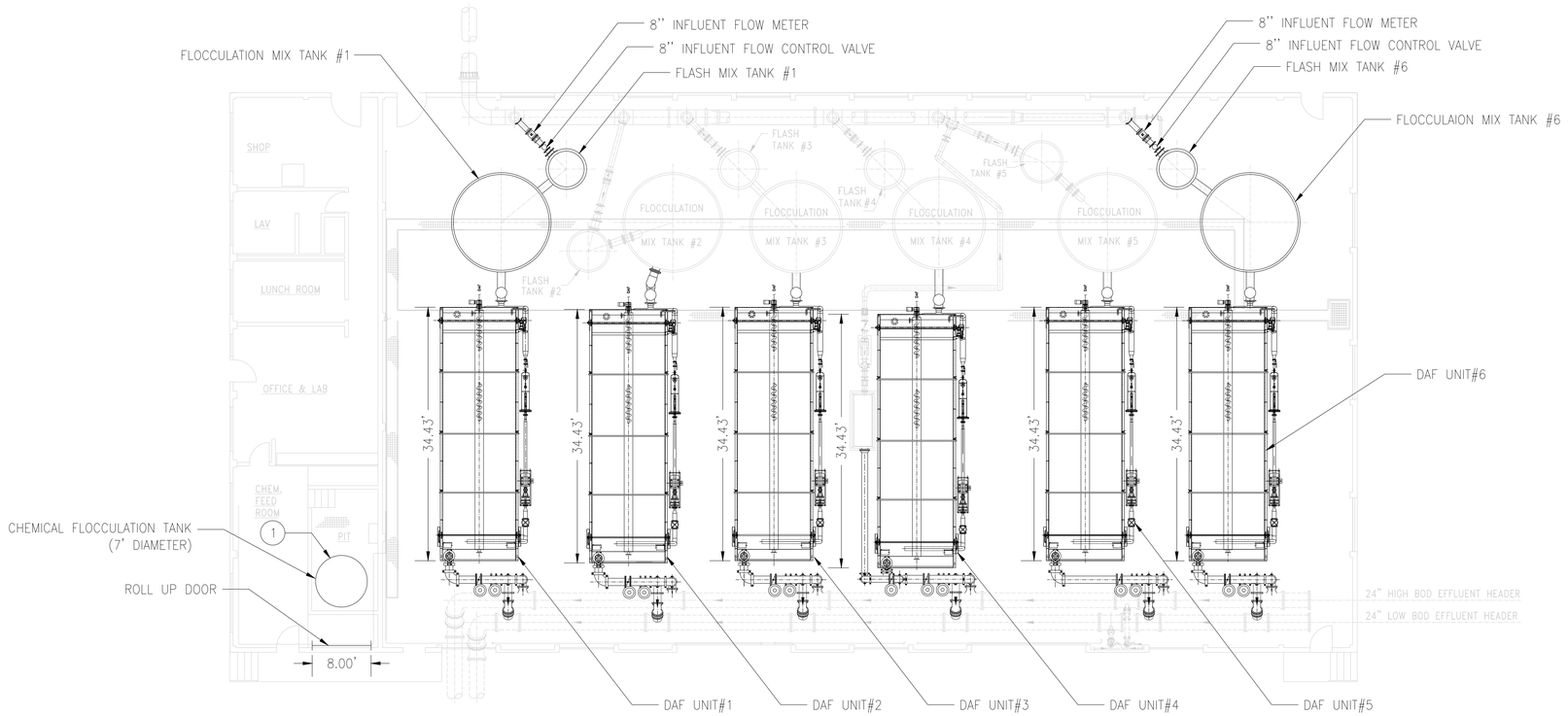
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POS PROJECT MANAGER: ETHAN CONLEY
POS PROJECT ENGINEER:
POS DESIGN ENGINEER:
POS DRAFTER:
POS SCALE: 1" = 10"
POS DATE:
POS CHECKED/APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION
SHEET TITLE: DAF AND BUILDING MODIFICATIONS DEMOLITION PLAN

POS WORK PROJECT NUMBER: 000000
CONSULTANT'S PROJECT NUMBER: 44846.10
POS PROJECT TRACKING NUMBER: STIA-2404 M2

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GENERAL NOTES:

1. INSTALL SIX NEW DAF UNITS AND CONNECT TO EXISTING INFLUENT AND EFFLUENT PIPING.

(#) KEYED NOTES:

1. EXISTING CHEMICAL FLOCCULATION TANK RELOCATED.

CALL 2 DAYS
BEFORE YOU DIG
1-800-424-5555

PLAN

DAF AND BUILDING MODIFICATIONS
PROPOSED PLAN
SCALE: 1" = 10'

N

1"=10'-0" 10 0 10 20
Scale Feet

NOT FOR CONSTRUCTION

Gresham Smith
10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR./ARCH:	MARK ERVIN
DESIGNER:	
DRAWN BY:	
SCALE:	1" = 10"
DATE:	
CHECKED BY:	
CHECKED/APPROVED BY:	

REVISIONS

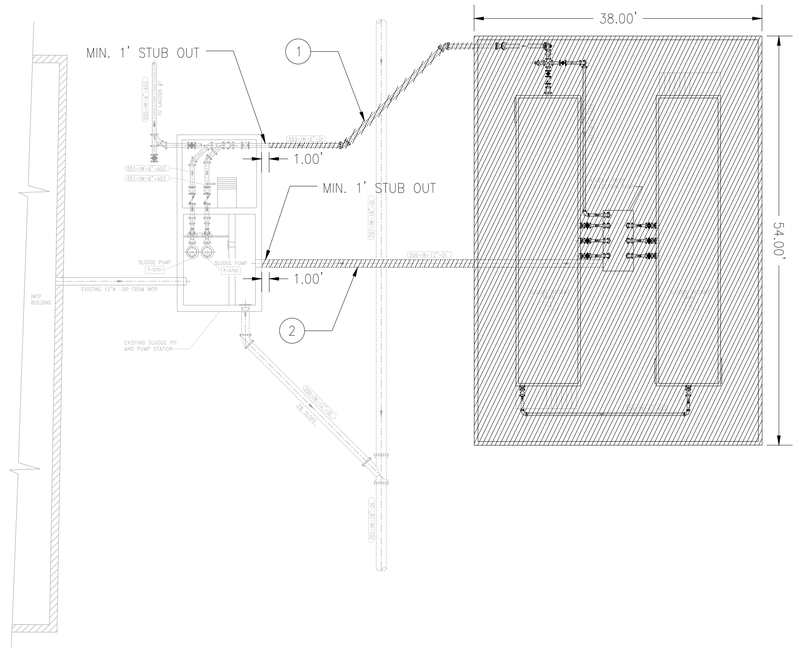
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POS PROJECT MANAGER:	ETHAN CONLEY
POS PROJECT ENGINEER:	
POS DESIGN ENGINEER:	
POS DRAFTER:	
POS SCALE:	1" = 10'
POS DATE:	
POS CHECKED/APPROVED BY:	

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION
SHEET TITLE: DAF AND BUILDING MODIFICATIONS PROPOSED PLAN

POS WORK PROJECT NUMBER	000000
CONSULTANT'S PROJECT NUMBER	44846.10
POS PROJECT TRACKING NUMBER	STIA-2404 M3

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GENERAL NOTES:

1. DEMOLISH EXISTING TWO DECANT TANKS, CONCRETE PAD, COLLECTION SUMP, PIPING, AND RELATED EQUIPMENT.

(#) KEYED NOTES:

1. DEMOLISH INFLUENT PIPING OF EXISTING TWO DECANT TANKS AND RETAIN 6" STUB OUT AT EXISTING SLUDGE PIT, AS SHOWN.
2. DEMOLISH EXISTING DISCHARGE PIPING OF COLLECTION SUMP AND RETAIN 12" STUB OUT AT EXISTING SLUDGE PIT, AS SHOWN.

PLAN

SOLIDS HANDLING MODIFICATIONS
DEMOLITION PLAN
SCALE: 1" = 10'

N

1"=10'-0"

10 0 10 20
Scale Feet

CALL 2 DAYS
BEFORE YOU DIG
1-800-424-5555

NOT FOR CONSTRUCTION

Gresham Smith
10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR./ARCH:	MARK ERVIN
DESIGNER:	
DRAWN BY:	
SCALE:	1" = 10"
DATE:	
CHECKED BY:	
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POS PROJECT MANAGER:	ETHAN CONLEY
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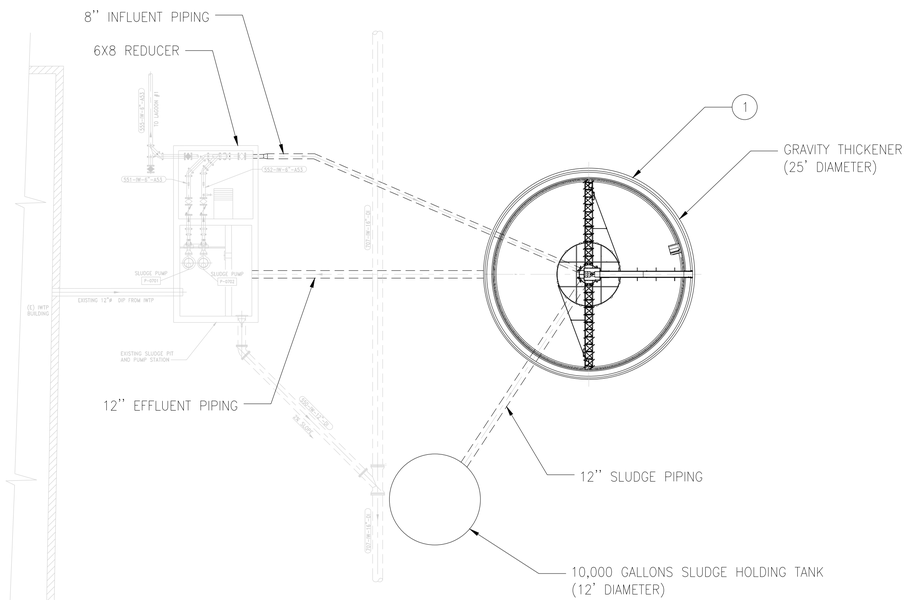
Port of Seattle SEA-TAC INTERNATIONAL AIRPORT

PROJECT NAME: **INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION**

SHEET TITLE: **SOLIDS HANDLING MODIFICATIONS DEMOLITION PLAN**

POS WORK PROJECT NUMBER	000000
CONSULTANT'S PROJECT NUMBER	44846.10
POS PROJECT TRACKING NUMBER	STIA-2404 M4

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GENERAL NOTES:

1. NOT USED

(#) KEYED NOTES:

1. INSTALL NEW GRAVITY THICKENER AND CONNECT TO EXISTING INFLUENT AND EFFLUENT PIPING.

PLAN
SOLIDS HANDLING MODIFICATIONS
PROPOSED PLAN
SCALE: 1" = 10'

N

1"=10'-0" 10 0 10 20
Scale Feet

CALL 2 DAYS
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1-800-424-5555

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10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR./ARCH:	MARK ERVIN
DESIGNER:	
DRAWN BY:	
SCALE:	1" = 10"
DATE:	
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REVISIONS

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POS PROJECT MANAGER:	ETHAN CONLEY
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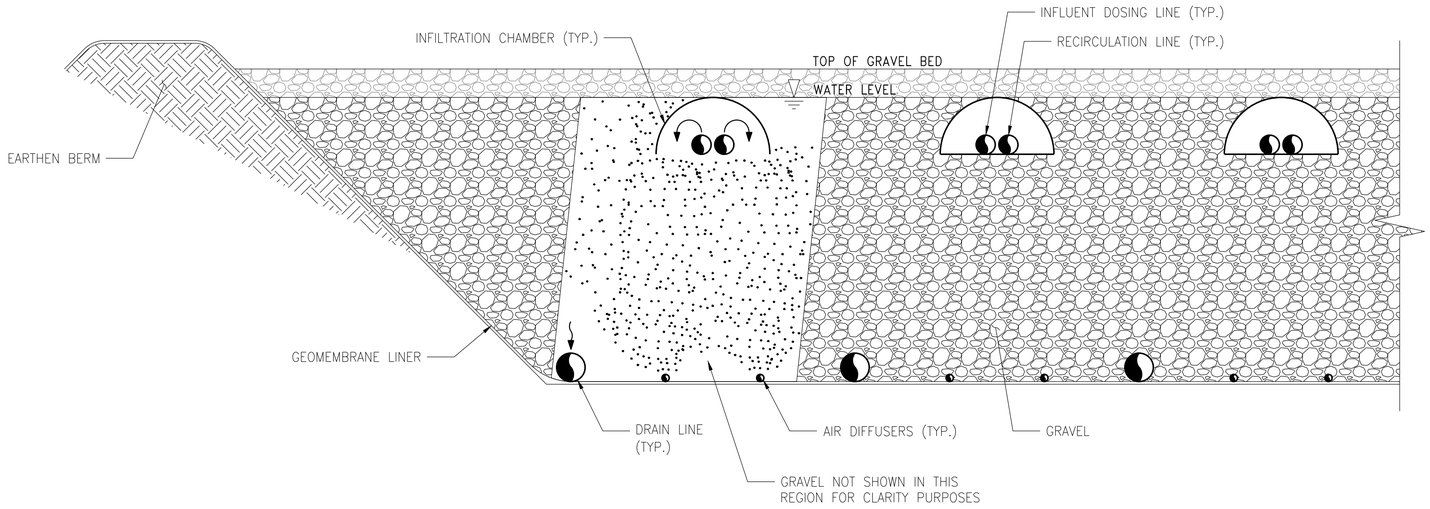
Port of Seattle SEA-TAC INTERNATIONAL AIRPORT

PROJECT NAME: **INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION**

SHEET TITLE: **SOLIDS HANDLING MODIFICATIONS PROPOSED PLAN**

POS WORK PROJECT NUMBER	000000
CONSULTANT'S PROJECT NUMBER	44846.10
POS PROJECT TRACKING NUMBER	STIA-2404 M5

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SECTION 1 / M6

AGB CELL TYPICAL SECTION
NOT TO SCALE

GENERAL NOTES:

1. NOT USED

(#) KEYED NOTES:

1. NOT USED

CALL 2 DAYS
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1-800-424-5555

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10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR./ARCH: MARK ERVIN
DESIGNER:
DRAWN BY:
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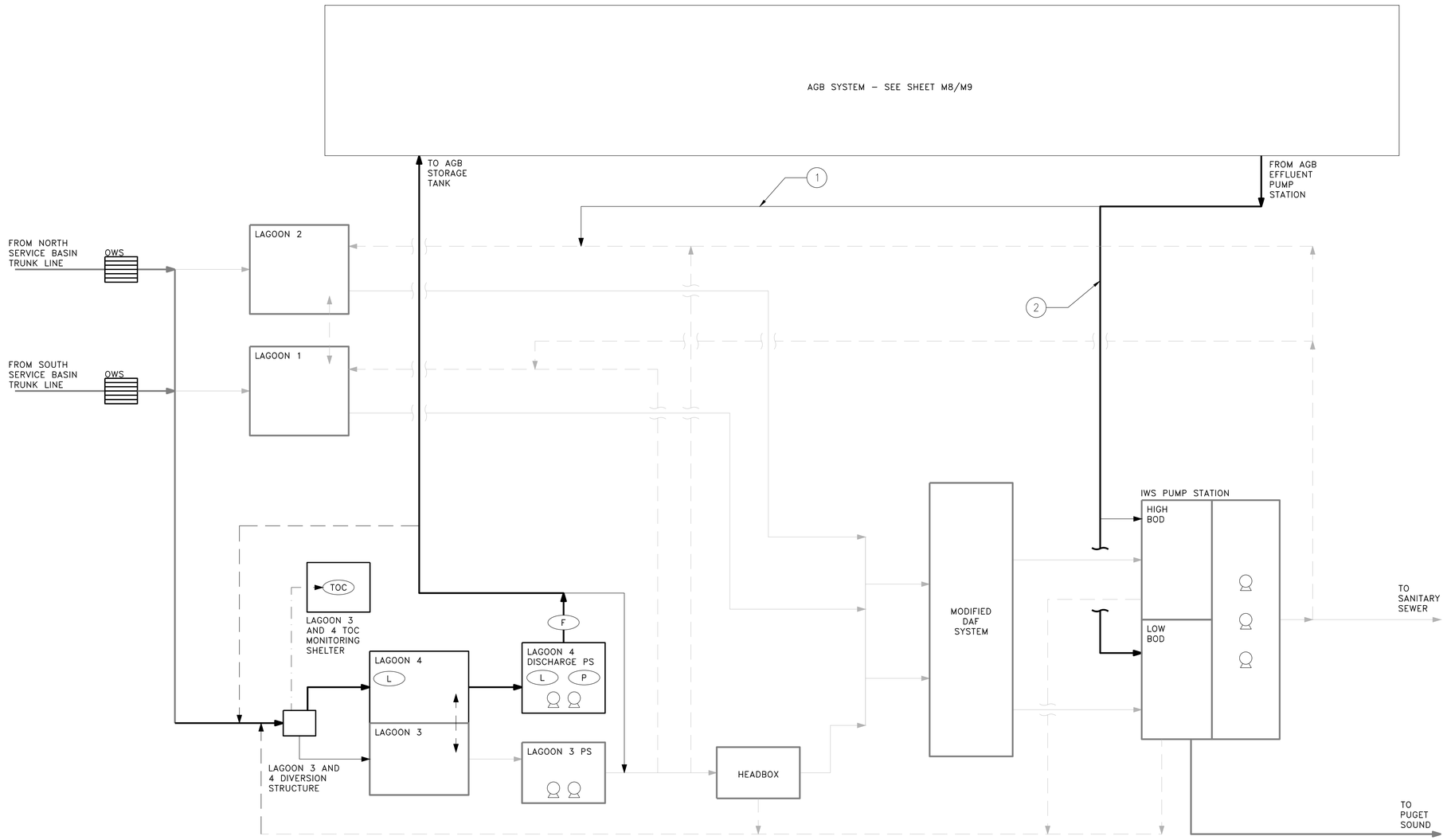
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POS PROJECT MANAGER: ETHAN CONLEY
POS PROJECT ENGINEER:
POS DESIGN ENGINEER:
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Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION
SHEET TITLE: AGB DETAILS

POS WORK PROJECT NUMBER: 000000
CONSULTANT'S PROJECT NUMBER: 44846.10
POS PROJECT TRACKING NUMBER: STIA-2404 M6

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GENERAL NOTES:

1. NOT USED

(#) KEYED NOTES:

1. AGB EFFLUENT MAY BE ROUTED TO LAGOON 2 FOR FLOW ATTENUATION (IF FLOW RATE EXCEEDS DISCHARGE FLOW LIMITS) OR FOR TERTIARY TREATMENT AT DAF SYSTEM.
2. AGB EFFLUENT MAY BE ROUTED TO IWS PUMP STATION FOR DISCHARGE TO PUGET SOUND (LOW BOD COMPARTMENT) OR SANITARY SEWER (HIGH BOD COMPARTMENT).

LEGEND:

- PRIMARY FLOW ROUTE FOR HIGH BOD RUNOFF (PROPOSED)
- SECONDARY FLOW ROUTE (PROPOSED)
- OVERFLOW OR RECIRCULATION ROUTE (PROPOSED)
- TOC SAMPLE PIPING (PROPOSED)
- PRIMARY FLOW ROUTE FOR HIGH BOD RUNOFF (EXISTING)
- SECONDARY FLOW ROUTE (EXISTING)
- OVERFLOW OR RECIRCULATION ROUTE (EXISTING)
- (TOC) TOC MONITORING POINT
- (L) LEVEL MEASURING INSTRUMENT
- (P) PRESSURE SENSING INSTRUMENT
- (F) FLOW METER
- PUMP

BLOCK DIAGRAM

P&ID – OVERALL PROCESS
NOT TO SCALE

1
M7

CALL 2 DAYS
BEFORE YOU DIG
1-800-424-5555

NOT FOR CONSTRUCTION

Gresham Smith
10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR/ARCH: MARK ERVIN
DESIGNER:
DRAWN BY:
SCALE: NOT TO SCALE
DATE:
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CHECKED/APPROVED BY:

REVISIONS

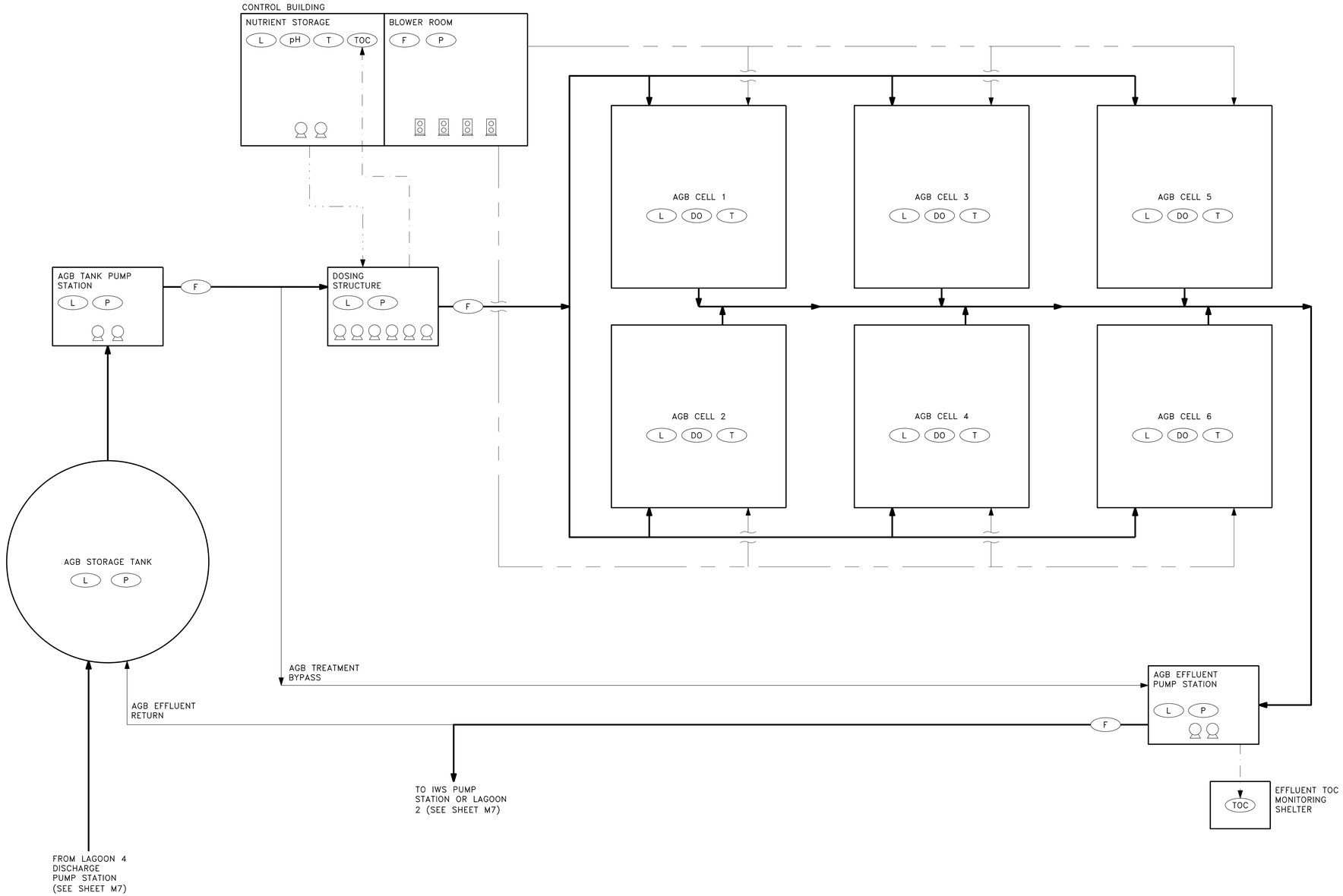
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POS PROJECT MANAGER: ETHAN CONLEY
POS PROJECT ENGINEER:
POS DESIGN ENGINEER:
POS DRAFTER:
POS SCALE: NOT TO SCALE
POS DATE:
POS CHECKED/APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION
SHEET TITLE: PROCESS AND INSTRUMENTATION DIAGRAM OVERALL PROCESS

POS WORK PROJECT NUMBER: 000000
CONSULTANT'S PROJECT NUMBER: 44846.10
POS PROJECT TRACKING NUMBER: STIA-2404 M7

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BLOCK DIAGRAM

P&ID – AGB PROCESS
PARALLEL FLOW MODE
NOT TO SCALE

1
M8

GENERAL NOTES:

1. IN PARALLEL FLOW MODE, FLOW FROM THE DOSING STRUCTURE IS SPLIT INTO UP TO SIX SEPARATE STREAMS. EACH STREAM ROUTES FLOW THROUGH A SINGLE AGB TREATMENT CELL BEFORE DISCHARGING TO THE EFFLUENT SYSTEM. WHEN A GREATER DEGREE OF BOD REMOVAL IS REQUIRED TO MEET NPDES PERMIT LIMITS, SERIES FLOW MODE (SHEET M9) MAY BE USED INSTEAD.

(#) KEYED NOTES:

1. NOT USED

LEGEND:

- PROPOSED PRIMARY PIPING
- PROPOSED SECONDARY PIPING
- PROPOSED NUTRIENT PIPING
- PROPOSED AIR SUPPLY PIPING
- PROPOSED TOC SAMPLE PIPING
- (TOC) TOC MONITOR
- (L) LEVEL MEASURING INSTRUMENT
- (P) PRESSURE SENSING INSTRUMENT
- (F) FLOW METER
- (pH) pH MONITORING PROBE
- (DO) DO MONITORING PROBE
- (T) TEMPERATURE MONITORING PROBE
- PUMP
- BLOWER

CALL 2 DAYS
BEFORE YOU DIG
1-800-424-5555

NOT FOR CONSTRUCTION

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10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR./ARCH: MARK ERVIN
DESIGNER:
DRAWN BY:
SCALE: NOT TO SCALE
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REVISIONS

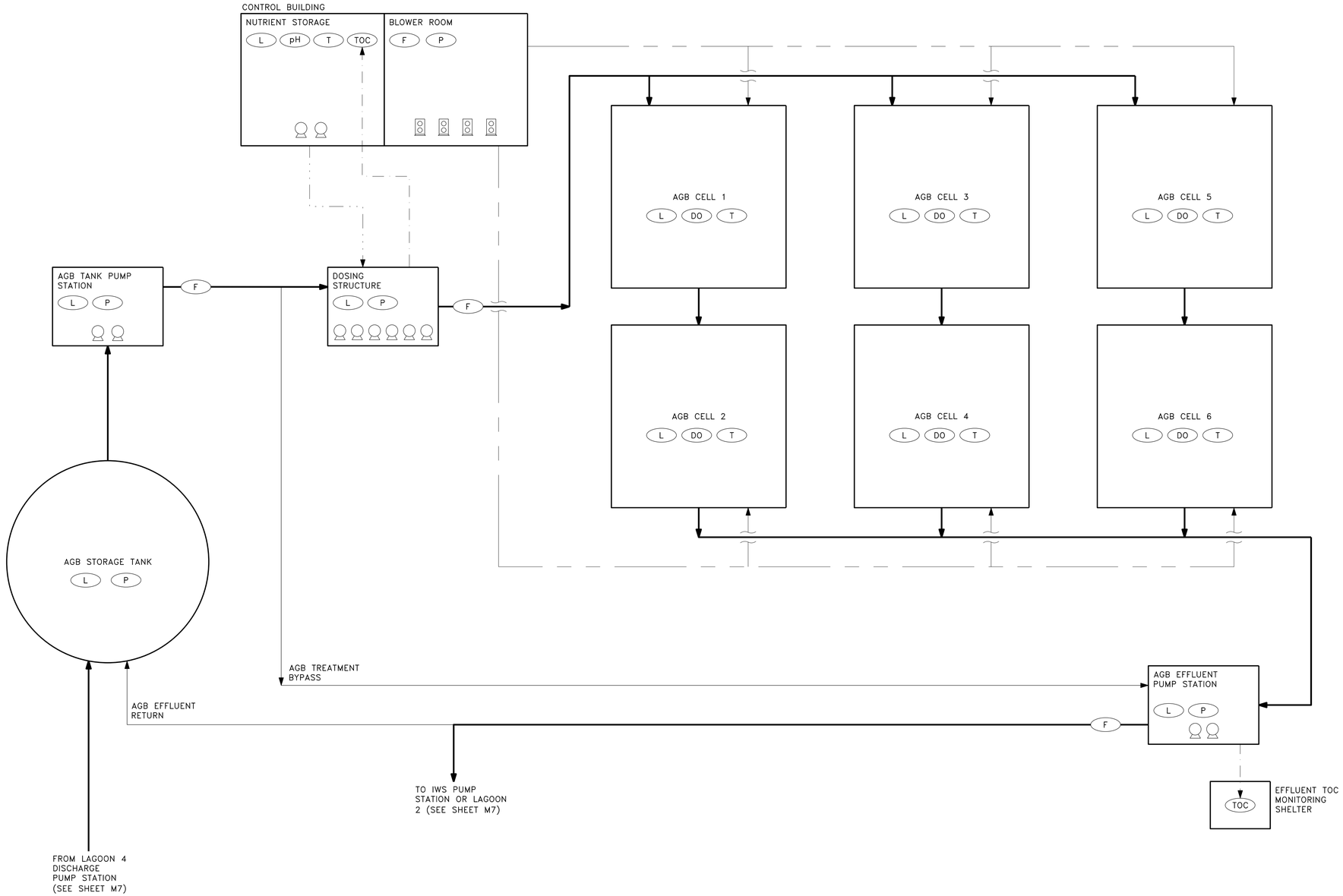
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POS PROJECT MANAGER: ETHAN CONLEY
POS PROJECT ENGINEER:
POS DESIGN ENGINEER:
POS DRAFTER:
POS SCALE: NOT TO SCALE
POS DATE:
POS CHECKED/APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION
SHEET TITLE: PROCESS AND INSTRUMENTATION DIAGRAM
AGB PROCESS - PARALLEL FLOW

POS WORK PROJECT NUMBER: 000000
CONSULTANT'S PROJECT NUMBER: 44846.10
POS PROJECT TRACKING NUMBER: STIA-2404 M8

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GENERAL NOTES:

1. IN SERIES FLOW MODE, FLOW FROM THE DOSING STRUCTURE IS SPLIT INTO UP TO THREE SEPARATE STREAMS. EACH STREAM ROUTES FLOW CONSECUTIVELY THROUGH A SERIES OF TWO CELLS, WHICH MAY PROVIDE A GREATER DEGREE OF BOD REMOVAL COMPARED TO THE DEFAULT PARALLEL FLOW MODE (SHEET M8).

(#) KEYED NOTES:

1. NOT USED

LEGEND:

- PROPOSED PRIMARY PIPING
- PROPOSED SECONDARY PIPING
- PROPOSED NUTRIENT PIPING
- PROPOSED AIR SUPPLY PIPING
- PROPOSED TOC SAMPLE PIPING
- (TOC) TOC MONITOR
- (L) LEVEL MEASURING INSTRUMENT
- (P) PRESSURE SENSING INSTRUMENT
- (F) FLOW METER
- (pH) pH MONITORING PROBE
- (DO) DO MONITORING PROBE
- (T) TEMPERATURE MONITORING PROBE
- PUMP
- BLOWER

CALL 2 DAYS
BEFORE YOU DIG
1-800-424-5555

BLOCK DIAGRAM

P&ID – AGB PROCESS
SERIES FLOW MODE
NOT TO SCALE

1
M9

NOT FOR CONSTRUCTION

Gresham Smith
10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR./ARCH: MARK ERVIN
DESIGNER:
DRAWN BY:
SCALE: NOT TO SCALE
DATE:
CHECKED BY:
CHECKED/APPROVED BY:

REVISIONS

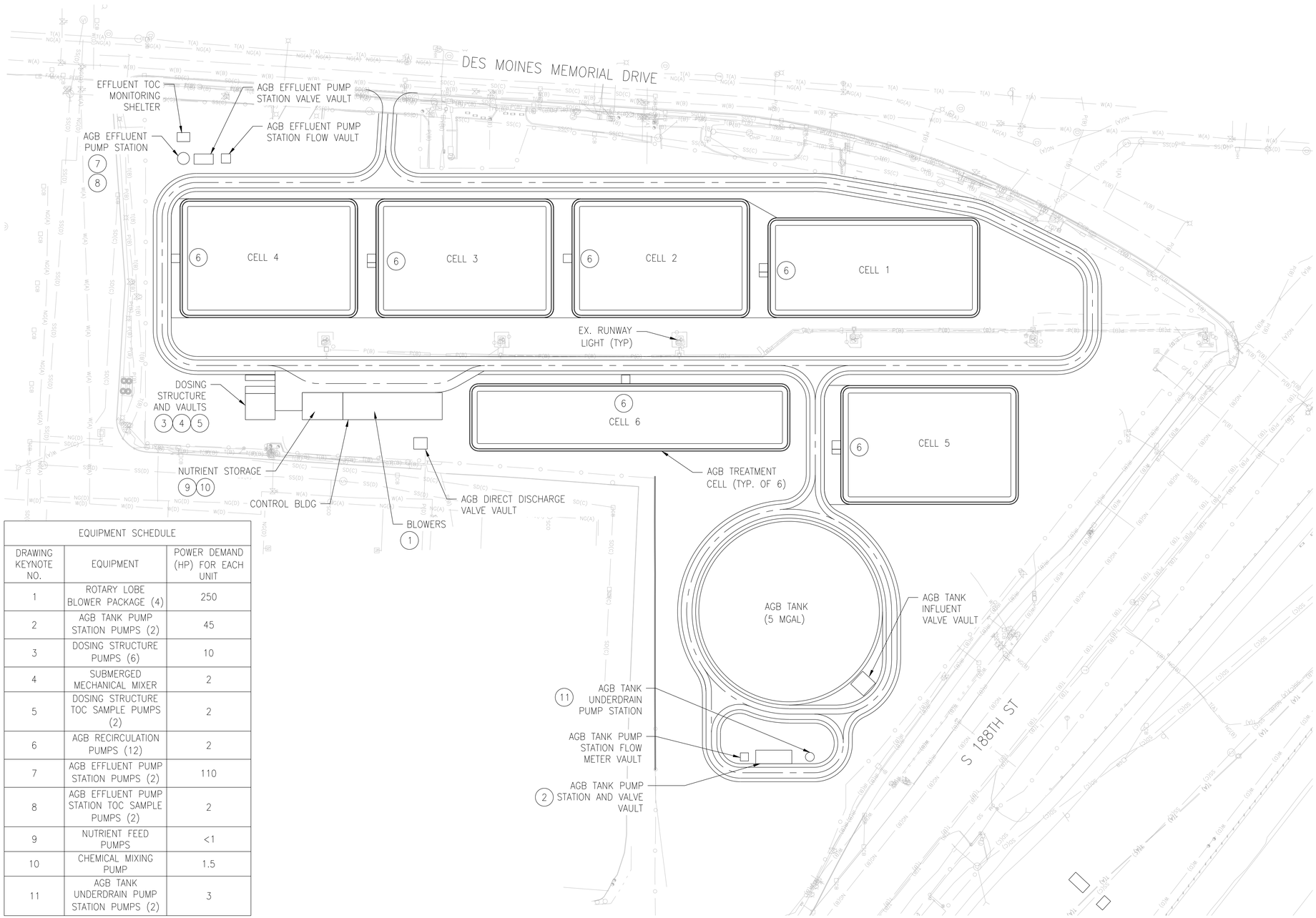
NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D
1	02-28-23	.	DRAFT ENGINEERING REPORT	.	.	.	.	.	.
2	03-21-23	.	DRAFT BASIS OF DESIGN	.	.	.	.	.	.
3	06-07-23	.	FINAL ENGINEERING REPORT	.	.	.	.	.	.
4	06-23-23	.	FINAL BASIS OF DESIGN	.	.	.	.	.	.
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POS PROJECT MANAGER: ETHAN CONLEY
POS PROJECT ENGINEER:
POS DESIGN ENGINEER:
POS DRAFTER:
POS SCALE: NOT TO SCALE
POS DATE:
POS CHECKED/APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION
SHEET TITLE: PROCESS AND INSTRUMENTATION DIAGRAM
AGB PROCESS - SERIES FLOW

POS WORK PROJECT NUMBER: 000000
CONSULTANT'S PROJECT NUMBER: 44846.10
POS PROJECT TRACKING NUMBER: STIA-2404 M9

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EQUIPMENT SCHEDULE		
DRAWING KEYNOTE NO.	EQUIPMENT	POWER DEMAND (HP) FOR EACH UNIT
1	ROTARY LOBE BLOWER PACKAGE (4)	250
2	AGB TANK PUMP STATION PUMPS (2)	45
3	DOSING STRUCTURE PUMPS (6)	10
4	SUBMERGED MECHANICAL MIXER	2
5	DOSING STRUCTURE TOC SAMPLE PUMPS (2)	2
6	AGB RECIRCULATION PUMPS (12)	2
7	AGB EFFLUENT PUMP STATION PUMPS (2)	110
8	AGB EFFLUENT PUMP STATION TOC SAMPLE PUMPS (2)	2
9	NUTRIENT FEED PUMPS	<1
10	CHEMICAL MIXING PUMP	1.5
11	AGB TANK UNDERDRAIN PUMP STATION PUMPS (2)	3

CALL 2 DAYS
BEFORE YOU DIG
1-800-424-5555

PLAN

ELECTRICAL PLAN
AGB SITE
SCALE: 1" = 60'

1"=60'-0"

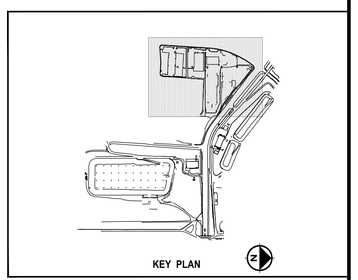
60 0 60 120
Scale Feet

GENERAL NOTES:

1. THE MAIN INCOMING POWER FOR THIS PROJECT SHALL BE COORDINATED WITH PUGET SOUND ENERGY.
2. CONNECTIONS FOR TEMPORARY BACKUP POWER SUPPLY SHALL BE PROVIDED AT AGB EFFLUENT PUMP STATION AND AT CONTROL BUILDING. SIZING SHALL BE DETERMINED DURING DETAILED DESIGN.

(#) KEYED NOTES:

SEE EQUIPMENT SCHEDULE.



NOT FOR CONSTRUCTION

Gresham Smith
10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR./ARCH: MARK ERVIN
DESIGNER:
DRAWN BY:
SCALE: 1" = 60'
DATE:
CHECKED BY:
CHECKED/APPROVED BY:

REVISIONS

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POS PROJECT MANAGER: ETHAN CONLEY
POS PROJECT ENGINEER:
POS DESIGN ENGINEER:
POS DRAFTER:
POS SCALE: 1" = 60'
POS DATE:
POS CHECKED/APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION
SHEET TITLE: ELECTRICAL PLAN AGB SITE

POS WORK PROJECT NUMBER: 000000
CONSULTANT'S PROJECT NUMBER: 44846.10
POS PROJECT TRACKING NUMBER: STIA-2404 E1

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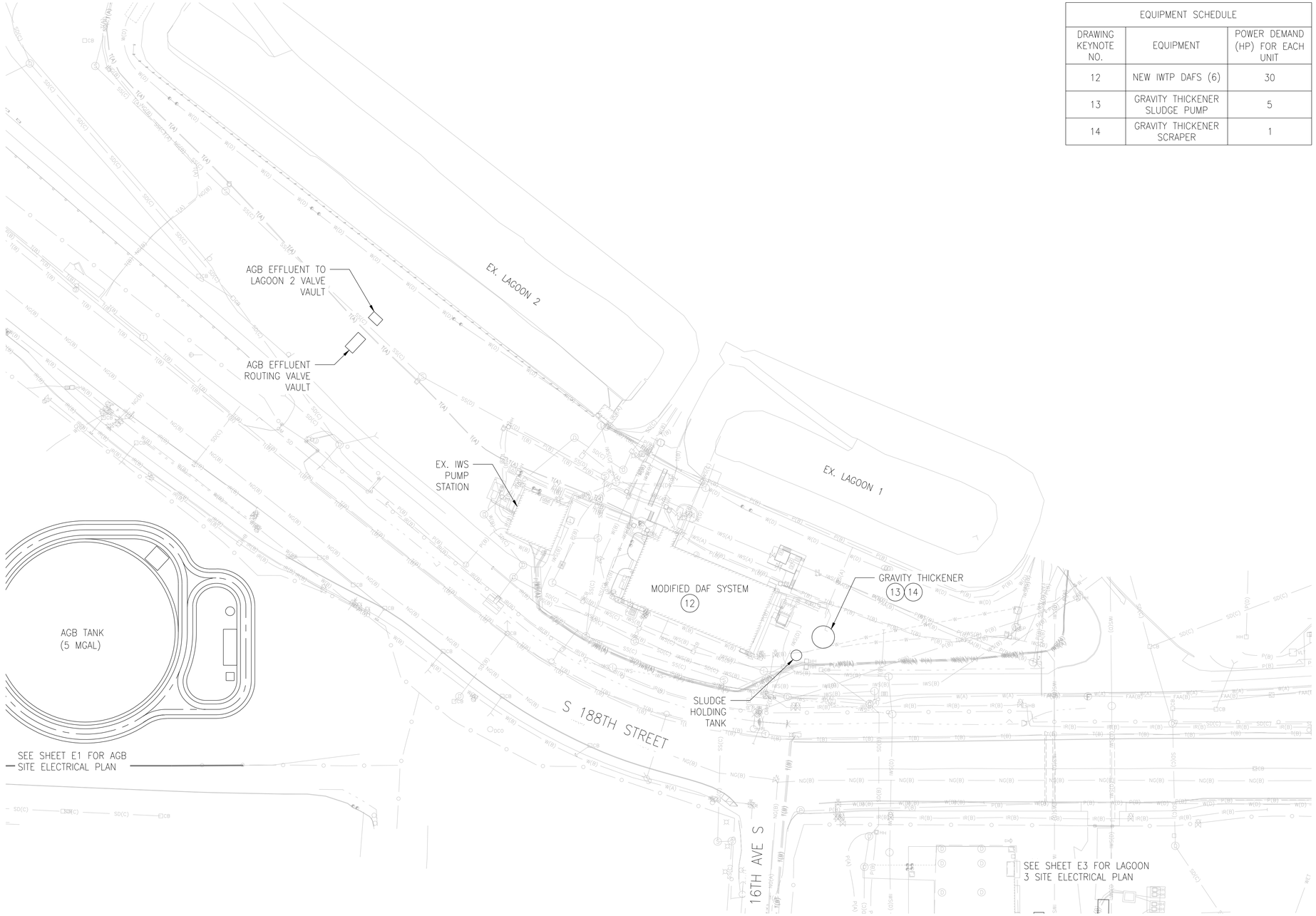
EQUIPMENT SCHEDULE		
DRAWING KEYNOTE NO.	EQUIPMENT	POWER DEMAND (HP) FOR EACH UNIT
12	NEW IWTP DAFS (6)	30
13	GRAVITY THICKENER SLUDGE PUMP	5
14	GRAVITY THICKENER SCRAPER	1

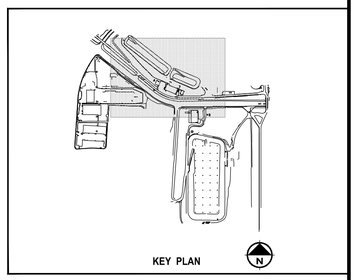
GENERAL NOTES:

1. THE BREAKER T-37B-2 IN PMI-37B HAS BEEN RESERVED TO FEED THIS SITE.

(#) KEYED NOTES:

SEE EQUIPMENT SCHEDULE.





CALL 2 DAYS
BEFORE YOU DIG
1-800-424-5555

PLAN
ELECTRICAL PLAN
IWTP SITE
SCALE: 1" = 60'

N

1"=60'-0" 60 0 60 120
Scale Feet

NOT FOR CONSTRUCTION

Gresham Smith
10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR./ARCH: MARK ERVIN
DESIGNER:
DRAWN BY:
SCALE: 1" = 60'
DATE:
CHECKED BY:
CHECKED/APPROVED BY:

REVISIONS

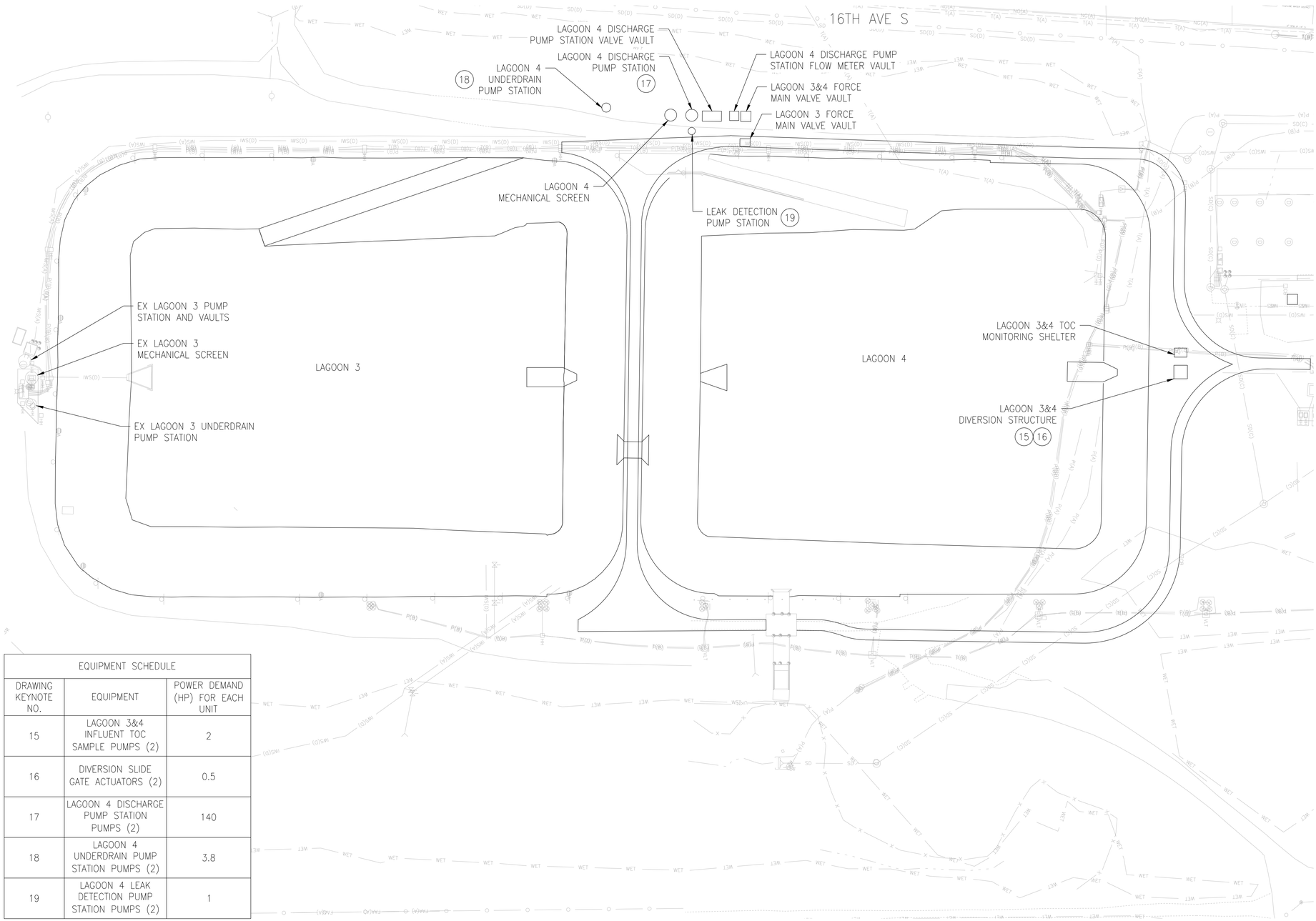
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POS PROJECT MANAGER: ETHAN CONLEY
POS PROJECT ENGINEER:
POS DESIGN ENGINEER:
POS DRAFTER:
POS SCALE: 1" = 60'
POS DATE:
POS CHECKED/APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION
SHEET TITLE: ELECTRICAL PLAN IWTP SITE

POS WORK PROJECT NUMBER: 000000
CONSULTANT'S PROJECT NUMBER: 44846.10
POS PROJECT TRACKING NUMBER: STIA-2404 E2

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EQUIPMENT SCHEDULE		
DRAWING KEYNOTE NO.	EQUIPMENT	POWER DEMAND (HP) FOR EACH UNIT
15	LAGOON 3&4 INFLUENT TOC SAMPLE PUMPS (2)	2
16	DIVERSION SLIDE GATE ACTUATORS (2)	0.5
17	LAGOON 4 DISCHARGE PUMP STATION PUMPS (2)	140
18	LAGOON 4 UNDERDRAIN PUMP STATION PUMPS (2)	3.8
19	LAGOON 4 LEAK DETECTION PUMP STATION PUMPS (2)	1

CALL 2 DAYS
BEFORE YOU DIG
1-800-424-5555

PLAN

ELECTRICAL PLAN
LAGOON 3 SITE
SCALE: 1" = 60'

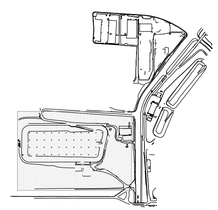
1"=60'-0" 60 0 60 120
Scale Feet

GENERAL NOTES:

1. THE MAIN INCOMING POWER FOR THIS PROJECT SHALL BE COORDINATED WITH PUGET SOUND ENERGY.

(#) KEYED NOTES:

1. NOT USED.



NOT FOR CONSTRUCTION

Gresham Smith
10 West Broad Street
Suite 1650
Columbus, OH 43215
614.221.0678

PROJECT ENGR./ARCH: MARK ERVIN
DESIGNER:
DRAWN BY:
SCALE: 1" = 60'
DATE:
CHECKED BY:
CHECKED/APPROVED BY:

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D
1	03-21-23	.	DRAFT BASIS OF DESIGN REPORT	.	.	.	.	.	.
2	06-23-23	.	FINAL BASIS OF DESIGN REPORT	.	.	.	.	.	.

POS PROJECT MANAGER: ETHAN CONLEY
POS PROJECT ENGINEER:
POS DESIGN ENGINEER:
POS DRAFTER:
POS SCALE: 1" = 60'
POS DATE:
POS CHECKED/APPROVED BY:

Port of Seattle
SEA-TAC INTERNATIONAL AIRPORT
PROJECT NAME: INDUSTRIAL WASTEWATER TREATMENT PLANT EXPANSION
SHEET TITLE: ELECTRICAL PLAN LAGOON 3 SITE

POS WORK PROJECT NUMBER: 000000
CONSULTANT'S PROJECT NUMBER: 44846.10
POS PROJECT TRACKING NUMBER: STIA-2404 E3

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Attachment B

NPDES Permit

NPDES Permit cannot be embedded in this PDF since it is encrypted.

Obtain a copy online at:

https://apps.ecology.wa.gov/paris/DownloadDocument.aspx?id=378024

or

https://www.portseattle.org/sites/default/files/2022-01/WA0024651_FinalPermit_2021-07-27_SeaTac%20%281%29.pdf

Attachment C

IWD Permit

DocuSign Envelope ID: 8C61B1CE-0B8E-45F4-B149-D4E53C0A5EB4

King County
Wastewater Treatment Division
Industrial Waste Program
Department of Natural Resources and Parks
201 South Jackson Street, Suite 5513
Seattle, WA 98104-3855
206-477-5300 Fax 206-263-3001
TTY Relay: 711

FINAL

July 19, 2021

SENT VIA EMAIL ONLY
ELECTRONIC READ RECEIPT REQUESTED

Stuart Mathews
Port of Seattle
P.O. Box 68727
Seattle,WA 98168
mathews.s@portseattle.org

Issuance of renewed Wastewater Discharge Permit No. 7810-05 to Port of Seattle by the King County Department of Natural Resources and Parks

Dear Mr. Mathews:

The King County Industrial Waste Program (KCIW) has reviewed and processed your application for issuance of an industrial wastewater discharge permit in accordance with Chapter 90.48 RCW as Amended, Public Law 92-500, and King County Code 28.84.060.

The enclosed issued Permit No. 7810-05 covers the wastewater discharges from the Port of Seattle, Sea-Tac International Airport, IWS - IWTP operation located at 17801 International Boulevard, Sea-Tac, Washington. All discharges from this facility, and actions and reports relating thereto, shall be in accordance with the terms and conditions of this permit.

The enclosed Permit No. 7810-05 supersedes and cancels Permit No. 7810-04 effective July 21, 2021.

King County Code 28.84 authorizes a fee for each Permit issued by the King County Department of Natural Resources and Parks. The current fee for issuance of a renewed Permit in Level C is $9000. King County will send you an invoice for this amount.

The main changes to this renewed permit are lower mass loading discharge limits for biochemical oxygen demand (effective October 1, 2022), the requirement to meet the measures, milestones, and due dates listed in the Compliance Schedule (S3.D), and an increase in maximum daily discharge volume – from 2.76 MG to 4.0 MG.

DocuSign Envelope ID: 8C61B1CE-0B8E-45F4-B149-D4E53C0A5EB4

If you have any questions about this permit or your wastewater discharge, please call Peggy Rice at 206-477-5462 or email her at peggy.rice@kingcounty.gov. You may also wish to visit our program's Internet pages at: www.kingcounty.gov/industrialwaste.

Sincerely,

DocuSigned by:
Mark Henley
E27BB25CD98948B...

Mark Henley
Program Manager

Enclosures

e-cc: Maia Hoffman, Washington Department of Ecology, mhof461@ecy.wa.gov
Andrew LaRue, Valley View Sewer District, andrewl@valleyviewsewer.org
Curtis Steinke, King County, curtis.steinke@kingcounty.gov
Sarah Cox, Port of Seattle, cox.sarah@portseattle.org

DocuSign Envelope ID: 8C61B1CE-0B8E-45F4-B149-D4E53C0A5EB4

Permit No.: 7810-05
Issuance Date: July 19, 2021
Effective Date: July 21, 2021
Expiration Date: July 20, 2026

King County

WASTE DISCHARGE PERMIT

Department of Natural Resources and Parks
Industrial Waste Program
201 S. Jackson Street, Suite 5513
Seattle, WA 98104-3855

In accordance with the provisions of Chapter 90.48 RCW as amended, Public Law 92-500, and King County Code 28.84.060, a Waste Discharge Permit is issued to:

Port of Seattle, Sea-Tac International Airport, IWS

Facility location:	17801 International Boulevard Sea Tac,WA 98158
Business hours phone:	206-787-5604
Emergency (24-hour) phone:	206-787-5911
Mailing address:	P.O. Box 68727 Seattle, WA 98168

Permission is hereby granted to discharge industrial wastewater from the above-identified facility into the King County sewerage system in accordance with the effluent limitations and monitoring requirements set forth in this permit.

This permit is based on information provided in the permit application, which together with the following conditions and requirements are considered part of the permit. All requirements and ordinances of King County pertaining to the discharge of wastes into the King County sewerage system are hereby made a condition of this permit. All discharges and activities authorized herein shall be consistent with the terms and conditions of this permit.

This permit is not transferable without authorization from the King County Industrial Waste Program (KCIW). Failure to provide advance notice of a transfer renders this waste discharge permit voidable on the date of facility transfer.

DocuSigned by:
By Mark Henley
E27BB25CD98948B...
Mark Henley, Industrial Waste Program Manager

DocuSign Envelope ID: 8C61B1CE-0B8E-45F4-B149-D4E53C0A5EB4

TABLE OF CONTENTS

S1 Emergency Contacts

S2 Permit Summary and Company Identification

S3 Special Conditions or Compliance Schedule

S4 Effluent Limitations and Self-Monitoring Requirements

S5 Sample Site Access and Identification

S6 Notification Requirements

S7 Monitoring and Record Keeping

S8 Operations and Maintenance

S9 General Conditions

S10 Washington State Department of Ecology Conditions

Company Fact Sheet

King County Code – Title 28

DocuSign Envelope ID: 8C61B1CE-0B8E-45F4-B149-D4E53C0A5EB4

S1. EMERGENCY CONTACTS

KING COUNTY

Industrial Waste Program (8 a.m. – 5 p.m., weekdays):	206-477-5300
Peggy Rice, Industrial Waste Compliance Investigator:	206-477-5462
Mark Henley, Industrial Waste Program Manager:	206-263-6994

Your emergency contact after 5 p.m. weekdays and on weekends is:

South Treatment Plant:	206-263-1760

If unable to reach anyone at this number call:

West Point Treatment Plant:	206-263-3801

WASHINGTON STATE DEPARTMENT OF ECOLOGY

24-Hour emergency spill phone number:	206-594-0000 (new)

DocuSign Envelope ID: 8C61B1CE-0B8E-45F4-B149-D4E53C0A5EB4

S2. PERMIT SUMMARY AND COMPANY IDENTIFICATION

A. Summary Information

The following industrial waste discharge sites have been identified for this facility:

Sample Site No.	*Limit Type*	*Daily Maximum Discharge Volume (MG)*	*Maximum Instantaneous Flow Rate (gpm)*	*Daily Maximum Flow Rate (gpm)*	*Sample Site Description*
A70101	KCLL GT 5000 & BOD Loading Limits	2.76 (effective July 21, 2021 until Sept. 30, 2022)	1,965	1,915	Effluent Wet Well at the Industrial Waste Treatment Plant (IWTP)
A70101	KCLL GT 5000 & BOD Loading Limits	4.0 (effective October 1, 2022- July 20, 2026)	2,883	2,778	

Effluent limitations and self-monitoring requirements for this sample site are detailed in S4.A of this permit.

B. Reports

Report Name	*Section(s)*	*Due Date*
Preliminary Planning Report (PPR)	S3.A	December 31, 2021
BTT Implementation Report	S3.A	December 31, 2021
Engineering Report - describe the preferred on-site storage and treatment alternative sufficient to develop design documents and meeting the requirements of WAC 173-240-130	S3.B	Draft - August 30, 2022
		Final - December 31, 2022
Design Documents - Plans and specifications meeting the requirements of WAC 173-240-140	S3.C	Draft (60%) - July 31, 2023
		Final (100%) - December 15, 2023
Monthly self-monitoring reports	S4.A	15th day of each month

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14-Day Report: Discharge or permit violation	S4.D	Within 14 days after a discharge or permit violation becomes known
Slug/Spill Control Plan	S6.A	As requested by KCIW
5-Day Report: Slug discharge or spill	S6.A	Within 5 days after a slug discharge or spill
Installation/Modification of Pretreatment System Report	S6.C	Prior to installation or modification
Hazardous waste discharge notification	S6.D	For existing discharges by October 21, 2021
Washington State Department of Ecology Dangerous Waste Reports	S6.D	As requested by KCIW

C. Major Changes in the Renewed Permit

This permit contains the following major changes since last issuance:

1. New Lower BOD Mass limits effective October 1, 2022 – daily maximum loading limits and monthly average loading limit. (S4.A)
2. The requirement to submit the Blend to Temperature (BTT) Implemetation Report and the Preliminary Planning Report (PPR) which includes information on the on-site storage and treatment alternative (S3.A), an engineering report that describes the on-site storage and treatment alternative (S3.B), and Design Documents (plans and specifications) (S3.C) for the design and construction of additional pretreatment and additional storage. For S3.C, design documents include plans and technical specifications that are directly related to IWTP modifications and additions to be implemented for the purposes of meeting the anticipated BOD mass loading limits.
3. The requirement to complete the measures and milestones by the due dates listed in the Compliance Schedule (S3.D) for the installation of additional pretreatment and storage (capital improvements), operational improvements, and BMP's.
4. An increase in maximum daily discharge volume effective October 1, 2022 – from 2.76 MG to 4.0 MG (S4.A)

D. Company Identification

SIC Code No.: 4581, 4512, 4513

Hazardous Waste Generator No.: WAD980980106

Industry Type: Transportation Facility

DocuSign Envelope ID: 8C61B1CE-0B8E-45F4-B149-D4E53C0A5EB4

S3. SPECIAL CONDITIONS AND COMPLIANCE SCHEDULE

Preliminary Project Report, Engineering Report, and Design Documents

All engineering and related design documents submitted must be stamped by a Professional Engineer, in accordance with chapter 173-240, WAC.

A. Preliminary Planning Report (PPR) and BTT Implementation Report

The permittee shall complete the Preliminary Planning Report by submitting to KCIW for review and approval a preferred on-site storage and treatment alternative that includes conceptual design criteria by the compliance schedule due date specified in S3.D. The permittee shall also submit the Blend-to-Temperature (BTT) Implementation Report to KCIW no later than December 31, 2021. The BTT Implementation Report shall provide a status update on the goal of reaching 100% BTT and any storage/treatment measures to compensate for less than 100% BTT implementation, if applicable.

B. Engineering Report

The engineering report shall describe the preferred on-site storage and treatment alternative sufficient to develop design documents (plans and specifications). The engineering report's on-site storage and treatment alternative shall include the measures necessary to achieve the following BOD limitations. An engineering report meeting the requirements of WAC 173-240-130 shall be submitted for review and approval to KCIW by the compliance schedule due date specified in S3.D.

The anticipated BOD mass loading limits (post-construction of on-site storage and treatment and any other recommendations by the report and approved by KCIW) are as follows:

- Maximum daily: 15,000 lbs/day
- Monthly average: 10,000 lbs/day
- Daily Maximum Hourly Load: 625 lbs/hr

C. Design Documents

Plans and specifications meeting the requirements of WAC 173-240-140, shall be developed for the preferred on-site storage and treatment option. The 60% and 100% plans and specifications shall be submitted for review and approval by the compliance schedule due date specified in S3.D.

D. Compliance Schedule - Implementation of Measures, Milestones and Due Dates

The Port of Seattle shall complete the following measures and milestones by the due dates.

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Measure	Milestone	Date Due
PPR for IWTP Modifications to Meet Anticipated 2026 BOD Limits	Final Preferred On-site Storage and Treatment option for IWTP modifications	December 31, 2021
BTT Implementation Report*	Final BTT achievement option	December 31, 2021
Engineering Report for IWTP Modifications (Storage/Treatment) to Meet Anticipated 2026 BOD Limits	Draft Submitted	August 30, 2022
	Final Submitted	December 31, 2022
Plans and Specifications for IWTP Modifications (Storage/Treatment) to Meet Anticipated 2026 BOD Limits	60% Design	July 31, 2023
	100% Design	December 15, 2023
Final Construction of IWTP Modifications (Storage/Treatment) to Meet Anticipated 2026 BOD Limitations	Start of construction - contract award	July 1, 2024
Final Construction of IWTP Modifications(Storage/Treatment) to Meet Anticipated 2026 BOD Limitations	Substantial Completion	March 31, 2026

*BTT shall be implemented to the max extent possible; if 100% BTT is not possible, the Port will submit in writing how the storage and treatment option will account for the difference between 75% (current state of implementation at permit issuance) and the goal of 100% implementation.

E. Flow Meter Calibration and Calibration Verification

The following are requirements for the calibration and calibration verification of flow meters.

1. The permittee must use calibrated flow meters to measure discharge volume and follow the manufacturer's specification for calibration.

2. At least annually, the permittee shall verify the calibration of the flow meter(s) used to calculate the discharge volume from the industrial wastewater treatment systems.

    a. The verification must be performed by qualified staff. This could be either permittee's employee or a third party.

    b. The verification may be performed on-site or at a vendor site.

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c. At a minimum flow meter verification must be conducted, either a) by discharge to or from a vessel of known volume, b) by use of another flow meter that is calibrated by an independent third party, or c) by recalibration by the original manufacturer or another vendor.

d. The acceptance limit for calibration verification is 90% -110% of the reference measurement. The permittee must re-calibrate the flow meter(s) per the manufacturer's specifications if the verification fails. All self-monitoring data taken with flow meters that fail verification must be noted on self-monitoring reports until the subject flow meter is back within acceptable limits.

3. Flowmeter calibration and verification must be documented, and records must be obtained and maintained on-site for a minimum of three years.

F. Notification to Cease or Reduce Discharge

King County and/or Valley View Sewer District representatives reserve the right to require that discharges to the municipal sanitary sewer system be temporarily ceased/stopped or reduced under the following conditions:

1. During periods of peak hydraulic or organic loadings.

2. When necessary for South Treatment Plant to avoid bypassing a portion of the plant flow around secondary treatment.

3. To prevent risk of a National Pollutant Discharge Elimination System (NPDES) permit violation(s) at South Treatment Plant.

G. Best Management Practices

1. Best management practices (BMPs) shall mean schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to implement the prohibitions listed in 40 CFR 403.5(a)(1) and (b). BMPs also include treatment requirements, operating procedures, and practices to control facility site runoff, spillage, or leaks; sludge or waste disposal; or drainage from raw materials storage (from 40 CFR 403.3(e)).

2. All industrial wastewater shall be routed through a fully operational, approved pretreatment system at all times when discharge to the sanitary sewer is occurring.

3. Port of Seattle, Sea-Tac International Airport, IWTP shall maintain all pretreatment and monitoring equipment and conduct operations according to KCIW approved documents, including, but not limited to, Port of Seattle, Sea-Tac International Airport, IWS most recent engineering report and operations and maintenance manual, as well as future KCIW approved reports.

DocuSign Envelope ID: 8C61B1CE-0B8E-45F4-B149-D4E53C0A5EB4

S4. EFFLUENT LIMITATIONS & SELF-MONITORING REQUIREMENTS

A. Effluent Limitations and Self-Monitoring Requirements:

1. The permittee shall comply with the following discharge limits and monitor its discharges to the King County sewerage system as specified in the following table below for the period July 21, 2021 – July 20, 2026.

Sample Site No.	***Limit Type***	***Sample Site Description***
A70101	King County Local Limits	Effluent Wet Well at the Industrial Waste Treatment Plant (IWTP)

Parameter	***Daily Average (mg/L)***	***Instantaneous Maximum (mg/L)***	***Maximum Loading[1] (lbs/day)***	***Sampling Frequency***	***Sample Type***
Arsenic, Total[2]	1.0	4.0	0.27	Once per Month	Composite
Cadmium, Total	0.5	0.6	0.17	Once per Month	Composite
Chromium, Total	2.75	5.0	1.2	Once per Month	Composite
Copper, Total	3.0	8.0	6.89	Once per Month	Composite
Lead, Total	2.0	4.0	1.2	Once per Month	Composite
Mercury, Total	0.1	0.2	0.06	NA	NA
Nickel, Total	2.5	5.0	2.49	Once per Month	Composite
Silver, Total	1.0	3.0	0.44	Once per Month	Composite
Zinc, Total	5.0	10.0	12.31	Once per Month	Composite
Cyanide, Amenable	2.0	3.0	NA	NA	NA
Nonpolar FOG	100	NA	NA	Once per Month	3 Grabs

pH (s.u.)[3]	***Daily Minimum***	***Minimum***	***Maximum***	Continuous	Recording pH Meter
	5.5	5.0	12.0		

[1] Applicable poundage limit for each parameter have been adjusted to prevent significant increase of pollutants at the South Treatment Plant influent.

[2] For the determination of total metals (which are equivalent to total recoverable metals) the sample is not filtered before processing.

[3] The "daily minimum" pH limit and the "minimum" pH limit are defined in S4.C.6.

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A. Effluent Limitations and Self-Monitoring Requirements (continued):

2. The permittee shall monitor its discharges to the King County sewer system and comply with the following discharge limits as specified below.

Sample Site No.	***Limit Type***			***Sample Site Description***	
A70101	King County Permit Limits			Effluent Wet Well at the Industrial Waste Treatment Plant (IWTP)	
Parameter	***Daily Maximum[1] (lbs/day)***	***Monthly Average[2] (lbs/day)***	***Daily Maximum Hourly Load[3] (lbs/hr)***	***Sampling Frequency***	***Sample Type***
Five-day Biochemical Oxygen Demand (BOD5)[4,5]	60,000	NA	2,500	Daily	Composite
Total Suspended Solids (TSS)	N/A	N/A	N/A	Daily	Composite
Five-day Biochemical Oxygen Demand (BOD_5)[4,5]	45,000	27,500	2,500	Daily	Composite
Total Suspended Solids (TSS)	N/A	N/A	N/A	Daily	Composite

[1] Daily Maximum Load equals the daily average concentration in mg/L, multiplied by the flow in million gallons per day, multiplied by 8.34.

[2] Monthly Average Load is the arithmetic mean of actual daily discharge load (sum of each daily discharge load divided by the total number of discharge days in a month). The permittee shall report the monthly average BOD on the monthly self-monitoring reports.

[3] Daily Maximum Hourly Load is the Daily Maximum Load (lbs. per day) divided by the number of hours of discharge in any given day. To avoid exceeding the Daily Maximum Hourly Load, the Port can use the TOC analyzer to monitor the discharge. However, the TOC analyzer readings shall not be used for compliance purposes.

[4] In case of anomaly during analysis, permittee may report BOD_5 concentration based on TOC using a KCIW approved statistical procedure. The permittee must indicate the use of the TOC in lieu of BOD_5 on self-monitoring reports.

[5] The daily maximum discharge limit for BOD of 60,000 lbs./day, the maximum hourly load for BOD of 2,500 lbs./day, and the daily maximum discharge volume of 2.76 MG are short term limits effective July 21, 2021 through September 30, 2022. The daily maximum discharge limit of 45,000 lbs./day, the monthly average limit of 27,500 lbs./day, the daily maximum hourly limit of 2,500 lbs./day for BOD and the increased daily discharge volume of 4.0 MG becomes effective on October 1, 2022, and lasts until the expiration date of this permit.

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A. Effluent Limitations and Self-Monitoring Requirements (continued):

3. The permittee shall monitor its discharges to the King County sewer system and comply with the following discharge limits as specified below.

Sample Site No.	*Limit Type*	*Sample Site Description*
A70101	King County Local and Permit Limits	Effluent Wet Well at the Industrial Waste Treatment Plant (IWTP)

Effective July 21, 2021 through September 30, 2022

Parameter	[1]Maximum Instantaneous Discharge Rate (gpm)	[1]Maximum Daily Flow Rate (gpm)	Maximum Daily Discharge Volume (MG)	Sampling Frequency	Sample Type
Flow	1,965	1,915	2.76	Continuous	Meter

Effective October 1, 2022 through July 20, 2026

Parameter	[2]Maximum Instantaneous Discharge Rate (gpm)	[2]Maximum Daily Flow Rate (gpm)	Maximum Daily Discharge Volume (MG)	Sampling Frequency	Sample Type
Flow	2,828	2,778	4.0	Continuous	Meter

[1] The instantaneous maximum flow rate limit is violated whenever any instantaneous recording is greater than 1,965 gpm. The daily maximum flow rate limit is violated whenever any continuous recording of 15 minutes or longer remains above 1,915 gpm within a 24-hour period.

[2] The instantaneous maximum flow rate limit is violated whenever any instantaneous recording is greater than 2828 gpm. The daily maximum flow rate limit is violated whenever any continuous recording of 15 minutes or longer remains above 2778 gpm within a 24-hour period.

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4. A self-monitoring report of all required and non-required sampling must be filed no later than the 15th day of the time period following the reporting period (i.e., the 15th day of the following month for monthly reports; January 15, April 15, July 15, and October 15 for quarterly reports; January 15 and July 15 for semiannual reports; and January 15 for annual reports). The permittee shall use the KCIW self-monitoring form to submit results unless an alternate form is approved by KCIW. If no discharge has occurred during the sampling period, the report shall be submitted notifying KCIW that no discharge has occurred.

5. The total volume discharged for any processing day shall be calculated by reading the volume passing through the IWTP effluent meter or shall be estimated using another KCIW approved method. The total volume for each processing day on which metal samples are collected shall be reported on self-monitoring reports. The total monthly discharge volume shall be reported on self-monitoring reports.

6. Volume and waste type from all batch discharges shall be recorded on the self-monitoring form.

7. For self-monitoring, the permittee shall collect composite samples in accordance with the following methods:

    a. Heavy metals and organics parameters (other than volatile organics):

        i. If time-proportioned composite sampling is authorized, a composite sample shall consist of four or more grab samples of equal volume collected at least 15 minutes apart and no more than two hours apart throughout the processing day from a well-mixed effluent chamber.

        ii. A flow-proportioned composite sample shall mean a sample composed of grab samples collected continuously or discretely, by hand or machine, in proportion to the flow at the time of collection or the total flow since the collection of the previous grab sample. The grab sample volume or frequency of grab collection may be varied in proportion to flow.

    b. A cyanide composite sample shall consist of four grab samples of the equal volume collected at least 15 minutes apart and no more than two hours apart from a well-mixed effluent chamber. Each aliquot shall be collected, treated, and preserved in the field in accordance with 40 CFR 136 and 403 appendix E. Treated aliquots may be collected into a single container and analyzed as one sample.

    c. For volatile organic analysis (VOA), a composite sample shall consist of four grab samples of equal volume collected at least 15 minutes apart and no more than two hours apart from a well-mixed effluent chamber. Each aliquot shall be collected and preserved in the field in accordance with 40

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CFR 136. The individual grab samples may be composited (at the laboratory) prior to analysis.

d. The three nonpolar fats, oils, and grease (FOG) grab samples shall be of equal volume, collected at least five minutes apart, and analyzed separately. When using U.S. EPA-approved protocols specified in 40 CFR Part 136, the individual grab samples may be composited (at the laboratory) prior to analysis. The result of the composite sample or the average of the concentrations of the three grab samples may be reported as Total FOG unless the value is 100 mg/L or greater, in which case the concentration of nonpolar FOG must be reported.

e. For situations where the only discharge for the 24hour period is of short duration (e.g., batch discharge), resulting in the inability to collect composite samples that meet the definitions described in Number 5.a-c above, the permittee shall collect grab samples every 15 minutes during the duration of the discharge. Regardless of the number of aliquots making up this sample, it will be used to evaluate compliance with daily average limits.

8. Should an automatic pH recording system fail (if required by permit or compliance order), the permittee shall manually check the pH at least four times per hour. Any discharge without a pH record shall be considered a violation of this permit.

B. Non-Required Self-Monitoring

All sampling data collected by the permittee, at the point of compliance, and analyzed using procedures approved by 40 CFR 136 or approved alternatives shall be submitted to KCIW whether required as part of this permit or done voluntarily by the permittee.

C. Violation Criteria

1. Wastewater from regulated processes shall comply with the effluent limitations prior to dilution with other wastewaters unless a fixed alternative discharge limit is approved by KCIW. (See Section S8.C.4 for further information about dilution.)

2. A review of any violation will include consideration of testing accuracy prior to enforcement action.

3. The more restrictive limitation (concentration or mass) shall prevail for determining violations.

4. Daily average and maximum monthly average limits apply to composite samples and to grab samples from short-term batch discharges.

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5. Instantaneous maximum limits apply to grab samples, with the exception of grab samples from short-term batch discharges.

6. The instantaneous minimum pH limit is violated whenever any single grab sample or any instantaneous recording is less than pH 5.0. The daily minimum pH limit is violated whenever any continuous recording of 15 minutes or longer remains below pH 5.5 or when each pH value of four consecutive grab samples collected at 15-minute intervals or longer within a 24-hour period remains below pH 5.5.

7. Non-polar FOG (mineral/petroleum origin) limit: 100 mg/L

   The limit for non-polar FOG is violated when either:

   - the arithmetic mean of the concentration from the individual analyses of three grab samples, taken no more frequently than 5-minute intervals, exceeds the limitation, or
   - the concentration of a single composite sample of three grab samples, taken no more frequently than 5-minute intervals, exceeds the limitation.

   Industrial users that violate the non-polar FOG limit may be required to complete, for King County review and approval, a FOG control plan.

D. Response when Violations Are Detected

1. When monitoring data show a violation, the permittee shall:

   a. Take immediate action to stop the violation and notify KCIW within 24 hours of learning of the violation.

   b. Collect a sample and submit new data to KCIW within 14 days of becoming aware of the violation.

   c. Submit a written report within 14 days of learning of the violation (*14-Day Report*). The report should explain the cause of the violation and corrective actions taken to respond to the violation and ensure ongoing compliance.

2. In the event the permittee is unable to comply with any of the conditions of this permit because of a breakdown of equipment or facilities, an accident caused by human error, negligence, or any other cause, such as an act of nature, the permittee shall:

   a. Take immediate action to stop, contain, and clean up the unauthorized discharges and correct the problem.

   b. Immediately notify KCIW and, if after 5 p.m. on weekdays and onweekends, call the emergency King County treatment plant phone

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number in Section S1 so steps can be taken to prevent damage to the sewerage system.

c. Submit a written report within 14 days of the event (*14-Day Report*) describing the breakdown, the actual quantity and quality of resulting waste discharged, corrective action taken, and the steps taken to prevent a recurrence.

3. Whenever an effluent check shows a pH violation, as defined in King County Code 28.84.060.N "Violations," the permittee shall take immediate steps to bring the discharge back into compliance. If this is not possible, the permittee shall cease discharge.

4. Compliance with these requirements does not relieve the permittee from responsibility to maintain continuous compliance with the conditions of this permit or the resulting liability for failure to comply.

E. Limitations Applicable to All Sites

1. General

The permittee's discharge shall not interfere with the operation of the King County sewerage system, cause King County to exceed its NPDES permit limits, or endanger local utility or King County sewer workers.

The permittee's discharge shall not violate any discharge standard, limitation, or specific prohibition of King County Code 28.84.060 or local discharge limits applicable on the date of discharge. (See Section 28.84.060.D-F of King County Code.)

Prohibitions previously referenced include, but are not limited to, substances causing fire or explosion hazards, flow obstruction, excess oxygen demand, and toxic vapors.

Limitations listed in Section S4 include, but are not limited to, restrictions on settleable solids, organic compounds, hydrogen sulfide, and polar FOG.

2. Organic compounds

No person shall discharge any organic pollutants that result in the presence of toxic gases, vapors, or fumes within public or private sewer or treatment works in a quantity that may cause acute worker health and safety problems. Organic pollutants subject to this restriction include, but are not limited to, the following:

- Any organic compound listed in the "Total Toxic Organics (TTO)" definition provided in 40 CFR Section 433.11(e) and 40 CFR Section 413.02(i)

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- Acetone, 2-butanone (MEK), 4-methyl-2-pentanone (MIBK), xylenes

Industrial users are required to implement source control strategies and best management practices to minimize the concentration of any of the aforementioned organic pollutants.

3. Lower explosive limit (LEL)

   At no time shall two successive readings on an explosive hazard meter at the point of discharge into the King County sewerage system (or at any point in the system) be more than 5% of the LEL. No single reading shall exceed 10% of the LEL.

4. Closed cup flashpoint

   Discharges shall not have a closed cup flashpoint of less than 140^{o} Fahrenheit or 60^{o} Centigrade using test methods specified in 40 CFR 261.21.

F. Responsibility for Compliance

It is the responsibility of the permittee to ensure that all effluent limitations of this permit are met whether or not self-monitoring for the parameter is required.

The effluent limitations specified in this permit are to be met by treatment or other means approved by KCIW. Dilution of contaminated stormwater with uncontaminated stormwater, or by municipal water, groundwater, or seawater, is prohibited by this permit.

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S5. SAMPLE SITE ACCESS AND IDENTIFICATION

A. Unobstructed access to sample sites shall be available to authorized KCIW personnel during normal operating hours. The permittee shall be responsible for providing alternate sample sites in the event of obstruction of access or upon evidence of tampering with the monitoring equipment.

B. The permittee shall allow KCIW to permanently label the sample sites used to collect wastewater samples.

C. The permittee shall, at all reasonable times, allow authorized representatives of KCIW to enter, inspect, and sample as specified in King County Code 28.84.060.L, “Inspection and Sampling of Industrial Users.”

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S6. NOTIFICATION REQUIREMENTS

A. Spills and Slug Discharges

1. The permittee shall notify KCIW immediately in the event of a spill or slug discharge to the sanitary sewer. A written report regarding the cause of the spill and/or slug discharge shall be submitted to KCIW within 5 days of the date of occurrence. The report should explain the cause of the violation and corrective actions taken to respond to the violation and ensure ongoing compliance. (See Section S8.B for spill and slug discharge control procedures.)

2. Following a spill and/or slug discharge, KCIW may require the submission or modification of a spill/slug control plan.

B. Changes in Discharge Characteristics

The permittee shall inform KCIW prior to any facility or manufacturing changes that will result in:

The permittee shall inform KCIW prior to any facility or manufacturing changes that will result in:

1. Introduction of new wastewater pollutants

2. Significant alteration in the volume (greater than 20% increase from permit application) or character of the pollutants discharged to the King County sewerage system

3. Discharge of waste streams not listed in the permit application

4. Addition of a new point of discharge or a new chemical, process, product, manufacturing line, or waste processing activity

5. Elimination or replacement of a process, manufacturing line, or activity that produces wastewater

6. A modification to the sample site or sample collection method

7. Changes in the potential for spill or slug discharges

No change shall be made until plans have been approved and either written permission or a new or modified permit has been received. In no case are any changes permitted that will cause violation of the effluent limitations specified herein.

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C. Installation/Modification of Pretreatment System

The permittee must provide engineering submittal(s) for KCIW review and approval prior to installing or modifying a pretreatment system. KCIW retains the authority to determine if the engineering submittal(s) must be developed under the supervision of a Washington state professional engineer and pursuant to Chapter 173-240 WAC.

D. Hazardous Wastes

1. Within 180 days following commencement of discharge or permit issuance, whichever is later, the permittee must notify KCIW, the U.S. EPA, and the Washington State Department of Ecology of any discharge of a listed or characteristic RCRA hazardous waste. Identifying the listed or characteristic RCRA hazardous wastes on the permittee's wastewater discharge permit application serves as notice to KCIW. This is a one-time notification requirement. The contents of the notification may vary according to the quantity of waste discharged. (See "Notification of the Discharge of Hazardous Wastes" in King County Code 28.84.060.)

2. Whenever the U.S. EPA publishes new RCRA rules identifying additional hazardous wastes or new characteristics of hazardous wastes, the permittee must notify KCIW, the U.S. EPA, and the Washington State Department of Ecology if any of these wastes are discharged to the King County sewerage system. Notification must occur within 90 days of the effective date of the published regulation.

E. Continuing Discharge after Permit Expiration Date

This permit does not authorize discharge after its expiration date. If the permittee wishes to continue discharge after the expiration date, an application must be filed for reissuance of this permit at least 180 days prior to the expiration date. If the permittee submits its re-application in the time specified herein, the permittee shall be deemed to have an effective waste discharge permit or authorization until KCIW issues or denies the new waste discharge permit. If the permittee fails to file its re-application in the time period specified herein, the permittee will be deemed to be discharging without a discharge permit after the current permit's expiration date.

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S7. MONITORING AND RECORD-KEEPING

A. Record Keeping and Retention

1. The permittee shall maintain records relating to all permitted discharges to the King County sewerage system including routine maintenance, waste disposal dates, manifests, self-monitoring reports, analytical lab results, pH monitoring records, and flow records.

2. All records required by the permit shall be available for review at reasonable times by authorized representatives of KCIW.

3. Records of all such testing shall be retained for a period of 3 years unless litigation or the direction of KCIW requires an extension of that time.

B. Recording of Results

For each measurement or sample taken to comply with this permit, the permittee shall record the following information:

1. Date, exact place, and time of sampling

2. Dates the analyses were performed

3. Person who performed the analyses

4. Analytical techniques or methods used

5. Results of all analyses

C. Representative Sampling

Samples and measurements taken to meet the requirements of this condition shall be representative of the volume and nature of the monitored discharge.

D. Test Procedures

All analyses shall be performed in accordance with procedures established by the administrator of the U.S. EPA pursuant to Section 304(g) of the federal Clean Water Act and contained in 40 CFR Part 136 and amendments thereto or with any other test procedure approved in writing by the U.S. EPA administrator, and/or KCIW. In all cases, except total dissolved sulfide, the detection limit shall be well below the discharge limit. Where 40 CFR Part 136 does not include a sampling or analytical technique for the pollutant in question, sampling and analysis shall be performed in accordance with the procedures set forth in the U.S. EPA publication entitled *Sampling and Analysis Procedures for Screening of Industrial Effluents or Priority Pollutants*, April 1977 or *Standard Methods*, latest edition and amendments thereto, or with any other sampling and analytical procedures approved by the U.S. EPA.

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E. Lab Accreditation

All self-monitoring data submitted to KCIW that required a laboratory analysis must have been performed by a laboratory accredited by the Washington State Department of Ecology for each parameter tested. This does not apply to field measurements performed by the permittee such as pH, temperature, flow, atmospheric hydrogen sulfide, total dissolved sulfides, settleable solids by Imhoff cone, or process control information.

F. Falsifying Information

The act of knowingly falsifying, tampering with, or knowingly rendering inaccurate any monitoring device, report, or method required pursuant to the federal pretreatment standards, King County Code 28.84.060, or special conditions of this permit shall constitute a violation of this permit, and shall be subject to the legal remedies available under "Revocation of Permit or Authorization" and "Penalties and Enforcements" in King County Code 28.84.060.

G. Toxicity Testing

If KCIW is required by the Washington State Department of Ecology to determine the source of a pattern of acute toxicity pursuant to its treatment plant NPDES permit, the permittee may be required to test its effluent for toxicity according to procedures to be determined by KCIW.

H. Signatory Requirements for Industrial User Reports

Any report required by this permit shall meet the signatory and certification requirements listed in King County Code 28.84.060 and King County Code 28.82.

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S8. OPERATIONS AND MAINTENANCE

The permittee shall use waste preventative practices to reduce or eliminate contaminant loading to the King County sewerage system. These practices shall include proper chemical storage, spill prevention and notification, and maintenance and operation of any required pretreatment equipment.

A. Chemical Storage

Chemical solutions, solid chemicals, waste materials, oils, and solvents shall be stored in a manner that will prevent the entry of these materials into the King County sewerage system.

1. Non-compatible chemicals shall be segregated and securely stored in separate containment areas that prevent the mixing of incompatible or reactive materials.

2. The permittee shall install shut-off devices to all drains in any hazardous waste storage areas.

3. Chemicals shall be dispensed only in roofed and bermed areas that eliminate potential spills to the King County sewerage system.

4. All empty barrels that have not been cleaned (steam-cleaned or triple-rinsed) shall be adequately stoppered and stored in an upright position.

5. Process tanks shall be located in a bermed, roofed, secured area capable of containing 110% of the volume of the largest tank. The permittee shall ensure that process solutions are used and stored in such a manner as to minimize spills of concentrated solutions to the sanitary sewer.

B. Spill or Slug Discharge Control Procedures (See Section S6.A)

1. In the event of a concentrated solution spill such as a tank failure, the permittee shall not discharge any spilled solution to the metropolitan sewer system unless laboratory test results indicate that the substance meets the conditions of this permit and the permittee receives approval from KCIW.

2. Concentrated waste or spilled chemicals that do not meet, or are not treated to meet, the discharge conditions of this permit shall be transported off site for disposal at a facility approved by the Washington State Department of Ecology or appropriate county health department.

3. The permittee shall maintain and inspect all process solution tanks on a regular basis. Any leaks shall be repaired promptly.

4. The permittee shall use spill prevention practices to preclude the discharge of liquids, solids, or gases which by reason of their nature or quantity are, or may

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be, sufficient either alone or by interaction with other substances to cause fire or explosion.

5. All process tanks and chemical storage containers shall be accurately labeled. Emergency phone numbers of King County, the fire department, the permittee's 24-hour corporate contact, and Washington State Department of Ecology shall be posted at all sites that KCIW requires.

6. The permittee shall ensure that concentrated waste from process tank filters and other equipment is prevented from entering the sanitary sewer unless it is treated to meet the discharge conditions of this permit.

7. The permittee shall maintain and use product recovery options such as drag-out rinses for each plating bath or process as required to meet the discharge conditions of this permit. Recovered materials shall not be discharged to the sanitary sewer unless they are treated to meet the discharge conditions of this permit.

C. Pretreatment Equipment Maintenance and Operations

1. All pretreatment systems used to bring the permittee's discharge into compliance with King County's discharge limitations and all compliance monitoring equipment shall be maintained continuously in satisfactory and effective operations by the permittee at the permittee's expense, and shall be subject to periodic inspections by authorized KCIW personnel. These systems shall be attended at all times during discharge to the King County sewerage system. In the event that such equipment fails, the permittee must notify KCIW immediately and take spill prevention precautions.

2. The permittee shall not initiate construction or modification of a pretreatment system prior to receiving KCIW approval of plans and specifications per WAC 173-240. In addition, KCIW may require an engineering report and an operations and maintenance manual.

3. KCIW shall be contacted before the beginning of any limited experimental modifications or new equipment testing that could reasonably be expected to affect effluent quality or quantity. This experimental work shall proceed only after securing written approval from KCIW and following the permittee's adherence to any applicable special conditions.

4. The effluent limitations specified in this permit are to be met by treatment of the wastes for pollutant removal. The use of municipal water, groundwater, seawater, stormwater, or other materials, including waste products, for the purpose of diluting a waste to achieve those limitations, is prohibited.

5. The permittee shall adequately maintain and efficiently operate all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit.

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D. Water/Sewer Meter Requirements

The permittee shall obtain or maintain access to a water or sewer meter that can provide accurate information regarding industrial process wastewater and cooling water discharge to the sewer. Another method of volume determination may be used only upon approval by KCIW.

E. Solid Waste

1. The permittee shall handle and dispose of all solid waste material (as defined in WAC 173-304-100) not otherwise authorized by this permit in such a manner as to prevent its entry into the King County sewerage system.

2. All covers, screening devices, sumps, hoppers, conveyors, and other facilities provided for the recovery and handling of solid wastes are to be maintained in an efficient operating condition.

F. Stormwater

Stormwater, surface water, groundwater, and roof runoff shall be excluded, except where specifically authorized by this permit or King County Code 28.84.060, from the King County sewerage system.

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S9. GENERAL CONDITIONS

A. The discharge of any pollutant more frequently than, or at a level in excess of, that identified and authorized by this permit shall constitute a violation of the terms and conditions of this permit. Whenever the permittee refuses to take corrective action or continues the violating condition, the imposition of civil penalties including fines up to $10,000 for each violation per day and/or termination of this permit may result. Termination of this permit may require disposal of the industrial waste in some manner other than into the public sewer, private sewer, or side sewer tributary to the King County sewerage system at the expense of the person holding the permit. Any person causing damage to a public sewer or treatment facility by discharges in violation of the terms and conditions of this permit shall be liable for any such damage incurred by King County as a result of such damage or discharge. Where criminal enforcement action is considered in a particular case, that case may be referred to state or federal authorities.

B. The diversion or bypass of any discharge from any pretreatment facility utilized by the permittee to maintain compliance with the terms of this permit is prohibited except where unavoidable to prevent loss of life or severe property damage. The procedure outlined in Section S4.D shall be followed in case of such a diversion or bypass.

C. After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its terms for those causes cited in King County Code 28.84.060.

D. If a toxic standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the federal Clean Water Act for a toxic pollutant, which is present in the discharge authorized herein, and such standard or prohibition is more stringent than any limitation upon such pollutant in this permit, this permit will be revised or modified in accordance with the toxic effluent standard or prohibition and the permittee shall be so notified. Section 307(a) requires that the administrator of the U.S. EPA shall promulgate effluent standards (or prohibitions) for toxic pollutants that he or she has listed as such.

E. Nothing in this permit shall be construed as excusing the permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

F. All requirements and ordinances of the U.S. EPA and the Washington State Department of Ecology pertaining to hazardous and toxic wastes, disposal facilities, and discharge of wastes into the King County sewerage system, are hereby made a condition of this permit.

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S10. WASHINGTON STATE DEPARTMENT OF ECOLOGY CONDITIONS

This permit does not constitute authority for discharge into waters of the state. Any such discharge is subject to enforcement action by the Washington State Department of Ecology.

Upon issuance of this permit, the permittee assumes the responsibility to abide by the following environmental requirements and any other appropriate regulations stipulated by the Department of Ecology. **The Department of Ecology retains authority to enforce these permit conditions (RCW 70.105 and RCW 90.48).**

A. Conditions to Protect Ground and Surface Waters

1. Contaminated waters or wastes shall not be discharged to state waters.

2. Boiler blowdown and water shall not be discharged to state waters.

3. Solid chemicals, chemical solutions, waste materials, oils, and solvents shall be stored in a manner that will prevent the entry of these materials into state, ground, or surface waters, and in a manner that will prevent spillage by overfilling, tipping, or rupture.

4. The permittee shall handle and dispose of all solid waste material in such a manner as to not cause any adverse effect on ground or surface water quality.

5. Filtered solids or sludge shall be stored in such a manner that drainage from this material is prevented from either draining across public rights-of-way or entering the local storm drain system or the groundwater.

6. No emulsifiers or dispersants are to be used on waters of the state without approval from the Department of Ecology.

7. If corrosive processing solutions are used, the processing/plating floor shall be sealed with corrosion-resistant material that prevents leakage. This coating shall be repaired or replaced as needed.

Questions regarding the implementation of conditions outlined in Section S10 should be directed to the regulatory authority, the Washington State Department of Ecology, at 206-594-0000 (new) (Northwest Regional Office, 3190 160th Avenue SE, Bellevue, Washington 98008-5452).

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King County

Industrial Waste Program
Company Fact Sheet

June 19, 2021

COMPANY INFORMATION

Company/Agency name: Port of Seattle, Sea-Tac International Airport (STIA), Industrial Wastewater Drainage System (IWS) – Industrial Wastewater Treatment Plant (IWTP)
Facility address: 17801 International Boulevard
Sea Tac,WA 98158
Mailing address: P.O. Box 68727
Seattle, WA 98168
Treatment plant: South Treatment Plant (SP)
Corp. contact & phone: Stuart Mathews, 206-787-5604
Site contact & phone: Sarah Cox, 206-787-7137
Company/Agency type: Air Transportation Facility
Days operating IWTP: Average: 77 days/Maximum: 365 days
SIC number: 4581, 4512, 4513
EPA ID number: WAD980980106
Compliance investigator: Peggy Rice

PERMIT INFORMATION

Permit number: 7810-05
Effective date: July 21, 2021
Expiration date: July 20, 2026

Description of sample sites, limit types, and discharge volumes:

Sample Site No.	Description	Limit Type	Maximum Daily Discharge Volume (MG)
A70101	Effluent Wet Well at the Industrial Waste Treatment Plant (IWTP)	King County Local Limits & BOD Loading Limits	4.0 Effective October 1, 2022 through July 20, 2026
			2.76 Effective July 21, 2021 through September 30, 2022

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Safety
An escort is required during sampling and inspections. Safety shoes, safety vest, passport, or other official personal identification, and safety glasses are required during inspections and sampling events at this facility

MONITORING FEE PARAMETER

Sample Site No.	Fee Type
A70101	Total Suspended Solids
A70101	Biochemical Oxygen Demand

Compliance Monitoring & Administration (CM&A) Fee

Category: NON-CATEGORICAL
Tier: 4
The placement of this facility in the above fee category and tier is based on meeting the following criteria: KCIW personnel samples at the STIA IWTP semi-annually for field parameters, trace organics, conventionals, trace metals, and HEM. Each sampling event requires 2 trips by KCIW staff, and there is one sample site.

This facility pays surcharge fees based on the mass loading in lbs/day for each day the IWTP effluent is discharged to the sanitary sewer and the BOD concentration is over the domestic strength of 300 mg/L.

PERMIT PROCESSING

Permit number: 7810-05

Action	Date
Application due	January 22, 2021
Application received	January 21, 2021
Application sent to local sewer agency	February 16, 2021
Inspection date	June 16, 2021
Final publication date	June 1, 2021
Published volume	4 million gallons per day
Draft issued	June 15, 2021
Final issued	July 19, 2021

COMMENTS

Nature of Business
The Port of Seattle (Port), Sea-Tac International Airport (STIA) is a large airport serving the Pacific Northwest. The airport opened in 1944 and is owned and operated by the Port of Seattle

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(Port). The airport is situated entirely within the city of Sea-Tac and occupies more than 2,500 acres of land. The Port provides facilities for tenants engaged in passenger and air cargo transportation. In addition to the main terminal, which has four concourses, there are two satellite terminals. Industrial activities at the airport include aircraft and ground vehicle maintenance, fueling, washing, aircraft and ground deicing/anti-icing, and other miscellaneous airport-related activities.

This permit addresses industrial wastewater associated with industrial activities from airport operations and discharges of contaminated stormwater to the local and regional King County (KC) sanitary sewer system.

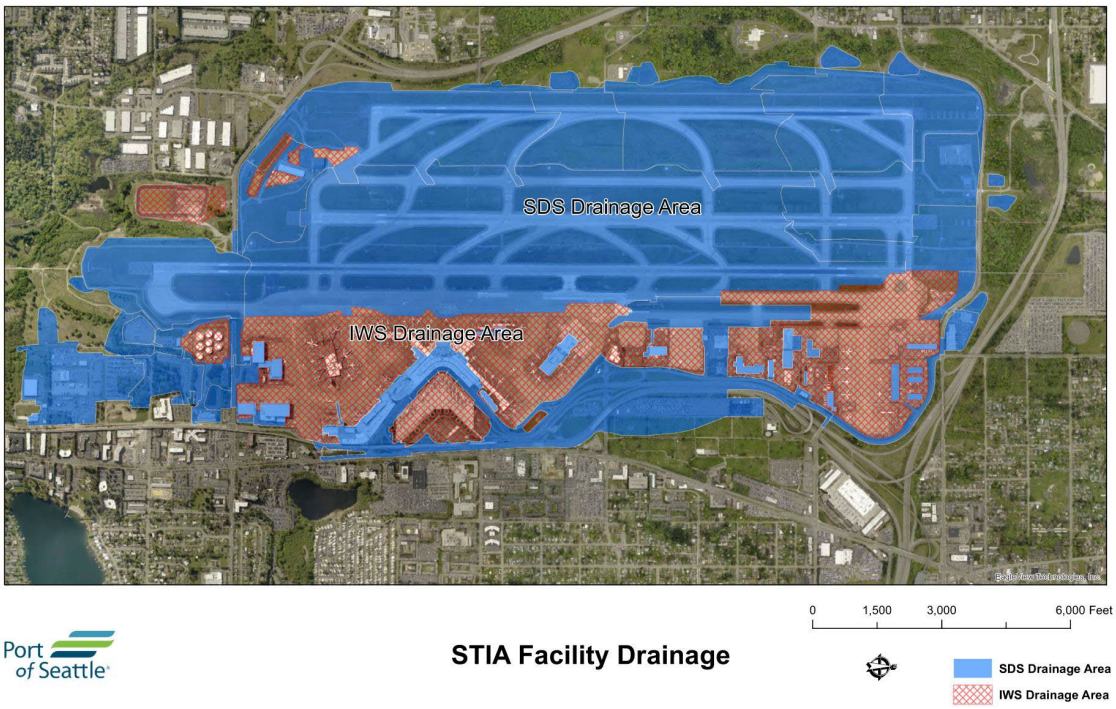
Sources of Wastewater

The STIA operates an Industrial Waste System (IWS) that collects stormwater contaminated by industrial activities from airport and airline operations. The IWS collection area is approximately 372 acres and includes activities from tenants and Port industrial activities. Runoff is collected from the airport terminal, air cargo facilities, deicing areas, fuel farms, hangars, and aircraft maintenance areas. Stormwater runoff can contain variable levels of fuel, oil, deicing/frost chemicals, aqueous fire-fighting foam, and wash water.

The IWS collects industrial wastewater from two drainage basins: The North Service Basin and the South Service Basin. The IWS North Service Basin includes portions of the airport area between Taxiways A and B and Air Cargo Road, as well as the Weyerhaeuser area on the southern side of the airfield. The IWS South Basin includes the Fuel Farm and Passenger Gate Ramp areas, as well as aircraft hangers. Each drainage basin accounts for approximately half of the ~372-acre IWS area.

Water stored in Lagoons #1 and #2 drains by gravity to the IWTP. Water is pumped from Lagoon #3 to the IWTP. Some settling of solids occurs in the lagoons.

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Treatment System

The Industrial Waste Treatment Plant consists of three storage lagoons totaling 80 million gallons of storage capacity and six treatment trains. The treatment train consists of mechanical screening, coagulation, mixing chemicals in flocculent tanks, and removing floc and other oil particles in a dissolved air floatation (DAF) unit. The IWTP generally operates after periods of significant rainfall. Even during the winter months, the IWTP operation may be intermittent depending on weather conditions. Discharges from the IWTP are permitted by the Department of Ecology NPDES Permit WA-0024651 to Puget Sound and a KCIW Waste Discharge Permit for discharges to the sanitary sewer system and South Plant. Runoff with low BOD concentrations is discharged directly to Puget Sound after treatment per NPDES Permit conditions. High BOD runoff is segregated and discharged to King County South Treatment Plant via Valley View Sewer District sewer conveyance lines. The lagoons are cleaned of the sediments annually, typically during the drier summer months.

The IWTP is located at the southwestern end of the airport, south of Lagoons #1 and #2 and north of 188th Street, just west of the tunnel under the eastern-most airport runway known as 16 Left/34 Right. The IWTP is designed to remove petroleum hydrocarbons and suspended solids using a dissolved air flotation (DAF) process. The facility consists of six treatment trains each with the flash mix, flocculation, and DAF tanks. The DAF process begins with the addition of coagulation chemicals to the influent water in a flash mix chamber, followed by gentle mixing in a flocculation tank to coagulate suspended solids and oil droplets. The water then flows by gravity to the DAF units. Air bubbles released in the DAF units float the floc particles. Flight scrapers push the float over a scum beach. The skimmed float flows out of the IWTP building in

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a floor trench to a sludge sump at the eastern side of the IWTP building. The DAF float is collected in the sludge sump and pumped to two decant tanks located east of the IWTP building. The float is allowed to separate into water and sludge phases. The water layer is decanted and returned to the IWS lagoons. The decant tanks are cleaned every other year. Sludges are analyzed and disposed of as necessary. The treated water in the DAF units flows over an outlet weir. Effluent from all the DAF units is combined; pH adjustments are made if necessary and flows first into an effluent wet well. From the wet well, if the BOD concentration indicates low BOD via the TOC analyzer (less than 25 mg/L during summertime or 45 mg/L during the winter months), the IWTP effluent flows through an 18-inch line, to the Midway Sewer District's 30-inch effluent trunk line, and discharges through a diffuser into Puget Sound (Outfall 001). The discharge occurs 1,400 feet from shore at a depth of 178 feet.
The IWTP Improvements Project, including the installation of the Total Organic Carbon (TOC) analyzer, was completed in the summer of 2006 allowing for monitoring and segregation of high and low biochemical oxygen demand (BOD) concentration in IWS runoff. The TOC analyzer is automated and instantaneous, and the BOD is calculated accordingly.

During the last permit cycle in 2016, the Port, at KCIW's request, developed a statistical procedure to estimate BOD concentrations based on the TOC analyzer measurement and the actual BOD laboratory analysis. The analyzer's results were comparable with the lab results with no significant difference. KCIW approved the procedure in 2016 and the procedure was implemented by January 1, 2017.

"High BOD" effluent is water that is above the maximum daily concentration or could cause the IWTP to exceed the average daily or average maximum monthly Final Effluent Limitations specified in their NPDES permit. In the summer, the limit for BOD is 25 mg/L, in the winter the BOD limit is 45 mg/L. Treated wastewater containing high BOD concentrations is routed to King County South Treatment Plant (KC SP) at Renton via the Valley View Sewer Districts' conveyance line, while wastewater with low BOD concentrations is discharged to the Puget Sound via the Midway Sewer District Outfall (Outfall 001).

Compliance History
The Port of Seattle's, IWTP received the Gold award in 2020, 2019, and 2018. No award was issued for 2017 due to two self-reported flow rate violations along with two late reports. Because a required report was received late in 2016, a silver award was issued for 2016.

Trends in Discharge of Pollutants of Concern
The Port's BOD loading is the main concern for King County's SP operations and KCIW. At times, these discharges have adversely affected the secondary activated sludge process at South Treatment Plant (SP) operations, with the potential to deteriorate the final effluent quality and solids handling facilities. The primary pollutant of concern is total glycols/BOD present in the discharge. Other pollutants such as heavy metals, nonpolar FOG, organics, and pH may also be present to a lesser extent.

Stormwater containing BOD greater than permitted by the Port's NPDES permit is sent to SP for treatment. Glycols are highly water-soluble substances with a high BOD. The discharge is considered compatible waste and assumed treatable by an activated sludge biological treatment process provided the receiving biological treatment plant has adequate capacity to treat incoming

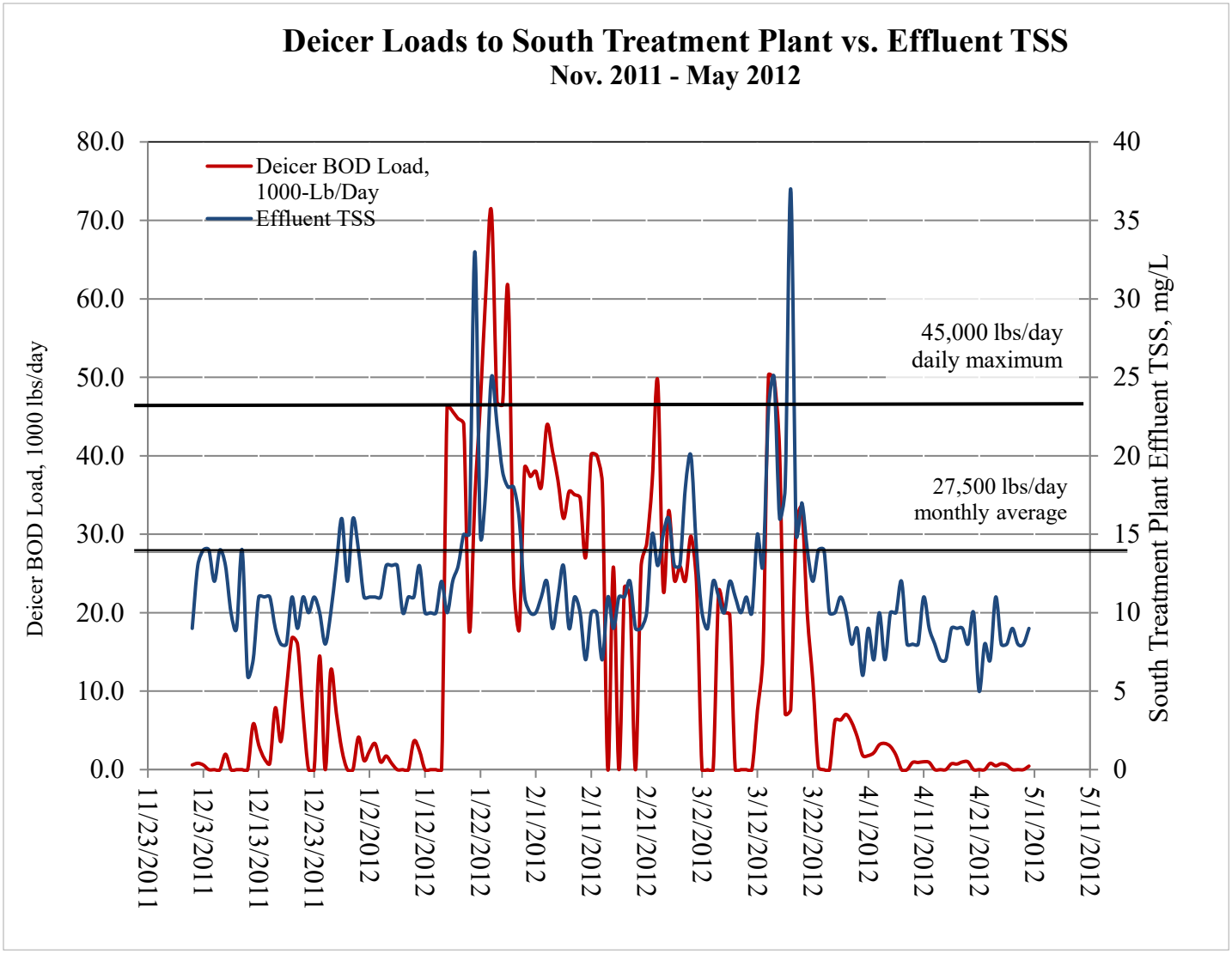
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loads. Historically, on some occasions during earlier permit cycles, the Port's deicing loading represented over 40% of all of SP's average BOD loading to the secondary process (BOD equivalent of 125,000 households or 275,000 people). Deicing loadings change SP's biomass in a manner that degrades settling performance in the secondary clarifiers, which could result in TSS effluent violations. Deicing loadings can also lead to filamentous bacteria growth which leads to high sludge volume index and poor settling. Additional biomass from deicing can overload the clarifiers' capacity exceeding the ability of the clarifiers to keep the solids from escaping into the effluent. During high flow events, the sludge blanket can rise and washout of the clarifiers with the potential to lose the biological treatment process. To prevent the loss of biological treatment, operators would need to bypass the secondary treatment process which would be considered a violation of SP's NPDES permit. In summary, high deicing loads have the potential to pose a threat to normal plant operations and cause chronic inhibition and, in the long run, possible interference and upset, compromising SP's compliance with the County's NPDES permit. The capacity at SP is expected to become more limited due to projected growth in the Puget Sound area and, presumably, expansion of Sea-Tac airport. After more than 10 years of experience, analyzing the operational data, and observations, acceptance of this discharge at the current loading rates is problematic and not feasible long-term without additional storage and pretreatment by the Port.

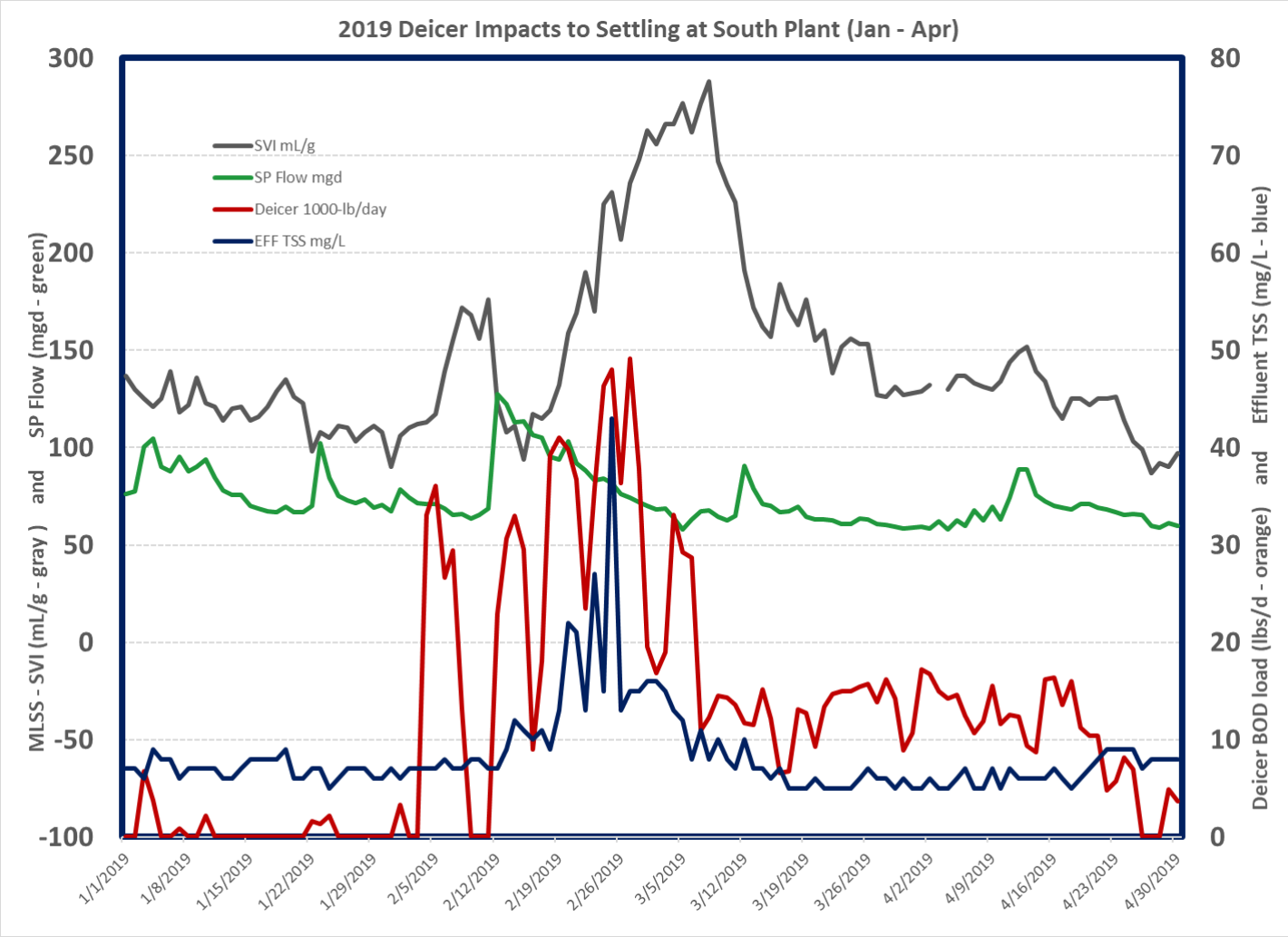
The following graphs depict the effects of incoming BOD load from the Port of Seattle deicing operations during 2011 -2012 and in 2019. As shown, high effluent TSS values at SP were exhibited on at least two occasions when the Port's daily maximum discharge limit was at 60,000 lbs/day. In 2019, as shown in the graph below, the SP effluent TSS and Sludge Volume Index (SVI), which is an indication of the SP's solids settleability, was affected by high BOD loads from the Port of Seattle during deicing operations. SVI values above 100 mL/g may be considered problematic.

These graphs indicate that the SP operation is adversely affected by loads of high strength BOD and is likely to violate its NPDES permit limit for TSS due to poor SVI if the current trends continue.

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The previous permit 7810-04 (2016-2021) had initial limits of a daily maximum load of 60,000 lbs/day and a maximum hourly load of 2,500 lbs/day. It also specified final limits of the daily maximum load of 45,000 lbs/day, an average monthly load of 27,500 lbs/day, and a maximum hourly load of 2,500 lbs/hr, which were to go into effect once the Comprehensive Stormwater Report (CSR) recommendations were approved and implemented. However, the CSR was not finalized by the Port during the 2016-2021 permit cycle and thus, these second set of lower limits did not go into effect before that permit expired.

Because the CSR recommendations were not fully completed, approved, and implemented during the 2016-2021 permit cycle, those lower limits never went into effect as expected. However, during the February 2019 and February 2021 deicing events, it was brought to KCIW's attention by the SP personnel that the discharge from the Port of Seattle is causing deleterious effects on the plant operations, effluent quality and if not addressed could cause NPDES permit violations for the County. Therefore, KCIW decided to implement the reduced limits (daily maximum load of 45,000 lbs/day, an average monthly load of 27,500 lbs/day, and a maximum hourly load of 2,500 lbs/hr) in the draft permit as soon as this permit (7810-05) was to go into effect on July 21, 2021. (Note: After receiving the Port's comments on the draft permit 7810-05, KCIW decided to permit the Port with the short-term discharge limits, as shown in the below table 1, for one deicing season to give the Port additional time to optimize operational strategies and further implement BTT technology.) Additionally, due to new data/information gathered from the SP operations staff since the issuance of the last permit, discharges from the IWTP have had the potential to cause interference in the operation of the SP on at least two occasions during February 2019 and February 2021.

In February 2021, after a 3-day snowfall resulting in increased aircraft deicing, SP operations staff noticed the incoming high BOD was causing changes to the biomass in a manner that degraded the settleability of sludge in the clarifiers. SP operations staff asked the Port's IWTP to reduce the amount of BOD being discharged to 24,000 lbs/day and 1,000 lb/hr in response to the poor settling performance in the clarifiers at the SP. The Port reduced the amount of the BOD discharges, but it took over one month for the sludge settleability characteristics, as indicated by the sludge volume index to return to normal levels. Consistent with the responsibilities of delegated pretreatment programs and to further protect the operation of the south plant, KCIW is expected to impose more restrictive permit limits to be implemented at the beginning of the next permit cycle in July 2026 as shown in the table below. The 2026-2031 restrictive limits were developed by SP operations staff and industrial waste engineers and are based on past BOD loading data correlated with the various operational indices of the SP. These limits are expected to be protective of the operations of the SP in the long term.

Table 1

Biological Oxygen Demand (BOD)	**Discharge Limits listed in Previous Permit (No. 7810-04)**	**Short-term Discharge Limits listed in New Permit (7810-05) effective July 21, 2021 – Sept. 30, 2022 (one deicing season)**	**Interim Discharge Limits listed in New Permit (7810-05) effective Oct. 1, 2022 - July 20, 2026**	**Proposed Discharge Limits for next Permit Cycle (July 21, 2026-July 20, 2031)**

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Daily Maximum Load (lbs/day)	60,000	60,000	45,000	15,000
Average Monthly Load (lbs/day)	NA	NA	27,500	10,000
Maximum Hourly Load (lbs/hr)	2,500	2,500	2,500	625

To ensure that the reduced interim limits in this permit are achievable, King County analyzed the Port's BOD sampling data from the last five years to determine the likelihood of complying with these new lower interim BOD limits, without the full implementation of operational BMPs as conditionally approved as part of the CSR. Considering the efforts of the Port during the last permit cycle for implementing various BMPs identified in the partially approved CSR, and potentially more to be implemented during the 2021 permit cycle, KCIW concluded, the interim limits are justified and should be achievable. See below for King County's statistical analysis. KCIW acknowledges the Port's modeling analysis that indicates a 17.3% risk of exceeding storage capacity in any given season without mitigative measures fully in place. In the event of permit exceedances, the KCIW will consider its enforcement discretion per its enforcement response plan, and as long as the Port is making good faith efforts in meeting compliance schedule milestones, adhering to SP operation staff directives, and it is not in a significant non-compliance status. Please note, however, as per 40 CFR Part 403.8 (f)(2)(viii), any upset or interference of the treatment plant operations (POTW) caused by an industrial user (IU) would place the industrial user in Significant Noncompliance (SNC). As a delegated pretreatment program, KCIW is required to initiate enforcement action against an IU that is in SNC. Specifically, if the IU- has caused, alone or in combination with other discharges, interference, or pass-through (including endangering the health of POTW personnel or the general public), then the IU must be placed in SNC status.

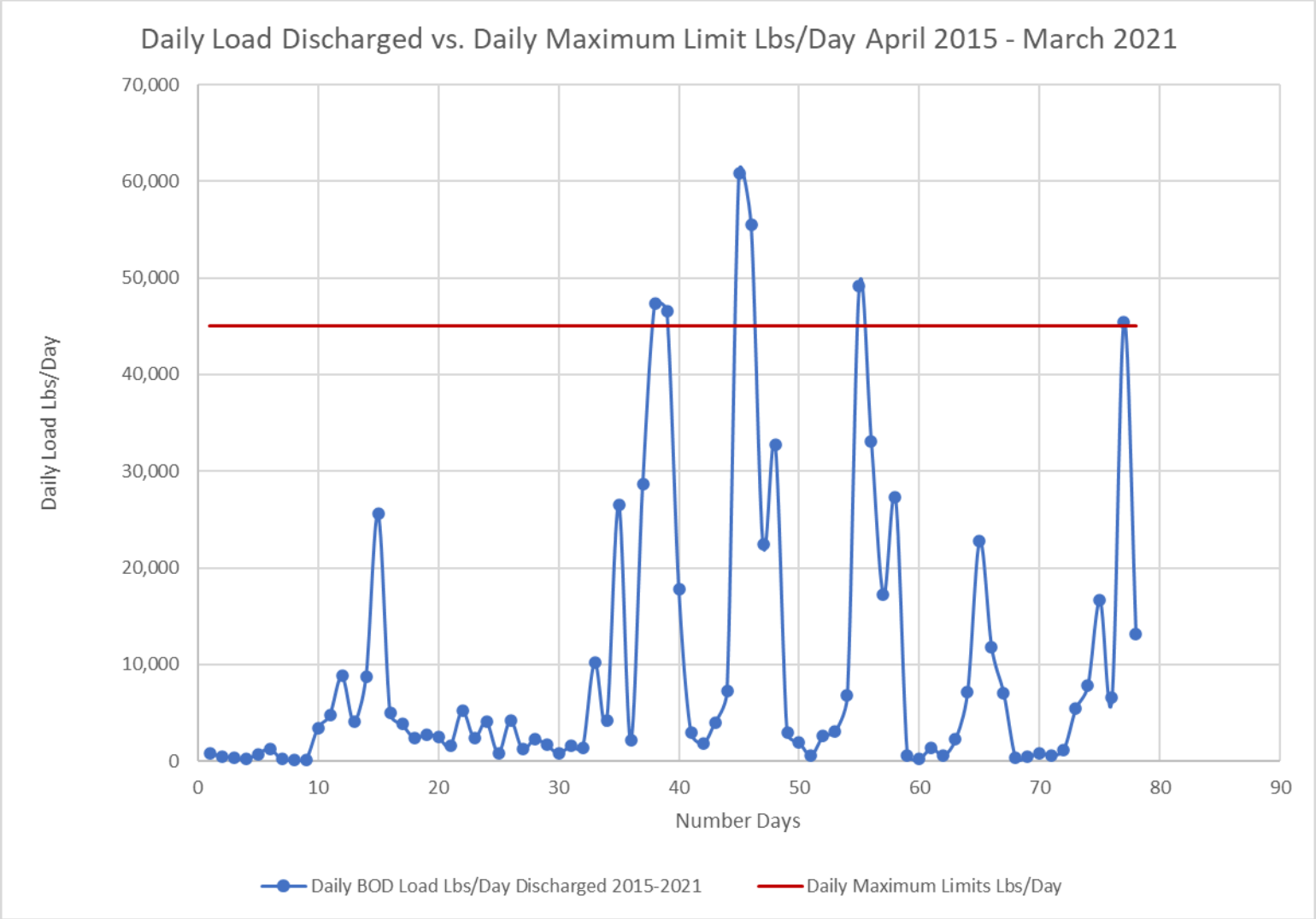
As indicated by the italicized font in Table 2, there were only six instances in the last five years where the Port's loading to the SP exceeded the proposed new interim daily maximum load limit of 45,000 lbs/day.

Table 2.

Daily Maximum Load per Month for BOD in lbs/day	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
January	26,490	***47,358***	***55,662***	6,762	22,778	6,559
February	2,144	***46,590***	22,386	***49,149***	11,778	***45,472***
March		17,790	32,763	33,074	7,046	13,126
April		2,970	2,918	17,233	319	
May				2,756		

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June				574	450	
July					773	
August				243	616	
September		1,779	1,944	1,345	1,193	
October		4,030	615	577	5,449	
November		7,229	2,612	2,270	7,828	
December	28,721	***60,804***	3,071	7,169	16,628	



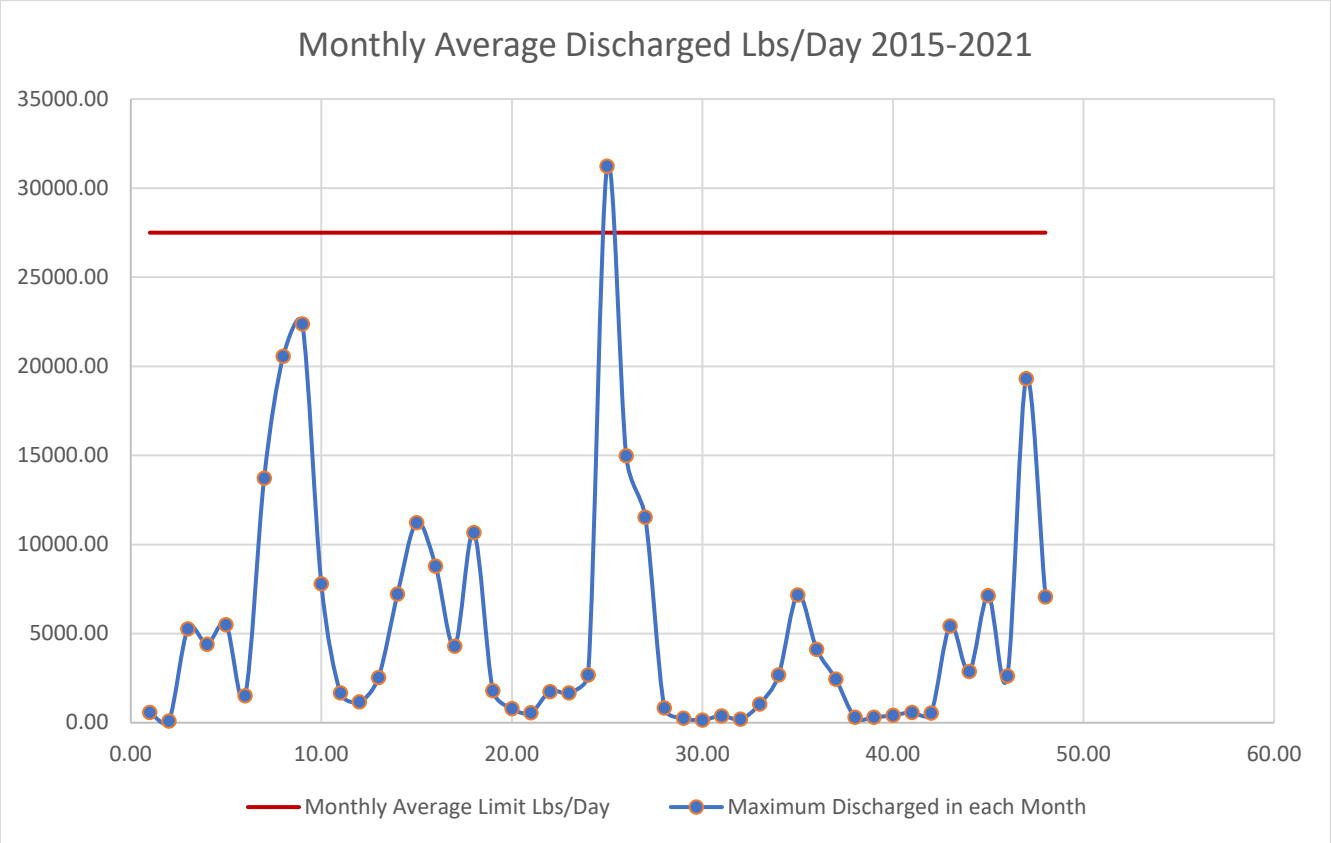
Also, as indicated by the italicized font in Table 3 below, only once in the last five years was the new interim maximum monthly average load of 27,500 lbs/day exceeded.

Table 3.

Monthly Average for	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**

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BOD in lbs/day							
January		5,510	20,565	8,790	2,690	7,178	2,624
February		1,525	22,389	4,298	***31,235***	4,118	19,316
March			7,795	10,679	14,979	2,451	7,070
April	577		1,676	1,811	11,538	319	
May					833		
June					259	306	
July	105					424	
August					150	588	
September			1,168	796	387	846	
October			2,550	571	200	5,440	
November	5,274		7,229	1,759	1,046	2,874	
December	4,408	13,732	11,224	1,678	2,684	7,130	



Compliance review during last permit cycle

Heavy metals (arsenic, cadmium, chromium, copper, lead, nickel, silver, zinc)

Effluent from the IWTP over the last five years has complied with all heavy metals discharge limits. Sample results from KCIW's semi-annual monitoring and the Port's monthly self-monitoring for all heavy metals sampled and analyzed have been either very low or not detected.

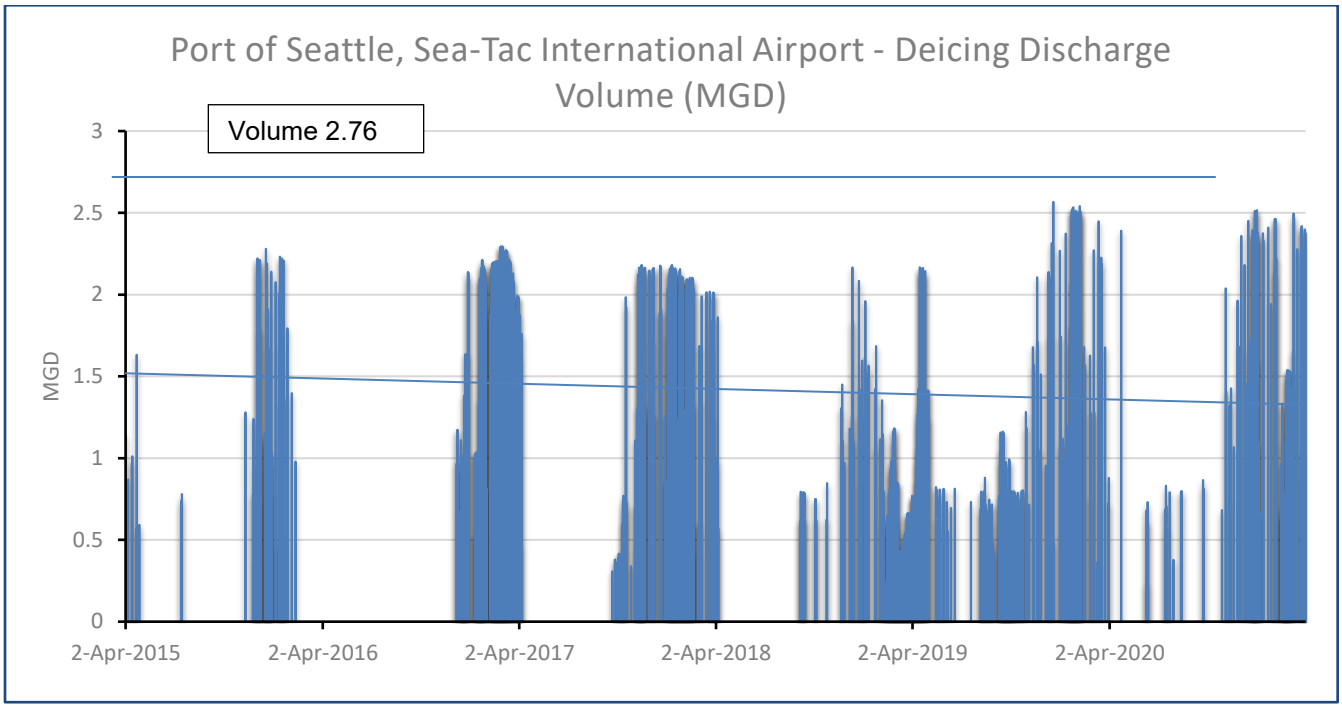
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Semi-volatile Organics (BNA) and Volatile Organics (VOA)
Sample results from KCIW's semi-annual monitoring for BNA and VOA have been mostly not detected or detected at very low levels.

Maximum Daily Discharge Volumes
The maximum daily allowable discharge volume of 2.76 MGD was not exceeded during the last five years. With this new permit, the Port has requested an increase in the daily discharge volume from 2.76 MG to 4.0 MG. Valley View Sewer District (VVSD) has voiced concerns over approving the high volume requested, citing capacity issues downstream of the Port's connection to the VVSD and the risk of an overflowing maintenance hole with the increased pumping volumes.

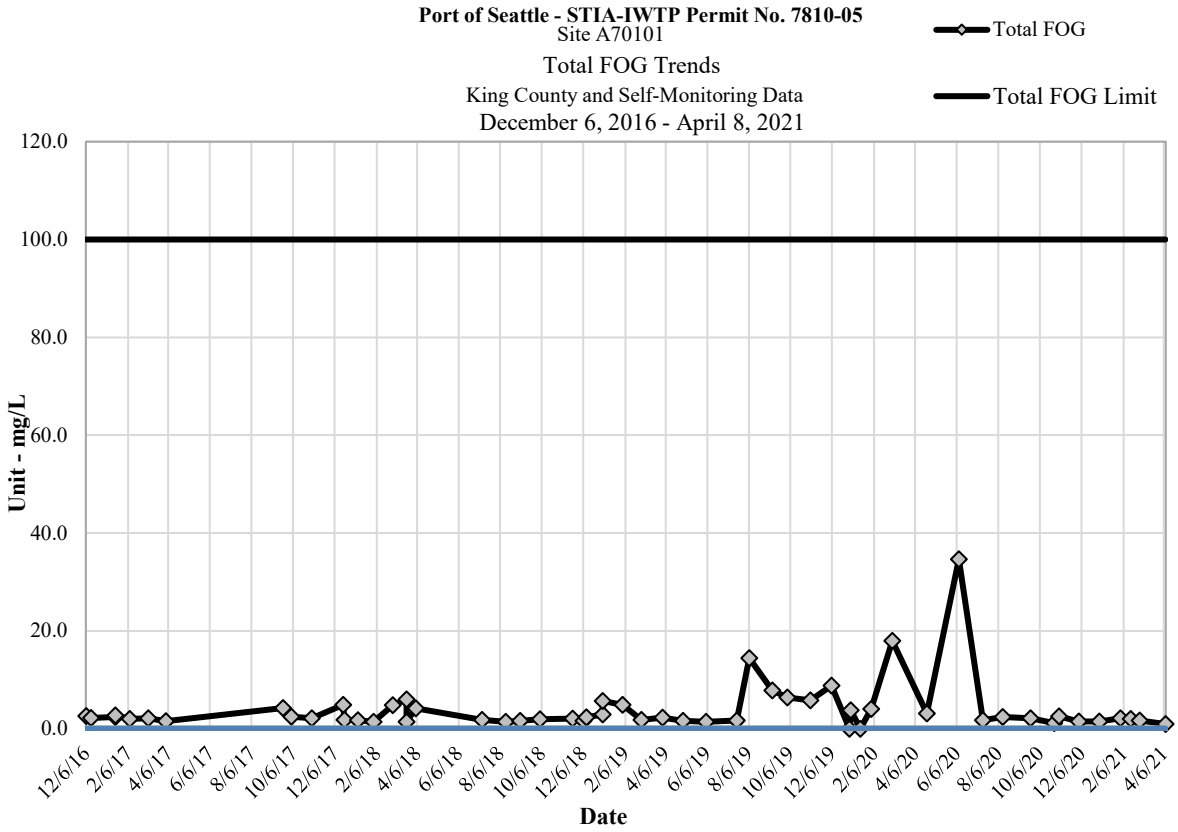
VVSD requested that this new permit contain language requiring the Port to install and maintain an overflow monitoring device in the VVSD conveyance line at the Port's expense and in consultation with VVSD. This request by VVSD was not included in this discharge permit as a permit requirement. VVSD will need to work with the Port directly to accomplish this monitoring measure. However, it is a condition of this permit that the Port, when asked to by either King County or the VVSD, must cease or decrease discharge volume to the sewer when requested by the local sewer agency or by KCIW.

See the discharge volume trend chart below.



Non-polar Fats Oils and Grease (Total FOG)
Due to the potential for spills of various pollutants (jet fuel, diesel, gasoline, and lubricants) within the footprint of the IWS, self-monitoring sampling for total FOG is required monthly and performed semi-annually during KCIW compliance monitoring. The following graph indicates that effluent from the IWTP over the last five years has complied with the 100 mg/L discharge limit and the IWTP is effective.

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Slug and/or Spill Control Plan

This facility is required to have a slug control plan due to the potential for spills of various pollutants within the footprint of the IWS. Pollutants stored and used within the footprint of the IWS include; de-icing chemicals, anti-freeze, diesel, gasoline, herbicides, jet fuel, lavatory chemicals, lead-acid batteries, lubricants, paint, and paint-related materials, cleaning solutions, solvents, and used cooking oil. A Slug Control Plan along with a Stormwater Pollution Prevention Plan was submitted on January 21, 2021, along with the discharge permit application. The submittal has been reviewed and approved by KCIW. Slug Plans are reviewed annually for accuracy.

Self-Monitoring Requirements

The self-monitoring requirements listed in this permit remain the same as the self-monitoring requirements listed in their most recent permit and are as follows:

Daily: Biological Oxygen Demand (BOD), Total Suspended solids (TSS), continuous pH (report the high and the low pH for each day during discharge to the sewer), daily discharge volume (in MG), and flow rate (in gpm). Flow rate and discharge volume are measured with an effluent meter.

Monthly: arsenic, cadmium, chromium, copper, lead, nickel, silver, zinc, and non-polar FOG. In addition, the Port of Seattle (PoS) is required to report the maximum daily BOD in lbs/day measured for each month as well as the average BOD in lbs/day for each month.

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BOD and discharge volume are the main parameters of concern for the PoS IWTP during de-icing and large storm events. Daily monitoring for BOD, TSS, and daily discharge volume is necessary in order to determine compliance with the daily mass loading and the calculation of the extra surcharge fees. Based on the mass loading values, KCIW determines the surcharge fees for discharging high-strength wastewater. King County recovers the additional costs associated with the treatment of high-strength wastewater. Discharges of BOD above the domestic strength values of 300 mg/L for BOD and 400 mg/L for TSS pay an extra surcharge fee.

King County Compliance Monitoring Program

Twice annually during the winter months and during the time of discharges to the sanitary sewer, KCIW samples at the IWTP for BOD, TSS, Heavy Metals, Total FOG, continuous pH, grab pH, discharge volume, and total toxic organics (VOA and BNA). KCIW has added the collection of grab heavy metals to the list of samples collected semi-annually.

Monitoring Methods

Physical samples:
For daily average limits the following sample collection type is representative: Flow-proportional composite sample
For instantaneous discharge limits, grab samples are collected

pH monitoring: Continuous and Grab
Continuous pH monitoring with pH data logger
Grab pH with a handheld meter

Flow monitoring: Effluent meter

Special Conditions

The special conditions listed in S3 of Permit 7810-05 are:

- the requirement to complete the Preliminary Planning Report (PPR) and to submit the Blend to Temperature (BTT) Implementation Report (S3.A), the requirement to submit an engineering report (S3.B), and the requirement to submit Design Documents (S3.C). The analysis and the submittals are needed in order for the Port to meet the anticipated lower limits for BOD for the 2026-2031 permit. (S4.A)

- a compliance schedule with due dates and implementation dates in order to track the progress and keep the project of meeting lower BOD discharge limits and minimizing wastewater discharges to the sanitary sewer on schedule. (S3.D)

- the requirement to calibrate the effluent meter that measures discharge volume and flow rate annually. This requirement is typical for all industrial users and is required in order to properly calculate flows and generate accurate surcharge fees. (S3.E.)

- the requirement to cease discharge or reduce discharge from the IWTP when instructed to by either King County or VVSD staff. This requirement is typical for SIU's discharging high volumes of wastewater and would be used during periods of peak hydraulic loading and when the conveyance system and/or the SP is overloaded with volume or high strength wastewater and there is a risk of an NPDES permit violation at the SP. (S3.F)

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- the requirement to adhere to the BMP's listed in the permit application, slug plan, and other future approved measures. (S3.G)

Limit Calculations

The Port's IWTP discharges are regulated under King County's local discharge limits. Because BOD is considered a compatible pollutant that is treatable at the SP, BOD is not typically a parameter that has a discharge limit. But due to the high volume of water generated and the high BOD content in the wastewater from deicing activities, KCIW must impose loading limits in order to protect the operations of the SP. These new interim limits calculated by SP operations staff and industrial waste engineers are based on past BOD loading data and Port of Seattle effluent data correlated with the operations of the KC SP.

Considering the efforts of the Port during the recent permit cycle implementing various BMPs identified in the partially-approved CSR, and potentially more to be implemented during the 2021 permit cycle, KCIW concluded that the interim limits are justified and should be achievable initially without causing any interference at the SP, in most cases. After submission of comments on the draft permit and fact sheet, Port and KCIW staff met to discuss and better understand the comments received and discuss implications. At the conclusion of the discussions, KCIW has agreed to retain the BOD maximum day loading limit of 60,000 lbs/day for the first deicing season (2021-2022). KCIW reluctantly made this compromise in order to allow the Port more time to make operational adjustments and further implement BTT before the second deicing season occurs. The interim BOD limits of 45,000 lbs/day for daily maximum, 27,500 lbs/day for monthly average, and 2,500 lbs/day for the hourly load will go into effect at the start of the 2022 deicing season (October 1, 2022).

Taking into account the increased growth in population in the King County service area, and in order to be more protective of the SP operations, KCIW will impose even lower BOD limits in the 2026 permit cycle providing more confidence for KC staff that SP is protected from interference caused by the Ports' high volume and the high BOD.

It was determined based on data analysis by KCIW and SP Process Engineers that the interim BOD limits proposed for this discharge permit (2021-2026) should prove to be protective of the SP operations in the short-term only. However, as per 40 CFR Part 403.8 (f)(2)(viii), any upset or interference of the treatment plant operations (POTW) caused by an industrial user (IU) would place the industrial user in Significant Noncompliance (SNC). As a delegated pretreatment program, KCIW is required to initiate enforcement action against an IU that is in SNC. Specifically, if an IU has caused, alone or in combination with other discharges, interference, or pass-through (including endangering the health of POTW personnel or the general public) then the IU must be placed in SNC status.

Changes since the Last Permit

The major change to this permit is the requirement to meet new lower BOD limits for daily maximum loading, monthly average loading, and hourly loading effective July 21, 2021. (S4.A)

To support the goal of meeting the lower BOD limits, another major change to and requirement of this permit is the requirement to complete and submit the Preliminary Planning Report by

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submitting a preferred on-site storage and treatment alternative (S3.A), an engineering report that describes the preferred on-site storage and treatment alternative (S3.B), and Design Documents (plans and specifications) (S3.C) for the design and construction of additional on-site pretreatment facilities to lower the BOD loadings in the effluent from the IWTP.

At the Port's request, an increase in the maximum daily discharge volume – from 2.76 MGD to 4.0 MGD (S4.A) has been implemented. The Port needs this increase in daily discharge volume to better regulate and manage the high strength discharges and avoid BOD discharge violations.

The requirement to temporarily cease discharge or reduce discharge volume when notified by VVSD or King County WTD staff has been added in S3.F.

Comments

Publication: An advertisement for higher discharge volume was published in The Seattle Times and The Daily Journal of Commerce on May 18, 2021 and June 1, 2021. No comments were received in response to the public notice advertisement published in The Seattle Times and the Puget Sound Business Journal.

Application: Because of the concern by VVSD over the Port's requested increase in permitted maximum daily discharge volume, VVSD requested that KCIW add a few conditions on their behalf in the draft permit. Specifically, VVSD requested that the Port cease discharge when asked to (by VVSD or KC staff) during periods of peak hydraulic loading and that the Port be required to work with the VVSD to purchase, install and maintain a monitoring and notification system to measure capacity in and overflows from their conveyance system. KCIW added the cease discharge requirement but not the VVSD's request to include a permit condition requiring the Port to purchase and maintain a monitoring and notification system. KCIW is unable to add permit requirements that require resources by the Port on behalf of another entity such as the local sewer agency. This contractual arrangement is best handled directly between the local sewer agency and the Port. Accordingly, VVSD will need to work with the Port directly regarding the installation and maintenance of a conveyance line monitoring and notification device. VVSD has the opportunity to comment on the draft permit.

First draft: Issued on June 15, 2021 via email.

During the public comment period, comments on the Draft Permit (7810-05) were received from the Port of Seattle and Department of Ecology.

On June 23, 2021, KCIW received an email that stated VVSD had no comments, but instead a reminder to the Port and to KCIW that the VVSD team would be monitoring their sewer conveyance system closely to ensure the Port's discharges do not increase the risk of sewer overflows.

Port of Seattle Comments

On June 29, 2021, KCIW received 14 pages of written comments from the Port of Seattle. Due to the extensive nature of the comments, the Port's comments and KCIW's responses are included in Appendix A of this fact sheet.

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Washington Department of Ecology
On June 21, 2021 and June 28, 2021, Maia Hoffman, Pretreatment Coordinator for Ecology, submitted her comments on the draft permit to KCIW. Ecology's comments and KCIW responses are included in Appendix B of this fact sheet.

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Appendix A – Port of Seattle's Comments on the Draft Permit and Fact Sheet & KCIW's Responses to the Port's Comments

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Port of Seattle

Seattle-Tacoma International Airport
P.O. Box 68727
Seattle, WA 98168-0727

June 29, 2021

Peggy Rice
King County Wastewater Treatment Division
Industrial Waste Program
201 S. Jackson St., Room 513
Seattle WA 98104-3855

RE: Seattle-Tacoma International Airport
Draft Waste Discharge Permit No. 7810-05

Dear Ms. Rice:

On behalf of the Port of Seattle, thank you for the opportunity to review and provide comments on the King County's Draft Waste Discharge Permit No. 7810-05 ("Permit"). The Port recognizes the importance of working collaboratively with King County to ensure that Seattle-Tacoma International Airport discharges do not interfere with or upset King County's South Treatment Plant (STP), as well as working together towards environmental stewardship of our public lands and waterways.

The current Permit, through a Comprehensive Stormwater Report (CSR), required the Port to identify measures to meet reduced effluent limits and strategies to minimize and eventually eliminate its dependence on the King County sanitary sewer system and treatment plant to the maximum extent practicable. The Port analyzed the best approach to meet reduced effluent limits and in October 2019 King County accepted the Port's proposed measures and implementation schedule to meet the reduced effluent limits in 2025. The Port initiated implementation of both the source control measures and infrastructure improvements. The Port also evaluated the most viable pre-treatment technology considering the Pacific Northwest weather, Airport's infrastructure, and permit conditions. However, after evaluating the economic feasibility based on a mass loading removal efficiency, King County determined the forthcoming permit cycle would have further reduced effluent limits. The County shared the reduced limits with the Port in April 2021.

The new draft Permit includes a revised effective date of the reduced effluent limits and includes further reduced limits effective in July 2026. The fact sheet also incorrectly assumes that the Port can comply with the reduced limits without infrastructure improvements. This effective date makes the Port's Industrial Waste Treatment Plant (IWTP) vulnerable to exceeding storage capacity and noncompliance of both the NPDES and King County permit conditions. As recently discussed, the Port would like to pursue operator workshops that identify operational improvements to mitigate risk for both the Airport and King County's South Treatment Plant (STP). In the meantime, the Port proposes to retain the 2016 permit effluent limits until the Port and County agree upon a plan for alternate operating conditions similar to methods implemented under previous permit cycles.

To meet the July 2026 effluent limits, the Airport must reevaluate the necessary improvements and how to incorporate pretreatment into current infrastructure. The draft Permit includes a prescriptive design and construction schedule. In part because the required improvements must be reviewed and approved by the Department of Ecology, it is very unlikely that the Port will be able to meet the proposed

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Port of Seattle

Seattle-Tacoma International Airport
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schedule. This schedule also assumes the Port would design and construct under one contract. Based on the limited construction windows and necessary phasing, the Port will likely need to implement the improvements under a series of contracts. The Port has therefore proposed an alternative and more realistic implementation approach in the enclosure.

Concurrently, the Port is evaluating alternative solutions to an onsite treatment plant at the airport that would meet King County's STP needs. The Port has requested discussions with KCIW regarding the potential for a regional-based solution to the Port's contributions to the South Treatment Plant (STP) load capacity issue. A regional-based solution may act, in part or in full, as an alternative to implementing extensive IWTP modifications to address the STP capacity issues and the impact of Port discharges on the STP.

The enclosed comments contain the Port's response to the draft Permit, organized as follows:

1. Proposed Definition of Key Terms for Inclusion in the Draft Permit
2. Impact of the Port-King County Regional Solution Approach Discussions on Implementation of Permit Conditions
3. Detailed Comments on the Draft Permit Language
4. Detailed Comments on the Draft Permit Fact Sheet

The Port appreciates your consideration of our comments and welcomes additional discussions with King County. Given the highly significant long-term impacts of the Permit conditions to both the Port and King County, we want to have a permit that both protects the County's STP and helps the Port meet its obligations to the traveling public, FAA, and the Department of Ecology. These two goals are both complementary and achievable. We look forward to working with you to develop long-term solutions to this challenge, with environmental stewardship as our primary goal. If you have questions regarding this submittal, please contact Sarah Cox directly at (206) 787-7137.

Sincerely,

Stuart Mathews
Director, Aviation Maintenance Department

Enclosure: Request for Modifications, Draft Permit #7810-05

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PART 1, PORT OF SEATTLE COMMENTS ON DRAFT KING COUNTY INDUSTRIAL WASTE DISCHARGE PERMIT ("DRAFT PERMIT")

Proposed Definition of Key Terms for Inclusion in the Draft Permit

Several important terms are used throughout the Draft Permit in establishing permit conditions. It is essential that the terms be appropriately defined and consistently applied to provide clarity and avoid confusion for both parties. The Port proposes the following definitions for the key terms. The Port proposes adding a terms section after or as part of Section S2.

Industrial Wastewater: As indicated in the Port's NPDES permit, industrial wastewater is defined as the stormwater runoff from areas where industrial activities occur at SEA (terminal air cargo, deicing areas, hangars, and maintenance areas). Industrial wastewater includes constituents from industrial activities such as those from deicing, wash water, fueling, lubricants, fire-fighting foam, cleaning agents, solid waste decant leachate, well construction and monitoring, pipe pressure testing, and construction activities.

Industrial Wastewater System (IWS): The IWS at SEA encompasses the infrastructure used to convey, manage, and treat industrial wastewater for the purposes of complying with applicable regulations and permits, including the Port's NPDES permit and IWD permit. The IWS includes three major subsystems: North Service Basin drainage system, South Service Basin drainage system, and the Industrial Wastewater Treatment Plant.

Industrial Wastewater Treatment Plant (IWTP): The IWTP is the IWS subsystem used to reduce the extent of constituents in the Industrial Wastewater prior to discharge to Puget Sound through Outfall 001 under the Port's NPDES permit or discharge to the King County Sewerage System through sanitary sewer discharge point for sample site A70101 under the Port's Industrial Waste Discharge Permit. Any new or modified components and processes downstream of the North and South Service Basin discharge points to the IWTP that are implemented to meet the anticipated BOD load limits in Draft IWD Permit Section S3. "Special Conditions and Compliance Schedule, Part B. Engineering Report" will be considered to be part of the IWTP~~.~~

Treatment: The processes through which contaminants and constituents of concern are removed or otherwise modified in the Port's IWTP for the purposes of complying with the Port's NPDES and IWD permit requirements.

Pretreatment: Any IWTP treatment process applied to industrial wastewater that is discharged to the King County Sewer System. The existing IWTP processes for storage and Dissolved Air Flotation (DAF) are used to reduce solids, metals, and FOG quantities as well as adjust pH prior to discharge to the King County Sewerage System and are therefore considered to constitute pretreatment. Should additional processes, including biological treatment and equalization storage, be implemented at the IWTP in the future to meet anticipated 2026 BOD load limits, those processes will be considered as additions to the pretreatment system.

KCIW's Response to Comment on Part 1:

KCIW will include the definitions for the key terms listed above, with some modifications such as KCIW's edits to include "all discharge limits", rather than just "anticipated BOD load limits". These key term definitions are included as Appendix C to the final fact sheet.

PART 2, COMMENTS ON DRAFT IWD PERMIT

COMMENT 2.1

Risk of Noncompliance with Proposed 2021-2026 Discharge Limits

The implementation of the 2021-2026 reduced effluent limits prior to the full installation of the operational best management practices and infrastructure improvements will place the Port at risk of maintaining adequate storage capacity. These new limits were presented to the Port in April 2021 almost two years after the County approved the infrastructure and effective effluent limit implementation date. These new limits were presented to the Port in April 2021 almost two years after the County approved the infrastructure and effective effluent limit implementation date. The Port proposes to maintain the 2016 permit limits and add a plan for alternate operating conditions similar to methods implemented under previous permit cycles.

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Aircraft deicing application and use of Port storage capacity are driven by seasonal weather patterns. A detailed deicing model analysis was conducted by the Port's consultant using the 50 year set of weather data; that analysis concluded there is a 17.3% chance in any season of the Port being unable to meet the proposed permit limits with the current level of BMPs implemented. The Port exceeded the proposed interim limits as recently as several months ago. There is a significant risk to the Port's ability to contain runoff should more extreme weather and deicing conditions be encountered before mitigating measures can be fully implemented.

While the Port intends to operate in a way to meet the new lower limiting IWD BOD loads, if those more extreme winter conditions arise and/or if KCIW limits discharges even further for other reasons, the Port risks violating the NPDES permit and/or the IWD permit, potentially for extended periods. To mitigate risk, the Port requests a series of technical workshops with King County and Port operation teams. The outcome may identify opportunities for different operating approaches and result in a combination of best practices that will meet the respective facilities' operational needs.

KCIW's Response to Comment 2.1:

The 2016-2021 permit contained two sets of mass-based BOD effluent limits. The initial limit for BOD was 60,000 lb/day on a maximum daily limit basis. The second set of mass-based effluent limits in the 2016-2021 permit included a maximum daily BOD limit of 45,000 lb/day and a monthly average BOD limit of 27,500 lb/day. An hourly load limit of 2,500 lbs/hr was included in the interim and final limits of the 2016-2021 permit. It was intended that the Comprehensive Stormwater Report would be reviewed, approved, and recommendations implemented during the 2016-2021 permit cycle. Accordingly, the maximum daily BOD limit of 45,000 lb/day, a monthly average BOD limit of 27,500 lb/day and an hourly load limit of 2,500 lbs/hr were supposed to go into effect during the 2016-2021 permit cycle.

The Port proposes to "maintain the 2016 permit limits". Since there were two sets of limits in the 2016-2021 permit, it's assumed that the Port is requesting that the initial 2016-2021 mass loading limit of 60,000 lb/day on a maximum daily basis be specified in the proposed permit. This request, although initially denied in the draft permit, will be granted but for a limited time of one deicing season, in this final permit from the effective date until October 1, 2022. KCIW granted this request after discussing the Port's proposal to initiate a series of technical workshops with King County and the Port's operation teams, hearing the Port's need for more time to institute some of the remaining operational BMP improvements, and to assist in minimizing the Port's risk. Effective October 1, 2022, the maximum daily BOD limit of 45,000 lbs/day and a monthly average BOD limit of 27,500 lbs/day will go into effect and will be the limits until the permit expires in 2026. The final permit has been modified to include the temporary discharge limits of 60,000 lbs/day, However, please note that KC is certain, based on past deicing discharge events, that the BOD discharge limits of 60,000 lbs/day have proven to be too high to be protective of the operations at King County's South Treatment Plant (SP). The requirement to meet the proposed limits in this renewed permit (2021-2026) was supposed to be effective during the 2016-2021 permit cycle. Meeting the proposed limits for BOD (maximum daily BOD limit of 45,000 lb/day and a monthly average BOD limit of 27,500 lb/day) is already overdue and based on interviews with SP staff, even these limits are not necessarily protective long-term. In order to responsibly fulfill KCIW's role as a delegated pretreatment program and to protect the operations of the POTW (SP) the Port's request of a BOD limit of 60,000 lbs/day will be granted on a temporary, limited basis for the 2021/2022 deicing season to give the Port time to organize the technical workshops with KC and to institute operational changes to reduce BOD .

On October 1, 2022, the proposed interim BOD limits (daily maximum = 45,000 lbs/day, monthly average = 27,500 lbs./day, and maximum hourly load = 2,500 lbs./day) will go into effect and holds the Port accountable to a certain standard and provides some level of safeguard to SP operations. Continuing to impose the 2016 initial BOD discharge limit of 60,000 lbs/day for more than one de-icing season would not be appropriate and SP at risk. The Washington Department of Ecology (Ecology) supports KCIW's decision to impose the proposed discharge limits listed in this renewed waste discharge permit as well as the future lower BOD permit limits (15,000 lbs/day maximum day and 10,000 lbs/day maximum monthly) which will go into effect in the next permit cycle (2026). Ideally, KCIW would impose the final BOD limits of 15,000 lbs/day maximum day and 10,000 lbs/day maximum monthly in this permit, but we recognize that the Port needs time to plan, design and construct the storage/treatment option.

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KCIW acknowledges that the proposed discharge limits pose some risk for the Port of violating their KCIW permit. However, the Port has stated that they have already implemented 75% of the blend-to-temperature system and instituted other BMPs to date and future operational strategies which should mitigate this risk. Conversely, it is important to note that without lower discharge limits, the Port's deicing loadings also put the County's compliance with our NPDES permit to Puget Sound at risk, may cause interference, and jeopardize our delegated pretreatment program with enforcement from Ecology for not running an effective pretreatment program that protects the SP.

Please note that if the Port violates a discharge limit, but there is no interference at the SP, KCIW can use discretion in processing the related enforcement action. However, if interference in the operation of the STP occurs without violating the discharge limits and is found to be due to the discharges from the Port, as per 40 CFR Part 403.8, KCIW would be required to place the Port in significant noncompliance (SNC) and initiate an enforcement action.

The Port's request to initiate a series of technical workshops with King County and the Port's operation team in order to mitigate risk and potentially identify opportunities for different operating approaches is authorized and can be pursued. However, the proposed technical workshops will not supersede the Port's requirement to meet the initial temporary discharge limits, the proposed interim BOD discharge limits starting October 1,2022 or the future 2026 proposed discharge limits. It should also be noted that the operational workshops should be focused on optimizing operational strategies in the short-term to protect both entities permits and facilities. In the past, SP operators have had to expend considerable time and resources in managing the Port's deicing loads. This runs counter to the basic tenets of an industrial waste pretreatment program. Namely, significant industrial users are supposed to pretreat their wastestreams sufficiently before they are discharged to the sanitary sewer system so that they do not cause problems at the County's wastewater treatment plant nor have to be actively managed by operators. The Port's deicing loadings are the only wastestreams at SP that has required special management on a routine basis.

COMMENT 2.2

Impact of the Port-KCIW Regional Solution Approach Discussions on Implementation of IWD Permit Conditions

The Draft Permit includes anticipated BOD mass loading limits for the next permit term starting in 2026 for the allowable discharges from the Port's IWTP to the King County Sewerage System. The anticipated limits represent a significant reduction from the existing permit limits. Meeting the anticipated limits across the range of potential airport operations and weather conditions will require a highly significant investment from the Port and likely result in extensive changes to the IWTP site layout and operations.

Given the impact of the potential IWTP changes, the Port has requested discussions with KCIW regarding the potential for a regional-based solution to the Port's contributions to the South Treatment Plant (STP) load capacity issue. A regional-based solution may act, in part or in full, as an alternative to implementing extensive IWTP modifications to address the STP capacity issues and the impact of Port discharges on the STP. A regional-based solution is the Port's preferred alternative. Potential individual or combinations of solutions of this type include evaluating opportunities like using glycol in the STP denitrification process, finding mutually beneficial solutions to the regional combined sewer overflows, and evaluating joint processing of spent glycol from multiple regional airports. These types of solutions would be preferrable to onsite treatment for the Port because they may help address the Port's spatial constraints and help create a better regional beneficial use.

As described in the detailed comments below on Draft IWD Permit Section S3. "Special Conditions and Compliance Schedule, Part D. Compliance Schedule – Implementation of Measures, Milestones, and Due Dates," the Port intends to submit the Preliminary Planning Report (PPR) to KCIW on or before December 31, 2021 as proposed in the Draft Permit[1]. The Port is requesting that KCIW provide any comments on the PPR as described in the comments to the compliance schedule in S3.

At the time of this comment letter submittal, the outcome of requested future Port-KCIW discussions on a regional solution is unclear. The outcome of those discussions may affect the appropriateness of

[1] Note to KCIW: In general in the Draft Permit, the PPR is defined as "Preliminary Planning Report," but in Section S3.A the PPR is defined as "Preliminary Project Report." Please revise.

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implementing certain actions identified in the Draft Permit. To address the impact of the Port-KCIW regional solutions discussions, the Port proposes the following approach to managing the proposed compliance requirements in the Draft Permit:

- If by January 31, 2022 the Port and KCIW agree that an alternative regional solution will not be pursued, the Port will commit to submitting to KCIW an Engineering Report meeting the conditions set forth in Draft IWD Permit Section S3. “Special Conditions and Compliance Schedule, Part B. Engineering Report.” The Engineering Report will include a proposed compliance schedule and effective date for the remainder of the implementation steps associated with modifying the IWTP to meet the reduced BOD mass load limits (see comments below on the need for development a compliance schedule in conjunction with the Engineering Report rather than fully describing a compliance schedule in the Draft Permit). Proposed durations for draft report development, review, and report finalization to be applied after finalization of the PPR are provided below under “Port Comment 3.3.”

  The January 31, 2022 determination is based on the PPR delivered 12/31/21 with a 28-day review period by KCIW as described later in Part 3.

- If by January 31, 2022 the Port and KCIW agree than an alternative regional solution will be further pursued, the Port proposes that a Memorandum of Understanding be developed documenting the objectives of the regional solution evaluation, responsibilities of the Port and KCIW, and the subsequent activities to be executed in pursuit of the objectives. In this eventuality, execution of the work associated with producing an Engineering Report on planned IWTP modifications is premature and will be postponed until such time that the Port and KCIW agree on an IWD permit modification that redefines the timeline and content for an Engineering Report (if needed).

KCIW’s Response to Comment 2.2

The Port requested discussions with KCIW regarding the potential for a regional-based solution to the Port’s contributions to the South Treatment Plant load capacity issue. Although unclear of the components of a “regional based solution”, the Port can evaluate a regional-based approach but must still meet the requirements listed in the permit, specifically, S3.A., S3.B, S3.C, and S3.D (submittal of PPR, engineering report, design documents, and compliance schedule) of the renewed discharge permit. KCIW is keeping the storage and treatment option in the compliance schedule listed in this renewed permit as the default solution. Should the regional based solution be approved by KCIW, KCIW would consider a modification to the permit and associated compliance order schedule. At this point in time, KCIW cannot allow undefined, conceptual regional alternatives to drive the permitting process, knowing the deicing loads are adversely affecting SP operations. In order to not lose any more time in making progress toward reducing BOD loadings to SP, the Port should pursue the storage/treatment option in parallel with the regional-based alternatives evaluation.

As mentioned by the Port’s comment, one regional based solution included evaluating opportunities like using glycol in the SP denitrification process. KCIW discussed this proposal with SP operations staff. At this time, it is uncertain whether the use of glycol is feasible for the SP denitfification process in terms of a carbon source, logistics (site constraints and storage), alignment with complying with the final 2026 BOD loading limits, and the timeframe to get the deicing loads under control. The Port also mentions CSO control. Please note that SP does not serve a combined sewer service area, so it is unclear how this would address hydraulic or BOD/organic loading issues at SP.
KCIW is respectfully denying the Port’s request to revise the elements listed in the Compliance Schedule in S3.D of the KCIW discharge permit; however, some due dates have been extended (see responses below).

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PART 3, PORT COMMENTS ON DRAFT IWD PERMIT:

Detailed Comments on Draft Permit Language

COMMENT 3.1

Draft Permit Reference: S2. Permit Summary and Company Identification, B. Reports (Page 4)

Port Comments:

3.1.1 The table under S2B. "Reports" on Page 4 should be split into two tables:

i. Table 1 for design and construction related reports associated with the compliance schedule

ii. Table 2 for ongoing operations related reports

3.1.2 See Comment 3.3 for comments on the compliance schedule that affect the line items and dates in the reports table.

3.1.3 Line 9 of the Section S2.B table "Installation/Modification of Pretreatment System Report." This item references Section S.6C, which indicates that engineering submittals for KCIW review and approval are required prior to installing or modifying a pretreatment system. The Draft Permit already describes specific submittals (PPR, Engineering Report, Design Documents, Reporting on blend-to-temperature stations). To avoid ambiguity as to whether additional submittals are required under the heading of "Installation/Modification Pretreatment System Report," the Port requests that KCIW delete Line 9 of the table.

Proposed Changes to Draft Permit Language:

1. Revise the table in S2.B by splitting into one table for design/construction and one table for ongoing operations.
2. Revise the "Due Dates" in the table based on comments below to the Compliance Schedule in S3.D.
3. Delete Line 9 of Section S2.B table.

KCIW's Response to Comment 3.1

The Port has requested that KCIW revise the table in S2.B, revise the due dates in the S3.D. Compliance Order, and delete line nine of S2.B. "Installation/Modification of Pretreatment System Report". In regard to the table in S2.B, it is standard practice for KCIW to list all required reports in one table. As for the compliance schedule, the Port must begin to show significant progress towards installing additional storage/pretreatment to meet the future discharge limits (2026) by submitting the required reports in the timeframe listed. Timely progress and submission of reports will allow KCIW to use its enforcement discretion if violations were to occur. Otherwise, KCIW will not be able to use its discretion. S6.C. is standard template language, common for all SIUs. Although the language in S6.C. seems redundant to the requirements listed the Special Conditions and Compliance Schedule (S3.A – S3.D), it is not and the requirements in S6 apply to all elements of the pretreatment system. The requirements in S3 are more detailed and specific for the Port. At the Port's request, a minor extension to the due dates for the required engineering reports submittal has been granted.

KCIW has made the changes to S2.B. to reflect the changes made to the measures, milestones, and due dates in S3.D. Compliance Order but denies the Port's request to delete Line 9 of the Section S2.B table "Installation/Modification of Pretreatment System Report" because this requirement applies to all components and modifications of the pretreatment system, not just ones associated with BOD loading as described in S3.

COMMENT 3.2

Draft Permit Reference: S2. Permit Summary and Company Identification, C. Major Changes in the Renewed Permit (Page 5)

Port Comments:

3.2.1 Item S2.C.1. This line refers to the new lower BOD limit that KCIW intends to in place in the 2021 issued IWD permit. As discussed in Comment 2.1, the Port has significant risk of noncompliance with the proposed lower BOD limits for this period.

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3.2.2 *Item S2.C.2*. To avoid confusion, the requirements for which specific Design Documents are to be submitted should be clarified. See below for proposed changes.

3.2.3 Item S2.C.3. The item indicates that the draft permit includes a "requirement to report regularly on progress toward this goal and on this project." It isn't clear if this requirement refers only to the required submittals of the PPR, Engineering Report and Design Documents or to some other reporting requirement. The Port believes the specifically required documents are sufficient to keep KCIW abreast of progress.

Proposed Changes to Draft Permit Language is S2.C:

1. Add the following to the end of S2.C.2: "Design Documents include plans and technical specifications that are directly related to IWTP modifications and/or additions to be implemented for the express purposes for meeting the anticipated BOD mass loading limits in Draft IWD Permit Section S3. "Special Conditions and Compliance Schedule, Part B. Engineering Report." The submitted Design Documents exclude plans and technical specifications that are associated with the IWTP general improvements that may be ongoing at the Port but are not directly associated with meeting the anticipated BOD mass loading limits identified in Section S3."
2. Delete "A requirement to report regularly on progress toward this goal and on this project" in Item S3.C.3.

KCIW's Response to Comment 3.2

Section S2.C of the permit summarizes the major changes in the renewed permit, including the lower limits for BOD. KCIW is authorizing on a short-term, temporary basis, the Port's request to maintain the discharge limits (60,000 lbs/day maximum) listed in the Port's 2016 discharge permit, despite knowing those limits for BOD are not necessarily protective of the operations at the SP. Updated language was added to S2.C.1 to reflect the changes and the short term duration of the discharge limits was added to S4 of the discharge permit.

In regard to S2.C.2, KCIW has added modified language to the end of that section to indicate that the design document that are required in the compliance schedule relate to those documents related to meeting the final BOD loading limits.

KCIW agrees with the Port's opinion that by adhering to the due dates listed in the S3.D. compliance schedule, there is no additional need to report on milestones because the required measures and dates of submittals are sufficient for KCIW to determine progress towards the installation of additional pretreatment and storage, operational improvement, and BMP implementation. KCIW will remove the additional requirement to report regularly on progress towards those goals found in S2.C.3

COMMENT 3.3

Draft Permit Reference: S3.D Compliance Schedule – Implementation of Measures, Milestones and Due Dates (Pages 6 and 7)

Port Comments:

3.3.1 *Compliance Schedule Approach*. KCIW has provided a series of actions and completion dates in the draft compliance schedule in this section of the Draft Permit. The listed actions, submittals, durations, and completion dates fail to consider multiple critical implementation activities that have significant schedule implications. Developing a compliance schedule that meets KCIW's objectives in a way that is achievable for the Port and ultimately provides the protection that KCIW seeks for the STP must account for the following:

- Durations for KCIW to review and approve the each required submittal, including accounting for time to coordinate comments with the Port and time for the Port to revise the documents. Because KCIW is indicating these submittals must be approved, the Port cannot begin activities subsequent to those submittals until the KCIW approval is received. Proposed review durations are provided below.
- Durations for receipt of permits and approvals necessary to design, construct, and operate a modified IWTP, including those from agencies other than KCIW such as

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Federal Aviation Administration (FAA), local building permit agencies, and Washington Department of Ecology. While the Port can control the time to prepare permit applications, the timelines for these agencies to review and provide the required permits and approvals are beyond the Port's control. In many cases, these permits and approvals are regulatorily required to start design, construction, and operations.

- Durations to procure professional and construction services in a manner that meets the Port's own organizational obligations.
- Implementation of modifications to the IWTP will likely be executed in phases, with multiple sets of design documents and multiple construction periods. This is needed to:
    - manage Port compliance with the IWD limits in place in the 2021-2026 period
    - meet KCIW's requirement for ongoing progress
    - accommodate the need to continue operation of the IWTP while modifications are being constructed, which is critical as some integration of new IWTP features with existing IWTP infrastructure is required.
    - accommodate limitations on construction during the winter / deicing season

A compliance schedule needs to appropriately reflect such phasing.

- Prior to the completion of the PPR, the Port will not know exactly what IWTP modifications will be implemented or where new construction will occur. The time required for design and construction is highly dependent on these factors, as well as the extent that the existing IWTP will be modified.

Given the factors above, it is inappropriate and counterproductive to include a full compliance schedule identifying design and construction dates in the IWD permit to be issued in July 2021.

The Port proposes the program below in which the following will occur:

- Port completes the PPR per the date in the Draft Permit (December 31, 2021)
- KCIW commits to a timeframe for review and approval for the PPR (See comment 3.3.3 below)
- Depending upon the outcome of the Port-KCIW discussions on a regional solution as described in Part 2 of Port Comments above, the Port completes a Draft Engineering Report within seven months of final approval of the PPR. This timeframe is based upon the Port's capital improvement program project management delivery process. The Port proposes to include a proposed compliance schedule for the remainder of the implementation activities in the Draft Engineering Report. KCIW will have the ability to review and comment on the proposed compliance schedule before the Final Engineering Report is submitted by the Port. The Draft Engineering Report will also be submitted to the Department of Ecology for review and approval per the Airport's NPDES permit requirements.

3.3.2 *Compliance Schedule Table Items 1 and 2: Blend-to-Temperature Source Control.* In the draft CSR, the Port did indicate two centralized Blend-to-Temperature (BTT) stations would be designed and constructed for 100% BTT utilization within the next IWD permit term. However, since the draft CSR submittal and establishment of that compliance schedule, the mechanism for achieving BTT has changed. The airlines and their deicing providers, who have FAA regulatory responsibility for applying the deicer to aircraft, have moved toward a BTT system that uses either: 1) a fixed blend-to-temperature system specific to that particular airline's operations or 2) blending-to-temperatures in deicing trucks rather than in a fixed station. As of June 25, 2021, over 75% of the deicing operations at SEA incorporate some type of blend-to-temperature system exceeding the CSR implementation schedule of 50% by 2023. Additional conversions to BTT by many of the other applicators is likely over the next several years. Should the BTT conversion not reach 100% of the deicing operation, the Port will compensate for the shortfall through storage

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and/or treatment capacity. The current BTT usage will be evaluated in the PPR to determine if 100% BTT utilization is required or if better implemented through storage and/or treatment.

As discussed with KCIW, the process described above may eliminate the need for the centralized BTT systems originally envisioned in the Comprehensive Stormwater Report and referenced in the Draft Permit. Based on this evolution, the Port requests that the "Source Control: Blend-to-Temperature – Station 1" and "Source Control: Blend-to-Temperature – Station 2" measures be deleted from the Draft Permit.

3.3.3 *Compliance Schedule Table Item 3: KCIW Review Schedule for the PPR.* Since the activities associated with development of the Engineering Report cannot begin until KCIW provides final approval on the PPR, the Port requests that KCIW specify the PPR review times in the compliance schedule. See Proposed Changes, Item 1 below for the Port's recommendation.

3.3.4 *Compliance Schedule Table Item 4: Durations for Preparation of an Engineering Report*. Submitting an Engineering Report sufficiently developed to initiate the detailed design requires completion of the following: an approximately 15% complete set of design documents, basis of design, finalization of sites for construction of IWTP additions, acquisition of permits associated with agencies other than KCIW, cost evaluation, and coordination with other Port operations and projects. This process requires numerous supporting activities, including:

- Collection of field data (e.g., topographical survey, geotechnical survey, groundwater surface determination, utility survey, delineation of jurisdictional surface waters).
- Preparation of materials for required permits and approvals from FAA (e.g., approval for potential Runway Protection Zone intrusions, approval for crossing/moving FAA electrical and communications utilities, 7460 permits, Safety and Phasing Plans)
- Initiation of SEPA and NEPA activities, including preparation of materials to submit documentation to seek environmental impact approvals prior to construction
- Modeling and engineering calculations to finalize capacities and footprints
- Coordination with Port operations, emergency response, security, and maintenance regarding site access
- Initial evaluation of site preparation needs, including demolition

The tasks required to produce a draft Engineering Report, as described above, require a minimum of 7 months, especially given the need for extensive field data collection. After comments on a Draft Engineering Report are received from KCIW and Department of Ecology, a minimum of 2 months is required to produce a Final Engineering Report.

KCIW's expected duration for review of the Draft Engineering Report is not provided in the Draft Report, but that duration needs to be specified in any compliance schedule to allow the Port to plan for how to meet the schedule.

3.3.5 *Compliance Schedule Table Item 5: On-Site Storage and Treatment System Plans and Specifications.* The Port believes that the design process is best served with an initial KCIW review of plans and specifications at a 60% design completion point rather than a 90% completion point. At 60%, the plan and section drawings will have been developed, along with a list of technical specifications, equipment list, and detailed process description. This is sufficient to communicate the features of the system. Providing input at 60% allows the Port time to adapt to KCIW comments without schedule disruption or significant rework. Conversely, if the 90% completion submittal requirement remains, any major changes would almost certainly require extensive revisions, unnecessarily wasting resources and impacting schedule. It is common practice in aviation to provide such initial reviews at 60% rather than 90%.

Like the PPR, KCIW should specify the anticipated review times for a 60% and 100% review in a compliance schedule. Without knowledge of those review times, the Port cannot adequately plan to meet an overall compliance schedule.

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KCIW should also indicate specifically what elements of the design documents will be reviewed. The Port believes the KCIW review should be focused on overall evaluation of the suitability of the system described in design documents to meet the Port's permit limitations. It is neither appropriate nor necessary for KCIW to provide quality control-based comments; comments on specific equipment/instrument/material choices; comments on specific manufacturers to be listed in specifications; or comments on siting/access.

3.3.6 *Compliance Schedule Table Item 6: Construction of Storage and Treatment System.* While it is appropriate for KCIW to specify an overall substantial completion date, it is neither appropriate nor productive for KCIW to specify when the construction Notice-to-Proceed (NTP) should be issued. The NTP is affected by many factors, including the Port's procurement schedule, the construction schedule proposed by the bidders, and timing needed to account for integration of IWTP with existing IWTP operations. As noted previously, there may also be different phasing and contracts resulting in multiple Notices to Proceed. Assigning a specific date for NTP serves no meaningful purpose if a substantial completion date is specified and creates unnecessary coordination to change the NTP should circumstances warrant. Proposed substantial completion dates (assuming a phased implementation) will be proposed in the Engineering Report.

Proposed Changes to Draft Permit Language for Compliance Schedule Table:

1. Section S3.C, Design Documents: Change "90%" to "60%"
2. Section S3.D, Lines 1 and 2 of Compliance Schedule Table (BTT):
    a. Delete Lines 1 and 2 (BTT – Station 1 and BTT – Station 2)
3. Section S3.D, Line 3 of Compliance Schedule Table (PPR): Propose addition of the text in italics in the table below.

Measure	**Milestone**	**Date Due**
PPR for IWTP Modifications to Meet Anticipated 2026 BOD Limits	*Preferred Concept For IWTP Modifications*	December 31, 2021 - *KCIW provides review comments within 14 calendar days of receipt of the PPR* - *Port provides response to KCIW initial comments on PPR within 7 calendar days or receipt of KCIW comments* - *KCIW provides final approval of PPR within 7 calendar days of receipt of KCIW comments*

4. Section S3.D, Line 4 of Compliance Schedule Table (Engineering Report): Propose modification with text in italics in the table below.

Measure	**Milestone**	**Date Due**
Engineering Report for IWTP Modifications to Meet Anticipated 2026 BOD Limits	*Draft Submitted*	*7 months after final approval of PPR* - *KCIW provides review comments within 14 calendar days of receipt of draft* - *Port provides response to KCIW comments within 14 calendar days of receipt* - *KCIW-Port reconciliation of comments and responses within 7 calendar days of Port response*
	Final Submitted	*2 months after reconciliation of draft report comments*

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5. Section S3.D, Line 5 (Plans and Specifications): Propose modification with text in italics in the table below.

Measure	Milestone	Date Due
Plans and Specifications for IWTP Modifications to Meet Anticipated 2026 BOD Limitations	*60% Draft Submitted*	*6 months after final approval of PPR* - *KCIW review comments within 14 calendar days of receipt of draft* - *Port response to KCIW comments within 14 calendar days of receipt* - *KCIW-Port reconciliation of comments and responses within 7 calendar days of Port response*
	Final Submitted	*5 months after reconciliation of 60% comments*

6. Section S3.D, Line 5 of Compliance Schedule Table (Notice to Proceed): Propose deletion of this line.

7. Section S3.D, Line 6 of Compliance Schedule Table (Substantial Completion):

Measure	Milestone	Date Due
Final Construction of IWTP Modifications to Meet Anticipated 2026 BOD Limitations	*Substantial Completion*	*Date to be determined based on proposal in Draft Engineering Report*

KCIW's Response to Comment 3.3
(S3.D of Permit – Compliance Schedule)
The Port is requesting changes to the measures, milestones and due dates listed in the compliance schedule (S3.D). The Port believes that the design process is best served with an initial KCIW review of plans and specifications at a 60% design completion stage rather than a 90% completion stage. KCIW agrees with that assessment and has changed the requirement for the submittal of onsite storage and treatment system plans and specifications from a 90% design to a 60% design with an extension of the due date from June 15, 2023 to July 31, 2023. S3.C and the row specific to plans and specifications of S3.D (Compliance Schedule) have been revised to reflect this change.

The Port is requesting KCIW remove the required measure for Blend-to-Temperature (BTT) stations listed in rows of the Compliance Schedule (S3.D.). In the draft CSR, the Port did indicate two centralized Blend-to-Temperature (BTT) stations would be designed and constructed for 100% BTT utilization within the next permit term. However, since the draft CSR submittal, it is KCIW's understanding that the mechanism for achieving BTT has changed. The airlines and their deicing providers, have moved toward a BTT system that uses either: 1) a fixed blend-to-temperature system specific to that particular airline's operations or 2) blending-to-temperatures in deicing trucks rather than in a fixed station. KCIW acknowledges that more than 75% of the de-icing operations already incorporate some form of BTT technology, exceeding the CSR implementation schedule milestone of 50% BTT by 2023. KCIW is continuing to require this BTT source control measure goal be implemented at the maximum extent practicable because the Port will be in a better position to meet the more stringent limits in this permit and the future 2026 discharge limits. KCIW has replaced the requirement of BTT Station 1 and BTT Station 2 of S3.D with a requirement to submit a BTT Implementation Report by December 31, 2021. This revised requirement gives the Port additional time to determine if implementing additional BTT technology up to 100% is possible and feasible, given the overall solution described in the PPR. As agreed to by the Port, if the Port does not plan to accomplish 100% BTT implementation, the Port would make up the difference with the pretreatment and storage option. The BTT Implementation Report will provide the status of progress incorporating BTT in deicing at the Port and the ultimate strategy/method with respect to BTT achievement.

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The Port is requesting that in the row of S3.D regarding the "PPR" measure be revised to "PPR for IWTP Modifications to Meet Anticipated 2026 BOD Limits", the milestone of "Final Preferred On-site Storage and Treatment option" be revised to "Preferred Concept For IWTP Modifications", and the due date be modified to include the timelines and due dates for KCIW review. KCIW has accepted the Ports proposed edit generally with some minor additions for clarification for the description of the measure and has added additional language to the milestone. The due date of December 31, 2021 remains unchanged for the PPR. The Port's request to include additional deadlines with specific dates for KCIW review of the PPR is denied. KCIW does not include or impose review deadlines on ourselves in waste discharge permits issued to other SIUs. KCIW has every intention to prioritize and review the Port's submittals in an expedited manner, but will not include the due dates for the KCIW program review in the discharge permit.

The Port is requesting that in the row of S3.D regarding the "On-site Storage and Treatment System Engineering Report" be revised to "Engineering Report for IWTP Modifications to Meet Anticipated 2026 BOD Limits". KCIW has revised the measure description using the Port's preferred language with a minor addition and has changed the due date for the submittal from June 15, 2022 to August 31, 2022, to accommodate the Port's request of submitting the draft Engineering Report at 7 months after the approval of the PPR. The Port's request to include additional deadlines with specific dates for KCIW review of the Engineering Report is denied because KCIW does not include or impose review deadlines on ourselves in waste discharge permits issued to other SIUs. KCIW has every intention to prioritize and review the Port's submittals in an expedited manner, but will not include the due dates for the KCIW program review in the discharge permit.

The Port is requesting that in the row of S3.D regarding the "On-site Storage and Treatment System Plans and Specifications" be revised to "Plans and Specifications for IWTP Modifications to Meet Anticipated 2026 BOD Limitations". KCIW has revised the measure description using the Port's preferred language with a minor addition and has changed the due date for the initial design documents submittal from June 15, 2023 to July 31, 2023. KCIW is honoring the request to change the milestone from "90% design" to "60% design". The Port believes that the design process is best served with an initial KCIW review of plans and specifications at a 60% design completion point rather than a 90% completion point. KCIW agrees with that assessment and has changed the requirement for the submittal of onsite storage and treatment system plans and specifications from a 90% design to a 60% design. The Port's request to include additional deadlines with specific dates for KCIW review of the Plans and Specifications is denied because KCIW does not include or impose review deadlines on ourselves in waste discharge permits issued to other SIUs. KCIW has every intention to prioritize and review the Port's submittals in an expedited manner and according to KCIW procedures but will not include the due dates for the KCIW program review in the discharge permit.

The Port is requesting that the row regarding S3.D "Construction of storage and treatment system", "Notice to Proceed", along with the due date of "July 1, 2024" be deleted and instead revise the table row of S3.D to "Final Construction of IWTP Modifications to Meet Anticipated 2026 BOD Limitations" for the measure, to "Substantial Completion" for the milestone, and the due date of December 31, 2025 to "Date to be determined based on proposal in Draft Engineering Report". KCIW denied the request to delete the row regarding the Notice to Proceed of S3.D, because the start of construction is an important milestone and without it, the compliance schedule is too open-ended. Per discussions with the Port, "Notice to Proceed" has been changed to "Start of Construction - Contract Award". The due date of July 1, 2024 remains unchanged. The date for substantial completion has been extended from the draft permit by 3 months and revised to March 31, 2026 for the final permit.

COMMENT 3.4

Draft Permit Reference: S3. Special Conditions and Compliance Schedule – Part G (Page 8)

Port Comments:

3.4.1 The Port recommends deleting this section as the items are either covered elsewhere or more appropriately located elsewhere. See proposed changes below.

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Proposed Changes to Draft Permit Language for S3.G Best Management Practices:

1. Move Item 1 "BMPs shall mean…" to the proposed definitions section.
2. Move Item 2 (related to wastewater routing) to Section S4.A and change text to: *At all times when discharge to the sanitary sewer is occurring, all industrial wastewater shall be routed through a fully operational IWTP with modifications to meet anticipated BOD limits approved by KCIW.*
3. Delete Item 3 (related to maintenance) as this item is already covered in Section S8.C.

KCIW's Response to Comment 3.4

The Port is requesting the deletion of S3.G "Best Management Practices". The Port contends that the three items listed under the Best Management Practices are either covered elsewhere or more appropriately located elsewhere. KCIW respectfully denies the request by the Port to modify #1 and #2 because BMP special conditions are standard for all SIU permits. Changing them creates inconsistency with other SIU waste discharge permits. In regard to #2, BOD is not the only pollutant of concern that should be routed through the fully operational and approved pretreatment system. Based on discussions with the Port, after their submission of comments on the draft permit, the Port has indicated that not all flows may need (or desired) to be routed through the future BOD treatment system, and hence the statement about "all industrial wastewater shall be routed through a fully operational IWTP with modifications to meet anticipated BOD limits". Because the storage/treatment system for BOD loadings is expected to be completed toward the end of this proposed permit cycle, language specific to routing certain flows through the future BOD treatment system is not necessary in this permit. Therefore, for Item #2, the original draft language has been retained. In regard to Item #3, S3.G.3 is different than S8.C. Specifically, S3.G.3 requires the Port to operate and maintain all monitoring and pretreatment equipment according to approved documents like the O&M Manual whereas S8.C speaks to the need for operations staff to perform proper O&M. The request to delete S3.G. "Best Management Practices" from the permit has been denied.

COMMENT 3.5

Draft Permit Reference: S4A. Effluent Limitations & Self-Monitoring Requirements – Maximum Instantaneous Flow (Page 9) & S4.C Violation Criteria

Port Comments:

3.5.1 Requesting to add instantaneous flow variance language to maximum daily discharge rate. The Port believes this omission is an error since this condition was added into the 2019 permit modification (7810-04).

The IWTP conducted a pilot test to determine natural fluctuations in order to set discharge rates to the maximum possible to comply with the instantaneous maximum effluent and discharge the permitted maximum daily discharge. A statistical analysis was conducted and reviewed by King County. Based on the analysis, the Port requests to add the following instantaneous flow non-compliance language to account for the natural flow fluctuations and provide the plant the ability to discharge at the permitted value.

Proposed Changes to Draft Permit Language for SA. Effluent Limitations & Self-Monitoring Requirements – Maximum Instantaneous Flow (Page 9) & S4.C Violation Criteria (page 13):

1. Add a footnote 3 to the maximum instantaneous flow rate on page 9 that states: *"The instantaneous maximum flow limit is violated whenever any instantaneous recording is greater than 2778 gpm. The daily maximum instantaneous flow limit is violated whenever any continuous recording of 15 minutes or longer remains above 2828 gpm or longer within a 24-hour period."*
2. Add section to the Violation Criteria, "The instantaneous maximum flow limit is violated whenever any instantaneous recording is greater than 2778 gpm. The daily maximum instantaneous flow limit is violated whenever any continuous recording of 15 minutes or longer remains above 2828 gpm or longer within a 24-hour period."

KCIW's Response to Comment 3.5

The Port requested to add the following instantaneous flow variance language to maximum discharge rate in S4; "The instantaneous maximum flow limit is violated whenever any instantaneous recording is greater than 2778 gpm. The daily maximum instantaneous flow limit is violated whenever any continuous

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recording of 15 minutes or longer remains above 2828 gpm or longer within a 24-hour period." and to S4.C. "Violation Criteria.
KCIW has added a footnote to S4.A.3. that allows the Port to exceed the daily maximum flow rate limit of 2,778 gpm as long as the continuous recording of 15 minutes or longer remains at or below 2,778 gpm within a 24-hour period. Please note that flow rate limits may be revised at any time at VVSD's or King County's request if the high flow rate is having an impact on the sewer conveyance with regards to capacity and sewer overflows.

COMMENT 3.6
Draft Permit Reference: S4.A.2 Effluent Limitations & Self-Monitoring Requirements – Table (Page 10)
Port Comments:

3.6.1 Due to the challenges of waiting over five days for results of BOD analyses, plus the occasional irregularity experienced with BOD_5

***Proposed Changes to Draft Permit Language for S4.A.2 BOD_5 parameter**:*

1. Per Comment 3.4, add the following in S4.A "*At all times when discharge to the sanitary sewer is occurring, all industrial wastewater shall be routed through a fully operational IWTP with modifications to meet anticipated BOD limits approved by KCIW*."
2. Add a footnote to the BOD load limitations in the compliance table that states: "*At their discretion, the Port may submit a request to KCIW with supporting documentation to convert the BOD_5 mass load limitation to a TOC mass load limitation*".

KCIW's Response to Comment 3.6
In regard to the first requested change above and S3.G.2, BOD is not the only pollutant of concern that should be routed through the fully operational and approved pretreatment system. All pollutants of concern are to be routed through the fully operational pretreatment system to meet all local discharge limits, not just to meet BOD limits only. Please see KCIW's Response to Comment 3.4. The draft permit language in S3.G.2 has been retained for the final permit.

The Port is also requesting to add a footnote to S4.A.2 that states "At their discretion, the Port may submit a request to KCIW with supporting documentation to convert the BOD_5 mass load limitation to a TOC mass load limitation". KCIW is denying that request because although proven useful as a screening tool for determining high BOD vs. low BOD and communicating information to SP staff in real time as an indicator for BOD loading, the TOC analyzer results are not an EPA approved method for determining compliance with BOD mass loading limits. As stated in footnote 4 of S4.A.2.,KCIW will consider using a surrogate BOD value, based on TOC results, if the Port's laboratory occasionally fails to provide the results on time or the BOD results are somehow compromised. KCIW will make a determination on a case-by-case basis and by using supporting documentation provided by the Port. Based on historical data, it appears that there was only a couple of instances during the previous permit cycle when the BOD sample could not be used. It is also important to note that BOD concentration values are required for the purposes of billing surcharge treatment fees. TOC is not an approved surcharge parameter at this time.

COMMENT 3.7
Draft Permit Reference: S8. Operations and Maintenance – Part C (Page 23)
Port Comments:

3.7.1 The Draft Permit includes the following requirement in Item 1: "These systems shall be attended at all times during discharge to the King County sewerage system". The Port requests that this statement be amended to allow for possibility of automated operation with remote access through the SCADA system, including controls, data, and alarms. Numerous deicer management and treatment systems in the U.S. over the last 15 years have run in an automated mode outside of the weekday shifts with use of appropriate offsite access technology. This includes operations where the effluent is discharged to sanitary sewers. In these operations, at least one operator is on-call with remote access to the full SCADA control system and is required to both periodically check-in on

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performance data and review alarms. Should situations arise where onsite presence is needed when the facility is not normally manned, protocols are in place for the on-call operator to go to the site within a certain timeframe. Should the Port decide to pursue the option for occasional remote access operation, information on the remote access system will be described in the Engineering Report with equipment shown on the plans and specifications.

Proposed Changes to Draft Permit Language for S8.C.1:

1. Item 1.
    - Change “All pretreatment systems” to “The IWTP system” at the start of the first sentence to align with the definitions used in this document.
    - Change “These systems shall be attended at all times during discharge to the King County sewerage system” to “These systems shall be attended at all times or appropriately monitored with remote access during discharge to the King County sewerage system.”
2. Item 2
    - Change “The permittee shall not initiate construction or modification of a pretreatment system prior to….” to “The permittee shall not initiate construction or modification of the IWTP system for the purposes of meeting anticipated BOD limits prior to….” to align with the definitions used in this document.

KCIW’s Response to Comment 3.7

The Port is requesting that references to “pretreatment system (s)” be revised to “IWTP system”. KCIW is denying that request because this permit is a waste discharge permit specific to industrial wastewater and the permit condition speaks specifically to compliance with KCIW discharge limitations. The IWTP system is for both NPDES and IWD permit compliance, so IWTP is not the correct term.

In S8.C.1. Pretreatment Maintenance and Operations, the draft permit states “These systems shall be attended at all times during discharge to the King County sewerage system”. The Port requests that this statement be amended to allow for the future allowance of automated operation with remote access through the SCADA system, including controls, data, and alarms. Based on conversations with the Port, currently the IWTP is always staffed when discharging to the sanitary sewer. It is also KCIW’s understanding that the Port has no ability to reduce or cease discharges immediately because remote capability is not currently in place that allows for this type of operation. Therefore, KCIW is denying this request to edit the permit language at this time. Should the Port decide to pursue the option for occasional remote access operation, information on the remote access system would need to be described in an Engineering Report and approved by KCIW. Depending on Engineering Report contents regarding automated operation and remote access, the Port’s requested language may be added in a future revision to this permit or included in the next permit, if approved by KCIW.

PART 4, PORT COMMENTS ON DRAFT IWD PERMIT:

Comments on Draft Permit Fact Sheet

General comment:

While the Port acknowledges the performance issues encountered at the STP with the potential link to deicing discharges and concurs with KCIW assertions on the need to manage the level of discharges to the STP, the Port takes exception to the stated and implied level of certainty on the conclusions made in the Fact Sheet. This overstatement of certainty applies to both the conclusions on STP impacts from Port discharges and the implied lack of risk to the Port from lower future limits.

Regarding the Deicer Loads to STP vs. Effluent TSS, while KCIW has stated there is a potential relationship between the Port’s deicing discharges and the impacts to TSS, many variables are not accounted for in KCIW’s analysis, including the effects of other discharges and STP operations. KCIW does not state whether potential confounding factors were evaluated to determine the source of the STP TSS concentrations or sludge volume index (SVI) instability. For example, were the characteristics of

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other permittees' discharges evaluated and ruled out as potentially contributing factors? Or, did KCIW eliminate the possibility of correlations of Port flow rates to STP TSS concentrations? The Port requests that KCIW modify the language in the Fact Sheet to reflect that the data suggests a correlation with Port discharges rather than a causal relationship and that the requested lower effluent limits are an estimate based on a limited data set.

Regarding the implications that the Port's risk is minimal if lower BOD limitations are applied upon the next permit issuance prior to implementation of mitigation measures, KCIW's assessment is based on a limited data set. The assessment also does fully consider the implications to the Port should circumstances be encountered that caused the Port to run out of storage capacity. KCIW's limited study of the last five years of data does not account for the potential seasonal variability, which affects the Port's ability to comply with permit limits. A detailed deicing model analysis was conducted by the Port's consultant using the 50 year set of weather data; that analysis concluded there is a 17.3% chance in **any** season of the Port being unable to meet the proposed permit limits with the current level of BMPs implemented. The Port exceeded the proposed interim limits as recently as several months ago. Contrary to KCIW's assertion, this evidence suggests a significant risk to the Port should more extreme weather and deicing conditions be encountered before mitigating measures can be fully implemented. While the Port intends to operate in a way to meet the new lower limiting IWD BOD loads, if those more extreme winter conditions arise and/or if KCIW limits discharges even further for other reasons, the Port risks violating the NPDES permit and/or the IWD permit, potentially for extended periods. It is imperative that KCIW understand that IWS stormwater has to be routed to the IWTP regardless of available capacity of IWTP storage. It is unlikely that measures such as temporary storage would provide sufficient mitigation. Although KCIW has offered to consider discretion in enforcement, KCIW has also indicated enforcement action against the Port may be unavoidable. As such during the period where limits are potentially in place without the full set of mitigation measures, the most prudent solution is for KCIW and the Port to work together on collaborative measures to minimize impacts to the STP without putting the Port in an untenable compliance and operational position.

The Port offers the following comments and proposed changes (text to be removed is indicated in ~~strikethrough~~ and text to be added are in <u>underline</u>).

	Citation	Summary	Comment	Proposed Change
1	Page 5, paragraph 3	Trends in Discharge of Pollutants of Concern	Evidence provided is not conclusive. Suggested rewording.	…At times, ~~it has~~ <u>these discharges may</u> adversely affect~~ed~~ the secondary activated sludge process at South Treatment Plant…
2	Page 5, paragraph 3	Trends in Discharge of Pollutants of Concern	Evidence provided by KCIW does not consider the complete dataset for the past ten years. Suggested rewording.	…After more than 10 years of experience and ~~analyzing the~~ operational ~~data~~ <u>observations</u>, acceptance of this discharge at current loading rates…
3	Page 6, paragraph 1	Trends in Discharge of Pollutants of Concern	Suggested edit to provide clarity.	…As shown, high effluent TSS values <u>at STP</u> were exhibited on at least two occasions when the <u>Port's</u> daily maximum discharge limit was at 60,000 lbs/day.
4	Page 6, paragraph 1	Trends in Discharge of Pollutants of Concern	Evidence provided is not conclusive. Suggested rewording	…which is an indication of the STP's solids settleability<u>, appeared to be</u> ~~was~~ affected by high

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				BOD loads from the Port…
5	Page 6, paragraph 2	Trends in Discharge of Pollutants of Concern	Evidence provided is not conclusive. Suggested rewording	These graphs ~~indicate~~ suggest that the STP operation is adversely affected by loads of high strength BOD…
6	Page 6, Figure	Trends in Discharge of Pollutants of Concern	The data appear to be from the date range of December 2012 to April 2013, as cited in the title of the figure.	November ~~2011~~ 2012 to April ~~2012~~ 2013
7	Page 8, paragraph 2	Trends in Discharge of Pollutants of Concern	Evidence provided is not conclusive. Suggested rewording	…it was brought to KCIW's attention by the STP personnel that the discharge from the Port of Seattle ~~is~~ may be causing deleterious effects on plant operations…
8	Pages 9 and 10	Trends in Discharge of Pollutants of Concern	Evidence provided is not conclusive.	The text should be reworded to: - state the conclusions are based on a limited data set - acknowledge the Port's modeling analysis that there is a 17.3% risk of exceeding storage capacity in any given season when mitigative measures are not fully in place - Remove the language indicating the interim limits are achievable and replace with language acknowledging the risk
9	Page 14, paragraph 4	Special Conditions	Request to modify the fact sheet per comments provided on S3 of the draft permit.	See comments for S3
10	Page 15, paragraph 2	Limit Calculations	Evidence provided is not conclusive. Suggested rewording	…KCIW concluded that the interim limits effective July 21, 2021, are justified and ~~achievable initially without causing~~ are not likely to cause interference at the STP…

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KCIW's Response to Fact Sheet Comments from the Port

The Port takes exception to the stated and implied level of certainty on the conclusions made in the draft Fact Sheet with regard to the impact of the Port's discharges to the SP and KCIW's assessment that the interim discharge limits are achievable. The Port's perceived overstatement of certainty applies to both the conclusions regarding the impacts to STP operations from Port discharges and the implied lack of risk to the Port from lower future limits.

KCIW respectfully disagrees with the Port's opinion that KCIW has overstated the conclusion that the high volume, high BOD discharges from the Port are the reason for the deleterious effects on the operations of the SP. KCIW respectfully contends that the evidence is conclusive. KCIW has correlated data from the Port's self-monitoring data and discharges to the sanitary sewer with the data from the SP and concludes that the data and evidence are clear, despite having a limited data set. During peak deicing events, the Port's discharge represents over 40 % of the total BOD loading to the secondary process or the equivalent of 125,000 households (275,000 people). The Port represents the largest organic loading to South Plant and deicing events have tracked closely to high SVI and high TSS values. The Port's BOD loading also takes up significant secondary capacity that is not available for future growth or additional NPDES permit limits from Ecology. KCIW would not be requiring the Port to spend very significant amounts of funds on the storage/treatment option if we were not confident in the problems arising at SP during the Port's deicing loadings and for the risk of non-compliance for the County's NPDES permit and disruption of operations. KCIW's requirement to install storage/treatment at the airport is also consistent with requirements for other significant industrial users to pretreat industrial wastewater and within KCIW's responsibility, as a delegated pretreatment program, to protect the County's sewer and treatment plant infrastructure.

KCIW acknowledges that the Port's discharges to SP are at risk of violating the new interim discharge limits, but should be achievable by implementing the various operational BMP's (75% of blend-to-temperature already completed) and potentially more that will be implemented during the 2021-2026 permit cycle. Operational adjustments will also help ensure permit compliance. Nonetheless, KCIW is honoring the Port's request to retain the initial 2016 BOD loading limits in this proposed permit for the first deicing season.

For the Port's comments in the above table, KCIW has the following responses. For table rows 1, 4, 5, and 7, KCIW and SP staff contend that the evidence and data is conclusive that high deicing loads have adversely affected the secondary activated sludge process and operations. Therefore, KCIW has retained the fact sheet language from the draft permit for the final permit. For table row 2, SP staff did analyze and review data as well as make observations associated with deicing loadings. KCIW has accepted some of the Port's proposed language in the final fact sheet. For row 6, KCIW has updated the dates in the graph so that they are correct. For row 8, KCIW has acknowledged the Port's modeling effort and associated risk of exceeding the storage capacity in the fact sheet. KCIW contends that the interim limits are still achievable through operational strategies and further BTT implementations and has given the Port 14 months to fine tune operational strategies and further implement BTT in the final permit before the interim BOD limits are to go into effect. Per the Port's request on row 9, the fact sheet has been modified to reflect comments made in S3. For row 10, KCIW has revised the fact sheet language to reflect discussions between the Port and KCIW after the Port submitted their formal comments on the draft permit. Specifically, KCIW will delay the effective date of the BOD limits (interim limits) included in the draft permit until the second de-icing season (effective October 1, 2022). The interim limits are defined as 45,000 lbs/day maximum day, 27,500 lbs/day monthly average, and 2,500 lbs/hr for BOD and will be effective October 1, 2022. For this final permit, the initial, short-term BOD loading limits are the same as the initial limits in the 2016 permit (60,000 lbs/day – maximum day) and are effective from July 21, 2021 through September 30, 2022.

KCIW appreciates the Port's review and comment on the Draft Permit and Fact Sheet.

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Appendix B – Washington Department of Ecology's Comments on the Draft Permit and Fact Sheet & KCIW's Responses to Ecology's Comments

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The following comments were received from Maia Hoffman, WA Dept. of Ecology, on the Draft Waste Discharge Permit 7810-05. KCIW's italicized responses follow each of Ecology's comments.

1. Section S4.A – There are three different pH limits listed including a daily minimum, minimum, and maximum. Clarify definitions for daily minimum versus minimum. Are the minimum and maximum intended to be instantaneous limits?

   KCIW's Response to Comment #1:
   The instantaneous minimum and daily minimum pH limits are defined in Permit Condition S4.C.6 and are reiterated below.

   > *The **instantaneous minimum** pH limit is violated whenever any single grab sample or any instantaneous recording is less than pH 5.0.*
   >
   > *The **daily minimum pH limit** is violated whenever any continuous recording of 15 minutes or longer remains below pH 5.5 or when each pH value of four consecutive grab samples collected at 15-minute intervals or longer remains below pH 5.5 or when each pH value of four consecutive grab samples collected at 15-minute intervals or longer within a 24-hour period remains below pH 5.5*

   The maximum pH limit of 12.0 is considered an instantaneous limit for this permit. The maximum pH limit is violated whenever any single grab sample or any instantaneous (continuous) recording is greater than pH 12.0.

2. Section S4.A and fact sheet page 14 – Does KCIW ever collect grab samples to ensure compliance to instantaneous limits?

   KCIW's Response to Comment #2
   Yes, KCIW's Sampling Team typically collects grab samples at the same time they are installing the auto sampler to collect composite samples over the course of a discharging day. Because the composite heavy metals sampling data from the Port's deicing/stormwater discharges have been either non-detectable or very low, KCIW hadn't requested that a grab sample be collected as specified in the draft fact sheet.

   Grab samples for pH are already collected semi-annually, although mistakenly left out in the fact sheet. KCIW will correct that error in the final fact sheet. In addition, KCIW will add a semi-annual grab sample for heavy metals to the sampling schedule as a work order in our PIMS database and reflect that addition in the final fact sheet.

3. The permit includes BOD load limits (daily max, average monthly, and daily max hourly) in Section S4.A. A footnote of this section outlines that the Port is authorized, in cases of an anomaly during analysis, to report a BOD value based on the approved TOC concentration statistical procedure. Since the Port has this TOC/BOD statistical procedure in place, KCIW may want to explore including a benchmark for TOC for reporting purposes. If the benchmark TOC limit is exceeded, the Port would be able to notify KCIW and KC STP of a possible BOD effluent limit exceedance more quickly than waiting 5 days for the BOD results. This reporting may help KC STP prepare for any operational challenges associated with higher BOD loading from the Port.

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KCIW's Response to Comment #3:

As BOD5 has an approved EPA analytical method, Table S4 uses BOD5 for purposes of compliance with the mass loading limits. Only in the case of an anomaly during BOD laboratory analysis would the Port substitute a TOC value for a BOD value for purposes of compliance reporting, as TOC is not an approved EPA compliance method. According to SP staff, when the Port is discharging deicing wastewater to the sanitary sewer system, the Port sends a daily email to SP staff that includes the estimated BOD concentration and daily flow. The estimated BOD concentration is based on the TOC reading, historical TOC:BOD data and the approved statistical procedure. Therefore, KC SP staff are notified in relative real-time of the deicing loads and any potential operational challenges. KCIW does not believe that establishment of a TOC benchmark is necessary as the estimated BOD value is communicated to SP staff. SP and Valley View Sewer District staff also have the ability to reduce or halt the Port's discharge under certain conditions per Permit Condition S3.F.

4. The permit includes a compliance schedule for the Port to analyze, design, and implement treatment alternatives to meet more stringent BOD load limits KCIW intends to apply at the start of the next permit cycle (in 2026). The fact sheet describes the reasoning for the more stringent limits, past permit-related efforts to reduce the BOD loading to KC STP, and the operational challenges at KC STP due to the high BOD load from deicing operations at the airport. The intent of the pretreatment program is to prevent introduction of pollutants to a POTW that will interfere with operations or will cause pass through or interference (40 CFR 403.2). King County is delegated authority to implement the pretreatment program and therefore has a responsibility to develop appropriate and technically based effluent limits to meet the objectives of the program. Although BOD (glycol) is treatable by KC STP, capacity issues and operational challenges have been observed at KC STP at times of higher BOD loading from the Port. Ecology supports KCIW including the compliance schedule in this upcoming permit term to plan for an implement storage or treatment to meet the more stringent BOD load limits.

KCIW's Response to Comment #4:

KCIW appreciates Ecology's review and comment on the Draft Permit and Fact Sheet and recognition that the compliance schedule and lower BOD loading limits are justified.

Thank you,

Maia Hoffman, P.E.

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Appendix C – Key Terms and Definitions

At the Port's request, the key terms used in the Port's permit and fact sheet and their definitions are included as an appendix in this fact sheet and are listed below. KCIW has modified some of the Port's definitions for clarity and simplicity. KCIW has also added definitions for short-term and interim discharge limits for BOD.

Key Terms

Industrial Wastewater: As indicated in the Port's NPDES permit, industrial wastewater is defined as the stormwater runoff from areas where industrial activities occur at SEA (terminal air cargo, deicing areas, hangars, and maintenance areas). Industrial wastewater includes constituents from industrial activities such as those from deicing, wash water, fueling, lubricants, fire-fighting foam, cleaning agents, solid waste decant leachate, well construction and monitoring, pipe pressure testing, and construction activities.

Industrial Wastewater System (IWS): The IWS at SEA encompasses the infrastructure used to convey, manage, and treat industrial wastewater for the purposes of complying with applicable regulations and permits, including the Port's NPDES permit and IWD permit. The IWS includes three major subsystems: North Service Basin drainage system, South Service Basin drainage system, and the Industrial Wastewater Treatment Plant.

Industrial Wastewater Treatment Plant (IWTP): The IWTP is the IWS subsystem used to reduce the extent of constituents in the Industrial Wastewater prior to discharge to Puget Sound through Outfall 001 under the Port's NPDES permit or discharge to the King County Sewerage System through sanitary sewer discharge point for sample site A70101 under the Port's Industrial Waste Discharge Permit. Any new or modified components and processes downstream of the North and South Service Basin discharge points conveyed to the IWTP that are implemented to meet all the permitted discharge limits are considered to be part of the IWTP. Lagoons 1, 2 and 3 are considered the first component of the IWTP.

Treatment: The processes through which contaminants and constituents of concern are removed or otherwise modified in the Port's IWTP for the purposes of complying with the Port's NPDES and IWD permit requirements.

Pretreatment: Any IWTP treatment process applied to industrial wastewater that is discharged to the King County Sewer System. The existing IWTP processes for storage and Dissolved Air Flotation (DAF) are used to reduce solids, metals, and FOG quantities as well as adjust pH prior to discharge to the King County Sewerage System and are therefore considered to constitute pretreatment. Should additional processes, including biological treatment and equalization storage, be implemented at the IWTP in the future to meet anticipated 2026 BOD load limits, those processes will be considered as additions to the pretreatment system.

Short-Term Discharge Limits for BOD Mass Loading – 60,000 lbs/day for daily maximum and 2,500 lbs/hr for the hourly load) are effective July 21, 2021 through September 30, 2022

Interim Discharge Limits for BOD Mass Loading – 45,000 lbs/day for daily maximum, 27,500 lbs/day for monthly average, and 2,500 lbs/hr for the hourly load. These BOD discharge limits are effective October 1, 2022 through July 20, 2026

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King County

Industrial Waste Program Monthly Self-Monitoring Report

Send to: King County Industrial Waste Program

Phone 206-477-5300 / FAX 206-263-3001
Email: info.KCIW@kingcounty.gov

Company Name: Port of Seattle, STIA, IWS - IWTP **Sample Site No.** A70101 **Permit/DA No.:** *7810-05*

Please Specify Month & Year: **Month:** _____ **20**____

This form is available at www.kingcounty.gov/industrialwaste.

All units are mg/l unless otherwise noted.

Sample Date (circle)	**Sample Type** C (Composite) G (grab) BC (batch)	pH Min	pH Max	Arsenic, As	Cadmium, Cd	Chromium, Cr	Copper, Cu	Lead, Pb	Nickel, Ni	Silver, Ag	Zinc, Zn		NP Fats, Oils, and Grease (Average of 3 grabs)	Daily Flow (GPD) Industrial	Notes (indicate Batch Discharge where applicable)
1															
2															
3															
4															
5															
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Monthly Min pH _____ & Date _____ Total Monthly Flow (gallons) _____

Monthly Max pH _____ & Date _____ Maximum Daily Flow _____ & Date _____

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. I further certify that all data requiring a laboratory analysis were analyzed by a Washington State Department of Ecology accredited laboratory for each parameter tested.

Signature of Principal Executive or Authorized Agent _____ Date _____

PLEASE CIRCLE ALL PERMIT VIOLATIONS

Due Date: **Monthly report is due by the 15th each month.**

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King County

Industrial Waste Program Monthly Self-Monitoring Report

Send to: King County Industrial Waste Program

Phone 206-477-5300 / FAX 206-263-3001
info.KCIW@kingcounty.gov

Company Name: Port of Seattle, Sea-Tac International Airport, IWS Sample Site No. A70101 Permit/DA No.: 7810-05

Please Specify Month & Year: Month: _____ Year: _____

All units are mg/l unless otherwise noted. ▼

Sample Date (circle)	pH Min	pH Max	Total Suspended Solids (TSS) mg/L	Biochemical Oxygen Demand (BOD_5) Concentration mg/L	Biochemical Oxygen Demand (BOD_5) Load lbs./Day	Biochemical Oxygen Demand (BOD_5) Hourly Load lbs./Hr	Total Daily Flow (MGD)	Highest Discharge Rate (GPM)	Notes:
	CONT.	CONT.	Daily	Daily	Daily	Daily	CONT.	CONT.	
	MEAS.	MEAS.	Composite See Note	Composite See Note	Calculate (Concentration mg/L) * (Total Daily Flow MGD) * 8.34	Calculate (Total Daily Load) / (Hours of Discharge)	MEASURMENT	MEASURMENT	
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I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. I further certify that all data requiring a laboratory analysis were analyzed by a Washington State Department of Ecology accredited laboratory for each parameter tested.

Date

Signature of Principal Executive or Authorized Agent

Monitoring Results	Low / Date	High / Date			Monthly Average Load lbs./day / Maximum Daily Load lbs./day	Maximum Hourly load lbs./hr / Report Date Occurred	Maximum Daily Flow MGD / Total Flow for Month– Report MG	Highest Discharge Rate GPM / Report Date Occurred	Note: Sample type shall be Flow Proportional Composite
Permit Limit	5.5 s.u.	12 s.u	N/A	N/A	Effective October 1, 2022 through July 20, 2026. Maximum Daily Load=45,000 lbs./day, Monthly Average Load Limit= 27,500.0 lbs./day, Maximum hourly load = 2,500 lbs./day Maximum daily discharge volume of 4.0 MGD becomes effective.	Maximum hourly load = 2,500 lbs./day	4.0 MGD – effective October 1, 2022 through July 20, 2026 ---------- Temporary Maximum Daily Flow =2.76 MGD – Effective July 21, 2021 through September 30, 2022	Effective October 1, 2022 - Instantaneous maximum discharge rate = 2,828 gpm Average Maximum discharge rate = 2,778 gpm ---------- Temporary max discharge rate (effective July 21, 2021 through September 30, 2022) = 1,965 gpm Average Maximum discharge rate = 1,915 gpm
	Min	Max			Effective July 21, 2021 through September 30, 2022, a temporary, maximum daily loading limit =60,000 lbs./day and maximum hourly load = 2,500 lbs./day. Maximum daily discharge volume of 2.76 MGD remains in effect.				

PLEASE CIRCLE ALL PERMIT VIOLATIONS

Due Date: Monthly report is due by the 15th of the month following the sampling month.

Attachment D

Land Use Alternatives Analysis for Runway 34L RPZ

Gresham Smith
Gresham Smith Project: 44846.10
Port Contract No. P-00320039
Attachment D

Land Use Alternatives Analysis for Runway 34L RPZ

For Construction and Operation of Expanded IWTP

July 2022

Port of Seattle

Seattle-Tacoma International Airport

Seattle, Washington

Version 2

Gresham Smith Project No. 44846.10

Port Contract No. P-00320039

Gresham Smith

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Acronyms/Abbreviations

ADO	(FAA) Airport District Office
AGB	Aerated gravel bed (treatment system)
ALP	Airport Layout Plan
AOA	Air Operations Area
BOD	Biochemical oxygen demand
FAA	Federal Aviation Administration
IWD	Industrial Waste Discharge (Permit)
IWS	Industrial Wastewater System
IWTP	Industrial Wastewater Treatment Plant
KCIW	King County Industrial Waste Division
NPDES	National Pollutant Discharge Elimination System (Permit)
OFA	Object Free Area
OFZ	Obstacle Free Zone
Port	Port of Seattle
RO	(FAA) Regional Office
RPZ	Runway Protection Zone
RSA	Runway Safety Area
SEA	Seattle-Tacoma International Airport
SIDA	Security Identification Display Area

1. Executive Summary

The use of deicing chemicals is essential to safe and efficient aircraft operations. A byproduct of the use of these chemicals is stormwater run-off which must be managed, and frequently must be treated, prior to discharge.

Historically the treatment of effluent with high deicer content at Seattle-Tacoma International Airport (SEA) has been done by the King County Industrial Waste Division, subject to permit requirements. Recently King County has imposed new limitations on SEA requiring additional pretreatment of the high BOD effluent. The Port of Seattle (Port) has determined that, to meet these new requirements, an expansion to the existing Industrial Wastewater Treatment Plant (IWTP) is necessary by July 2026.

The Port, along with its consultant Gresham Smith, conducted a thorough siting study and is proposing to locate the expanded IWTP in the Runway Protection Zone (RPZ) for Runway 34L.

The intent of the RPZ, as stated by the Doolittle Commission, is "to control the erection of *public and residential buildings* (emphasis added) as a protection from nuisance and hazard to people on the ground." As stated in the Airport Design Advisory Circular, "The FAA adopted "Clear Zones" with dimensional standards to implement the Doolittle Commission's recommendation." The Airport Design Advisory Circular goes on to state that "…clear zones be kept free of structures and any development that would create a place of public assembly."

This technical memorandum details the alternatives analysis conducted by the Port to demonstrate that the proposed alternative is appropriate and reasonable.

The proposed alternative will construct a non-public treatment plant within the RPZ without constraining the safe and efficient operation of the airport. The facility will be designed and constructed in a way that it will not become an obstruction to navigation which addresses another tenet of the Doolittle Commission subsequently adopted by the FAA.

The Port submitted draft Version 1 of this memorandum on March 2, 2022 for FAA review. The FAA Airport District Office (ADO) provided written comments via email on March 21, 2022 and provided further clarification through a conference call with the Port on April 28, 2022. The Port performed additional analysis to respond to FAA comments and presented the results and revised the alternatives including the new preferred alternative in a virtual meeting on June 27, 2022. The revised alternatives are presented in this revised memorandum Version 2.

2. Summary of Alternatives Analysis Process and Requirements

2.1 Process and Requirements

The Port of Seattle (Port) seeks to construct and operate portions of the Seattle-Tacoma International Airport's (SEA) expanded Industrial Wastewater Treatment Plant (IWTP) within the Runway Protection Zone (RPZ) for Runway 34L. Aspects of the expanded IWTP may be considered incompatible land uses per Federal Aviation Administration's (FAA) Advisory Circulars and guidance documents. The Port is providing this alternatives analysis with a request for FAA to assess whether the airport sponsor has "made an adequate effort to pursue and give full consideration to appropriate and reasonable alternatives" (per FAA draft Advisory Circular 150/5190-4B – June 2021). Key information associated with this alternatives analysis is summarized below.

- An expansion of the SEA IWTP is required to meet regulatory requirements contained in an Industrial Waste Discharge (IWD) permit issued by King County to the Port (July 2021). The expanded IWTP has the following characteristics:
    - Treats stormwater runoff containing deicing chemicals to meet permit limits
    - Requires a footprint of 14 to 20 acres
    - Must be operational by July 2026 per IWD permit condition
- A preliminary planning analysis of the expanded IWTP performed by the Port includes the following findings:
    - Available space at the existing IWTP location is insufficient to site the expanded IWTP infrastructure
    - Available space at other locations outside of the Runway 34L RPZ that provides the required expanded IWTP acreage and sufficient proximity to the existing IWTP, and meets constructability and operational needs, is severely limited
    - A Port-owned area at Des Moines Memorial Drive and S. 188th Street that is within the Runway 34L RPZ area has sufficient acreage and proximity to the existing IWTP to meet the expanded IWTP project needs

This document provides the information required to facilitate FAA's review of the sufficiency of the alternatives analysis for the RPZ incompatible land use analysis in the Runway 34L for the expanded IWTP. It includes presentation of the required three alternatives including those that preclude introducing incompatible land uses, minimizing the impact of incompatible land uses, and mitigating risk from incompatible land uses.

Per draft AC 150/5190-4B, if FAA agrees that the alternatives analysis is acceptable, the Port will prepare a recommendation for an Airport Layout Plan change and, if necessary, an airspace determination. Alternatively, if the FAA determines the alternatives analysis is insufficient, FAA will provide feedback and guidance to the Port.

2.2 Interested Parties

The following entities may have an interest in the project and are considered interested parties:

- Port of Seattle
- Airlines Operating at SEA
- King County Industrial Waste Division
- State of Washington Department of Ecology
- City of SeaTac
- Federal, State, and Local Transportation Authorities
    - U.S. Department of Transportation
    - State of Washington Department of Transportation
    - FAA
    - City of SeaTac Public Works Department

2.3 FAA Regulatory Basis for RPZ Land Use

This analysis is based on the following guidance and criteria from FAA related to RPZ land use.

- Memo entitled “Interim Guidance on Land Uses within a Runway Protection Zone” issued to the Regional Airport Division Managers on September 27, 2012.
- Draft AC 150/5190-4B “Airport Land Use Compatibility Planning”, dated June 2021.
- AC 150/5300-13B “Airport Design”, issued March 31, 2022.

Key guidance and criteria from these documents include the following:

- Airport compatible land uses are those that can co-exist with a nearby airport without constraining the safe and efficient operation of the airport or exposing people working or living near-by (Draft AC 150/5190-4B). Additionally, the FAA expects the airport sponsor to take active steps (in accordance with Grant Assurances) to prevent or mitigate any new incompatible land use within the RPZ. Because the Grant Assurances requires sponsors to take “appropriate action, to the extent reasonable,” the FAA expects sponsors to proactively identify a full range of alternatives and prepare a sufficient evaluation to be able to draw a conclusion about what is “appropriate and reasonable.”
- The RPZ serves to enhance the safety of the public through protection of people and property on the ground. (AC 150/5300-13B)
- “The extended Runway Safety Area and Runway Object Free Area protect the most critical runway ends.” (AC 150/5300-13B)
- Per AC 150/5300-13B, land uses that are permissible in RPZ without further evaluation include the following, which may be applicable to the proposed project:
    - Airport service roads
    - Underground facilities that meet other design criteria (may be applicable to piping, vaults, and certain aspects of treatment in the expanded IWTP)
- FAA internal review - Regional Office (RO) and Airport District Office (ADO) staff , at their discretion, may consult with the National Airport Planning and Environmental Division (APP-400) when the following land uses would enter the limits of the RPZ (only elements relevant to the expanded IWTP are listed)

  - Buildings and structures
  - Vehicular parking facilities
  - Wastewater treatment facilities
  - Above ground utility infrastructure
- Prior to contacting APP-400, the RO and ADO staff must work with the airport sponsor to identify and document the full range of alternatives that could:
  - Avoid introducing the land use issue within the RPZ
  - Minimize the impact of the land use in the RPZ
  - Mitigate risk to the public, including people and property on the ground
- The description of the alternatives must include the following elements:
  - Sponsor's statement of the purpose and need of the proposed action
  - Identification of any other interested parties and proponents
  - Identification of all Federal, State, and local transportation agencies involved or interested in the issue
  - Analysis of (and issues affecting) sponsor control of the land within the RPZ
  - Summary of all alternatives considered, including the following categories, with narrative descriptions of each alternative provided with exhibits or figures:
    - Alternatives that preclude introducing the incompatible land use within the RPZ
    - Alternatives that minimize the impact of land use in the RPZ
    - Alternatives that mitigate risk to the public, including people and property on the ground within the RPZ
- Rough order of magnitude cost estimates associated with each alternative
- A practicability assessment based on the feasibility of the alternative in terms of cost, constructability, operational impacts and other factors

3. Alternatives Analysis

3.1 Purpose and Need of the Proposed Action

The existing IWTP is located on the south side of the airport, approximately 2,000 feet southwest of Runway 34C and consists of lagoons for temporary detention of stormwater and a treatment works to remove solids and fuel. The existing IWTP is not capable, however, of treating deicing chemicals.

In the existing IWTP, treated stormwater with higher concentrations of deicers is discharged to the sanitary sewer under an Industrial Waste Discharge (IWD) permit issued by the King County Industrial Waste Division (KCIW) to the Port. Treated stormwater with lower concentrations of deicers is discharged to Puget Sound through a National Pollutant Discharge Elimination System (NPDES) permit issued by the Washington Department of Ecology to the Port.

The purpose of the proposed expanded IWTP is to temporarily store and biologically treat applied stormwater runoff from the airport's Industrial Waste System (IWS) drainage areas during winter when deicers are applied at the gates and aircraft deicing areas in the IWS. The IWTP expansion is needed because, as described below in more detail, KCIW has imposed significant restrictions on the quantity of stormwater containing deicers that can be discharged to their sanitary sewer system.

The proposed expansion of the SEA IWTP consists of an integrated process for conveying, storing, and treating stormwater containing deicing chemicals prior to discharge of the treated industrial stormwater to either the sanitary sewer or the surface water [Puget Sound] under terms of the applicable KCIW and NPDES permits respectively.

Over the last ten years in successive permit cycles, KCIW has progressively reduced the daily amount of deicers that can be discharged to the sanitary sewer. The limiting parameter is the mass load of Biochemical Oxygen Demand (BOD) that can be discharged per day, which correlates to the amount of deicer. In the previous permit cycle, the permitted BOD allowed to be discharged to the sanitary sewer was reduced from 60,000 pounds BOD /day to 45,000 pounds BOD / day. Starting in July 2026, the allowable loading will be reduced to 10,000 lbs/day on a monthly average, a six-fold reduction from original permit requirements.

This reduction on allowable BOD (deicer) that can be discharged to the KCIW treatment facility will require the Port to design, construct, and operate its own facility to treat stormwater runoff containing deicers. The buildings, structures, equipment, and instrumentation needed to treat the deicer are described as the "expanded IWTP."

3.2 Summary of Expanded IWTP Elements Common to All Alternatives

3.2.1 System Components

The facilities required in an expanded IWTP to meet the IWD permit conditions include an assembly of various types of infrastructure including buildings, structures, equipment, instruments, and utilities. Key components of the expanded IWTP facilities include:

- Pump stations
- Hydraulic control structures and vaults
- Stormwater conveyance piping
- Stormwater storage structures
- Site stormwater runoff controls
- Oil-water separators
- Biological treatment structures and equipment
- Solids treatment equipment
- Control and utility building
- Control hardware
- Electrical hardware
- Utility lines (electric, telecommunications, water, sewer, natural gas)
- Access roads
- Road vehicle parking

3.2.2 Expanded IWTP Process Function

Stormwater containing deicers is routed to lagoons in the existing IWTP. Portions of that flow will be diverted to new storage structures. Stored stormwater with deicers is metered through oil-water separators, a biological treatment system called an Aerated Gravel Bed (AGB), and a solids filtration process. Following treatment the stormwater is routed back to the existing IWTP for discharge either to the sanitary sewer or the surface water.

In the preliminary planning stages, for the expanded IWTP, multiple technical alternatives were evaluated that would allow the Port and deicing operators to continue to deice aircraft in a way that meets FAA safety requirements while meeting both KCIW's IWD and NPDES permit conditions. Those measures included minimized glycol content in applied deicers through Blending-to-Temperature and use of pressurized air deicing, deicing in smaller areas to reduce the quantity of stormwater impacts, working with the local KCIW South Treatment Plant personnel to explore alternatives to minimize the impacts of deicers discharged by the Port to their treatment plant, and implementing various kinds of onsite treatment for deicers. Improvements in these source reduction measures are being implemented, which has the effect of reducing the footprint of the expanded IWTP. For stormwater that must be treated for deicers, the unique weather and airport operations conditions at SEA limit the types of deicer treatment technologies that can be utilized, including the impracticability of glycol recycling. Ultimately, it was determined that additional storage for deicer-impacted stormwater plus the use of onsite aerated gravel bed

biological treatment of deicers was the method that would provide the best way to meet the process, operations, and compliance needs for the facility. Given the selected process configuration and deicer treatment technology, the focus of this alternatives analysis was on determining potential and preferred sites for the expanded IWTP and minimizing the RPZ impacts for those sites, as described below.

3.2.3 Considerations for Siting Expanded IWTP

The following were considerations associated with siting the expanded IWTP that are common to all alternatives.

3.2.3.1 Area Requirements

A total area of 14 to 20 acres is required for the expanded IWTP facility components. For process performance and management reasons, most of those components must be located within a contiguous area. These include: excessive lag times from pumping water long distances that complicate process control and compliance decisions; performance and maintenance issues from deicers stored in long pipelines for extended periods; and increased number of failure points.

3.2.3.2 Component Heights

Some of the expanded IWTP infrastructure can be located below grade, some at grade, and some above local grade level. It is not possible to locate all components at or below grade level based on operational, maintenance, safety, and access needs. Placing structures below grade also generally increases the cost of construction significantly.

3.2.3.3 Integration with and Proximity to Existing IWTP

Figure 1 is a diagram showing how the expanded IWTP (labeled as “New IWTP Components) relates to the existing IWTP.

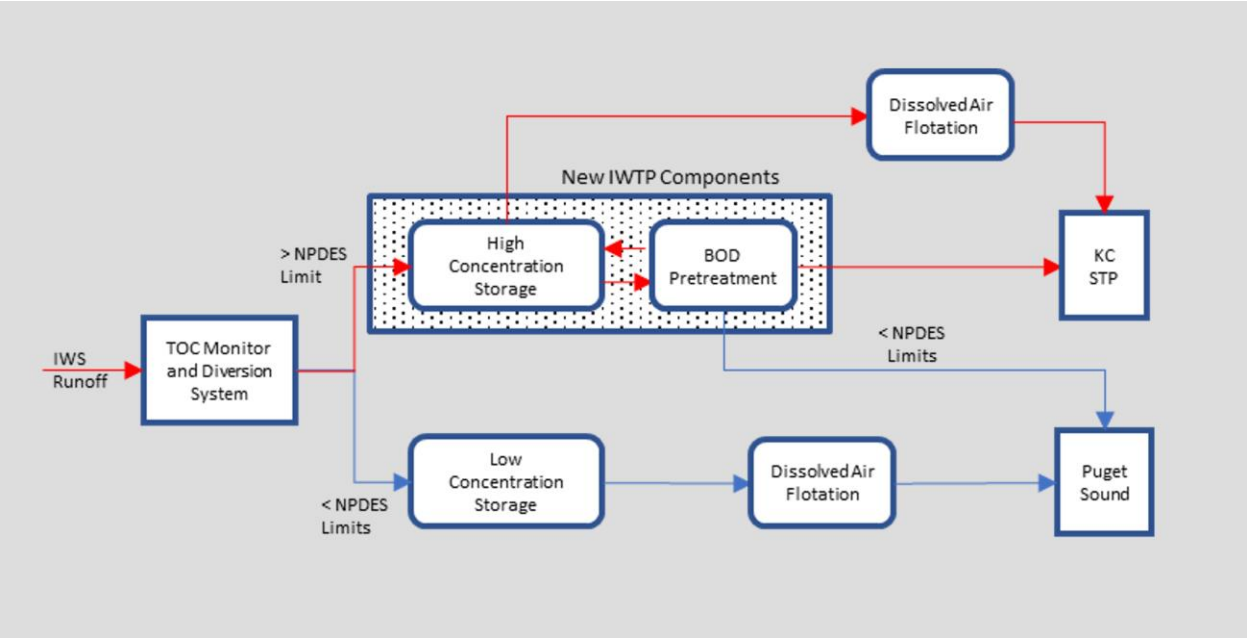


Figure 1. Process Flow Diagram for Integration of Existing and Expanded IWTP

Portions of the expanded IWTP need to be integrated into the existing IWTP, including:

- Diversion of influent flows at the upstream end of the existing IWTP
- Junction of treated flows from the expanded IWTP with the existing IWTP infrastructure used to discharge treated water to the sanitary sewer and surface water
- Integration of electrical system
- Integration of control system

Because of the linkages of the existing IWTP to the expanded IWTP components, it is important that the expanded IWTP components be located in relatively close proximity to the existing IWTP to allow sufficient process control and operations that achieve compliance with the stormwater discharge permits. In particular, stormwater, chemical supply, and air supply feeds to treatment need to be located in the same area as the treatment cells to achieve the required quantity and balance of influent flows that is necessary to get uniform treatment. If uniform treatment is not achieved, larger footprints for treatment units are needed to compensate. Separating system components among various sites also significantly increase the costs for piping, pumping, electrical, and control system components.

Each of the alternatives considered in this analysis requires the above components. One of the potential sites considered is within the Runway 34L Runway Protection Zones (RPZ). The alternatives analysis for this RPZ land use evaluation described below focused on identifying one or more sites that had the space and features to accommodate the expanded IWTP elements.

4. Alternatives that Preclude Introducing Incompatible Land Use within RPZ

The first category of alternatives evaluated by the Port for the expanded IWTP were those that do not require constructing the expanded IWTP in the RPZ.

For evaluating non-RPZ sites, the following characteristics of an expanded IWTP site were considered as minimum requirements to meet the expanded IWTP compliance, hydraulic, control, operations, and maintenance needs:

- Minimum of 14 acres of contiguous area
- Sites not occupied by current airport infrastructure and operations
- Sites not allocated to future airport development as depicted on Sheet 4 of SEA's interim Airport Layout Plan (ALP), conditionally approved by the FAA on December 3, 2018
- Sites outsides of runway safety areas, runway object free areas, runway obstacle free areas, taxiway safety areas, taxiway object free areas
- Sites compatible with imaginary surfaces and other airspace requirements
- Sites where construction of the expanded IWTP would not result in unacceptable airport operational impacts caused by the need to shut down runways, taxiways, or other movement areas for extended periods
- Sites where access, due to SIDA security constraints and other operational constraints due to low visibility and snow removal operations, would not significantly limit operation of the expanded IWTP for operations personnel, maintenance personnel, or non-Port third party personnel
- Sites within reasonable proximity to the existing IWTP to avoid unacceptable IWTP process impacts (e.g., hydraulic, process control, discharge compliance, maintenance issues)

The analysis of potentially applicable sites for the expanded IWTP outside of the RPZ included evaluating whether the sites with the above characteristics were available in the following areas:

- Areas adjacent to the existing IWTP
- Areas outside of the Air Operations Area (AOA) and within the SEA property boundaries or non-Port property listed as for sale
- Areas within the AOA that did not interfere with airport operations

4.1 Potential Siting of Expanded IWTP adjacent to the Existing IWTP Site

The existing IWTP (Figure 2) is located southwest of the Runway 34L threshold and southeast of Runway 34C threshold. It is bounded on the south by the airport perimeter road and South 188th Street. It is bounded on the north by general aviation facilities. The Lagoon 3 area is also bounded by the Runway 34C approach lighting and wetland areas. There is less than 4 acres of available space near the existing IWTP that is not in an RPZ. While some individual expanded IWTP components (pump stations, hydraulic structures, piping) can be located in this area adjacent to the existing IWTP, there is insufficient space for the main treatment components of an expanded

IWTP. As a result, constructing the expanded IWTP fully within or adjacent to the existing IWTP site is not feasible.

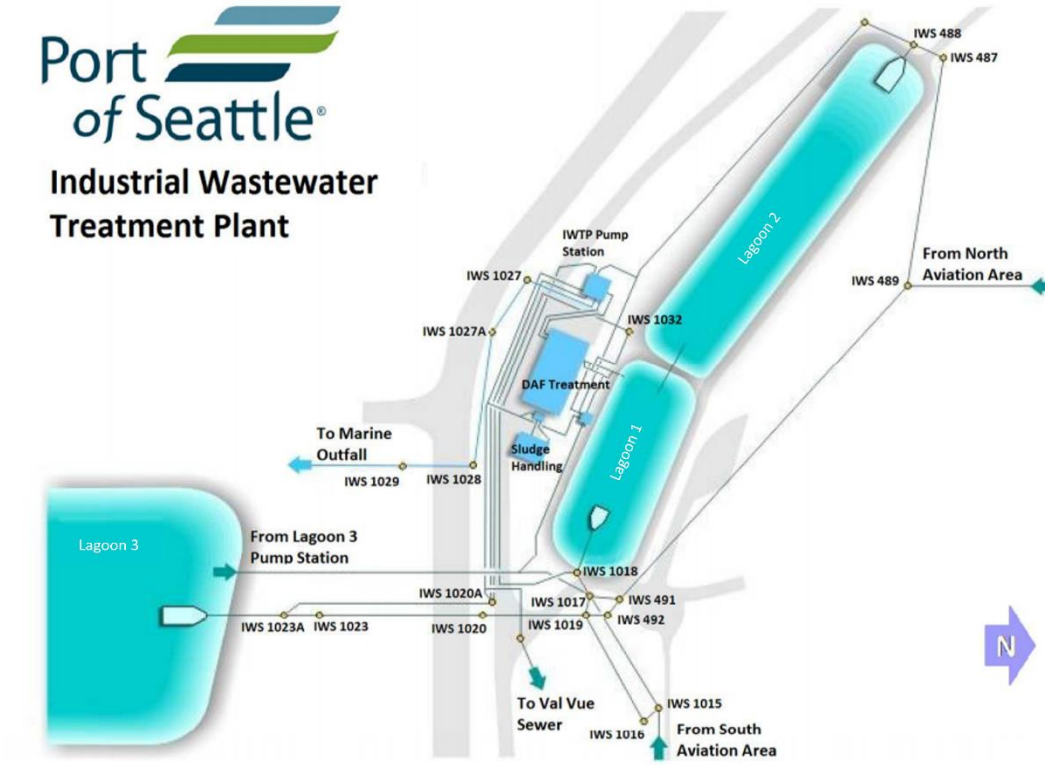


Figure 2. Existing IWTP

4.2 Areas Outside the AOA

There is no contiguous landside area within the SEA property boundaries on which the 14-acre expanded IWTP facility could be sited and breaking the expanded IWTP in smaller areas scattered throughout the landside areas of SEA is not feasible. Figure 3 shows properties owned by the Port south of South 188th Street that are within close proximity of the existing IWTP, represent approximately 14 acres, and are within the 34L RPZ.



Figure 3. Properties owned by Port within the Runway 34L RPZ

When evaluating property acquisition outside the 34L RPZ, the Port only considered properties for sale by willing sellers. Acquiring properties through eminent domain processes can take years and is not likely to meet the required permit schedule. Acquisition of nearby property or properties was evaluated for feasibility, despite the likely timeline of 3 to 4 years for the process, which would not meet the required permit compliance schedule.

The Port conducted a property search in January 2022 using an approximate 1-mile radius from the existing IWTP to evaluate potential candidate properties for acquisition to site the IWTP Expansion components. The results are summarized in Table 1 and Figure 4. None of the available properties for sale met the criteria for size or proximity to the existing IWTP. Several parcels identified were up to 5 acres in size, which is much less than the 14 acres needed and the closest of these sites was over 0.75 miles away. This distance would create operational challenges for the IWTP expansion if constructed. Furthermore, it may not even be feasible to find a viable route for the piping from the existing IWTP to these offsite properties through this urban area with existing utility and infrastructure conflicts.

Table 1. Summary of available properties for sale in proximity to SEA IWTP Building

Parcel number	Owner	Parcel address	Jurisdiction	Zip code	Size (acres)
3223049096	MARKERR PROPERTIES LLC	18017 DES MOINES MEMORIAL DR S	BURIEN	98148	4.04
3445000140	ECHO FOUR LLC	204TH ST S	SeaTac	98198	1.68
3445000141	PORT OF SEATTLE	N/A (adjacent to 20501 28TH AVE S)	SeaTac	98198	1.05
3445000155	PORT OF SEATTLE	20501 28TH AVE S	SeaTac	98198	0.97
2823049016	PORT OF SEATTLE	200TH ST S	SeaTac	98158	5.0

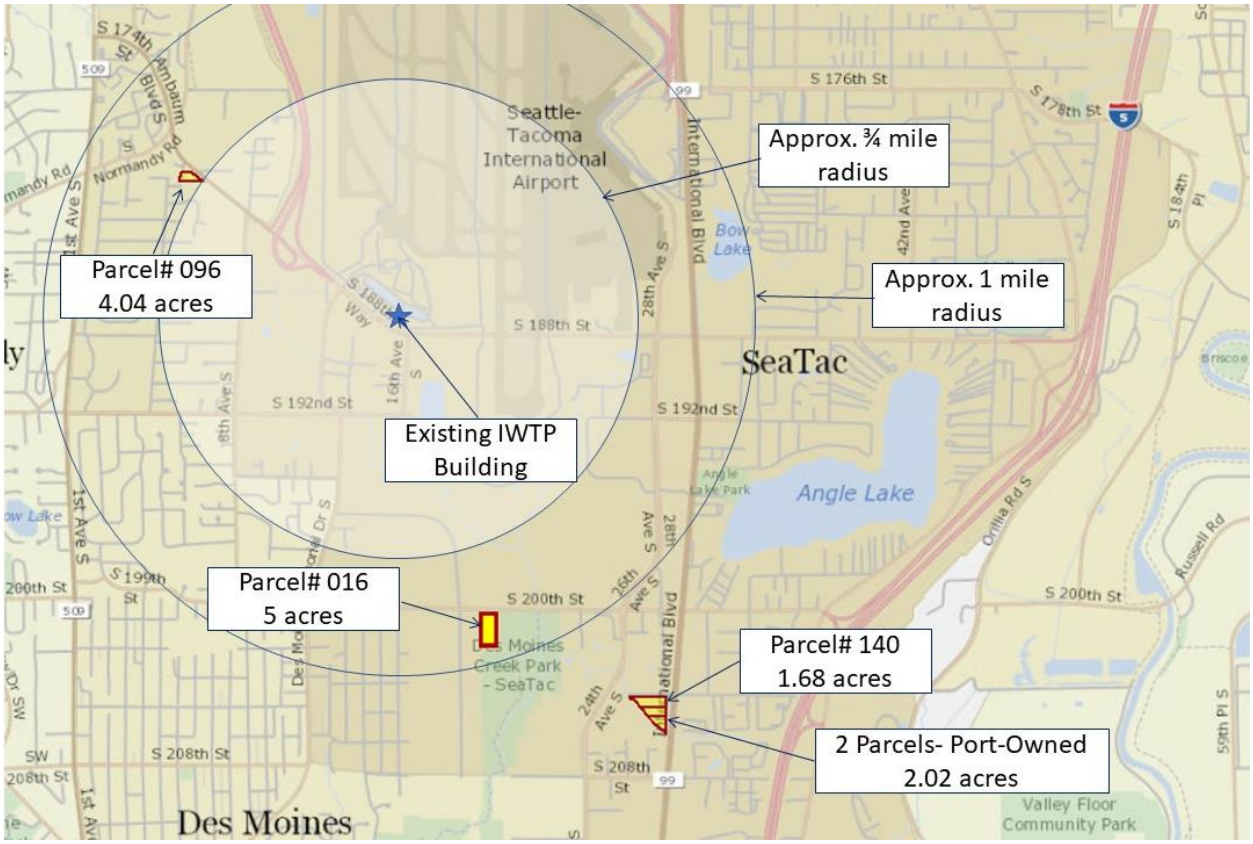


Figure 4. Available properties for sale in proximity to SEA IWTP Building

4.3 Areas within the AOA

The primary non-RPZ area that was considered that had potential available space with the AOA is an infield area bounded by Runway 34L, Taxiway J, Taxiway T, and Taxiway N (Figure 5). This area was given significant consideration and would need further review by the ADO, Air Traffic Control, and a Safety Risk Management Panel to gain approval. A conceptual siting layout is illustrated in Figure 6. While the area is potentially large enough to site the required expanded IWTP storage and treatment without impacting safety areas and object free areas, there are highly significant drawbacks to this infield site, including:

- The infield site is approximately 1.5 miles from the existing IWTP. Because of the need to connect the existing and expanded IWTP elements, siting the operation in the infield creates the following IWTP operational challenges:
    - Potential for non-uniform treatment performance because of challenges in syncing collection, storage, treatment, and discharge operations.
    - Water containing deicers would potentially sit in the pipelines between the existing IWTP and expanded IWTP for long periods of time without being able to be easily drained, creating issues with in-pipe degradation, pH reductions, and solids settling.
    - IWTP operators would need to drive between the two facilities across the airfield during a given day, crossing three taxiways, creating significant inefficiencies in their ability to execute their work (Figure 5).
    - Access to the site by IWTP operators as well as third party vendor personnel would cause additional traffic within the AOA which would need to be managed by the control tower.
- Site access would be restricted during low visibility weather events and during snow events. While the expanded IWTP can operate for short periods without operators present on the site, access by crews is needed for sampling, site observations, troubleshooting, nutrient supply, short-term maintenance, and preventative maintenance. Since the expanded IWTP must be functional during deicing events, this limitation could obstruct appropriate operation and management of the IWTP in this location.
- Construction at this site risks potential impacts to NAV AIDS, which would need to be evaluated further to determine feasibility.
- High height cranes and earthwork equipment are required for some construction, triggering extensive temporary closures of the adjacent runway.
- The concept for the expanded IWTP treatment requires numerous truck loads of aggregate from outside of the airport plus the likely need to haul excavated soils from the site. It is expected that significant truck traffic over a 6- to 8-month period would result in the need to shutdown taxiways for extensive periods of time.
- This area has a significant grade change. To accommodate the construction of the IWTP expansion, a large volume of fill would need to be imported and grading to meet FAA design standards may need to occur within the RW34L-16R OFA and RSA, as well as the adjoining taxiways' OFA and SA.

Given the already constricted flight operations at the airport, it is unlikely that closures of taxiways and runways for large portions of the airfield for 8 to 12 months during construction would be

compatible with airport operational needs. The operational challenges of separating IWTP operations by 1.5 miles would also create significant IWTP operational inefficiencies, compliance risks, and additional maintenance over time. As a result, this infield site was considered unlikely to be viable.

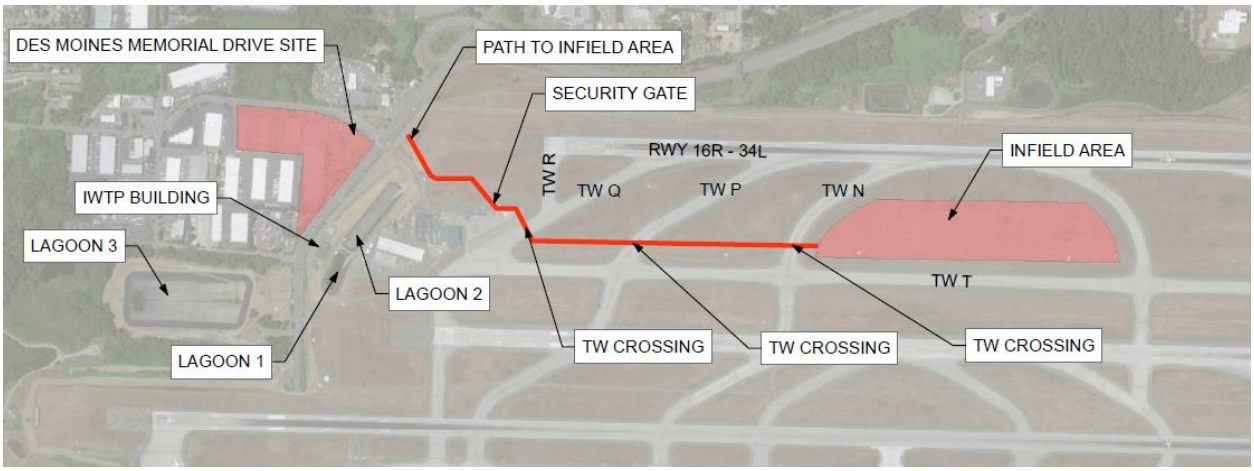


Figure 5. Potential Infield Area Location for Expanded IWTP and Access Route

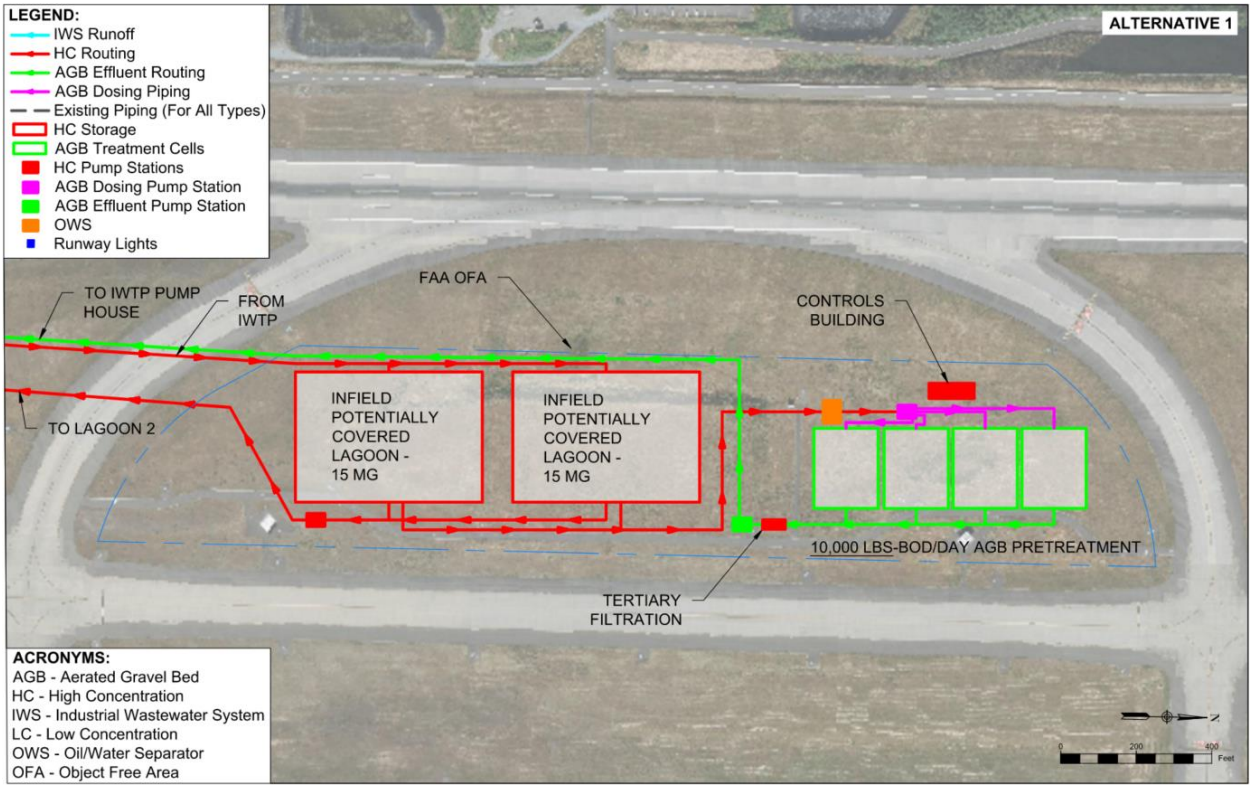


Figure 6. Alternative 1-- Potential Siting within the Infield Area Avoiding RPZ Impacts

Based on the siting analysis described above, no airport areas outside of the Runway 34L RPZ were found to be large enough to meet the expanded IWTP acreage requirement, at a close enough proximity to the existing IWTP to avoid substantial negative impacts to the IWTP performance and compliance, and at location that would avoid substantial airport operational impacts during construction and operation of the IWTP.

5. Alternatives That Minimize the Impact of the Land Use Within the RPZ

The second category of expanded IWTP siting alternatives considered was alternatives where some elements of the expanded IWTP would be introduced to the RPZ, but impacts from those features would be minimized.

Evaluating alternatives for minimizing impacts within the RPZ included the following considerations:

- Minimizing the extent of above grade infrastructure within the RPZ
- Minimizing the need for extensive presence within the RPZ from IWTP operators, maintenance staff and managers and well as minimizing the need to access components within the RPZ from outside personnel.

Certain expanded IWTP features can be located underground or at grade, including:

- Conveyance piping,
- Certain stormwater, valve, and instrumentation vaults,
- A buried storage tank, and
- An aerated gravel bed treatment system which can be constructed at or just slightly above grade.

In addition, alternatives were considered that would potentially reduce or eliminate the need for above ground storage structures within the RPZ. The expanded IWTP requires 30 million gallons of stormwater storage capacity. That storage can be provided using above ground storage tanks, below ground storage tanks, or lined lagoons. As described in in Alternative 2 and Alternative 3, the use of concrete above ground storage tanks has many benefits, but also includes certain risks within the RPZ.

5.1 Summary Comparison of Storage Options

The options for the type of storage structure suitable to a given situation are dependent upon the characteristics of the structures themselves and of the site. Above ground storage tanks are clearly the best option for the expanded IWTP because of the following:

- Smallest footprint of the three types, which is essential on a space constrained site
- Minimal impacts from the high local groundwater table
- Eliminates the maintenance and access issues associated with lagoons and underground storage tanks
- Eliminates need for additional pump station
- Most effective means of managing odors

Table 2 summarizes the opportunities and challenges with the various stormwater storage alternatives as applied to this project.

Table 2. Comparison of Stormwater Storage Opportunities and Challenges

Item	Above Ground Storage Tanks	At Grade or Slightly Above Grade Lagoons	Underground Storage
Relative Cost	Cost dependent upon whether completely above ground or partially buried	Lowest cost, but cover to minimize hazardous wildlife attractiveness raises costs	1.5 to 2 times higher cost than above ground storage
Footprint	Smallest footprint	Largest footprint	Because of limitations in the maximum depth, footprint is 3 to 5 times larger than for above ground storage tanks.
Groundwater	Minimal impacts on tank stability and needed foundation.	Drainage system under liner required to prevent floating and damage.	Continuous pumping of groundwater likely needed to prevent floating the tank from hydrostatic pressure
Supporting Infrastructure	Manage flows out by gravity	Likely requires a floating cover and another pump station	Requires adding another pump station.
Constructability	Most straightforward construction	Significant earthwork. If existing lagoons modified, construction limits ongoing IWTP operations.	Significant earthwork and larger setbacks or shoring needed to keep soil stabilized.
Operations	Easiest to achieve mixing.	Lacks compartmentalization reducing flexibility in operations	Similar to above ground tanks.
Maintenance	Least likely to have maintenance issues	Access is inhibited by presence of floating covers	More difficult to clean and remove solids and fuel than other options. Increased safety requirements such as confined space entry
Odors	Easiest to control odors from single vent per tank.	Greatest risk of odors and other than a cover little ability to easily control odors.	Likely need to manage odors from multiple vents.

5.2 Summary of Alternative 2 Partitioning Lagoon 3 for Storage

Despite the advantages of above ground storage tanks, the Port did explore an alternative (Alternative 2) through partitioning of an existing open 76 million gallon lined stormwater storage pond (Lagoon 3) within the existing IWTP footprint. In this scenario, Alternative 2, the existing lagoon would be split into two sections, one for clean stormwater and one for stormwater containing higher concentrations of deicers. The partitioning would require a full width wall or berm to be constructed in the existing lagoon. However, implementing Alternative 2 has some potentially significant obstacles, including:

- The ability to construct a partition wall of sufficient structural integrity will depend upon local geotechnical characteristics and may not be feasible. Additional geotechnical evaluation is necessary before a determination can be made. An earthen berm has fewer geotechnical challenges but inherently occupies more of the available volume than a wall.
- The design must consider the storage volume lost by the partitioning structure itself. For example, a berm would occupy a large volume of space within Lagoon 3, and the required detention capacity would not be met within the existing footprint.
- Presence of groundwater near the base of the lagoon that could impact structure stability.
- The need to construct the wall without interfering with the approach light lane for Runway 34C.
- Long-term presence of odors from open water sources of stormwater containing deicers.
- Excessive buildup of algae.
- Reduction in flexibility for other potential uses of the lagoon including water reuse and emergency use for stormwater storage during extreme events.
- Highly significant challenges in how to construct with water in the lagoon while the lagoon needs to be used on an ongoing basis for stormwater attenuation and treatment.
- This work would occur within the Runway 34C RPZ.

These potential obstacles to using Lagoon 3 and reducing the need for stormwater storage in the RPZ were evaluated in detail to determine the most feasible components for Alternative 2. To avoid the geotechnical concerns of a partition wall, as well as other potential conflicts with existing utilities, the use of an earthen berm is proposed for Alternative 2. Because the berm occupies significant volume in the existing lagoon footprint, a 5 million gallon buried storage tank is proposed at the 34L RPZ site adjacent to the proposed AGB cells. This buried storage tank provides a number of additional benefits beyond achieving the required storage volume, including:

- If used preferentially for high concentration storage, it reduces the risks of odor and algae build up in the high concentration compartment of Lagoon 3.
- Improves AGB treatment operations by providing a volume of high concentration wastewater nearby for immediate processing.
- Creates better options to manage airport stormwater during construction of Lagoon 3 partitioning, reducing risks of NPDES permit noncompliance.

Figure 7 shows Alternative 2. The key features in Alternative 2 include the following elements within the RPZ:

- Earthen berm to partition Lagoon 3 into two compartments
- One buried 5 million-gallon stormwater storage tank (red circle)
- Four aerated gravel bed treatment cells (green rectangles)
- Solids removal treatment units
- Oil/water separator
- Concrete hydraulic structures, including those for mixing, hydraulic control, valve vaults, flow control, instrumentation

- Site stormwater control basins and/or structures
- Utility structures
- Control panels
- Control and utility building
- Below grade piping
- Above grade piping
- Access roads and parking
- Fire suppression system

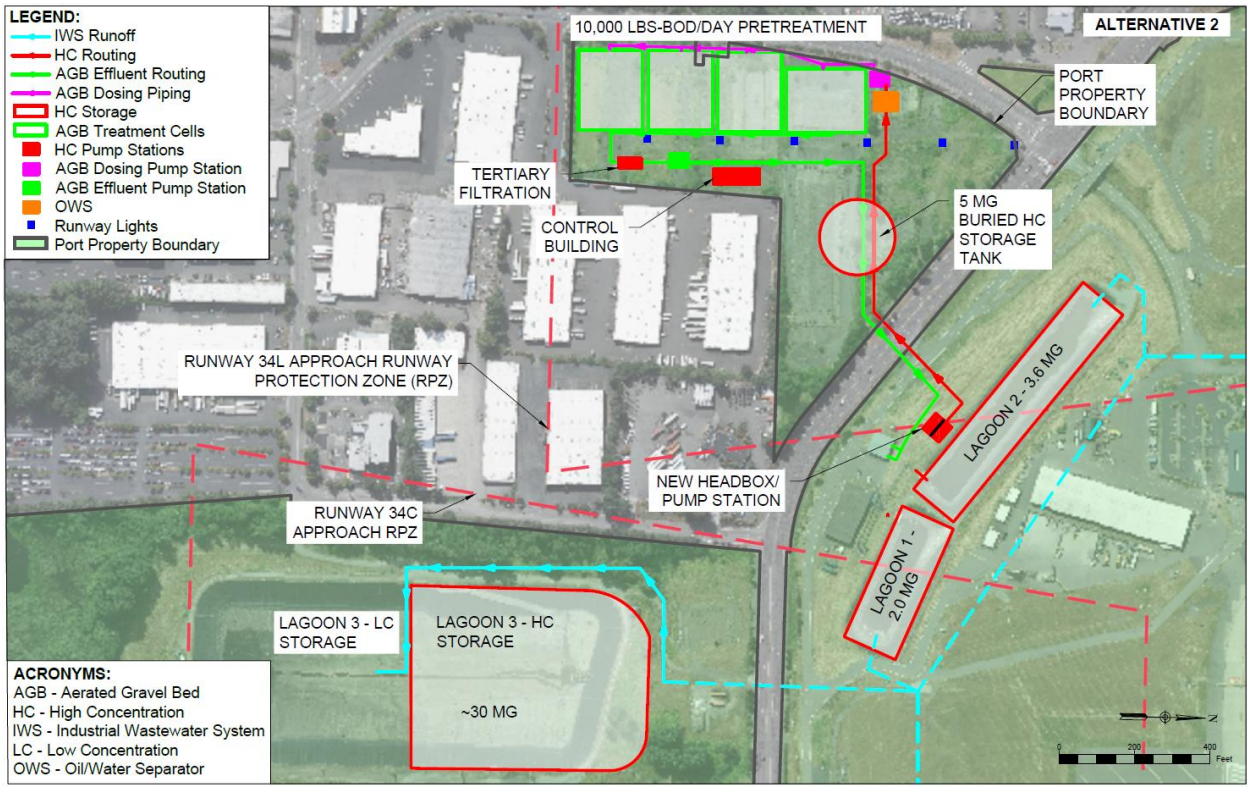


Figure 7. Alternative 2 – Potential Siting with Minimal RPZ Impacts

Figure 8 illustrates an elevation view of the expanded IWTP site within the Runway 34L RPZ to represent the buried storage tank and control building for Alternative 2. This view shows these new elements in relationship to the existing ground elevation, runway approach lights, and runway approach surface. Other below ground and “at grade” structures are not shown for clarity.

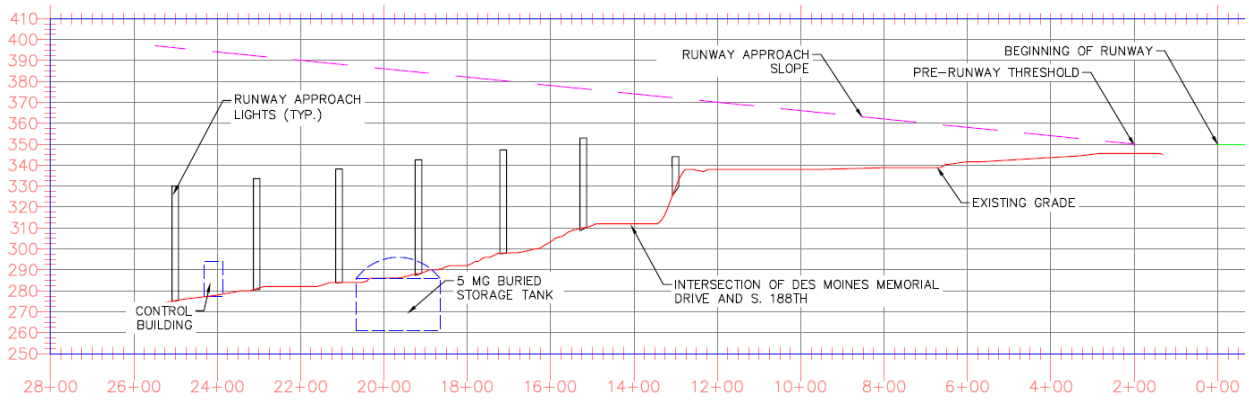


Figure 8. Elevation view of proposed buried storage tank and control building in the Runway 34L RPZ area

Alternative 2 provides the most acceptable means of meeting the needs of the expanded IWTP, while minimizing the risks in the RPZ. Features of the site and analysis of airport sponsor control of the land within the RPZ are discussed in Section 7. The IWTP expansion would be an airport-operated, non-public facility and would not create a place of public assembly or become a nuisance or hazard to people or property on the ground.

Specific steps can be taken with Alternative 2 to mitigate the risk to SEA property, staff and vendors on the ground, including:

- Maintaining controlled access to the property with appropriate fencing and gate controls to prevent public access.
- Increasing the extent that structures can be placed below or at grade, including hydraulic structures, aerated gravel bed cells, and oil/water separators without creating a convoluted operations or maintenance process for the expanded IWTP
- Limiting the amount of time IWTP operator spend at the site by maximizing the ability to perform day-to-day system controls functions from the existing IWTP (outside the RPZ)
- Adding noise insulation to the controls building to help protect the facility operators from aircraft noise.

6. Alternatives that Mitigate Risk to the Public, including People and Properties on the Ground

6.1 Summary of Alternative 3 using the RPZ Site

The final alternative category considered for siting the expanded IWTP within the Runway 34L RPZ was alternatives that involved introducing desirable land uses that may be viewed as incompatible within the RPZ while taking steps to mitigate the risk to the public, including people and properties on the ground.

Figure 9 shows Alternative 3 with key features which include the following elements within the RPZ:

- Three 10 million-gallon stormwater storage tanks (red circles)
- Four aerated gravel bed treatment cells (green rectangles)
- Solids removal treatment units
- Oil/water separator
- Concrete hydraulic structures, including those for mixing, hydraulic control, valve vaults, flow control, instrumentation
- Site stormwater control basins and/or structures
- Utility structures
- Control panels
- Control and utility building
- Below grade piping
- Above grade piping
- Access roads and parking
- Fire suppression system

From many standpoints, Alternative 3 provides the most desirable means of meeting the needs of the expanded IWTP, given the operational benefits and minimized impacts to airport operations. Yet, Alternative 3 is not the preferred alternative due to the presence of the three above ground storage tanks which present a potential risk in the RPZ.

The IWTP expansion would be an airport-operated, non-public facility and would not create a place of public assembly or become a nuisance or hazard to people or property on the ground.

Specific steps can be taken with Alternative 3 to mitigate the risk to SEA property, staff and vendors on the ground, including:

- Maintaining controlled access to the property with appropriate fencing and gate controls to prevent public access.
- Increasing the extent that structures can be placed below or at grade, including hydraulic structures, aerated gravel bed cells, and oil/water separators without creating a convoluted operations or maintenance process for the expanded IWTP

- Limiting the amount of time IWTP operator spend at the site by maximizing the ability to perform day-to-day system controls functions from the existing IWTP (outside the RPZ)
- Adding obstruction lights to indicate the presence of aboveground objects within the RPZ
- Adding noise insulation to the controls building to help protect the facility operators from aircraft noise.

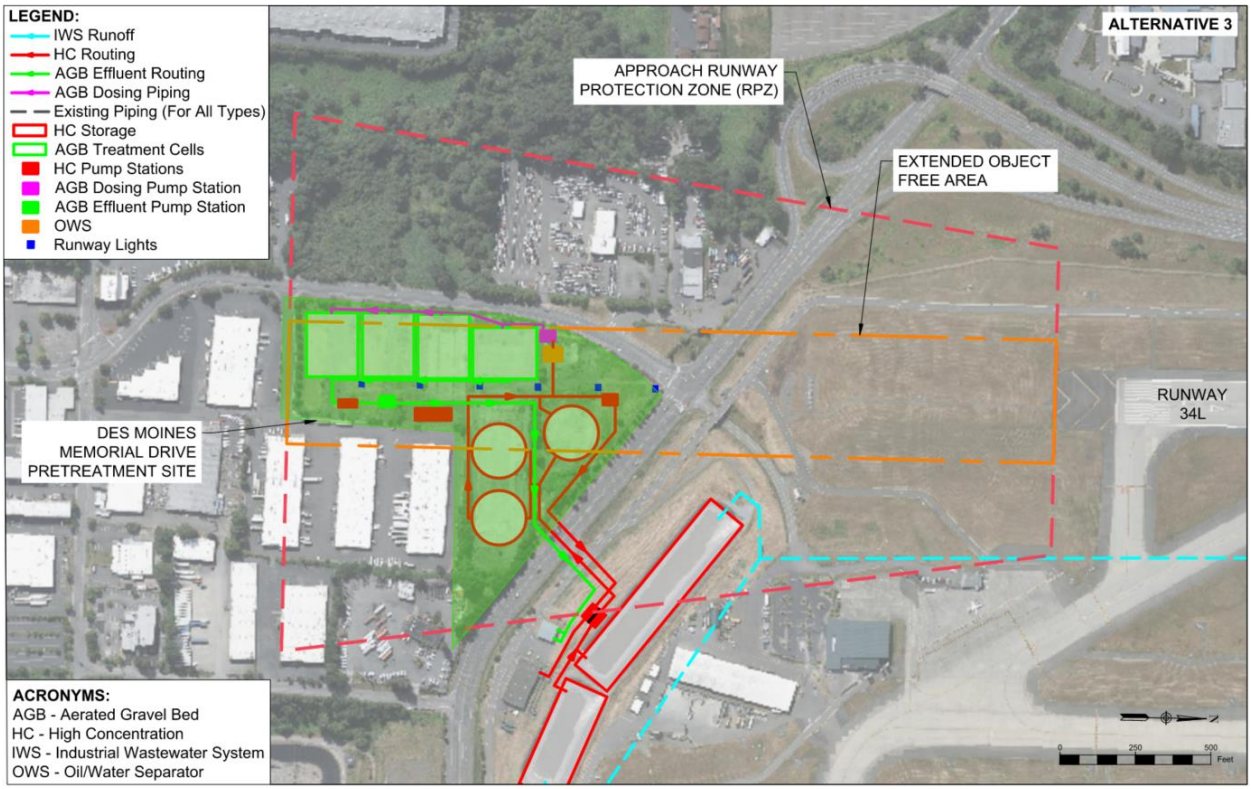


Figure 9. Alternative 3—Potential Siting of Expanded IWTP in Runway 34L RPZ with Mitigation Measures

As shown in Figure 10, the grade at the portion of the Runway 34L RPZ site where the expanded IWTP would be located ranges from 45 to 70 feet below the runway elevation. No structures in an expanded IWTP will reach the runway grade or the height of the runway approach lights. The FAA approach lighting for Runway 34L bisects the RPZ and will bisect the components of the expanded IWTP. Sufficient setback with no IWTP components on either side of the lights and an access road dedicated to the light lane will be designed and provided to FAA for review.

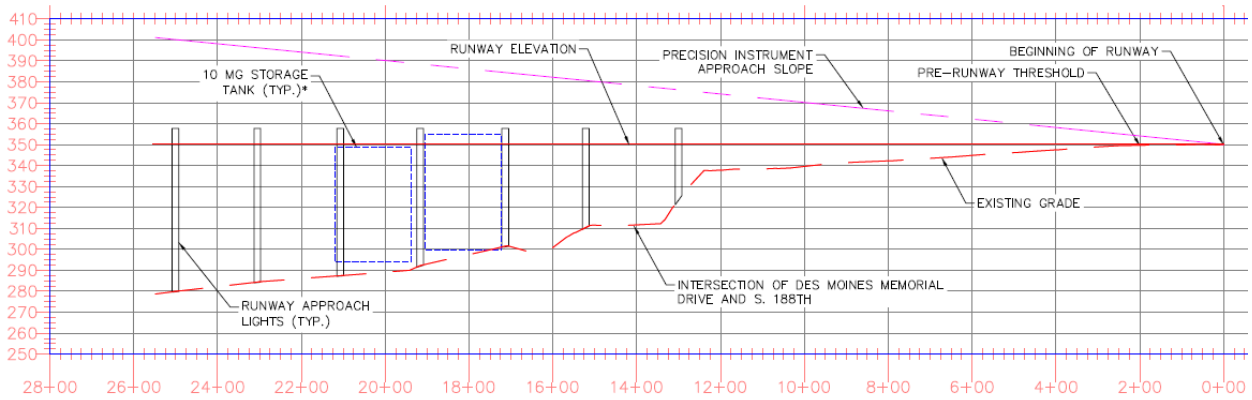


Figure 10. Elevation view of proposed above ground storage tanks in the Runway 34L RPZ area

7. Analysis of Airport Sponsor Control of Land Within the RPZ

The site under consideration is within the Runway 34L RPZ and is located east of Des Moines Memorial Drive and south of South 188th Street (Figure 7). The figure shows the property boundaries for the potential expanded IWTP site within the RPZ (edges of green shaded area). This entire expanded IWTP site is within the property boundaries of the Seattle-Tacoma International Airport. The Port acquired the subject property to facilitate the construction of Runway 34L-16R with financial assistance from two FAA grants-- AIP# 3-53-0062-63 in 1999 and AIP# 3-53-0062-096 in 2005. The existing buildings were demolished in order to construct the necessary runway approach lighting.

As seen in Figure 7, the 14-acre expanded IWTP would be almost completely within the approach RPZ and would occupy 18% of the approach RPZ area. Approximately 4 acres of the expanded IWTP would be located within the departure RPZ and would occupy 13% of that RPZ. The facilities would be located on the far end of the RPZ, south of South 188th Street and as such are not located within the core portion of the airfield. The proposed area is also outside of the Runway Safety Area and Obstacle Free Zone.

As described in the alternatives, the Port will maintain controlled access to the property with appropriate fencing and gate controls to prevent public access and allow authorized access only.

8. Practicability Assessment and Comparison of Alternatives

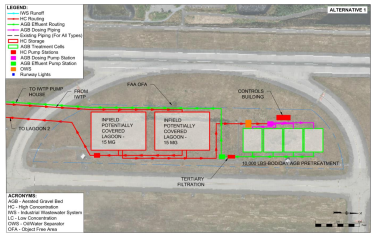
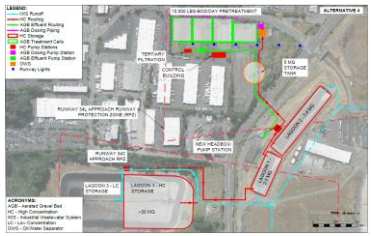
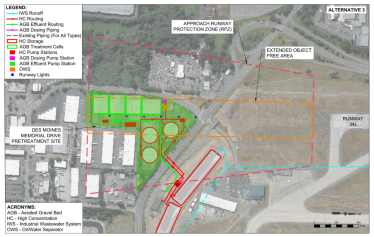
This section provides a practicability assessment based on the feasibility of the alternatives in terms of cost, constructability, operational impacts and other factors. Factors considered in comparing the alternatives include the following and are summarized in Table 4:

- Rough Order of Magnitude Costs for Alternatives (Table 3)
- Siting and Proximity Impacts
- Constructability and Construction Impacts
- Airport Operational Impacts
- IWTP Operations and Maintenance Impacts
- Environmental Compliance

Table 3. Rough order of magnitude costs for each of the alternatives.

Cost Item	Alternative 1—Avoid RPZ Impacts	Alternative 2—Minimize RPZ Impacts	Alternative 3—Mitigate RPZ Impacts
Diversion Headbox and Transfer Pump Station	$800,000	$800,000	$800,000
Aerated Gravel Bed System Components	$16,100,000	$16,100,000	$16,100,000
Diversion Piping and Pumping Costs	$3,600,000	$2,200,000	$1,500,000
Aboveground Storage Tanks	N/A	$6,000,000	$27,400,000
Infield Lagoon Storage	$18,000,000	N/A	N/A
Lagoon Storage Cover	$2,500,000	$2,500,000	N/A
Lagoon 3 - Wall Partition	N/A	$10,000,000	N/A
Lagoon 3 - New and Retrofitted Inlets	N/A	$2,500,000	N/A
Lagoon 3 - New and Retrofitted Liner, Underdrain, Netting	N/A	$6,000,000	N/A
Lagoon 3 - Maintaining Operations during Construction	N/A	$1,000,000	N/A
Contractor/Engineering/Owner costs	$20,500,000	$23,550,000	$22,900,000
Total	**$62,000,000**	**$71,000,000**	**$69,000,000**

Table 4. Comparison of Practicability of Alternatives

Practicability Considerations	Alternative 1 Construction Outside of RPZ to Avoid Impacts on RPZ	Alternative 2 Partial Construction within Runway 34L RPZ that Minimizes Impacts on RPZ Land Uses	Alternative 3 Construction within Runway 34L RPZs with Mitigation of Impacts	Conclusion
				
Rough Order of Magnitude Costs	$62,000,000	$71,000,000	$69,000,000	ROM costs are roughly equivalent, +/- 15% difference.
Available Site Area	Existing IWTP has insufficient area Runway 34L infield area only site with sufficient acreage	RPZ site has required acreage	RPZ site has required acreage	All three alternatives have sufficient acreage at the airport for the expanded IWTP.
Proximity to Existing IWTP	1.5 miles from existing IWTP	Adjacent to existing IWTP	Adjacent to existing IWTP	Alternative 3 is closest available site to existing IWTP. Alternative 1 creates multiple access, operations, and process complications.
Constructability	Earthwork over 6 to 12 months in Runway 34L infield and multiple borings under taxiways Cranes and excavators needed, causing extensive movement area shutdowns and operations on live surface (taxiways) to reach construction site	Adding a buried storage tank in the RPZ creates better options to manage airport stormwater during construction of Lagoon 3 partitioning Construction staging and phasing to be developed to not impact light lane with a Construction Safety and Phasing Plan to minimize risk to people in RPZ during construction	Construction staging and phasing to be developed to not impact light lane with safety plan to minimize risk to people in RPZ during construction	Constructing Alternative 1 has significant constructability impacts that affect airport operations and capacity. Alternative 3 has fewest constructability risks.

Practicability Considerations	Alternative 1 Construction Outside of RPZ to Avoid Impacts on RPZ	Alternative 2 Partial Construction within Runway 34L RPZ that Minimizes Impacts on RPZ Land Uses	Alternative 3 Construction within Runway 34L RPZs with Mitigation of Impacts	Conclusion
Airport Operations Impacts	Runway and/or taxiway shutdowns needed during construction and potentially during future maintenance for infield area site Cannot enter site during low visibility and snow conditions	The expanded IWTP is outside of the Runway Safety Area and Obstacle Free Zone, and no structures would reach the runway end elevation or the height of the runway approach lights Once constructed, operation and maintenance of the expanded IWTP can be performed independently of airport operations Access and clearance for Runway 34L light lane will be provided	The expanded IWTP is outside of the Runway Safety Area and Obstacle Free Zone, and no structures would reach the runway end elevation or the height of the runway approach lights Once constructed, operation and maintenance of the expanded IWTP can be performed independently of airport operations Access and clearance for Runway 34L light lane will be provided	Alternative 2 and 3 minimize impacts to airport operations. Construction and operation of Alternative 1 creates airport operational issues during construction and long-term facility operation that are challenging to mitigate. Alternative 3 creates significant above ground structures within the RPZ, despite mitigation in their design
IWTP Operations and Maintenance Impacts	Hydraulic/timing issues created by distance from existing IWTP Low pH, solids issues from water held in long pipeline All outside maintenance would need to cross taxiways	Having storage, treatment, and support components in one contiguous area provides most effective and efficient IWTP operation Additional storage is provided at Lagoon 3.	Having storage, treatment, and support components in one contiguous area provides most effective and efficient IWTP operations	Alternative 3 siting is the most advantageous configuration for IWTP operations and maintenance.
Environmental Compliance Impacts	Distance from existing IWTP could create compliance issues because of timing issues with monitoring and discharge and the potential for creating pH issues	Adding a storage tank in the RPZ in addition to a split Lagoon 3 provides better and real-time ability by operators to control discharges to surface water and sanitary sewer, minimizing environmental permits compliance risk	Operators will have direct and real-time ability to control discharges to surface water and sanitary sewer, minimizing compliance risk	Long-term, Alternative 3 siting provides the least level of risk of non-compliance with environmental permits.
Potential Impacts to Public, including People and Property on the Ground	Similar to existing operations, public access would be restricted Port staff and third party vendors would need to access site for periodic operations and maintenance tasks, but full-time presence on-site is not needed	Similar to existing operations, public access would be restricted Port staff and third party vendors would need to access site for periodic operations and maintenance tasks, but full-time presence on-site is not needed	Similar to existing operations, public access would be restricted Port staff and third party vendors would need to access site for periodic operations and maintenance tasks, but full-time presence on-site is not needed	Alternative 2 has same level of minimal additional risk as other alternatives, similar to existing operations.

9. Summary of Findings

The Port has evaluated both technical and siting alternative for the expanded IWTP project required for compliance with changes to the Port's Industrial Waste Discharge permit from King County. All siting options have similar technical components, but the siting alternatives have very different impacts on airport operations, construction requirements, environmental compliance, and cost. Although the Port sees significant advantages to Alternative 3, the Port is promoting Alternative 2 as its preferred alternative due to the minimized risks within the RPZ. The preferred alternative for locating parts of the expanded IWTP components within the departure and approach RPZ areas of Runway 34L and Runway 34C. While the preferred alternative would inhabit a portion of the RPZ, it is in the Port's opinion that this is the most appropriate solution for the following reasons: 1) this alternative does not increase risks to the public, create a place for public assembly, or create public buildings, 2) it has the least impact to IWS operations and aircraft operations during construction, 3) it has no impact to aircraft operations post construction (all structures outside of RSA, OFZ, and below runway elevation), and 4) it poses a low environmental compliance risk for the Port.

10. Next Steps

The Port is requesting the FAA review this alternatives analysis and indicate whether it meets the requirements identified in AC 150/5190-4B. Due to the Port's coordination with FAA while conducting this analysis and developing this memorandum, the Port believes the analysis will be acceptable to FAA. If FAA agrees the alternatives analysis is acceptable, the Port will prepare a recommendation for an Airport Layout Plan change and, if necessary, an airspace determination. If FAA determines the alternatives analysis is insufficient, FAA will provide feedback and guidance to the Port.

Additional considerations to be coordinated with FAA, include:

- Reflectivity / glare minimization
- Hazardous Wildlife Attractant minimization
- Avoiding interference with and impacts to FAA managed utilities and lighting

The Port will coordinate with FAA at the appropriate times during the project development, starting with the conceptual design phase in 2022.

Attachment E

AGB Background Information

AGB Background Information

Treatment technologies for stormwater containing deicers are a unique subcategory of the broader spectrum of wastewater and stormwater treatment technologies. The aviation industry recognized the need to document the considerations for selection and implementation of deicer treatment technologies through funding of deicer treatment research under the Airport Cooperative Research Program (ACRP). ACRP is a branch of the Transportation Research Board (TRB), which itself is part of the National Academies. ACRP published *Guidance for Treatment of Stormwater Containing Deicers* in 2013 to provide guidance on applicable deicer treatment technologies and their implementation at airports.[1] In 2023, ACRP will publish an update to that guidebook. The updated guidebook will include several elements providing detailed information on Aerated Gravel Bed (AGB) treatment, including:

- "Fact Sheet" describing the AGB technology functionality, applications, selection and performance criteria, and advantages/disadvantages.
- Case study summary of an AGB implemented at the Buffalo-Niagara Airport in 2009.
- Case study summary of a confidential airport that implemented an AGB system in 2022.

These draft documents are attached for your consideration in support of the SEA Engineering Report. These are considered pre-publication drafts and not for distribution beyond the scope of this project. Notification of the full published document can be provided after publication.

The above referenced documents describe the AGB technology, where it has been applied, and available information on performance. These documents were used, in part, in the preliminary design of the SEA AGB system. It is essential to understand that each AGB is designed to meet the unique needs of the individual airport sites. Unlike POTW discharges, there is no uniform treatment technology based national effluent limits for deicer discharges. As a result, each AGB system has its own unique BOD_5 mass load capacity, range of influent BOD_5 concentrations, flow rate range, percent BOD_5 removal, and acreage based on the characteristics of the stormwater to be treated, the permitted effluent limits, the local climate, and the extent of monitoring and automation in the system.

In instances where the AGBs have been specifically designed to meet low NPDES permit limits for BOD_5, COD, TOC, propylene glycol, and/or TSS, the AGB systems have shown the ability to produce effluent with BOD_5 concentrations consistently less than 50 mg/L, glycol concentrations less than 10 mg/L and TSS concentrations less than 20 mg/L. The AGB system also consistently

[1] National Academies of Sciences, Engineering, and Medicine 2013. *Guidance for Treatment of Airport Stormwater Containing Deicers*. Washington, DC: The National Academies Press.

remove 85% to 95% of the influent BOD_5 mass load. Because of variables unique to deicing, including highly variable flow rates, pollutant concentrations, temperatures, and seasonal startup status, the proposed SEA IWTP expansion system includes measures to monitor effluent and return the flows to storage should treated effluent concentrations exceed permitted levels. It is essential to understand that the capabilities of the proposed system are not only based on the capacities for treatment and anticipated treatment performance, but the flow management options that allow the treated effluent to be returned to storage on a temporary basis.

Aerated Gravel Beds

1. Treatment Technology Description

Process Description

The aerated gravel bed is a hybrid system that employs facets of engineered wetlands and aerated lagoons. The system is biological in nature and relies on aerobic bacteria to degrade glycols and other deicer compounds, including pavement deicers. From a wastewater treatment perspective, the system is a lightly loaded, aerobic, submerged, attached growth system. The main components of the system are shown in Figure 1.

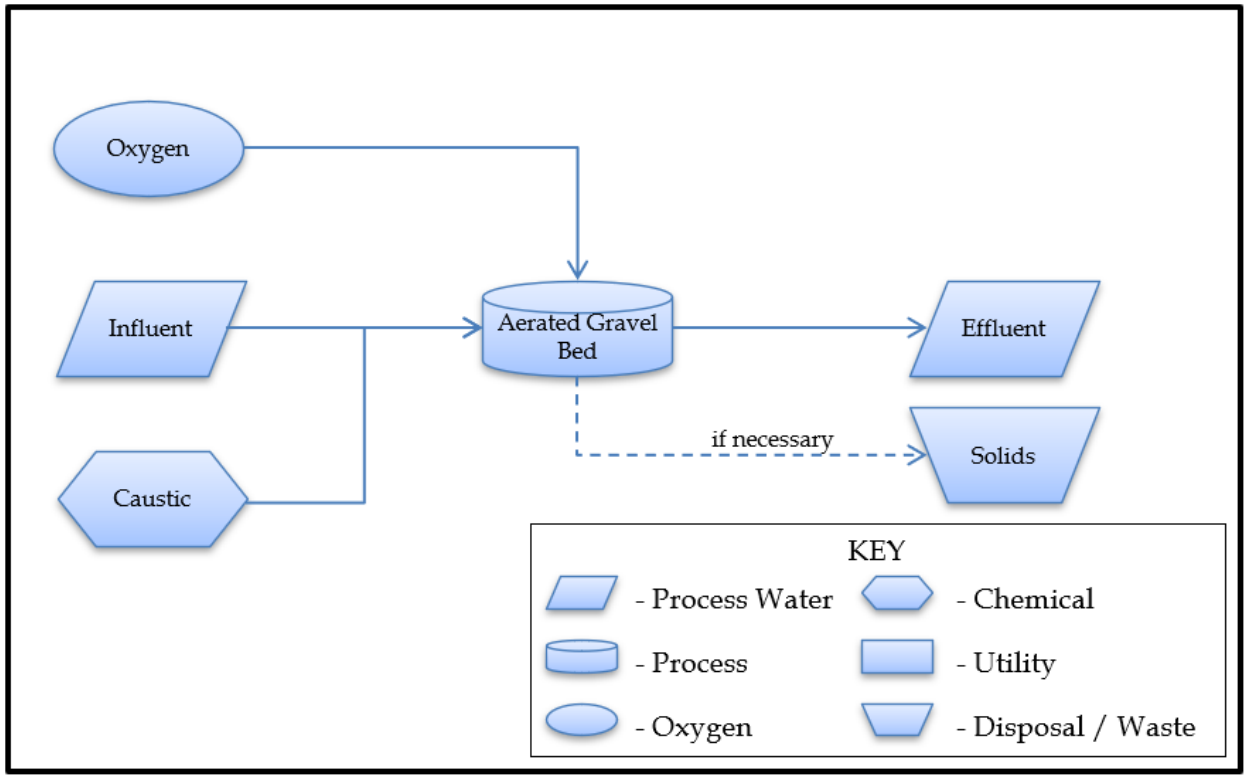


Figure 1. Aerated Gravel Bed Process Flow Chart.

In an aerated gravel bed system, influent flow is pumped uniformly over the top of the beds through a distribution system. The water discharged from the distribution system travels downward through the gravel bed and is captured in collection lines on the floor of the basin. The collection lines are connected to an effluent hydraulic control structure that controls the elevation of the water in the bed. The water level is maintained to keep gravel submerged and prevent exposed water on the surface. Aeration lines cover the bed floor and supply air bubbles to the water that maintains aerobic conditions for the bacteria. The treatment bed is lined with an impermeable liner, like those used for aerated lagoons.

The volumetric mass loading capacity to the AGB units (lbs BOD_5/ft3/day) is intentionally limited to a maximum value in the design process to prevent excessive growth of bacterial film and prevent clogging

of the gravel with biomass. Assuming a constant depth of gravel, this results in the footprint for the AGB system being directly proportional to BOD_5 mass load that is required to be treated for a particular application.

Like many other biological deicer treatment systems, the AGB system is best operated in BOD_5 mass load driven fashion with operators deciding on the mass loading rate and flow rates adjusted upward or downwards based on BOD_5 concentrations in the influent (i.e., large volumes can be treated when pollutant concentrations are low; however only low volumes can be treated with high concentrations).

The aeration system includes blowers, manifolds, diffusers, airflow monitoring, pressure gauges, and distribution control valves. Blowers are normally positive displacement, rotary-lobe type blowers. The diffusers are normally coarse bubble that employ drip tubing or slotted hard piping to uniformly distribute air over the floor of a bed.

The treatment process depends on a resident bacterial population for treatment. Visually the bacteria appear as a very thin film on the aggregate. At the start of the deicing season, some bacteria will be present in the beds or incidentally brought in with the runoff to be treated. To-date, not AGB units have required seeding of bacteria from an external source. As the system is started up each deicing season, the bacterial population will grow in response to a food supply (deicers), nutrients added to the influent, and oxygen. During the winter as long as sufficient deicer is available to treat, the bacterial population will reach a steady state, typically at the maximum design treatment mass load capacity. Some bacteria will die off during the season as part of the natural bacterial cycles and begin to be digested in the beds. The light mass loading of the AGBs in combination with the digestion in the beds results in low Total Suspended Solids (TSS) concentrations in the effluent and therefore typically no need for an external solids (sludge) removal process (if NPDES TSS limits are very low (<20 mg/L) some solids removal may be necessary). This is one of the major advantages of the AGB. At the end of the deicer season, when the deicer, oxygen, and/or nutrients are shutoff, the bacterial population will begin to die off at a fast rate. The die-off will reduce the amount of biomass, which reduces the treatment capacity. If controlled correctly, the shut off process will not produce large TSS concentrations in the effluent. Some biomass will typically be available at the beginning of the next deicer season and approximately a one-week start-up period is typically required to regain the treatment capacity.

A photo of the aerated gravel bed system at the Buffalo-Niagara International Airport during its installation is shown in Figure 2.



Figure 2. Aerated Gravel Bed at Buffalo Niagara International Airport (Courtesy Mark Liner).

Advantages

1. Relatively straight-forward operation, including automatic operation of pumps and manual operation of blowers.
2. Aerated, attached growth bacteria are suitable for achieving biological treatment during cold temperatures.
3. Ability to achieve low propylene glycol and BOD effluent concentrations.
4. Consistent and predictable performance over a wide range of influent concentrations, if loading into the treatment system is controlled.
5. Typically, no need for an external biological solids settling or sludge removal system, unless the airport's NPDES or Industrial User permit has very low TSS limits (e.g., < 20 mg/L).
6. Underground construction allows installation on unused airside land.
7. Able to handle a wide range of influent concentrations. Concentrations greater than 10,000 mg/L BOD_5 can be accommodated in conjunction with periodic flow distribution dosing protocols.

Disadvantage

1. Requires a larger land area per pound of BOD_5 treated compared to other treatment technologies.
2. Influent concentrations greater than 10,000 mg/L BOD_5 result in relatively low water volumes treated.
3. Overloading of system by operating about the maximum BOD_5 mass loading rates may result in biological plugging of gravel beds.
4. Challenge in perfectly matching nutrient feed amounts to nutrient needs at the start of season. Excessive nutrient deficiencies (nitrogen or phosphorus) can affect performance and potentially change the nature of the bacterial population.
5. Cost of system is linear with size, there are minimal economies of scale.
6. A goal of the system is to keep the water levels below the top of the gravel surface to prevent the AGBs becoming a hazardous wildlife attractant and to reduce typical deicer odors. This results in the need for 6 to 12 inches of unused gravel at the top of the beds to account for fluctuation in water levels during the course of operation.
7. All the water and air piping is buried in the gravel. While there are no moving parts buried in the gravel bed, should there be a need to repair piping, the gravel will need to be removed (with proper design and construction, this is an unlikely need).

Required Support Systems

1. Aeration System
    a. The aeration system provides air uniformly over the floor of the beds. Aeration system sizing dictates the treatment rate (in pounds per day) of the system.
    b. The equipment typically includes blowers and an air piping network to supply diffusers on a bed's floor.
2. Influent Dosing System

a. The influent dosing system distributes influent flow uniformly over the top of the beds. Daily volumes pumped to the beds must be adjusted according to influent concentrations.

b. The equipment includes pumps and piping distribution network.

c. The dosing system must provide a means for routine cleanout of accumulated debris.

3. Nutrient Feed System

a. Nutrient solution is paced into influent relative to the load of organics to account for nutrient deficiency. Online analytical equipment is required to determine exact concentrations of organics (glycol etc.) in the influent.

b. Nutrient solution must be prepared on site by airport staff or sourced from a third-party provider.

c. The equipment typically includes mixing/storage tanks and metering pumps.

4. Analytical System

a. Routine measurement of influent flows and concentrations is required to determine system loading, nutrient and aeration requirements.

b. Equipment may include on-line monitors or analytical test kits.

Variant Systems

The Reciprocating Subsurface Treatment System process is a variation of the aerated gravel bed. Rather than blowing air into the bottom of the gravel bed, bacteria is supplied oxygen by exposure to air. Reciprocating subsurface systems are designed in cell pairs and water is pumped in a batch from one cell to the pair. The biofilm on the gravel or other media is temporarily exposed to air and the water is pumped back and the alternate cell is exposed to air. The advantages to this system over the supplied air gravel bed are the lack of air piping buried in the soil and lower operating costs. The primary disadvantage is the limits on treatment capacity under certain conditions when sufficient oxygen from the atmosphere cannot be drawn into the lower levels of the gravel bed.

2. Information Supporting Technology Selection and Implementation

Potential Application Situations

Aerated Gravel Beds are best suited for situations with runoff glycol concentrations less than 10,000 mg BOD_5/L, although it can treat higher concentrations if the periodicity of dosing to the AGB units is adjusted. The primary concern with high concentrations is not the concentrations themselves but the challenges with obtaining even distribution of flows in the AGB beds if flow rates into the beds are not sustained.

The AGB system provides more stable operation than suspended growth systems like activated sludge and aerated lagoons within similar performance but requires more land area.

Current Applications of Aerated Gravel Bed Technology

Buffalo-Niagara International Airport (BUF)

Wilmington Air Park (ILN)

Heathrow International Airport (LHR)

Confidential U.S Airport

Edmonton International Airport (YEG)

Calgary International Airport (YYC)

Long Island MacArthur Airport (ISP)

Process Selection Criteria

Table 1. Aerated Gravel Bed Process Selection Criteria.

Parameter	Consideration	Description
Preferred Influent BOD_5 Mass Loading Range	No limit	No inherent minimum or maximum mass loading limits. AGB volume/footprint directly proportional to the required BOD_5 mass load and is often limited by available area at the airport.
Preferred Influent BOD_5 Concentration Range	100 to 10,000 mg BOD_5/L	Can treat a wide variety of concentrations because flow is adjusted with influent concentrations to achieve steady loads.
Preferred Influent Flow Range	Varies	The maximum flow rate capacity is a situation specific determination based on maximum mass load, lower limits of BOD_5 concentrations, and system hydraulics.
Typical effluent concentrations	<30 mg/L BOD_5 < 1 mg/L PG < 20 mg/L TSS	Effluent concentrations are very consistent in practice. Effluent BOD_5 concentrations are not necessarily directly proportional to influent BOD_5 concentrations.
Typical Range of Required Footprint	0.5 to 10 acres	Bigger systems ok if space is available. Required footprint directly proportional to required treatment BOD_5 mass load.
Typical Building / Equipment Height	< 20 ft.	A 3,000 to 5,000 ft2 building is typically recommended for housing blowers, nutrient feed, electrical, and controls.
Pretreatment Needs	Fuel, Trash, Solids	Typically, upstream oil-water separator, trash removal, and not routing construction sediment to AGBs.
Post-Treatment Processing	Operations	Typically, no post-AGB treatment processes needed. Site specific exceptions driven by permit conditions may include: TSS removal if limits less than 15 to 20 mg/L, aeration to increase dissolved oxygen, pH adjustment.
Utility Requirements	Operations	Requires electrical and water utility connections.
Open Water Surface	Bird attraction	Aerated gravel bed surface does not have open water.
Implementation Time	Scheduling	Design and construction typically require 18 to 36 months.
Staffing	Operations	Treatment plant operations are typically performed by 2-3 experienced wastewater treatment operators.

Implementation Considerations for Aerated Gravel Bed Systems

The following represent the considerations typically most important when considering potential selection on the aerated gravel bed technology.

1. *Aerated Gravel Bed is a good fit for airports with low-moderate BOD_5 concentrations and larger flow volumes but can be applied in other situations.*
   Airports that have larger collection areas because of at-gate or stand deicing typically have larger stormwater volumes and lower BOD_5 concentrations than airports using only deicing pads.

2. *Aerated Gravel Bed can potentially achieve low effluent BOD_5 concentrations.*
   BOD_5 of less than 30 mg/L are typically achievable with proper design and operation, but the situation specific effluent BOD_5 concentrations are dependent on many factors. The treatment system operates most efficiently when it receives a constant BOD_5 mass load (pounds per day). The treatment system can handle some variation in concentration by adjusting the flow rate to provide the constant load. Physical limitations in load removal for a given sized AGB are associated with maximum oxygen transfer efficiency of the aeration system, wastewater temperature, nutrient ratios, and residual dissolved oxygen.

3. *Aerated Gravel Bed is relatively unaffected by variability in deicing conditions.*
   Unlike the activated sludge and MBBR systems, the large treatment area and lightly loaded operational approach of the aerated gravel bed system results in a more robust treatment technology that isolates the AGB cells from day-to-day variation of deicing.

4. *Aerated Gravel Bed produces little to no sludge load as a byproduct that must be managed.*
   Unlike the activated sludge and MBBR systems, the aerated gravel bed produces little to no bacterial solids because of its light loading process approach. As a result, permanent unit processes for settling and dewatering sludge are not needed.

5. *Aerated Gravel Bed operation is less complex.*
   The aerated gravel bed is less complex operationally than the MBBR and activated sludge systems and can run for some periods unattended.

6. *Aerated Gravel Bed requires a larger available footprint for equivalent treatment.*
   The aerated gravel bed requires 2 to 3 times the acreage of activated sludge or MBBR system for an equivalent mass loading.

Cost Considerations

Accurate capital costs for aerated gravel bed systems need to be developed on a situation-specific basis. Factors that affect capital costs by situation include:

- Design capacity and size of the aerated gravel bed system
- Site specific needs for storage, pumping, conveyance, pretreatment pre-treatment or post-treatment processes outside of core aerated gravel bed process
- Site characteristics (e.g., site clearing, soil contamination, soil geotechnical characteristics, seismic requirements, earthwork needs)
- Utility needs (e.g., electric, gas, water, sewer, communications)
- Extent aerated gravel bed system needs to be integrated into existing infrastructure.
- Current material costs including cost impacts of supply chain issues.

Capital costs obtained from other airports using aerated gravel bed systems are almost always unreliable as estimates for aerated gravel bed systems at a new site because of differences in the above elements.

Capital costs are best obtained from bid prices from construction contractors. If cost estimates are needed before bid prices are available, development of Opinions of Probable Capital Costs should be prepared by certified cost estimators following guidelines from the Association for the Advancement of Cost Engineering (AACE) and American National Standards Institute (ANSI). As shown in the Table 3 below, Class 4 or 5 cost estimates can be prepared in early planning stages to get budgetary planning estimates. Once construction documents are complete, Class 3 estimates can provide more definitive estimates[1].

				Expected Range of Accuracy		
AACE Class	ANSI Classification	Typical Use	Project Definition	Low Expected Actual Cost	High Expected Actual Cost	Other Terms
Class 5	Order-of-Magnitude	Strategic Planning; Concept Screening	0% to 2%	-50% to -20%	+30% to +100%	ROM; Ballpark; Blue Sky; Ratio
Class 4		Feasibility Study	1% to 15%	-30% to -15%	+20% to +50%	Feasibility; Top-down; Screening; Pre-design
Class 3	Budgetary	Budgeting	10% to 40%	-20% to -10%	+10% to +30%	Budget; Basic Engineering Phase; Semi-detailed
Class 2	Definitive	Bidding; Project Controls; Change Management	30% to 75%	-15% to -5%	+5% to +20%	Engineering; Bid; Detailed Control; Forced Detail
Class 1		Bidding; Project Controls; Change Management	65% to 100%	-10% to -3%	+3% to +15%	Bottoms Up; Full Detail; Firm Price

Figure 3. AACE and ANSI Cost Estimation Classes.[1]

[1] Table based on AACE International Recommended Practice No. 18R-97: *Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Process Industries*. TCM Framework: 7.3 – Cost Estimating and Budgeting (Rev. March 6, 2019).

To provide some guidance for early-stage comparison of treatment technology options, preliminary planning level cost benchmarks for the core aerated gravel bed system treatment components have been summarized in Figure 4 based on COD load to be treated using the AACE/ANSI Class 5 cost estimation process.

The costs in Figure 4 include only the "core" aerated gravel bed treatment components:

- Gravel filled and lined treatment cells.
- Blower and aeration systems
- Nutrient supply system
- Pumping and piping systems
- Electrical, instrumentation, and controls for the systems above
- Basic utility building
- Basic site preparation

The costs in Figure 4 exclude the following:

- Deicer application, collection, conveyance, monitoring.
- Influent flow systems (pump stations, conveyance piping to treatment system).
- Spent deicer storage.
- Pre-treatment and post-treatment systems (e.g., oil-water separation, sediment removal, sludge processing).
- Utilities from external supply to treatment building.
- Site specific site work such as access roads, signage, lighting, access control, fencing, and stormwater drainage.

A 20 percent Uncertainty Contingency has been added to capital costs to reflect the detail accuracy of the estimate. Typically, the expected accuracy, within the industry of an estimate at conceptual stage of a project ranges from between -20/-50% to +30/+100 % of the final cost of the project. Since site-specific conditions have not been considered, the actual site-specific cost may be outside of this range. All costs were developed based on pricing from November 2022.

The major capital cost items for the core AGB units are reflected in the preliminary planning capital cost curve shown in Figure 4. The lighter lines represent application of a 20% continency in both directions. The costs should be only used for guidance in treatment technology selection and not for establishing capital budgets. Capital planning budgets need to be developed on a situation-specific basis.

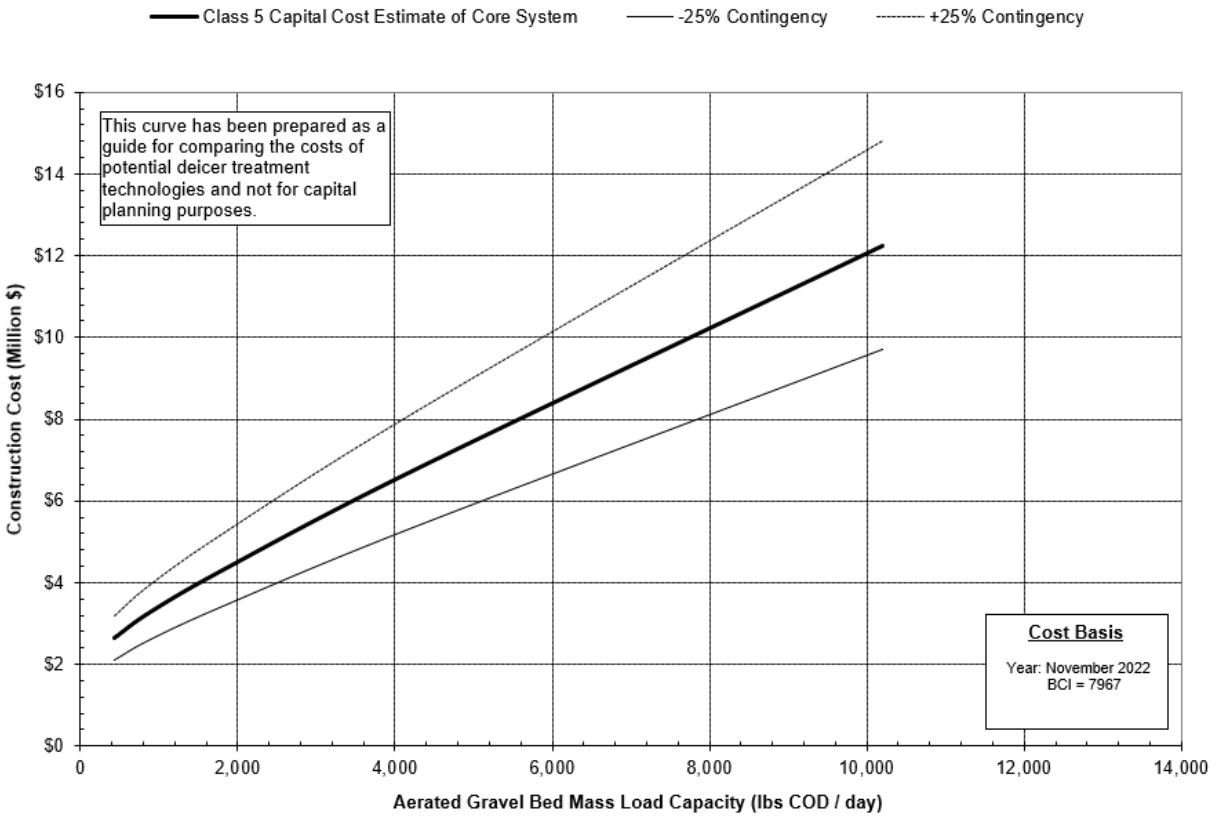


Figure 4. Preliminary Planning Capital Cost Curve

The major operational cost items for the core AGB units are reflected in the preliminary planning operations Class 5 cost curve shown in Figure 5. The major operating cost items are labor, utilities, and nutrients for larger systems. Operations and maintenance costs for an aerated gravel bed system include:

- Electricity (especially from blowers)
- Chemicals (nutrients)
- Laboratory analyses
- Labor (two operators)

Situation specific conditions that can affect operating costs include:

- Local utility rates
- Mass loading rates and flow rates (affects chemical use and power costs)
- Extent to which preventative maintenance is properly executed.
- Repairs and replacements needed.
- Solids disposal costs
- Length of operational time during the year
- Decisions to use more than the assumed number of operators.

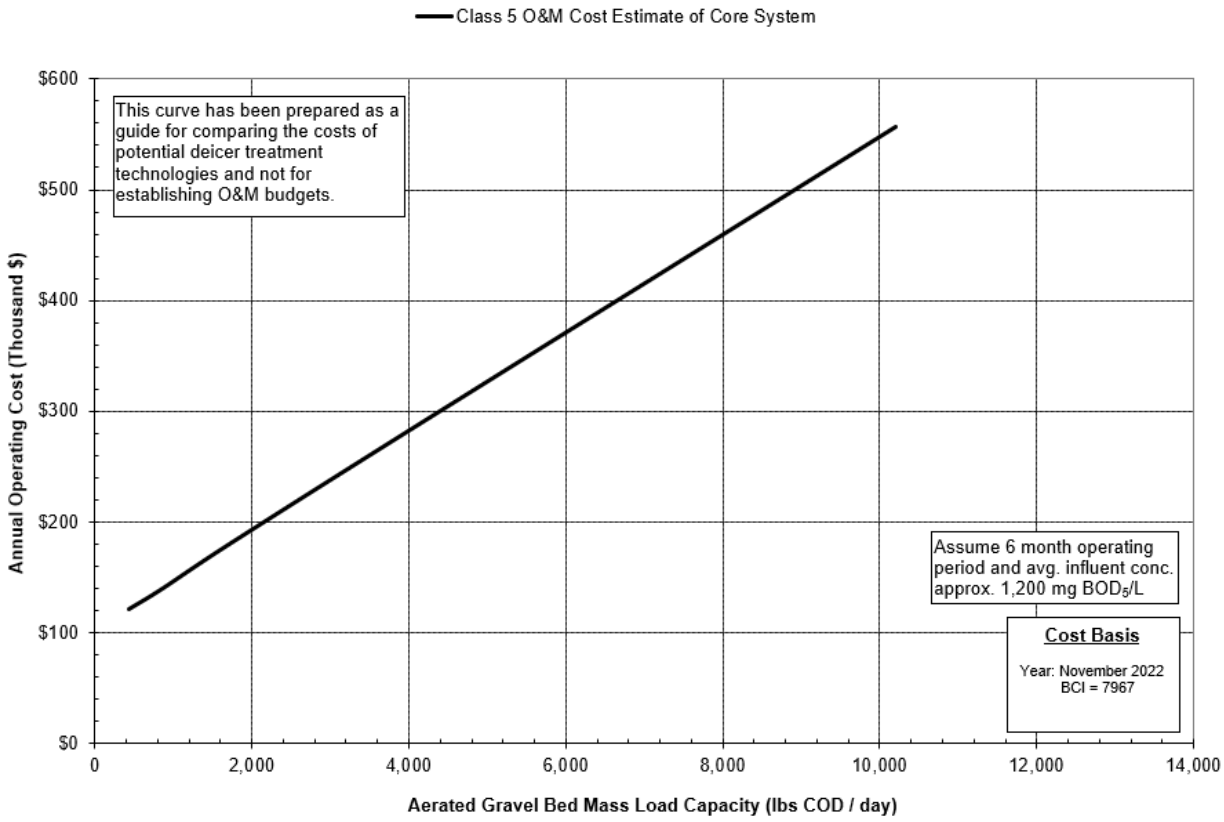


Figure 5. Preliminary Planning O&M Cost Curve

CASE STUDY

Airport Treatment Summary No. 3

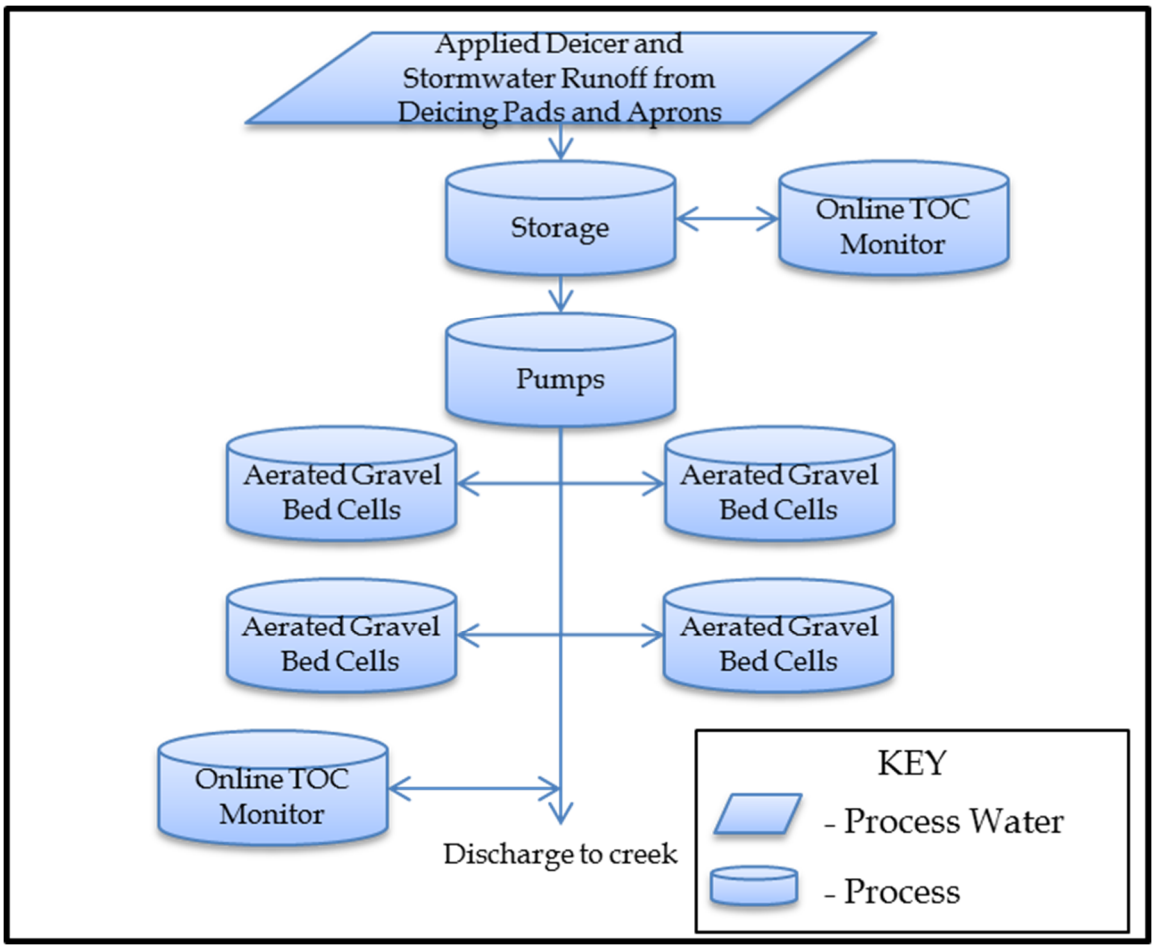
Airport: Buffalo Niagara International Airport - Buffalo, NY (BUF)

Treatment Technology: Aerated Gravel Bed

Years Operated: 2009 – 2023 (Currently Operational)

Deicer Management System Description

In 2009, the Buffalo Niagara International Airport (BNIA) implemented a system for collection and onsite treatment of stormwater containing deicers prior to discharge an adjacent stream. All stormwater from southeast side of airport, which includes the main terminal and air cargo, is captured for treatment. The treatment system was installed to comply with the New York State SPDES permit that regulates the discharge of organics (Biochemical Oxygen Demand – BOD_5) in the airport's outfall. The captured stormwater is stored in a 3-million gallon underground vault and 5-million gallon lagoon prior to treatment. Onsite treatment consists of an aerated gravel bed (AGB) located on the airside of the airport facility.



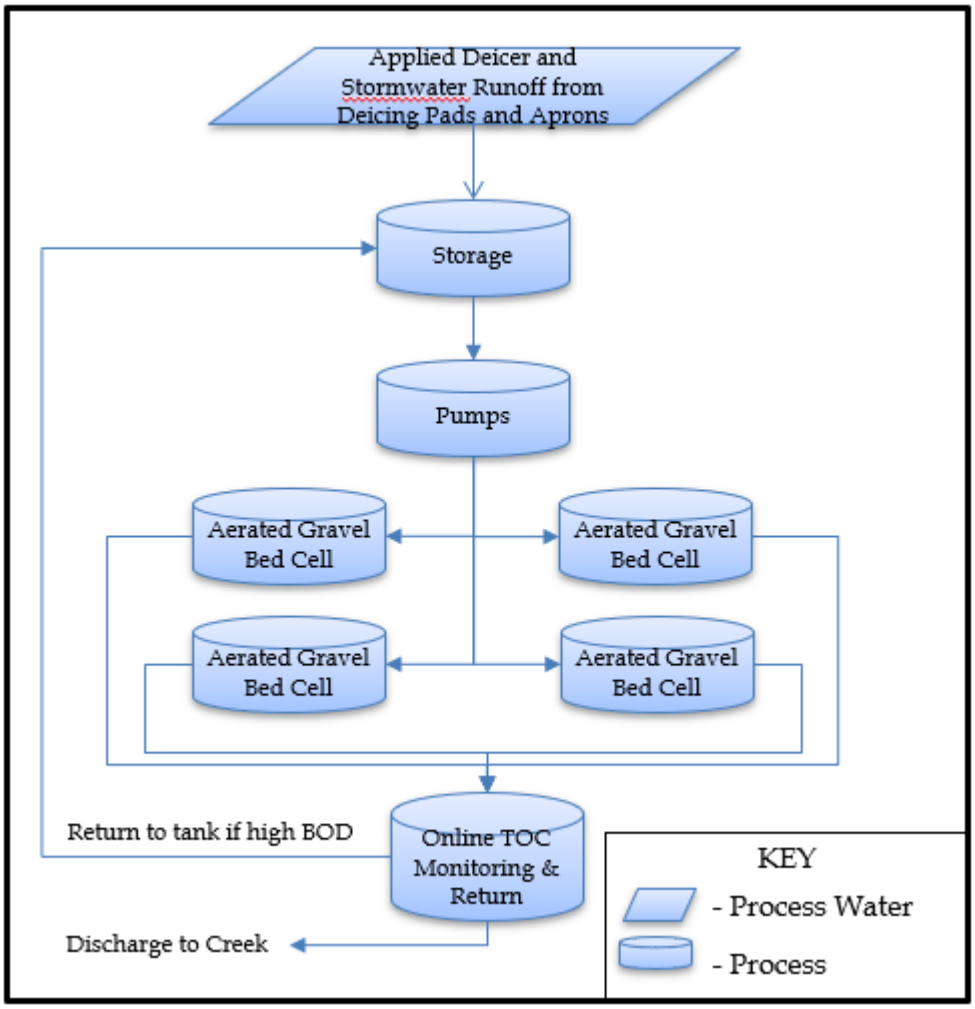


Figure 1. BUF Deicer Management System Process Flow Diagram.

Deicer Treatment Technology Selection Considerations

The airport's discharge to sanitary sewer is affected by limited hydraulic capacity (4-inch diameter gravity discharge) and as a result onsite treatment was required to reduce BOD_5 concentrations to acceptable concentrations to route runoff to the surface waters. Factors that were considered in selection of the onsite aerated gravel bed treatment technology included:

- Project Budget – $10M (2008).
- Limited land availability.
- Low profile system that could be constructed on unused airside land.
- Integration into the existing stormwater management system.
- System that has capacity to accept high variability of flow and strength of stormwater.
- Low operational requirements for staffing.

BNIA was the first airport to select the aerated gravel bed treatment technology. Extensive treatability and pilot scale tests were performed to establish technology capabilities and sizing parameters.

Deicer Treatment Technology Description

Description of Aerated Gravel Bed

Stormwater from storage is pumped into the AGB beds by dedicated dosing pumps. Each pump discharges into a network of submerged, distribution laterals. The laterals are placed uniformly over the surface of the bed and housed within infiltration chambers. Water from the laterals flows downward through the gravel layer and is collected in an underdrain system on the floor of the bed. The underdrains are connected to a hydraulic control structure with an adjustable weir that is used to set the water elevation in the bed. Discharges from the beds flow into a common gravity flow pipe that directs the treated flow to the airport's permitted outfall.

The gravel in the bed is uniform in size and without fines. The surface area of the gravel supports the growth of attached-growth bacteria that form a biofilm over the surface of the submerged gravel. The biofilm grows during the deicing season and degrades in the summer when no deicer is applied. The BNIA system consists of four gravel beds of equal size excavated from an existing open area near the airport's main runway. The gravel beds are vegetated with grasses growing in a mulch surface.

Description of Support Systems

The AGB at BNIA includes the following support systems for the treatment system: aeration system, dosing system, nutrient feed system, and analytical system. The aeration system uses four blowers with compressed air routed to manifold system and aeration tubing in the AGB bed for distribution in the aggregate.

The dosing system for supplying the deicer-impacted stormwater to the treatment system includes four dosing pumps and a dosing tank. The objective of the dosing system is to provide a uniform mass loading to the treatment cells to stabilize the biological population and provide for efficient treatment. Concentrations in the dosing tank are continuously monitored by a Total Organic Carbon (TOC) analyzer. The concentrations are multiplied by the flows pumped into the beds to determine a daily loading. The daily loadings are used to determine the number of blowers in operation and the nutrient requirements. Blower operation is controlled by operations staff and nutrient dosing is automated and linked to loading rates to the beds.



Figure 2. Construction of the BNIA Aerated Gravel Bed.

Treatment System Capacity and Performance Parameters

Table 1. System Component Capacities

Component/Parameter	Size / Capacity of Treatment Units	Number of Treatment Units	Total Capacity
Underground Storage	3.0 MG	1	3.0 MG
Lagoon Storage	5.0 MG	1	5.0 MG
Treatment Unit Volume	0.70 MG	4	2.8 MG
Treatment Unit Dimensions	166-ft x 300-ft x 5-ft	4	N/A
Treatment Facility Footprint	1.1 acres	4	4.4 ac

Table 2. Summary of System Performance

Parameter	Value	Unit
Design Flow Rates - Maximum	6,152	Gallons per minute
Design Treatment Load Capacity	10,000	lbs BOD_5/day
Design Influent Concentration - Range	50-5,000	mg BOD_5/L
Design Effluent Concentration (average)	30	mg BOD_5/L
Design Treatment Efficiency (average)	90	% Influent BOD_5

Cost Assessment for the BUF Aerated Gravel Bed Treatment System

Table 3. Costs for the Treatment System

Cost Category	Actual
Capital Cost*	$10M in 2008
Annual Operating Cost	Not Provided

* Capital costs are for the treatment system only. Costs do not include site specific costs for collection, storage, or discharge.

BNIA AGB Changes Since Startup

The following changes have been made to the system since startup:

1. 2020 construction of 5 MG storage lagoon.
2. New stormwater pump station to transfer stormwater to storage lagoon.
3. New snowmelter to manage snow piles.
4. Changed nutrient feed from dry chemical to aqueous solutions.
5. Onsite storage for nutrient solution delivery.
6. New level sensors to monitor levels in tanks.
7. SCADA upgrade, including some sensors to better track flow rates.
8. New TOC meters.
9. Repair of aeration tubing.

Lessons Learned from BNIA for Airports Considering Selection of the AGB Technology

Lessons learned from the AGB system at BNIA:

1. Treatment performance from the AGB is still strong and meeting expectations after 16 years of operation, with greater than 99% removal of BOD_5.
2. SCADA and monitoring upgrades can help reduce operation time for sampling, analysis and adjustments.
3. All piping must have cleanouts and undergo routine jetting to remove accumulated solids.
4. The design of the aeration system, including use of air tubing, with limited cleanout ability results in a maintenance challenge because of chemical scaling. Regular acid cleaning is required to prevent clogging of the air tubing.
5. Adding vegetation to the gravel in the AGB cells in unnecessary. It provides no treatment benefit and causes additional maintenance to be performed.
6. The system went online in spring of 2009 and performed as expected until late December 2009. In late December 2009 the formation of polysaccharides (slime) and foam was observed within the treatment bed. To remedy the reduced treatment performance and remove the polysaccharides, the aeration and nutrient addition was increased. After two months the system began operating at design performance.

Lessons Learned from BNIA for AGB Operators at Other Airports

Conclusions from operation of the aerated gravel bed at BNIA that can be utilized by other airports considering this technology include:

1. AGB performance is based mass load influent to the system. Frequent small loading is preferred over short, large loading.
2. Equalization of flows and loads is critical to optimizing system performance.
3. Nutrient addition is critical to process performance and must be diligently monitored and controlled.
4. Nutrient solution should be sourced for delivery and storage to the treatment system. Onsite preparation of nutrient solution is laborious and inefficient.

5. Plastics, ear plugs, and other debris may not readily flow or settle and must be removed by physical screening.
6. Analyzers must be cleaned of slime regularly.
7. Stormwater with deicer can be corrosive and corrosive-resistant materials should be used if possible (e.g., stainless steel monitoring pumps).
8. High influent BOD_5 concentrations will result in lower flow rates to the system to maintain constant BOD_5 mass loading rates. At very low flow rates, the uniformity of the distribution of water into the AGBs can be affected unless the influent feed is fed in a periodic rather than continuous manner.
9. Airport is considering nutrient monitoring of the treated effluent stream as part of a feedback loop to help correctly dose nutrient loads at the influent end of the AGB.
10. Clogging of dosing lines by plastics and other debris has been a persistent issue that requires routine jetting of dosing lines. Physical removal by filtering or other means should be considered for flow that is pumped into dosing laterals.
11. No issues have been observed in treating pavement deicers.

Documents and Information Review in Development of Airport Summary

Grady, C. D. (1999). *Biological Wastewater Treatment, Second Edition.* New York: Marcel Dekker.

Liner, M. (2011). Unique Ways Airports Deal with Environmental Issues. *45th International Aviation Snow Symposium.* Buffalo, NY.

Liner, M. (2013). Aerated Gravel Beds. *Deicing and Stormwater Mangement Conference - New and Emerging Technologies.* ACI.

Liner, M. (2017). Lessons Learned - An Update of Aerated Gravel Beds. *Deicing and Stormwater Management Conference.* ACI.

Liner, M., & Higgins, J. (2008). Best Available Design. *AAAE Deicing Conference.* AAAE.

Nelson Environmental Inc. (2009, June). Operation & Maintenance Manual Wetland Aeration System BNIA.

Redmon Engineering Company. (2007, February 26). Clean Water Test Results for Buffalo Aiport. *Report of the Clean Water Test Results of the Submerged Engineered Wetland Test Unit for Buffalo Airport*.

Wallace, S., Higgins, J., Liner, M., & Diebold, J. (2007). Degradation of aircraft deicing runoff in aerated engineered wetlands. *Multi Functions of Wetland Systems: An Internal Conference*, 26-29.

WSP. (2019). *BNIA - Subsurface Engineered Wetlands Expansion Design Rationale Report.* Buffalo, NY: WSP.

CASE STUDY

Airport Treatment Summary No. 5

Airport: Confidential Airport

Treatment Technologies: Aerated Gravel Bed

Years Operated: 2022 - 2023 (Currently Operational)

Deicer Management System Description

The airport facility that is the subject of this fact sheet wishes to remain confidential. Their deicer management operations include use deicing pads, with the ability to deice at the gates. Stormwater runoff containing deicer is routed to a diversion system, at which concentrations of Total Organic Carbon (TOC) are monitored to determine if runoff can be discharged or requires treatment. The deicer management system includes storage of stormwater containing deicer that exhibits TOC concentrations greater than the equivalent NPDES permit concentrations for BOD_5. All deicer treatment occurs onsite through use an aerated gravel bed treatment technology.

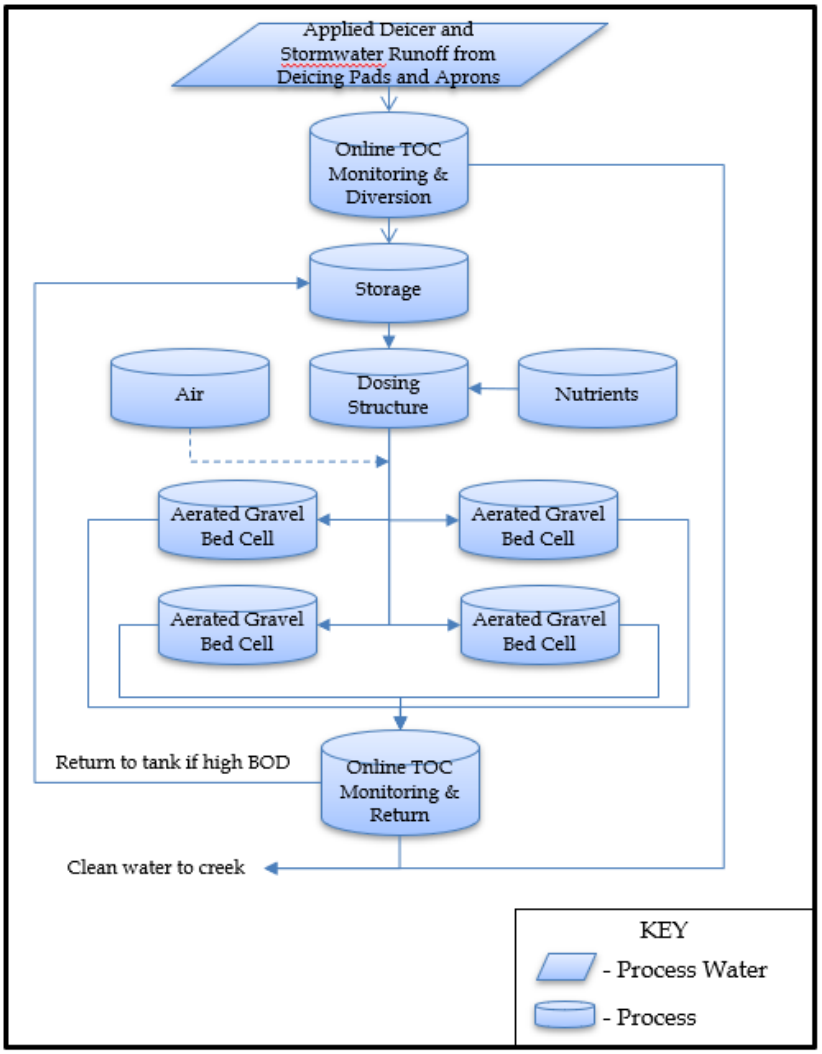


Figure 1. Deicer Management System Process Flow Diagram.

Deicer Treatment Technology Selection Considerations

Facility operational needs lead to application of pavement deicer over large apron areas in addition to the application of aircraft deicer. The NPDES permit limits are less than 100 mg/L. The high stormwater volumes, high peak flow rates, and potential for significant BOD_5 from aircraft and pavement deicer led to the need for a deicer management system that could process high flow rates, treat aircraft and pavement deicer, and produce effluent with low BOD_5 concentrations. The local winter weather is highly variable, with the potential for extended periods with little deicer use interspersed with heavy deicing periods associated with snow and ice events. Frost deicing is a regular occurrence.

Multiple deicer treatment technologies were considered but ultimately discarded, including recycling operations (insufficient volumes and concentrations for economical operation), activated sludge (concerns with operational impacts from light deicing periods), and MBBR (concerns with additional unit processes required to process sludge). Discharge of the stormwater to the local POTW was not an available option.

After considering the various treatment technologies, it was determined that the aerated gravel bed treatment technology was the optimal choice for the facility, based on the following considerations:

- Ability to process up to 8 million gallon a day under lower concentrations conditions.
- Ability to function under a range of BOD_5 concentrations expected in the runoff.
- Ability to consistently meet the NPDES permit limits for BOD_5.
- Ability to startup quickly after low deicing periods, including at the start of the winter season.
- Little to no biological sludge to process.
- Relatively passive operations, with the ability for the system run during evening and night shifts without operators on the site.
- Available area to provide the required footprint for both storage and the AGB treatment cells.
- No open water surfaces and associated attraction of hazardous wildlife.
- Ability to meet performance requirements even with intermittent deicing activities.
- Ability to effectively treat runoff when majority of BOD_5 is from aircraft deicers or pavement deicers.

Deicer Treatment Technology Description

Aerated Gravel Bed Treatment Technology

See the Aerated Gravel Bed Treatment Technology for details on the process components.

The AGB system for this airport represents state-of-the-art operation for the aerated gravel bed technology, with multiple options for adjusting to ambient conditions and responding to performance variation. The system is capable of running in parallel flow mode (maximum flow throughput) or series flow mode (best quality effluent).



Figure 2. Aerated Gravel Bed Cell.

Description of Support Systems

The aerated gravel bed treatment system includes the following support systems.

- Above ground storage tanks.
- Nutrient feed system.
- Aeration system.
- Dosing system.
- Effluent monitoring and return loop to storage tanks.

The system is highly monitored and controlled, with online measurement of water levels, water flow rates, nutrient loading rates, pH, temperature, dissolved oxygen, air flow rates and pressures, and TOC. TOC mass loading and nutrient levels into the aerated gravel bed cells are tightly controlled to maintain consistent bacterial populations, consistent BOD_5 removals and consistent BOD_5 effluent concentrations as conditions vary.

Treatment System Capacity and Performance Parameters

Table 1: System Component Capacities

Component/Parameter	Number of Units	Total Capacity
Storage Tanks	2	Greater than 15 MG
Aerated Gravel Bed Treatment Mass Load Capacity	4	10,000 lbs BOD_5/day
Aerated Gravel Bed Flow Capacity	4	Varies, with 8 MGD Max
Influent BOD5 Concentration Range	4	0 to 10,000 mg/L BOD_5, with higher concentrations possible with longer loading periods
Footprint of AGB Treatment Units	4	4 acres

Table 2: Summary of System Performance

Parameter	Value	Unit
BOD_5 Removal Efficiency	>95%	% influent BOD_5 load treated
Effluent BOD_5 Concentrations	<80	mg/L
Operational Water Temperature	>33	°F

Lessons Learned for Airports Considering Selection of Aerated Gravel Bed Technology

The following lessons learned are applicable to those considering aerated gravel bed treatment at other airports.

1. During the first year of operational treated effluent was able to meet BOD_5 permit requirements throughout the winter.
2. Aerated gravel beds such as the system installed at this facility are one of the more effective solutions for airports with larger volumes of runoff to process.
3. The AGB can consistently achieve low BOD_5 effluent concentrations.
4. Solids production is minimal due to managed bacterial growth, thereby eliminating the need for permanent and costly solids settling, dewatering and disposal infrastructure.
5. The system requires a significant amount of underground piping. Sufficient space must be provided for the installation of the piping.
6. Water levels can be kept below the gravel surface to avoid attracting birds and growing weeds.
7. Local availability and cost of the gravel that serves as the media surface for bacterial growth may play a significant factor in capital cost. Ideally limestone is used as the aggregate for the AGB units to provide pH buffering capacity, if needed, but granite or other stone materials can be considered.

Lessons Learned for Airports Operating Aerated Gravel Bed Treatment System

The following lessons learned are applicable to those operating aerated gravel bed treatment systems.

1. The system can startup quickly and begin treating within days of initial deicing loading.
2. Providing additional operational control features should be balanced with limiting excessive complexity.
3. In a multi-cell treatment system, operators may want to consider starting up AGB treatment unit at a time.

4. While the system can utilize a significant amount monitoring and controls to guide operations, operators should still perform daily visual checks and take daily grab samples to test for TOC, COD, NH3-N and Ortho-P along with occasional BOD_5 tests at an offsite lab.
5. As the system starts up, the BOD_5 mass load is gradually increased to build the bacterial population. Depending upon the water temperature, the system takes 1 to 2 days to fully response to mass load increases of 10 to 20%.
6. At the ends of the deicing season, some short-term increases in TSS can occur in the effluent when in flow through mode. At that time of season, operators should run the system in batch mode to digest the solids. However, in the first season of operations, the TSS concentrations after the end of the deicing did not rise above 20 mg/L in the treated effluent.

Attachment F

Implementation Considerations

Gresham Smith

TECHNICAL MEMORANDUM

TO:	Ethan Conley— Port of Seattle
FROM:	Tom Dietrich, Tim Arendt, Melanie Knecht— Gresham Smith
DATE:	March 21, 2023
SUBJECT:	**SEA IWTP Expansion Implementation Considerations Memo** Gresham Smith Project No. 44846.10

Introduction

The Port of Seattle (Port) is planning to expand the existing Industrial Wastewater Treatment Plant (IWTP) at the Seattle-Tacoma International Airport (SEA), which manages and treats industrial wastewater runoff within the Industrial Wastewater System (IWS). The "IWTP Expansion" project involves the expansion of existing on-site IWS storage and treatment capacity to comply with more stringent limitations for discharges of industrial wastewater to the King County sanitary sewer system. These proposed improvements are detailed in the Draft Basis of Design Report.

This memorandum, which is provided as an attachment to the Basis of Design Report, provides guidance for the phased implementation of the project, with the goal of maintaining continuity in IWTP operations and maintaining compliance with applicable discharge permits. Specifically, this memo provides considerations for the following aspects of project implementation:

- Field work and site characterization;
- Construction phasing;
- SCADA system modifications;
- Phasing of changes to system operations; and
- Overall project schedule.

Scope of Proposed Improvements

The project includes the following proposed improvements to the IWTP, which are detailed further in the Basis of Design Report:

- Addition of a new on-site biological "aerated gravel bed" (AGB) treatment system to allow discharges of treated industrial wastewater to Puget Sound in accordance with NPDES permit discharge limitations;
- Addition of 5 Mgal fully buried prestressed concrete storage tank at the AGB site ("AGB Tank") to expand high BOD industrial wastewater storage capacity;

- Splitting existing Lagoon 3 (low BOD storage) into two lagoons using a berm, resulting in a new high BOD lagoon ("Lagoon 4") and a reduced size low BOD lagoon ("Lagoon 3");
- Realignment of the existing Puget Sound outfall to go around the proposed expanded footprint of Lagoons 3 and 4;
- Modifications to existing IWTP dissolved air flotation (DAF) system, including replacement of DAF units and associated infrastructure with larger capacity units;
- Modifications to existing IWTP solids handling system, including replacement of the existing decant tanks with a gravity thickener unit; and
- Modifications to controls and flow routing schemes to integrate new and existing infrastructure, as detailed in Section 7 of the Basis of Design Report.

Proposed system infrastructure is illustrated on sheets C5 through C8 and proposed piping is illustrated on sheets C11 – C17.

Field Work and Site Characterization

Some initial field work was conducted to develop the Basis of Design Report, as described in Section 4.3. The Port surveyors conducted a detailed land survey in March 2022 to help fill data gaps in the base map, primarily at the properties south of S. 188th Street where the AGB treatment is proposed. The Port surveyor scope included topography, aboveground utilities, pavement extents, and fencing.

The following additional field work is recommended prior to start of design to address data gaps in field work to-date and Port base maps:

- Property boundary survey and easements delineation at the AGB site;
- Topographic survey for areas east and west of Lagoon 3, where there are data gaps in the Port's existing surface;
- Groundwater potentiometric surface measurements through year at AGB site and Lagoon 3 site;
- Groundwater flow rate characterization through year at AGB site and lagoon prior;
- Soil borings, geotechnical analysis, geotechnical report;
- Subsurface Utility Engineering survey at AGB Site, IWTP Site, and Lagoon 3

Construction Phasing

Construction phasing will need to be carefully planned out on this project to allow critical IWTP operations to continue without interruption and maintain compliance with discharge permits. A carefully coordinated phasing plan will also help to improve the efficiency of construction activities and reduce the need for rework, which will help to minimize overall construction costs and schedule impacts. The Port will need to work with the construction manager and design team to develop a detailed phasing plan based on constructability, costs, equipment procurement and schedule. A Construction Safety and Phasing Plan will also need to be developed in detailed design to represent phasing as it relates to site access, security, and compliance with FAA

requirements. Gresham Smith is providing some initial considerations below for construction phasing that are important to the transition of operations and maintaining permit compliance.

To facilitate collection, management, and treatment of IWS runoff throughout the construction process, we recommend that construction be split up into the following packages. Upon review and input from the Port, construction manager, and design team, some of the individual packages below could be combined based on schedule, efficiency, and cost.

1. AGB Site Preparation
2. Realignment of Outfall Pipe to Puget Sound
3. AGB Tank
4. Flow Routing Infrastructure
5. AGB Treatment System
6. Lagoon 3
7. Lagoon 4
8. DAF and Solids Handling Modifications

The proposed content of these packages and rationale for the sequencing are provided below.

1. AGB Site Preparation

The existing AGB Site includes some vegetation, existing structures and foundations, and utilities (active and inactive) that will need to be removed, demolished, or relocated prior to new structures being constructed and installed. The slope of the site, need for significant excavation for the storage tank construction, and excavation/embankment formation for the AGB cells will require a large amount of earthwork. Some soils will be suitable for use on the site, some will likely need to be hauled off. In some areas of the site, management of groundwater could add to the construction challenges, schedule, and cost as will sediment and erosion control.

Because of the extensive amount of site preparation work required, the Port may want to consider this as a separate package, with the work likely being the initial construction performed on the project.

2. Realignment of Outfall Pipe to Puget Sound

Low BOD discharges from the IWTP are drained through an existing gravity pipe that passes under the existing footprint of Lagoon 3 before continuing downstream to an outfall at Puget Sound. This portion of the existing Puget Sound outfall pipe crossing the Lagoon 3 site needs to be relocated to the east to avoid conflicts with construction activities required for modifications to Lagoons 3 and 4. This realignment should be scheduled early in the construction schedule to avoid delays in subsequent construction activities at the Lagoon 3 site. It can proceed as soon as site preparation activities are complete.

The existing outfall pipe should remain operational while the realigned pipe is being constructed along the new alignment to the east. The realigned pipe shall be constructed using trenchless methods to the extent feasible to minimize impacts to the Lagoon 3 outside berm, which is a

permitted dam. All construction in proximity of the existing Lagoon 3 dam shall be coordinated with Ecology Dam Safety Division permitting requirements.

The tie-in of the realigned pipe to the existing pipe at upstream and downstream ends should occur last and will require low BOD discharges to Puget Sound to cease on a temporary basis. During this time, low BOD wastewater will need to be captured and held within the lagoons upstream. If construction of the realigned pipe is able to avoid impacts to the integrity of Lagoon 3, Lagoon 3 may be used to hold low BOD wastewater while discharges to Puget Sound are shut down. Otherwise, it may be necessary to use Lagoons 1 and 2.

The shutdown of discharges to Puget Sound should be scheduled between deicing seasons to align with drier weather conditions, take advantage of the availability of Lagoons 1 and 2, and minimize the risk of a lagoon overflow. Once the realigned outfall pipe is connected and online, discharges to Puget Sound may resume. The abandoned portion of the outfall pipe may be demolished during the construction of Lagoons 3 and 4.

3. AGB Tank

Construction of the AGB Tank (and associated infrastructure) is a critical activity that should be scheduled to start as early as possible, once site preparation activities are complete at the AGB Site. The AGB Tank needs to be brought online before existing Lagoon 3 can be taken offline, to minimize the risk of non-compliance associated with a reduction in IWTP storage capacity. While the AGB Tank (5 Mgal) will not fully offset the temporary reduction in storage capacity at Lagoon 3 (76.2 Mgal), it will nearly double the storage capacity available at Lagoons 1 and 2 alone (5.6 Mgal) for a total IWTP storage capacity of 10.6 Mgal. This volume is expected to be sufficient for a wide range of weather conditions.

It is estimated that the tank construction from start to finish may take up to nine months to complete once excavation to the tank foundation elevation is completed. Construction of the tank underdrain system, gravity drain, and solids drain will need to be coordinated with construction of the tank foundation. Construction of the tank itself will be performed by the tank vendor and will require a corridor for construction access around the tank foundation. Both the Underdrain Pump Station and the AGB Tank Pump Station should be constructed in coordination with backfilling of the tank excavation.

Once the tank is constructed, an additional timeframe of 1 - 3 months may be required for application of the interior tank liner coating and leak testing, which needs to be completed with a full tank of water.

4. Flow Routing Infrastructure

Permanent flow routing infrastructure is recommended to be constructed concurrently with the AGB Tank, to enable flow routing between storage, treatment, and discharge facilities, including flow routing to the AGB Tank while Lagoon 3 is offline. Temporary flow routing infrastructure should be minimized to the extent possible to manage overall construction costs, including the significant costs associated with long-term pump rental. The following permanent flow routing infrastructure is recommended to be implemented at this phase:

- Lagoon 3 and 4 Diversion Structure;
- Lagoon 3 gravity influent piping (portion);
- Lagoon 4 Mechanical Screen;
- Lagoon 4 Pump Station, associated vaults, and force main to AGB Tank;
- AGB Tank Pump Station, associated vaults, and force main;
- AGB Direct Discharge Valve Vault;
- AGB effluent gravity piping (portion);
- AGB Effluent Pump Station, associated vaults, and force main; and
- AGB Effluent Routing Valve Vault.

Some of these alignments may also include electrical and controls conduit runs. Construction of pipe alignments through areas not owned by the Port may require easements and coordination with property owners on timing.

5. AGB Treatment System

Construction and commissioning of the AGB treatment system ahead of the construction at the Lagoon 3 site may help offset the limitations in available storage encountered while Lagoon 3 is temporarily offline during construction of the dividing berm.

From past experience, construction of AGB system components is best conducted by a contractor specializing in mechanical construction rather than site construction. Performance is sensitive to achieving uniformity of construction of in-cell piping for air and water delivery systems, which requires hand installation and level by level testing.

With the close proximity of the AGB Tank to AGB Cell No.5, the construction manager will need to evaluate if the tank and AGB Cell 5 area should be excavated and constructed concurrently or if the tank should be constructed first. A key consideration in this decision is avoiding any non-uniform settling of soils in the AGB cell area, which could create non-uniformity in the piping.

The ability to schedule this package concurrently with AGB Tank construction will depend on the extent of the site that is needed for construction laydown and staging while tank construction is ongoing.

6. Lagoon 3

The largest risk of impacts during construction of this project is associated with construction activities at Lagoon 3, which will require that Lagoon 3 be taken offline temporarily. As this will involve a temporary but significant (93%) reduction in total IWTP storage capacity, this should not occur until the AGB Tank and Flow Routing Infrastructure packages are complete, to help offset the reduction in storage capacity. To minimize the risk of permit non-compliance or overflow to Puget Sound, the timeframe when Lagoon 3 is offline should be aligned with the time period between deicing seasons to the extent possible.

It should be a high priority to get the modified version of Lagoon 3 back online as soon as possible, while the construction of Lagoon 4 can lag behind. The access ramp into Lagoon 3, and other

features specific to Lagoon 3, should be constructed concurrently with the dividing berm to the extent possible. Once the dividing berm is complete, the liner system and final touches on Lagoon 3 should be completed as soon as possible.

7. Lagoon 4

Lagoon 4 completion is lower priority than Lagoon 3, and construction activities that are specific to Lagoon 4 may be delayed if needed to expedite the completion of Lagoon 3. It may be beneficial to stagger Lagoon 4 activities just behind similar activities at Lagoon 3 (for example liner system and bird netting installation) to minimize the need for specialty contractors to demobilize and remobilize.

8. DAF and Solids Handling Modifications

Proposed modifications to the DAF system and solids handling system will at times require a complete shutdown of the DAF system. Under existing conditions, the DAF system treats all low BOD and high BOD wastewater prior to discharge to surface water and the sanitary sewer, respectively. Under current conditions, a shutdown of the DAF system would require significant storage capacity to hold water while the DAF system and associated discharges are ceased. However, once the AGB system is constructed and online, it will provide an avenue for treating stored industrial wastewater and discharging it to Puget Sound in accordance with NPDES limits while the DAF system is down. For that reason, it is recommended that the DAF and solids handling system modifications be delayed until the rest of the system is online and functional.

Other Considerations

Erosion and Sediment Control

The initial site work at the AGB site followed by AGB cell, piping, and tank construction will be a significant stormwater, erosion, and sediment control challenge. The site has a significant slope which will create larger runoff velocities and greater potential for erosion. Stockpiling of soils will almost certainly be necessary as the site is shaped, which will also create loose, exposed soil areas. The site has irregular topography that requires significant re-grading, and drainage patterns are likely to evolve repeatedly during construction. This may pose challenges for the contractors in directing runoff to sedimentation basins or other controls. We recommend that the construction management and design team work jointly to develop sediment and erosion control plans that are thoroughly considered with clear responsibilities for inspection and frequent discussions on necessary adjustments.

Temporary Flow Routing to Align with Construction Phasing

Flow routing within the IWTP will need to be phased during construction activities to align with existing treatment and storage infrastructure being taken out of service temporarily as well as new infrastructure going online. Key considerations for flow routing during construction include:

- When Lagoon 3 is taken offline for construction, Lagoons 1 and 2 will need to be prioritized, and a new flow route to the AGB Tank will need to be added.

- As long as the AGB treatment system is not operational yet, all flows to be discharged to Puget Sound or the sanitary sewer will continue to be treated by the DAF system.
- The AGB Tank will need to discharge to Lagoon 2 when DAF treatment is required. There is limited value in trying to segregate flows by concentration during this phase.
- Once the AGB treatment system becomes operational, it may allow discharges to Puget Sound without treatment by the DAF, provided that NPDES permit limits are met.

Table 1 illustrates potential phasing of flow routes based on infrastructure that is online and offline.

Table 1 – Phasing of IWTP Flow Routing for Storage, Treatment, and Discharge

Offline Systems	Online Systems	High BOD Flow Routing[1,2]	Low BOD Flow Routing[1,2]
• *AGB Tank* • *AGB* • *Lagoon 4*	• Existing Lagoon 3 • Existing DAF System	• Lagoons 1 & 2 → DAF → sanitary	• Lagoon 3 → DAF → Puget Sound
• *AGB* • *Lagoon 3* • *Lagoon 4*	• **AGB Tank** • **Flow Routing Infrastructure** • Existing DAF System	• Flow segregation by concentration not feasible • Temporary flow route to AGB Tank → Lagoon 2 → DAF → Sanitary / Puget Sound • Lagoons 1 & 2 → DAF → Puget Sound or sanitary	
• *Lagoon 3* • *Lagoon 4*	• **AGB Treatment** • AGB Tank • Flow Routing Infrastructure • Existing DAF System	• Temporary flow route to AGB Tank → AGB → Puget Sound	• Lagoons 1 & 2 → DAF → Puget Sound
• *Lagoon 4*	• **Lagoon 3** • AGB Treatment • AGB Tank • Flow Routing Infrastructure • Existing DAF System	• Temporary flow route to AGB Tank → AGB → Puget Sound • Lagoons 1 & 2 → DAF → sanitary	• Lagoon 3 → DAF → Puget Sound
• *N/A*	• **Lagoon 3 & 4** • AGB Treatment • AGB Tank • Flow Routing Infrastructure • Existing DAF System	• Lagoon 4 → AGB Tank → AGB → Puget Sound • Lagoons 1 & 2 → DAF → sanitary	• Lagoon 3 → DAF → Puget Sound

While Lagoon 3 is offline, flow in the IWS trunk line should be prioritized to Lagoon 1 or 2 under normal conditions. However, the AGB Tank may be needed at times to supplement storage capacity. As the permanent flow route from Lagoon 4 to AGB Tank will not be available initially, a temporary flow route will be necessary, using permanent infrastructure to the extent possible. Two options are proposed below, depending on infrastructure that is online or offline.

Temporary Flow Route to AGB Tank – Option 1

Option 1 minimizes the extent of permanent infrastructure that needs to be online. The flow routing steps involved in this approach are as follows (as shown on **Figure 1**):

- The existing diversion system will be used to divert flow from the IWS trunk into Lagoons 1 and 2 and allow lagoons to overflow into 24-inch overflow line.
- Once flows reach the south side of S. 188th Street, flows will be routed through a temporary pipe connection into the Lagoon 4 Force Main. Route flow by gravity (on temporary basis only) through the 18-inch force main to the AGB Tank.

This approach assumes that the portion of the Lagoon 4 Force Main along the south side of S. 188th Street will have a slight downward slope toward the AGB Tank. If a downward slope is not feasible, a temporary pump system may be required. Due to the reduced flow capacity of this option, Option 1 is intended only for temporary use until Option 2 infrastructure is able to be brought online.

Temporary Flow Route to AGB Tank – Option 2

Option 2 requires more infrastructure to route flow to the AGB Tank but does not require Lagoons 1 and 2 to be in an overflow condition. Once Option 2 infrastructure is online, it is recommended to be used for all flow routing to AGB Tank while Lagoon 3 remains offline. The flow routing steps involved in this approach are as follows (as shown on **Figure 2**):

- Flow in the IWS trunk will bypass Lagoons 1 and 2 and continue to the diversion structure at the Lagoon 3 Site.
- All flow will be routed into the Lagoon 3 gravity influent piping west of the diversion structure (this slide gate will remain closed when routing flow to Lagoons 1 and 2).
- Flow will be routed to through a temporary pipe (less than 20 ft in length) into the Lagoon 4 Mechanical Screen structure.
- Flow will drain into the Lagoon 4 Pump Station and will be pumped through the permanent force main to the AGB Tank Influent Valve Vault at the AGB Tank.

With this option, IWTP operators will have more control about when to route flow to the AGB Tank. Provisions for an emergency overflow should be considered, to address conditions where the flow rate in the IWS Trunk draining to the Lagoon 3 Site exceeds the capacity of the Lagoon 4 Pump Station.

Temporary Flow Route from AGB Tank to IWTP and Discharge Options

As long as the AGB treatment system remains offline, discharges from the AGB Tank will need to be routed to Lagoon 2 for treatment at the DAF system prior to discharging to Puget Sound or the sanitary sewer. This flow route can be accomplished using permanent flow routing infrastructure, as follows (as shown on **Figure 3**):

- AGB Tank contents will be drained to the AGB Tank Pump Station, which will pump flows through the force main to the AGB Direct Discharge Valve Vault.
- Flows will then drain into the existing AGB gravity effluent system and will be routed to the AGB Effluent Pump Station.
- AGB Effluent Pump Station will pump flows through the proposed force main back to the IWTP Site.

- At the Effluent Routing Valve Vault flows from the AGB Tank will be routed to Lagoon 2, where they will be stored until they can be treated at the DAF system and discharged to either Puget Sound or the sanitary sewer based on BOD concentration.

SCADA System Modifications

The IWTP Expansion will include a complex SCADA system, including:

- a large number of instruments with data outputs to PLCs;
- numerous pieces of equipment that will both receive and send signals to PLCs;
- local PLCs near key components;
- local PLCs near lagoon components;
- local PLC for the DAF units and sludge thickener;
- AGB site main PLC in the control building;
- Tie into a main PLC at the IWTP;
- Wired network, presumably with fiber optic cable; and
- Software with programming specific to the system needs.

The Port is also planning significant modifications to the SCADA system for the IWTP that may include new hardware (PLCs), wired network (assume fiber optic), computers with Human Machine Interface (HMIs), software, programming, and instruments.

Coordination between the IWTP Expansion and IWTP SCADA Replacement projects at the appropriate times is essential. Considerations include:

- Division of design responsibilities between the design teams for the two projects;
- Coordination on timing of construction of SCADA components, including aligning with phasing of the IWTP construction which would be required active SCADA system for different phases of the project;
- Coordination on approaches to drawing and specification development; and
- Determination of how system programming will be executed including which entities are providing direction to the programming team on loop narratives, equations, setpoints, alarms, the HMI interface, and data management.

Another related factor is system commissioning. It is presumed that existing IWTP with the updated SCADA system will require a complete system commissioning. In one form or another the commissioning process should include the subject matter experts for the various deicing and treatment components.

Overall Project Schedule

King County included a compliance schedule for the IWTP Expansion project within Schedule S3.D of their Industrial Waste Discharge (IWD) Permit,[1] which defined due dates for the engineering report, 60% and 100% design completion, construction advertisement/award, and construction completion. The Port subsequently developed an updated project schedule based on the current status of the project and anticipated time needed to reach major project milestones. Due to the inherent complexity of the project and the need to phase project implementation, the anticipated project schedule did not align with the compliance schedule. The updated schedule was submitted to King County for review and approval in the February 2023 draft engineering report.

A schedule for the major milestones for the project is provided in **Table 2.** The Port is currently developing a more detailed schedule. This schedule will continue to be revised and maintained by the Port Project Manager.

The anticipated project delivery method is using a General Contractor/Construction Manager (GC/CM), which will allow early development of a phasing plan. Typically, the CM will develop and update the schedule and phasing plan at each of the design deliverable milestones of 30%, 60%, 90%, and 100%. Since a CM may be more focused on scheduling and phasing based on construction methods, the information provided within this memo is offered for consideration based on minimizing impacts to IWTP operations and maintaining compliance with applicable discharge permits.

Additional operational and compliance considerations are related to the seasonal pattern of precipitation in the region as well as the nature of aircraft and pavement deicing operations. Both higher amounts of precipitation and deicing between October and April increase the demand on the IWTP system. Some elements of the project involve modifying existing infrastructure in the IWTP, which will require careful planning when taking out of service. Furthermore, establishing construction completion milestones in August or September will provide time for commissioning and startup of critical IWTP infrastructure prior to deicing season minimizing the potential for operational disruptions and permit compliance risks.

[1] King County Wastewater Discharge Permit 7810-05 (eff. July 21, 2021)

Table 2 – Anticipated Timeline for Final Design, Construction and Start Up

Item	Anticipated Start Date	Anticipated Completion Date
Engineering Report, Draft	February 1, 2022	February 28, 2023
Engineering Report, Final	March 28, 2023	May 31, 2023
Detailed Design Advertisement/Award	October 2023	June 2024
Plans and Specifications, 60% Design	Quarter 1, 2025	Quarter 3, 2025
Plans and Specifications, 100% Design	Quarter 4, 2025	Quarter 1, 2026
Construction Advertisement/Award	Quarter 4, 2023	Quarter 2, 2024
Construction	Quarter 1, 2026	Quarter 4, 2028
Commissioning and Start Up	Quarter 3, 2027	Quarter 4, 2028

FIGURE 1: TEMPORARY FLOW ROUTING TO AGB TANK – OPTION 1

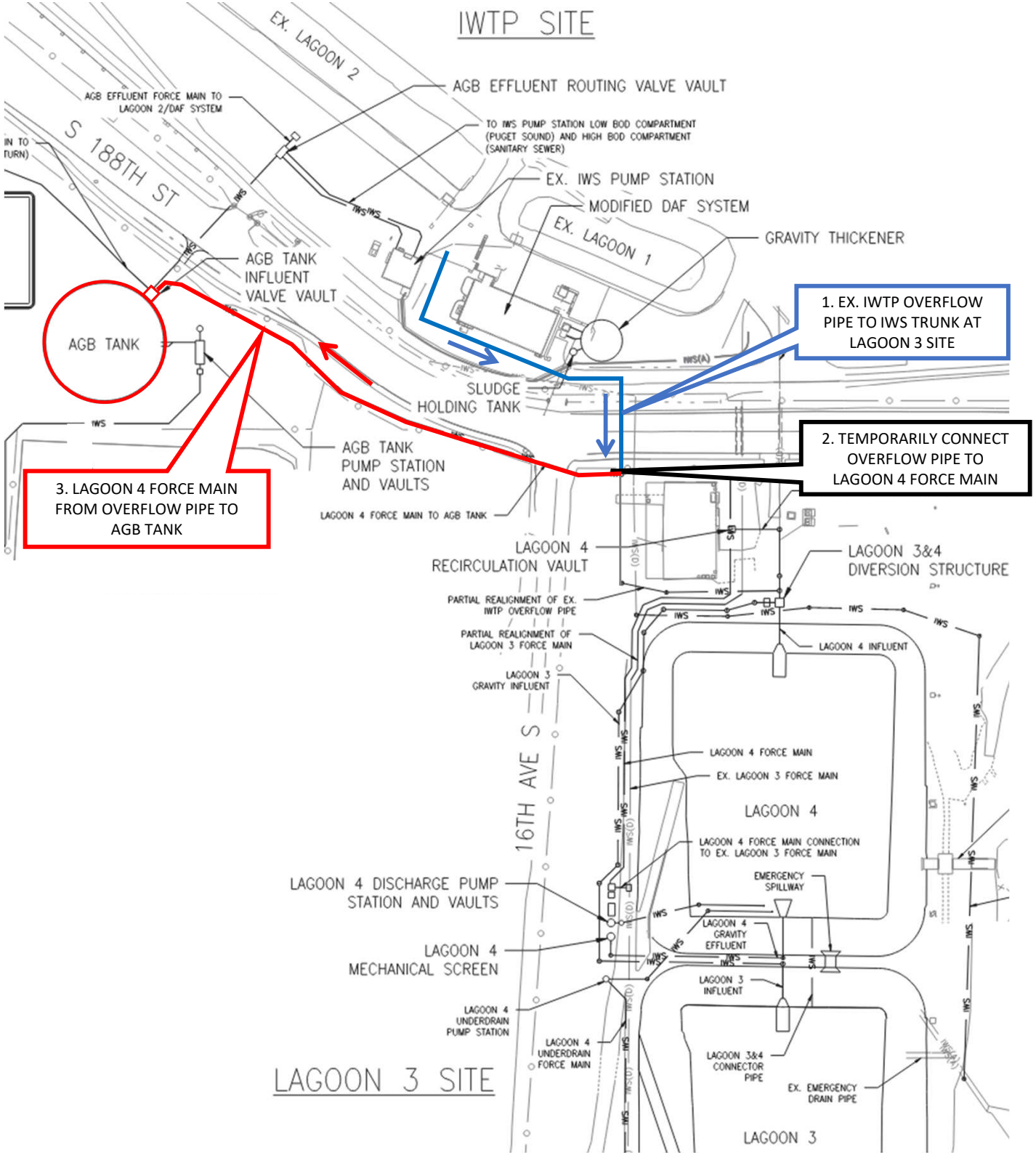


FIGURE 2: TEMPORARY FLOW ROUTING TO AGB TANK – OPTION 2

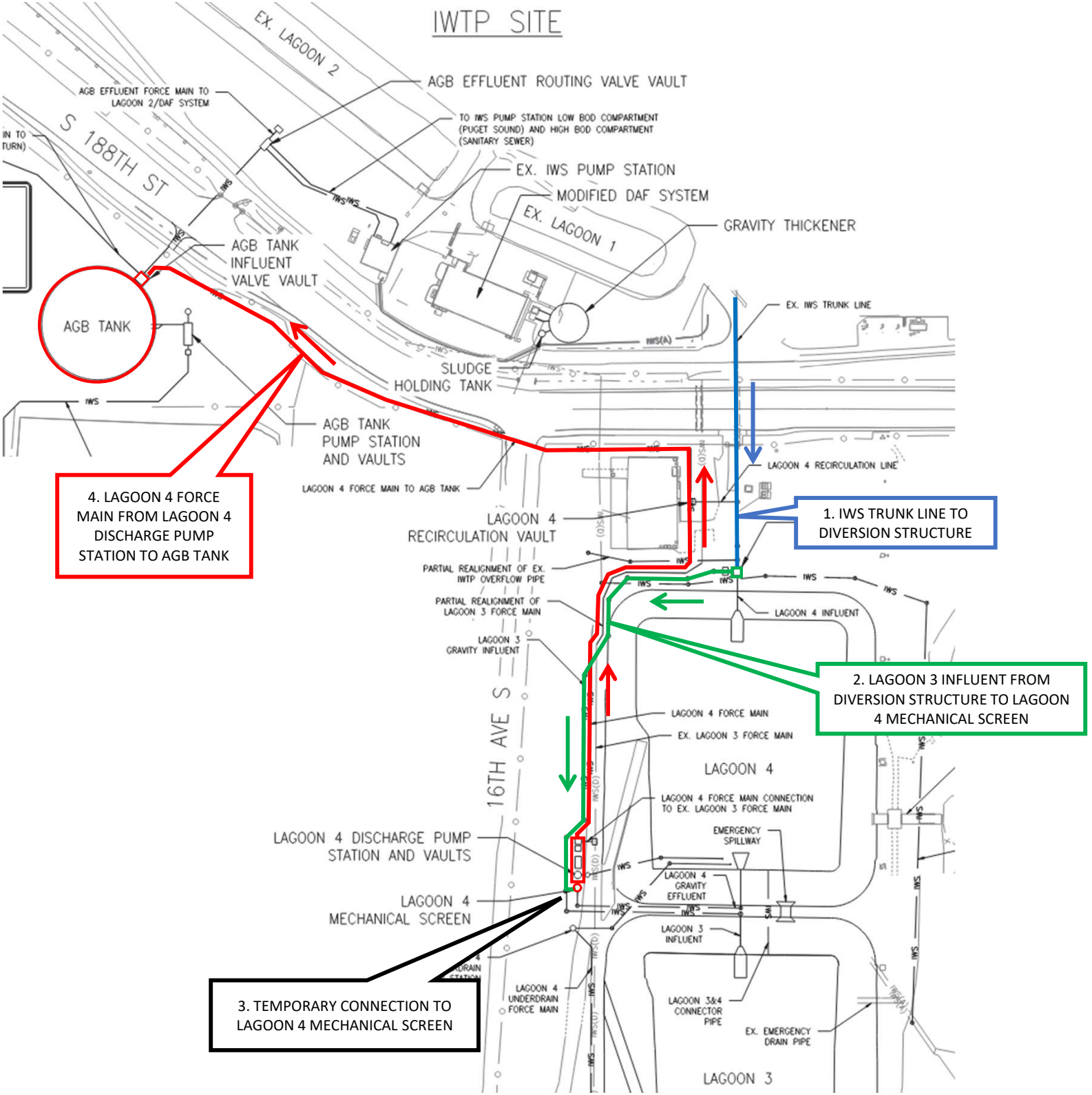
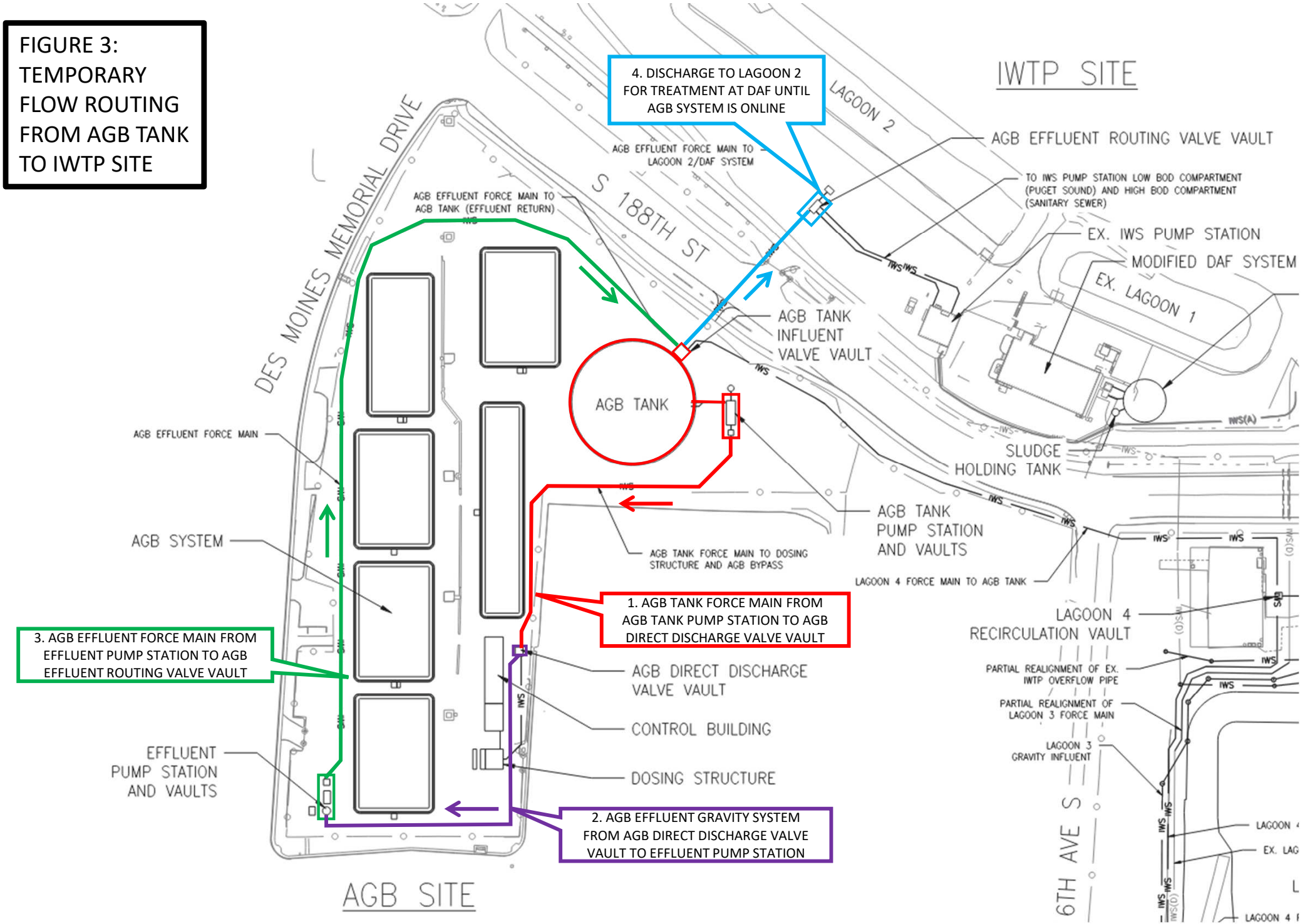


FIGURE 3: TEMPORARY FLOW ROUTING FROM AGB TANK TO IWTP SITE



Attachment G

Stormwater Management Concept

Date: March 17, 2023
Project: Port of Seattle International Airport (SEA) Industrial Wastewater Treatment Plant Expansion
To: Tom Dietrich, PE / Gresham Smith
Cc: Ann Costanza / Anchor and Jana Braaten / Port of Seattle
From: Robin Kirschbaum, PE / Robin Kirschbaum, Inc. (RKI)
Subject: IWTP Expansion Notebook – DRAFT Stormwater Management Concept

1 BACKGROUND

The Seattle-Tacoma International Airport's (SEA's) Industrial Wastewater Treatment Plant (IWTP) manages and treats industrial wastewater runoff within the Port of Seattle's (Port's) Industrial Wastewater System (IWS). The Port is currently in the notebook planning phase for the IWTP Expansion project, which involves the expansion of IWS storage and treatment capacity to comply with changes to the King County Industrial Waste Discharge Permit for discharges of industrial wastewater to the sanitary sewer. Because of the extensive site work involved in these upgrades, the project requires stormwater management in accordance with the Port of Seattle's Stormwater Management Manual (Port SWMM).

2 PURPOSE OF THIS MEMORANDUM

This memorandum documents the preliminary technical analysis of stormwater requirements pertaining to site stormwater runoff, and Best Management Practices (BMPs) needed to satisfy those requirements for the IWTP Expansion project. This memorandum is intended to be part of the overall IWTP Expansion Notebook, prepared by Gresham Smith for submittal to the Port.

3 PROJECT SITE

3.1 OVERALL PROJECT SITE

The overall project site, located in Des Moines Creek Watershed, consists of three work areas as shown in Figure 1. Area 1 is the Aerated Gravel Bed (AGB) site, which drains to City of SeaTac-owned stormwater conveyance pipes to the Northwest Ponds; Area 2 is the Lagoon 3 site, which primarily drains to the IWS; and Area 3 is the IWTP site, which also drains to the IWS. Since the AGB site is the only site that drains to a stormwater outfall and involves site disturbance (more than utility-only work), the AGB site is the only portion of the project subject to the Port's stormwater management requirements. The AGB site is described further in the section below and is the focus of this memorandum.

3.2 AGB SITE

3.2.1 Existing Conditions

The AGB site covers approximately 10.6 acres (461,302 square feet), mostly consisting mostly of concrete building foundations and asphalt pavement. These existing impervious surfaces cover approximately 70% of the AGB site, as shown in Figure 2. The site is located in the City of SeaTac, and outside of the Port's current NPDES permit boundary (Figure 1).

The site includes sloped areas and flat terraces, with site elevations dropping from north to south with an average slope of approximately 3%. Stormwater runoff from the northern portion of the of the site drains south and west, exiting the project site's western boundary via a 36-inch-diameter corrugated metal pipe, then flowing south along the eastern side of Des Moines Memorial Drive via a smaller 18-inch-diameter Lined Corrugated

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Polyethylene (LCPE) stormwater conveyance pipe. This City of SeaTac conveyance system turns east on S 192nd St and runs south to its outlet at the Northwest Ponds.

Stormwater runoff from the southern portion of the of the site drains east, exiting the site's eastern boundary in two locations via 10- and 12-inch-diameter pipes. These pipes discharge into a 12-inch-diameter pipe (unknown material type) running south beneath 13th Pl S, also draining to the Northwest Ponds.

This site consists of one Threshold Discharge Area (TDA). For purposes of this preliminary design, no infiltration was assumed. See additional discussion in the Recommended Next Steps Section (Section 8).

3.2.2 Proposed Conditions

The project proposes to construct a 5 million gallon (Mgal) underground storage tank in the northeastern corner of the site and 6 AGB cells separated with gravel berms. A new access road is proposed to ring the four westernmost cells and also ring the proposed tank (Gresham Smith 2022). Table 1 provides a breakdown of pervious and new and replaced hard surfaces proposed for the site while Figure 3 illustrates the proposed land use conversions.

As shown in the table, portions of the site that are existing impervious surface to remain undisturbed and portions of the site proposed to drain to the IWS (including the 6 proposed cells and adjacent berms) are not included in the Minimum Requirements (MR) evaluation, discussed further in Section 5 below. In total, 302,014 square feet out of the 461,304 square feet (65%) of the AGB site factor into the MR applicability evaluation (Section 5).

Table 1. AGB Site Proposed New and Replaced Hard Surfaces

Proposed New and Replaced Hard Surface Type	AGB Project Site Area (SF)	Area Included in MR Applicability (SF)
Existing Hard Surface (to Remain)	2,267	0
Surfaces Draining to IWS	157,023	0
Subtotal Not Included	***159,290***	***0***
Pervious Surface	188,829	188,829
Subtotal Pervious Surfaces	**188,829**	**188,829**
New Road	59,368	59,368
New Roof	4,257	4,257
Subtotal New Hard Surfaces	***63,625***	***63,625***
Replaced Road	17,106	17,106
Replaced Roof	32,454	32,454
Subtotal Replaced Hard Surfaces	***49,560***	***49,560***
Grand Total	***461,304***	***302,014***

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Legend

- City_SDS_Pipe_Daylight
- CIty_SDS_Pipe_Conveyance - AGB Site to Northwest Ponds
- AGB Project Site
- IWS_Catchbasins
- IWS_Manhole
- IWS_ConveyancePipe
- IWS_Pipeline
- SDS_Catchbasins
- SDS_Manholes
- SDS_ConveyancePipe
- Outfalls
- Streams_2016
- City_Areas_KC_Lines
- Streams
- Wetland_Buffers_2016
- Wetlands_2016
- City_Areas_KC
- Existing BMPs
- LID_Bioretention_and_Infiltration
- Port_NPDES_Permit_Application_Boundary
- Watershed_Boundary
- Project_Site_Area

Stormwater Peak Runoff Rate and Volume Control(BMP-S6/7-2)
Treatment(BMP-D67-1)
Treatment (Filter Strips)(BMP-S3-7)
Structural Source Control(BMP-S5-2)
Treatment(BMP-S3-9)
Treatment (Filter Strips)(BMP-S5-3)
Treatment(BMP-IWS-9)
Treatment(BMP-IWS-11)
Treatment(BMP-IWS-2)
Treatment(BMP-IWS-1)
Operational Source Control(BMP-S4-2)
Treatment(BMP-S3-8)
Treatment(BMP-S5-5)
S 188th St
Structural Source Control(BMP-IWS-22)
Treatment(BMP-IWS-15)
Stormwater Peak Runoff Rate and Volume Control(BMP-S3-3)
Operational Source Control(BMP-IWS-23)
Treatment (Filter Strips)(BMP-S3-4)
Operational Source Control(BMP-IWS-18)
Stormwater Peak Runoff Rate and Volume Control(BMP-D5b-1)
Treatment (Filter Strips)(BMP-S4-4)
Treatment(BMP-D5b-3)
Treatment(BMP-S2-1)
Treatment(BMP-S4-5)
Stormwater Peak Runoff Rate and Volume Control(BMP-D6-1)
Spill Control(BMP-D7-1)
Treatment(BMP-IWS-4)
Treatment(BMP-S3-4)
Des Moines Creek Watershed
Des Moines Memorial Dr S
16th Ave S
18th Pl S
8th Ave
6th Ave S
S 192nd St
192nd St
Burien
Des Moines
Westwood Park
S 194th St
Brentwood Apts
William W. King Apartments
SeaTac
Des Moines
36"CM
10"Unknown
18"CPE
12"CMP
36"Unknown
12"Unknown
36"CMP
42"CMP
48"CMP

Esri Community Maps Contributors, City of Burien, WA, City of SeaTac, King County, WA State Parks GIS, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, US Census Bureau, USDA, Maxar, Microsoft

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0 200 400 800 Feet

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Figure 1. Vicinity Map

IWTP Expansion Notebook - Stormwater Management Concept

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AGBProjectSite

AGBProjectSite

MON_WELL

MON_WELL

SURFACE_DATA

SURFACE_DATA

SEA_Existing

Surf_Type

Impervious

Pervious

Seatac_SD_Conveyence

Seatac_SD_Conveyence

Seatac_SD_Inlets

Lid Type

Unknown

Solid

Open

N

0 125 250

Feet

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DRAFT Figure 2. Existing Conditions

IWTP Expansion Notebook - Stormwater Management Concept

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0 100 200 Feet

Legend

City_Areas_KC
Wetlands_2016
AGBProjectSite
Fence

Exist_Surf_Type,Proposed_Surf_Type
Replaced Roof
Replaced Other Hard Surface (to IWS)
Replaced Road
Disturbed Pervious

New Roof
New Other Hard Surface (to IWS)
Existing Hard Surface (to Remain)
Impervious to Pervious
New Road

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Figure 3. Proposed Conditions

IWTP Expansion Notebook - Stormwater Management Concept

4 DESIGN STANDARDS, REQUIREMENTS, AND GUIDELINES

The following design standards, requirements, and guidelines govern the stormwater design for the site:

- 2017 Seattle Tacoma International Airport Stormwater Management Manual for Port Aviation Division (Port SWMM)
- 2018 Port of Seattle Low Impact Development (LID) Guideline
- 2019 Stormwater Management Manual for Western Washington (Ecology Manual)
- City of SeaTac Interlocal Agreement

5 MINIMUM REQUIREMENTS

In accordance with Volume I, Section 2.4 of the Port SWMM, the following Minimum Requirements (MRs) apply to the AGB project site.

- MR #1-5 apply to the new and replaced hard surfaces and the land disturbed
- MR #6-10 also apply to the new and replaced hard surfaces and converted vegetation areas

The Port may allow the Minimum Requirements to be met for an equivalent (flow and pollution characteristics) area within the same site.

Per Section 3.2 Exemptions in the Port SWMM, the following practices are exempt from the Minimum Requirements:

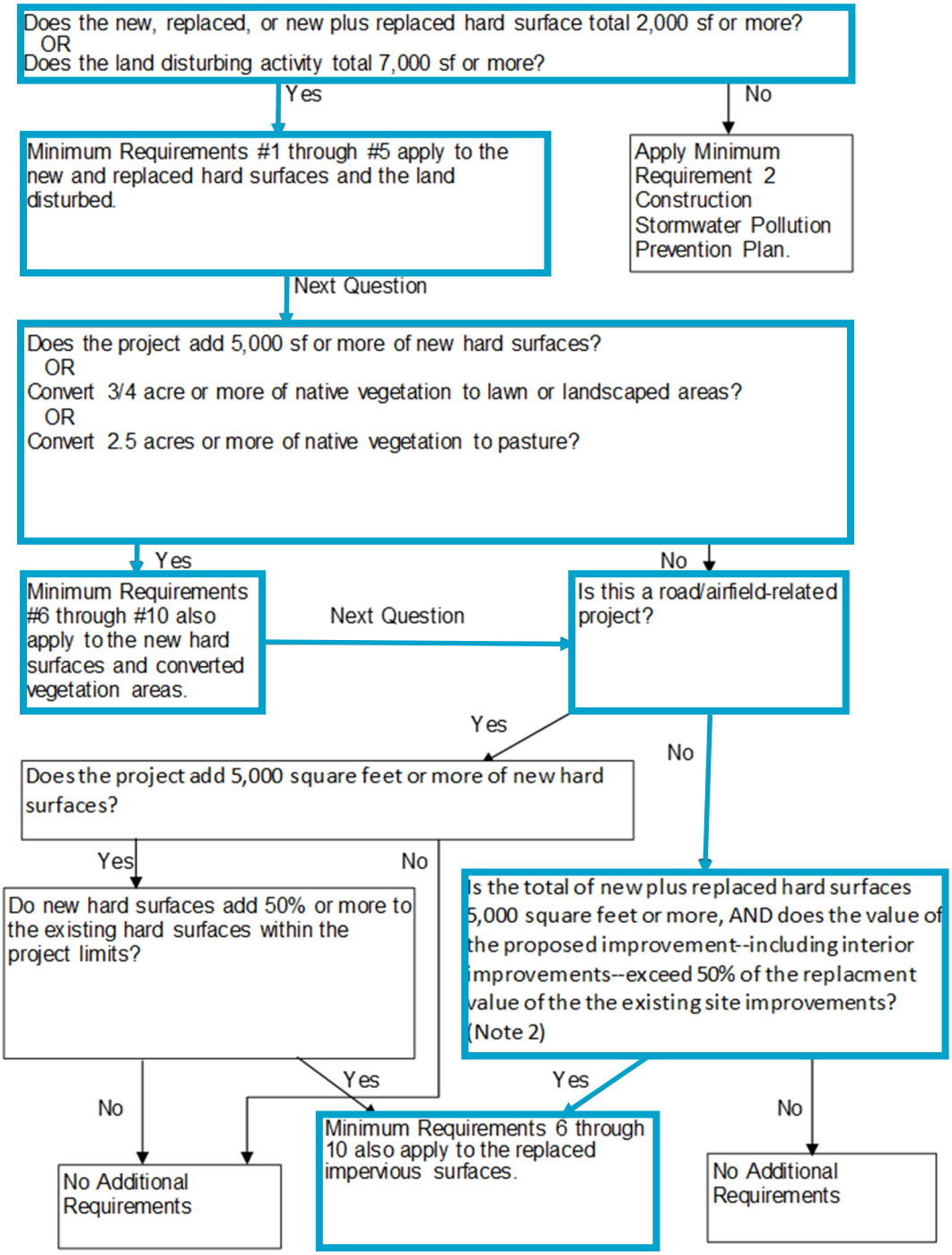
- **Underground utility projects:** Underground utility projects that replace the ground surface with in-kind material or materials with similar runoff characteristics are only subject to Minimum Requirement #2, Construction Stormwater Pollution Prevention.
- **Projects within IWS Footprint:** Areas draining to IWS are exempt from Minimum Requirements #1 through #10. Treatment requirements in the IWS, including source control BMPs, are determined by the Port on a case-by-case basis. Contact Port Environmental for more information.

  Areas draining to IWS have additional considerations and requirements pertaining to the Stormwater Site Plan. See Volume III, Chapter 3: Preparation of Stormwater Site Plans for further discussion.

Accordingly, the MRs apply to the AGB site only. The below text provides more information on specific project requirements for each of the 10 MRs. See Figure 4 for an annotated flow chart, modified from Figure I-4.2.2 in the Port SWMM, for more information on how these requirements were determined.

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Source: Port SWMM (2017), Figure I-2.4.2



1. For purposes of this manual, the project site is the portion of the area within the construction limits that drains to surface or storm water. The portion of the area within the construction limits that drains to IWS is not including in the definition of project site. Activities that require runoff to drain to the IWS include aircraft fueling, maintenance, or deicing onsite. Refer to Section 1.2 for further explanation of authorized discharges to the IWS.

2. The assessed value of the existing and proposed site improvements is based on the improvements within the project site.

Figure 4. Minimum Requirements Applicability Flow Chart

5.1 MR #1: PREPARATION OF STORMWATER SITE PLANS

This project must prepare a Stormwater Site Plan (SSP) for the Port's review no later than the 30% design stage. The SSP shall use site-appropriate development principles, as required and encouraged by local Port or City of SeaTac development codes, to retain native vegetation and minimize impervious surfaces to the extent feasible. The SSP must be prepared in accordance with Chapter 3 of the Port SWMM.

5.2 MR #2: CONSTRUCTION STORMWATER POLLUTION PREVENTION

As with all new and redevelopment projects, this project is responsible for preventing erosion and discharge of sediment and other pollutants into receiving waters. The Port's Programmatic Construction Stormwater Pollution Prevention Plan (SWPPP) requires project-specific SWPPPs. For relatively large projects such as this that disturb more than one (1) acre of total land area, the full SWPPP, including the monitoring plan will be required. All projects involving exterior construction must meet the Port's Erosion and Sediment Control Plan Specification requirements.

5.3 MR #3: SOURCE CONTROL OF POLLUTION

All known, available, and reasonable source control BMPs must be applied to all projects. Source control BMPs must be selected, designed, and maintained according to the Port SWMM.

5.4 MR #4: PRESERVATION OF NATURAL DRAINAGE SYSTEMS AND OUTFALLS

Natural drainage patterns shall be maintained, and discharges from the project site shall occur at the natural location, to the maximum extent practicable. The manner by which runoff is discharged from the project site must not cause a significant adverse impact to downstream receiving waters and downgradient properties. All outfalls require energy dissipation.

5.5 MR #5: ONSITE STORMWATER MANAGEMENT

This project must evaluate and use Low Impact Development (LID) BMPs in accordance with the thresholds, standards, and criteria provided in the *STIA LID Guideline* (RKI 2018) to infiltrate, disperse, and retain stormwater runoff on-site to the extent feasible without causing flooding or erosion impacts.

The LID BMPs provided in the LID Guideline comply with applicable Federal Aviation Administration (FAA) regulations. BMP design modifications are provided as needed for alignment with those regulations, particularly for airfield compaction, elimination of standing water, and minimizing wildlife attractants that help maintain passenger and aircraft safety.

Per the LID Guideline's Figure 3-2: STIA FAA Designated Operation Zones Limited LID Implementation, the AGB site lies almost entirely inside the Runway Protection Zone (RPZ) for Runway 34L. The RPZ is a trapezoidal shaped ground area off the runway end that enhances the safety and protection of the public by controlling the land uses and eliminating incompatible objects and activities.

Table 3-2 in the LID Guideline defines individual LID BMPs as either "Excluded", "Allowable", or "Allowable with Modifications" in the RPZ, as summarized below in Table 2.

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Table 2. LID BMPs Excluded, Allowed, or Allowed with Modifications in the RPZ

Excluded	Allowable (with required modifications) [a]		
	Lawn and Landscape Surfaces	**Roof Surfaces**	**Other Hard Surfaces [b]**
• BMP T8.40: Media Filter Drain • BMP T5.14A: Rain Gardens • BMP T5.17: Vegetated Roofs	• Extended Compost-amended Vegetated Filter Strips (Extended CAVFS) • ***BMP T5.13: Post-Construction Soil Quality and Depth***	• ***BMP T5.30: Full Dispersion*** • BMP T5.10A: Downspout Full Infiltration Systems • ***BMP T5.14B: Bioretention*** • ***BMP T5.10B: Downspout Dispersion Systems*** • BMP T5.10C: Perforated Stub-out Connections	• Extended Compost-amended Vegetated Filter Strips • ***BMP T5.30: Full Dispersion*** • ***BMP T5.15: Permeable Pavements*** • ***BMP T5.14B: Bioretention*** • ***BMP T5.12: Sheet Flow Dispersion*** • ***BMP T5.11: Concentrated Flow Dispersion***

Notes:

a. BMPs in bold italic font require design and construction modifications specified in the LID Guideline.

b. Because this project triggers all ten MRs, permeable pavement shall be prioritized over bioretention for Other Hard Surfaces.

Per the LID Guideline (RKI 2018), the Extended CAVFS was modified from the Ecology Manual CAVFS BMP T7.40 with modifications made to provide compatibility with Runway Safety Area (RSA) and Runway Object Free Area (ROFA) aircraft operation limitations under FAA regulation in those zones. The Third Runway and Runways 16L/34R and 16C/34C reconstructed CAVFS designs were based on recommendations included in the soil amendments analysis conducted as part of the 20016 Port's Stormwater Engineering Report prepared by R W Beck.

The result was 2 inches of compost incorporated into the upper 4 inches of soil disturbed during construction activities to achieve a composite topsoil with a minimum organic matter content of 10% (by weight). The Extended CAVFS lengths were also maximized from the runway shoulder to catch basin inlets (typically to 100 feet or greater).

The LID Guideline indicates that LID applicability should be identified during the project notebook phase and designed fully within the SSP no later than the 60% design phase. Based on the current design concept, LID requirements are expected to be applicable to this project. See Section 6.1 of this memorandum for additional discussion of LID BMPs.

5.6 MR #6: RUNOFF TREATMENT

This project requires construction of stormwater treatment facilities because the total pollution-generating hard surface (PGHS) exceeds 5,000 square feet. The treatment standard requires treating 91% of the entire runoff volume based on long-term continuous modeling. See Section 6.2 of this memorandum for additional discussion of proposed stormwater treatment BMPs.

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5.7 MR #7: FLOW CONTROL

As shown in Figure 5, the Enhanced Level 1 flow control standard with predevelopment conditions set to the 1994 land use condition apply to this project. The Enhanced Level 1 standard seeks to control flood flows at their current levels and to maintain peak flows within the capacity of the conveyance system for most storm events. Specifically, Level 1 flow control requires maintaining the predevelopment peak flow rates for the 2-year and 10-year runoff events. The Enhanced Level 1 flow control requires also maintaining the predevelopment peak flow rates for the 100-year runoff event.

The 1994 predevelopment condition is not defined in the Port SWMM. Per communications with Port Aviation staff (2022b), the 1994 predevelopment condition is defined for this project as 42 percent impervious and 58 percent pervious (pasture).

See Section 6.3 of this memorandum for additional discussion of proposed flow control BMPs.

5.8 MR #8: WETLANDS PROTECTION

Because the project discharges stormwater into a wetland via a stormwater system, it must comply with Guide Sheets #1 through #3 in Appendix I-D of the Ecology Manual. The hydrologic analysis must use the existing land cover condition to determine the existing hydrologic conditions unless directed otherwise by a regulatory agency with jurisdiction.

Additionally, stormwater treatment and flow control facilities must not be built within a natural vegetated buffer, except for:

- Necessary conveyance systems as approved by the Port, or
- As allowed in wetlands approved for hydrologic modification and/or treatment in accordance with Guide Sheet 2 in Appendix I-D of the Ecology Manual.

See Recommended Next Steps (Section 8) for additional discussion.

5.9 MR #9: MINIMUM REQUIREMENT #9: OPERATION AND MAINTENANCE

An operation and maintenance manual (O&M manual) that is consistent with the provisions in the Port's Stormwater Facilities, Inspections, Maintenance, and Operations Procedures Manual and with Volume V of the Port SWMM shall be provided for proposed stormwater facilities and BMPs, and the party (or parties) responsible for maintenance and operation shall be identified.

A copy of the O&M manual shall be retained in Port's Aviation Facilities and Infrastructure Department and the Aviation Maintenance Department. In coordination with the Facilities and Infrastructure Department, the Maintenance Department shall add the new facility to the Port's MAXIMO maintenance management system.

This O&M manual should be developed as part of 60% design and greater and must be submitted to the Port upon project completion.

5.10 MR #10: MINIMUM REQUIREMENT #10: OFF-SITE ANALYSIS AND MITIGATION (APPLICABLE TO OUTSIDE RETROFIT AREA)

Development projects that discharge stormwater off-site shall submit an off-site analysis report that assesses the potential off-site water quality, erosion, slope stability, and drainage impacts associated with the project and that proposes appropriate mitigation of those impacts. An initial qualitative analysis shall extend downstream for

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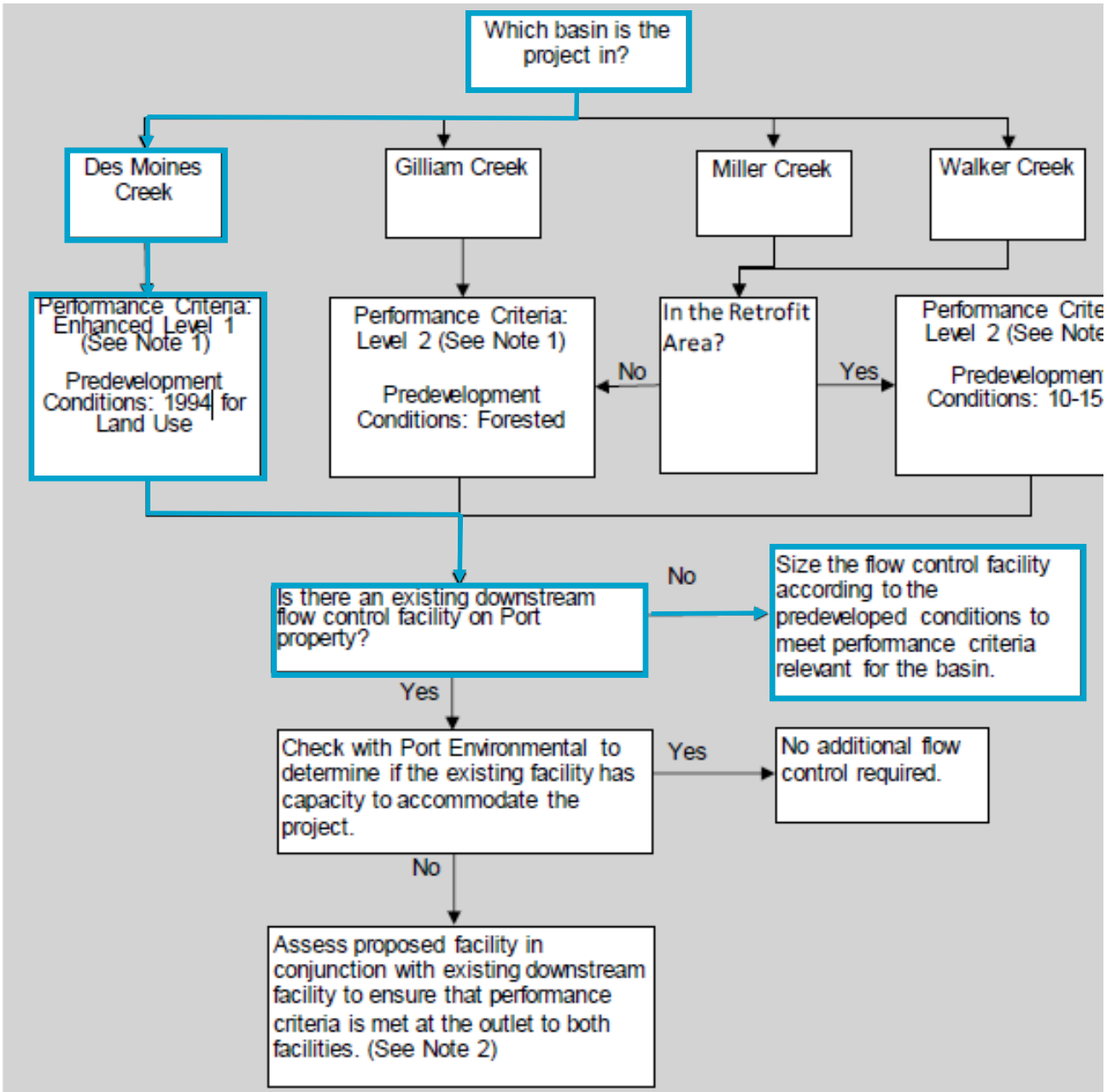
the entire flow path from the project site to the receiving water or up to one mile, whichever is less. If receiving water is within one-quarter mile, the analysis shall extend within the receiving water to one-quarter mile from the project site. The analysis shall extend one-quarter mile beyond any improvements proposed as mitigation. The analysis must extend upstream to a point where any backwater effects created by the project cease. Upon review of the qualitative analysis, the Port may require that a quantitative analysis be performed.

The existing or potential impacts to be evaluated and mitigated shall include:

- Conveyance system capacity problems;
- Localized flooding;
- Upland erosion impacts, including landslide hazards;
- Stream channel erosion at the outfall location; and
- Violations of surface water quality standards as identified in a Basin/Watershed Plan or a TMDL (Water Clean-Up Plan), or violations of groundwater standards in a wellhead protection area.

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Source: Port SWMM (2017), Figure I-2.5.1. Determining Flow Control Performance Criteria and Pre-Development Conditions



1. See Appendix I-G for definitions of Level 1, Enhanced Level 1 and Level 2 flow control requirements.
2. If the existing facility in Miller or Walker basins has insufficient capacity, the predevelopment conditions for the new facility shall be forested conditions.

References

- Proposed Design Refinements to the Comprehensive Stormwater Management Plan Master Plan Update Improvements, Seattle-Tacoma International Airport, Des Moines Creek Basin (Parametrix, August 2004)
- Proposed Design Refinements to the Comprehensive Stormwater Management Plan Master Plan Update Improvements, Seattle-Tacoma International Airport, Miller/Walker Creek Basin (Parametrix, June 2005)

6 PERMANENT STORMWATER CONTROL PLAN

6.1 ON-SITE STORMWATER MANAGEMENT BMPS

As discussed in Section 5.5, the project requires on-site stormwater management BMPs for the new and replaced hard surfaces and land disturbed (Table 1).

For purposes of this preliminary design, infiltration was assumed to be infeasible for the AGB Project Site. Recommended On-site Stormwater Management BMPs include the following:

- **Restored pervious surfaces:**
    - Extended Compost-amended Vegetated Filter Strips (Extended CAVFS); or
    - BMP T5.13: Post-Construction Soil Quality and Depth
- **Roof Surfaces:**
    - BMP T5.14B: Bioretention
    - BMP T5.10B: Downspout Dispersion Systems
- **Other Hard Surfaces:**
    - Extended CAVFS
    - BMP T5.14B: Bioretention

These BMPs are recommended because they are allowed for these surface types with applicable design modifications (Table 2); and because we understand that the Port has relatively more experience with these BMPs than the other allowed BMPs.

Per Table 3-3 of the LID Guideline, BMP T5.14V Bioretention designs must incorporate the following modifications:

- Constructed with underdrain
- Maximum ponding depth of 4 inches
- Facility must drain within 48 hours
- Vegetation consistent with SEA Wildlife Hazard Management Plan (WHMP)

Per the LID Guideline, BMP T5.10B: Downspout Dispersion Systems must also use vegetation consistent with the SEA WHMP.

As discussed above (Section 5.6), the Port modified Extended CAVFS from the Ecology Manual CAVFS BMP T7.40. The modified BMP includes 2 inches of compost incorporated into the upper 4 inches of soil disturbed during construction activities to achieve a composite topsoil with a minimum organic matter content of 10% (by weight). The Extended CAVFS lengths should be maximized (typically to 100 feet or greater). See additional discussion in Section 8.

As the site design evolves during detailed design, it will be necessary to confirm the feasibility of these recommended BMPs based on updated siting constraints. If the Port has not adopted specific design criteria for

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Extended CAVFS at the time of detailed design, or if the siting constraints are not compatible with Extended CAVFS requirements, standard CAVFS may be used in their place.

6.2 FLOW CONTROL BMPS

As discussed in Section 5.7, the project triggers MR #7 flow control requirements using the Enhanced Level 1 flow control standard, which requires maintaining peak flow rates for the 2-, 10-, and 100-year runoff events. Given the large area of cells and associated berm areas draining to the IWS in the proposed condition, only 6.9 acres contribute to the stormwater system in the proposed condition as compared to 10.6 acres in the predeveloped condition. Furthermore, while the predeveloped condition is modeled as having 42% impervious coverage, the impervious coverage drops slightly to 37% in the proposed condition.

See the predeveloped and proposed condition land use breakdown summary in Table 3 and see Figure 3 and Figure 6. The values in the table represent model inputs to Western Washington Hydrology Model (WWHM), which is a long-term continuous model allowed by the Port for use in flow control evaluation and sizing BMPs for meeting stormwater minimum requirements.

Table 3. Predeveloped and Proposed Land Use Inputs to WWHM for Flow Control Evaluation

Modeled Land Use Type	Area (Acres)	Percent (%)	Surface Type
Predeveloped (1994) Condition [a]			
Roads/Flat	4.4488	42%	Impervious
C, Pasture, Flat	6.1435	58%	Pervious
Total [b]	**10.5923**	**100%**	
Proposed (Developed Unmitigated) Condition			
Roads/Flat	1.7298	37%	Impervious. Other Hard Surfaces (non-roadway and non-building) modeled as Driveways/Flat
Roof Tops/Flat	0.8428		
C, Pasture, Flat	4.3349	63%	BMP T5.13: Post-Construction Soil Quality and Depth, modeled as pasture per Ecology Manual guidance
Total [b]	**6.9075**	**100%**	**Reduced drainage area compared to Predeveloped condition due to AGB cells and associated berms being diverted to the IWS in the proposed condition**

Notes:

a. 1994 Predeveloped condition assumed to be 42% impervious/58% pervious (pasture) per discussion with Port staff (2022b).

b. The total modeled area reduces in the proposed condition because the proposed AGB cells and berms dividing the cells drain to the IWS and are not included in the model.

Based on the large diversion of drainage area from the stormwater conveyance system to the IWS, as well as the slight reduction in percentage impervious cover, the peak flows are expected to be reduced in the proposed condition and flow control BMPs are not expected to be needed to meet the flow control standard. This assumption should be revisited and verified as designs progress through 30% and subsequent stages through final design.

The treatment BMPs proposed (Section 6.3) could potentially be modified to meet flow control in addition to runoff treatment requirements, if flow control were needed based on future design changes. Design

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modifications for bioretention flow control could potentially include, for example, extra gravel storage and elevated, orifice-controlled underdrains.

6.3 TREATMENT BMPS

As discussed above in Section 5.6 (MR #6: Runoff Treatment), water quality treatment BMPs are required for PGHS surfaces, which for this project include the proposed roadway surfaces as shown in Figure 6 and summarized in Table 4.

As shown in the table and Figure 6, a total of nine runoff treatment BMPs are proposed, including one bioretention with underdrain (BMP #1) and eight CAVFS (BMPs #2-9). Also shown in the table, preliminary modeling indicates the potential BMP area currently exceeds the minimum area needed to meet the 91% treatment standard (Section 5.6).

This excess capacity provides good design flexibility should changes in proposed conditions through final design dictate the need for flow control or additional on-site stormwater management or runoff treatment based on future site plan changes.

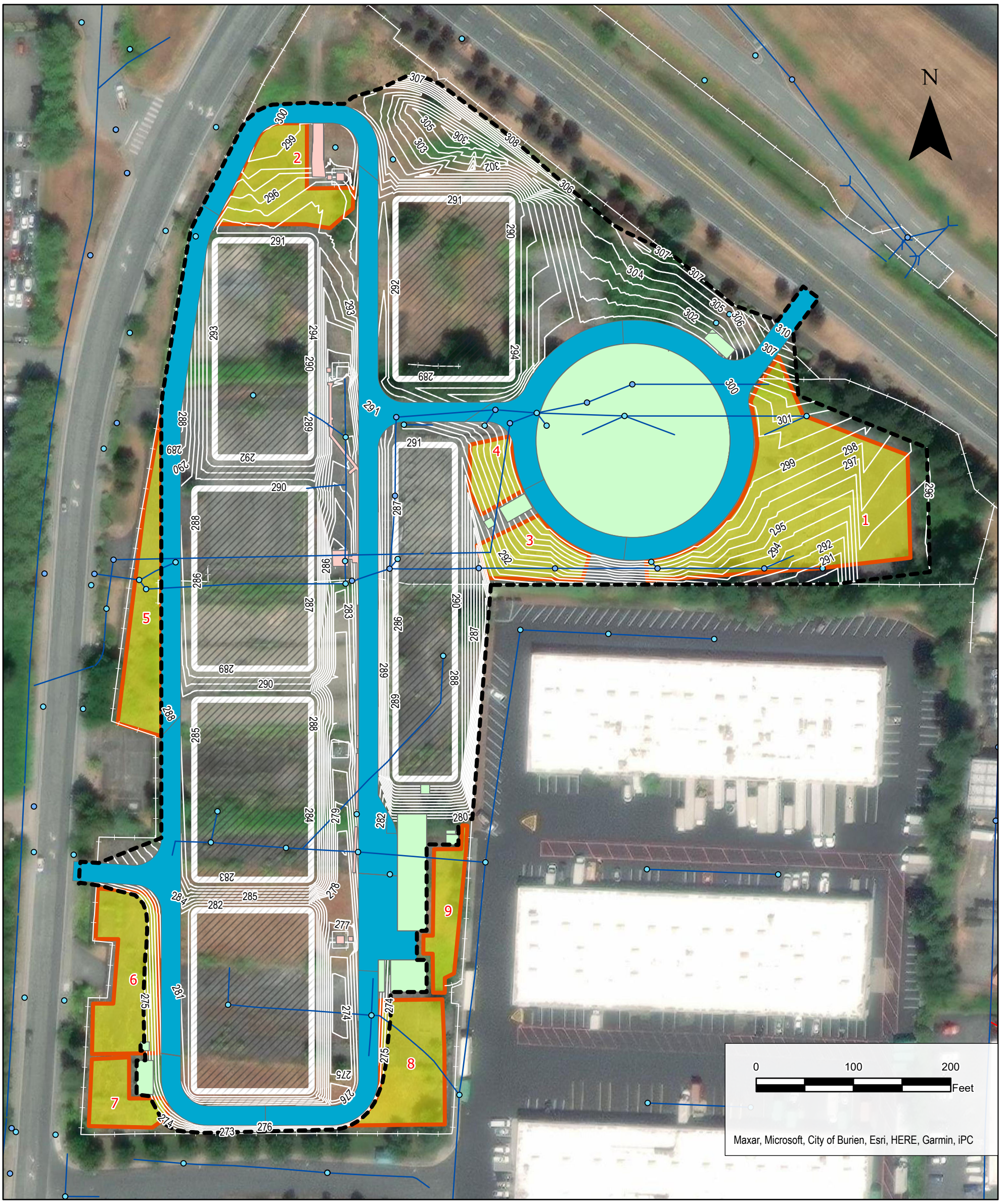
A test model run was performed in WWHM for BMP 1 to solve for the minimum bottom width needed for treating the roadway and dome of the large underground storage tank. This test model run indicates the required bioretention bottom width to provide the required 91% runoff treatment is 4.5 feet. This is nearly 6 times smaller than the available BMP bottom width in that area. Note, furthermore, that it is not necessary based on current designs to route the dome area to BMP 1 because it is not a pollutant-generating surface. The dome area was included in the sizing of BMP 1 for now to provide additional design flexibility and conservativeness at this stage of preliminary design.

The assumed drainage area for BMP #9 (CAVFS) currently includes the control building roof. Further evaluation is needed during detailed design to determine if a level spreader can be implemented at this location to allow CAVFS to be feasible, or if bioretention or a different type of BMP may be necessary.

See typical design details for bioretention with underdrain and CAVFS provided in Appendix A.

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Legend

Proposed_Surf_Type
- Building
- Other Hard Surface (to IWS)
- Existing (to Remain)
- Road
- Proposed Contours (11-14-22)
- Fence

AGBProjectSite

IWS
- IWS_Pipeline

SDS

Lid Type
- Unknown

Lid Type
- Unknown
- SDS_ConveyancePipe
- Potential BMP Area

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Port of Seattle | RKI planning engineering

Figure 6. Potential BMP Locations

IWTP Expansion Notebook - Stormwater Management Concept

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Table 4. Potential BMP Sizing and Modeled Percent Treated Summary

BMP	Type [a]	Road Drainage Area (Ac.)	Potential Building Drainage Area (Ac.) [b]	Total Potential Drainage Area (Ac.)	Potential BMP Top Area/ Total Potential Drainage Area (%)	Available Average BMP Top Width (ft)	Available Average BMP Top Length (ft)	Design Maximum Surface Ponding Depth (ft)	Modeled Percent Treated (%) [d]
1	Bioretention with Underdrain	0.2656	0.7172	0.9829	15%	40 / 30 [c]	160	0.33	99.77%
2	CAVFS [e]	0.1204	0.0000	0.1204	95%	50	100	0.33	99.79%
3		0.0645	0.0000	0.0645	85%	48	50	0.33	99.91%
4		0.1377	0.0000	0.1377	29%	35	50	0.33	97.90%
5		0.2460	0.0000	0.2460	23%	25	100	0.33	97.40%
6		0.2010	0.0010	0.2020	55%	30	160	0.33	99.70%
7		0.0657	0.0059	0.0716	90%	40	70	0.33	99.96%
8		0.1093	0.0328	0.1421	81%	50	100	0.33	99.61%
9		0.5154	0.0310	0.5464	14%	25	130	0.33	91.40%
Total/Avg. [f]		**1.7256 [f]**	**0.7879 [f]**	**2.5135**	**54%**	**37**	**102**	**0.33**	**98.21%**

Notes:

a. Required BMP design modifications need to be applied during future design phases.

b. Potential Building Drainage Area could be routed to the proposed BMPs to meet MR#5 (Section 7.1) and/or part or all of any flow control requirements (Section 7.2), should flow control be needed in future design phases.

c. The Available Average BMP Top Width for BMP 1 – Bioretention with Underdrain is approximately 40 feet. Because WWHM requires a bottom area, not a top area, an approximate 30-foot-average bottom width was entered into the model to account for reduced width due to ponding (assumed 4 inches), free board (assumed 1 foot), and side slopes (assumed 3 Horizontal : 1 Vertical).

d. Modeled Percent Treated is based on WWHM reported "Percent through Underdrain" for BMP #1 and "Percent through CAVFS" for BMPs #2-9.

e. CAVFS were modeled following Ecology's guidelines for BMP T7.40: Compost-Amended Vegetated Filter Strips (CAVFS). The Port's Extended CAVFS (Section 7.1) will be considered for future design phases, if approved specifications and modeling standards are available from the Port. See additional discussion in Section 8.

f. Total values are provided for Road Drainage Area, Potential Building Drainage Area, and Total Potential Drainage Area, while Average values are provided for all remaining columns.

g. The Road Drainage Area differs slightly (<1%) from the value shown in Table 3 due to sliver errors caused by intersecting various layers in GIS to support different analyses. Potential Building Drainage Area only includes larger buildings directly adjacent to proposed BMPs.

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7 SUMMARY AND CONCLUSIONS

This memorandum documents the preliminary technical analysis of stormwater requirements and BMPs needed to satisfy minimum requirements (MRs). As documented in this memorandum, all ten MRs apply to the project. On-site stormwater Management (MR #5) and Runoff Treatment (MR #6) BMPs are required for the project. Although MR #7 Flow Control applies, flow control BMPs are not expected to be needed to satisfy the Enhanced Level 1 flow control standard with 1994 Predevelop Land Use Condition applicable to the site. Proposed BMPs are summarized in Table 5.

Table 5. Summary of Proposed Permanent Stormwater Control BMPs

Minimum Requirement (MR)	Restored Pervious Surfaces	Roof Surfaces	Other Hard Surfaces
MR #5: On-site Stormwater Management	○ Extended Compost-amended Vegetated Filter Strips (Extended CAVFS); or ○ BMP T5.13: Post-Construction Soil Quality and Depth	○ BMP T5.14B: Bioretention; or ○ BMP T5.10B: Downspout Dispersion Systems	○ Extended Compost-amended Vegetated Filter Strips ○ BMP T5.14B: Bioretention
MR #6: Runoff Treatment [a]	BMPs not required	BMPs not required	
MR #7: Flow Control	BMPs not required		

Notes:

a. Runoff Treatment BMPs are required for PGHS roadway surfaces only, included in the "Other Hard Surfaces" category.

8 RECOMMENDED NEXT STEPS

The following provides a list of key recommended next steps for 30% and further design:

- Design Standards, Requirements, and Guidelines:
    - Confirm the 1994 land use condition assumptions to be used in flow control evaluation. The assumptions applied in this preliminary analysis were based on cursory discussion with Port staff (2022b) and should be further vetted and confirmed.
    - Identify any City of SeaTac requirements, as well as any potential partnership opportunities with the City for BMPs in the roadway right-of-way or other areas upstream of Northwest Ponds.
    - Confirm wetland impacts evaluation per MR #8 is required and perform the required analyses if so.
- On-Site Stormwater Management:

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- Confirm infiltration infeasibility or evaluate the feasibility of infiltration on the AGB project site in accordance with the LID Guideline.
- Coordinate with City of SeaTac to confirm locations of stormwater connections to City stormwater conveyance system.

- Flow Control/Runoff Treatment:
  - Tailor BMP selection and design for specific pollutants of concern, such as potentially pH, in future design phases as applicable.
  - Consider equivalent area methods for meeting flow control/treatment requirements if helpful in future design phases.
  - As design progresses, confirm feasibility of recommended BMP types and refine siting and sizing based on detailed siting constraints and design characteristics.
- Specifications/Modeling:
  - Confirm the availability of construction specifications and modeling methods or credits to be used for Extended CAVFS, if used in future design phases in place of standard CAVFS.
- Long-term Strategic Considerations:
  - Plan to incorporate AGB project site into NPDES permit applicability area (Figure 1).
  - Complete any additional analysis needed by the Port for the other two project sites (Figure 1). For example, the Lagoon 3 site may require additional reporting of land use changes even though the area is not subject to stormwater requirements.

9 REFERENCES

Gresham Smith 2022. *Preliminary proposed siting, surfacing, and grading designs for use in Preliminary Stormwater Site Plan for AGB site, Notebook phase.* October 10, November 14, and December 8.

Port of Seattle 2017. *Seattle Tacoma International Airport Stormwater Management Manual for Port Aviation Division*. Port of Seattle Aviation Environmental Programs. May.

Port of Seattle 2022a. Website on Industrial Wastewater Treatment Plant, accessed https://www.portseattle.org/programs/port-seattle-iwtp-effluent-discharge-rate on January 5.

Port of Seattle 2022b. Personal Communications via e-mail with Robin Kirschbaum of RKI and Jana Braaten, Senior Environmental Program Manager, of Port of Seattle Stormwater and Wastewater Division, regarding model assumptions for 1994 Predeveloped Land Use Condition flow control standard. December 29.

RKI 2018. *Seattle Tacoma International Airport (STIA) Low Impact Development Guideline*. Effective December 2016, Revised August 2018.

Washington State Department of Ecology 2019. *Stormwater Management Manual for Western Washington*. Publication No.19-10-021. July.

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APPENDIX A

BMP Typical Details (from Ecology Manual)

Typical Bioretention with Underdrain, with mark-ups showing Port-required design modifications

Compost Amended Vegetated Filter Strips

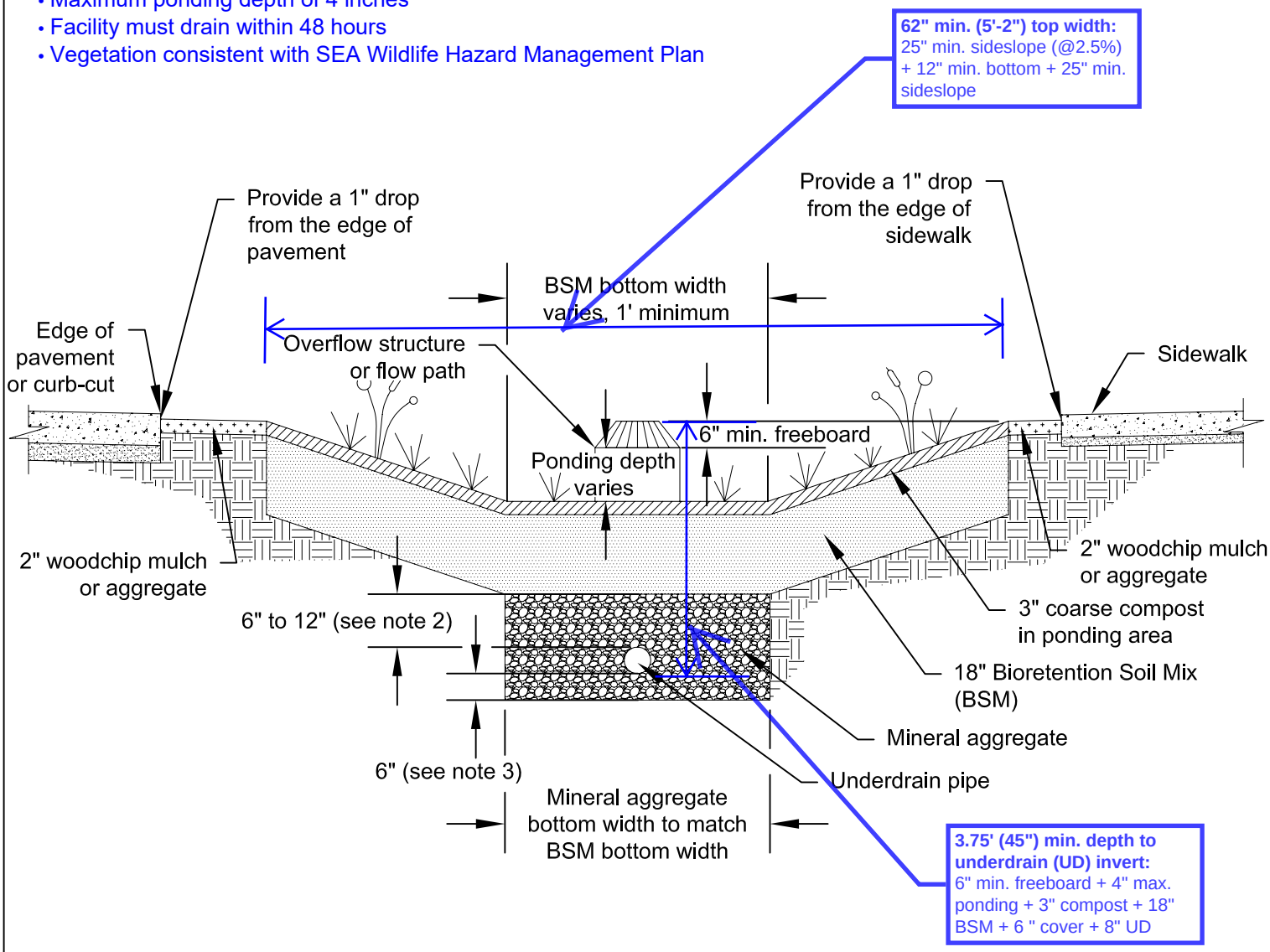
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From Table 3-3 of the LID Guideline:

- Constructed with underdrain
- Maximum ponding depth of 4 inches
- Facility must drain within 48 hours
- Vegetation consistent with SEA Wildlife Hazard Management Plan



Notes:

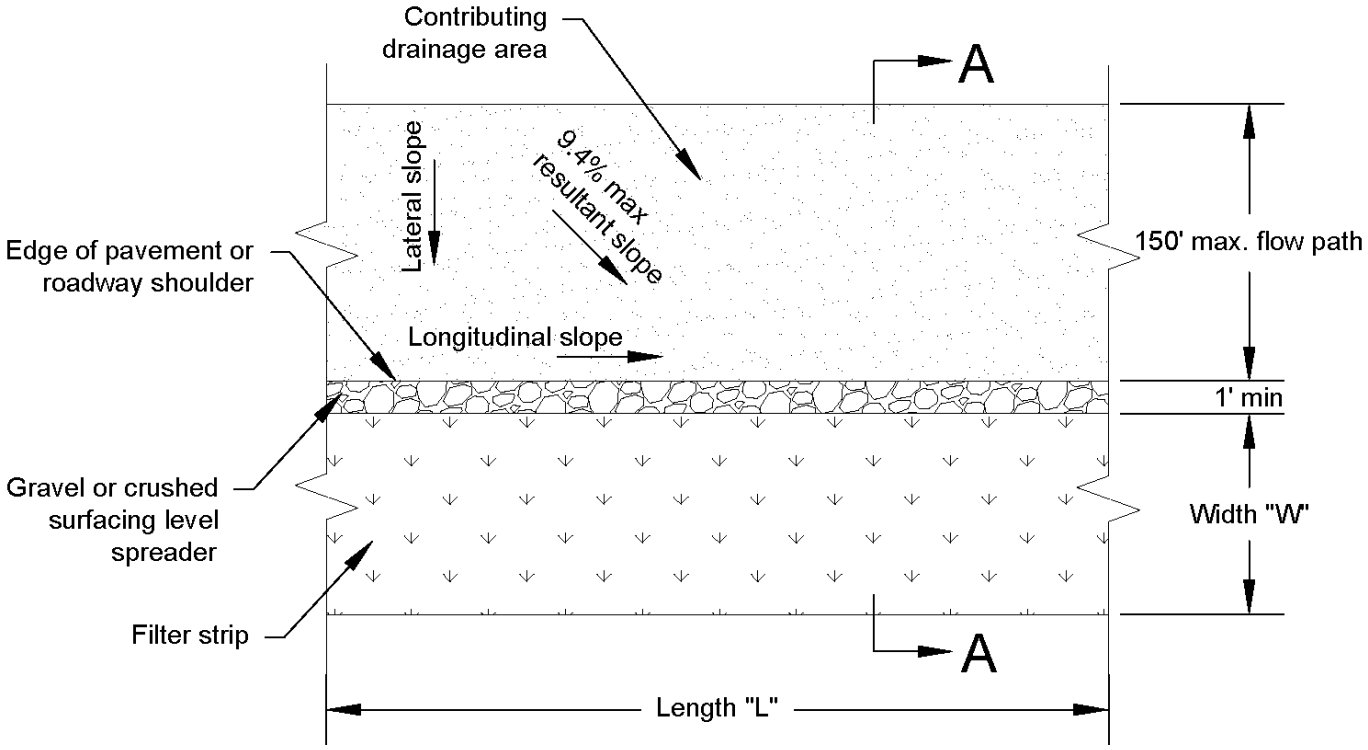
1. See **BMP T7.30: Bioretention** for further details regarding design, installation, and maintenance of bioretention.
2. Minimum 6" to discourage fines from entering the underdrain from the BSM. Maximum 12" to prevent unnecessary BMP depth from encroaching into the seasonal high ground water.
3. If depth to the seasonal high ground water allows, this distance may be larger.
4. When an underdrain is used, the design must ensure that the seasonal high ground water does not encroach into the BMP (including the mineral aggregate layer surrounding the underdrain pipe).

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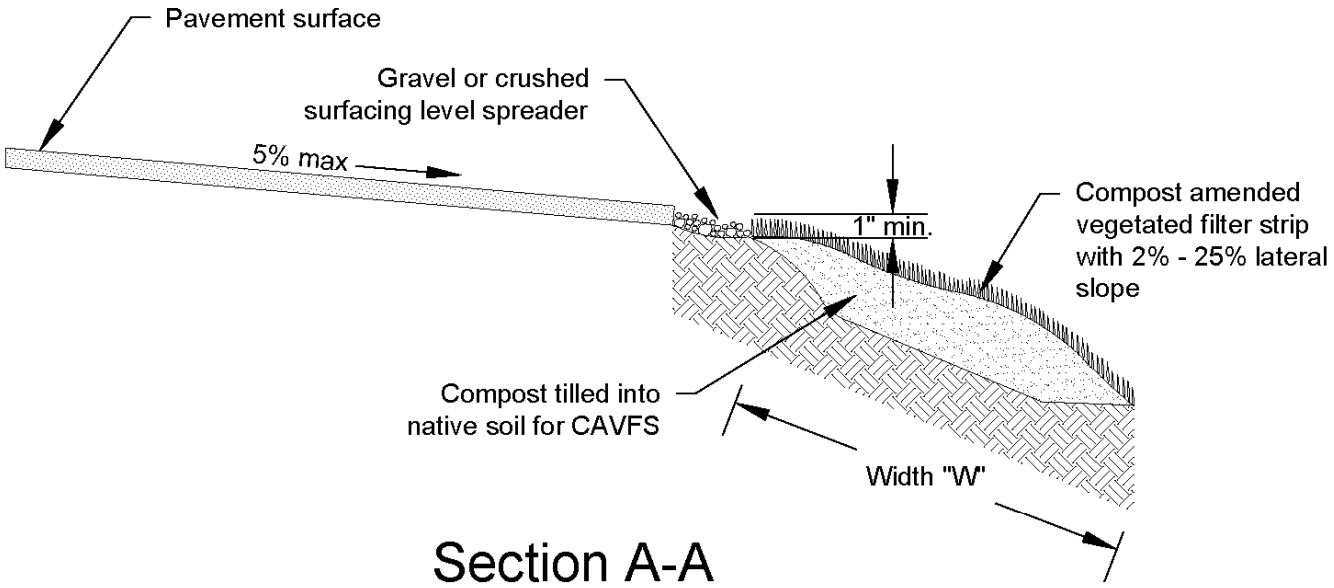
DEPARTMENT OF ECOLOGY
State of Washington

Typical Bioretention w/Underdrain

Revised January 2022



Plan View



Section A-A

This drawing is only an example that needs to be adjusted and revised for each project.

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DEPARTMENT OF ECOLOGY
State of Washington

Example of a Compost Amended Vegetated Filter Strip (CAVFS)

Revised June 2016

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Attachment H

Permits, Approvals, and Regulatory Requirements Matrix

Industrial Wastewater Treatment Plant (IWTP) Expansion
Port of Seattle – Seattle-Tacoma International Airport
Permits, Approvals, and Regulatory Requirements
March 21, 2023

This document describes the anticipated permits, approvals, and regulatory requirements to install additional storage and treatment to upgrade the existing systems at the Industrial Wastewater Treatment Plant at Seattle-Tacoma International Airport. This document has been prepared to support the development of the IWTP Expansion Project Notebook and establish an overview of the project purpose and design to support future environmental review and permitting documents.

PROJECT DESCRIPTION/ PURPOSE AND NEED FOR PROJECT

The Port of Seattle (Port) seeks to construct and operate an expansion of the Seattle-Tacoma International Airport's (SEA) Industrial Wastewater Treatment Plant (IWTP). The existing IWTP is located on the south side of the airport, approximately 2,000 feet southwest of Runway 34C and consists of lagoons for temporary detention of stormwater and a treatment works to remove solids and fuel. The existing IWTP is not capable, however, of treating deicing chemicals for the purposes of reducing Biochemical Oxygen Demand (BOD) loads and concentrations.

An expansion of the SEA IWTP is required to meet regulatory requirements contained in an Industrial Waste Discharge (IWD) permit (#7810-05) issued by King County to the Port (July 2021). The purpose of the proposed expanded IWTP is to temporarily store and biologically treat stormwater runoff from the airport's Industrial Waste System (IWS) drainage areas during winter when deicers are applied at the gates and aircraft deicing areas in the IWS. The IWTP expansion is needed to meet new restrictions on the BOD mass load from deicers contained in stormwater runoff deicers that can be discharged to the sanitary sewer system under the IWD permit.

The facilities required in an expanded IWTP to meet the IWD permit conditions include an assembly of several types of infrastructure including buildings, structures, equipment, instruments, and utilities. These expanded treatment facilities must meet the following criteria:

- Provide on-site treatment of SEA IWS runoff containing deicing chemicals to reduce BOD mass load and concentration to allow discharges to the sanitary sewer and surface water without exceeding the respective permit limits.

- Accommodate treatment facilities with a footprint of 14 to 20 acres.
- Be located in relatively close proximity to the existing IWTP facilities to allow efficient operational process control of stormwater, chemical nutrients, and air.
- Ability to install some new infrastructure components above grade to meet operational, maintenance, safety and access needs.
- Ability for the BOD treatment system unit processes to be substantially complete and operational by July 2026 (based on IWD Permit conditions).

A preliminary planning analysis of the expanded IWTP performed by the Port includes the following findings:

- Available space at the existing IWTP location is insufficient to accommodate the necessary expanded IWTP infrastructure.
- Two Port-owned sites south of S. 188th Street and just west of Des Moines Memorial Drive have sufficient acreage and proximity to the existing IWTP to meet the expanded IWTP project needs.

The resulting site layout for the expanded IWTP facilities is shown in **Figure 1**.

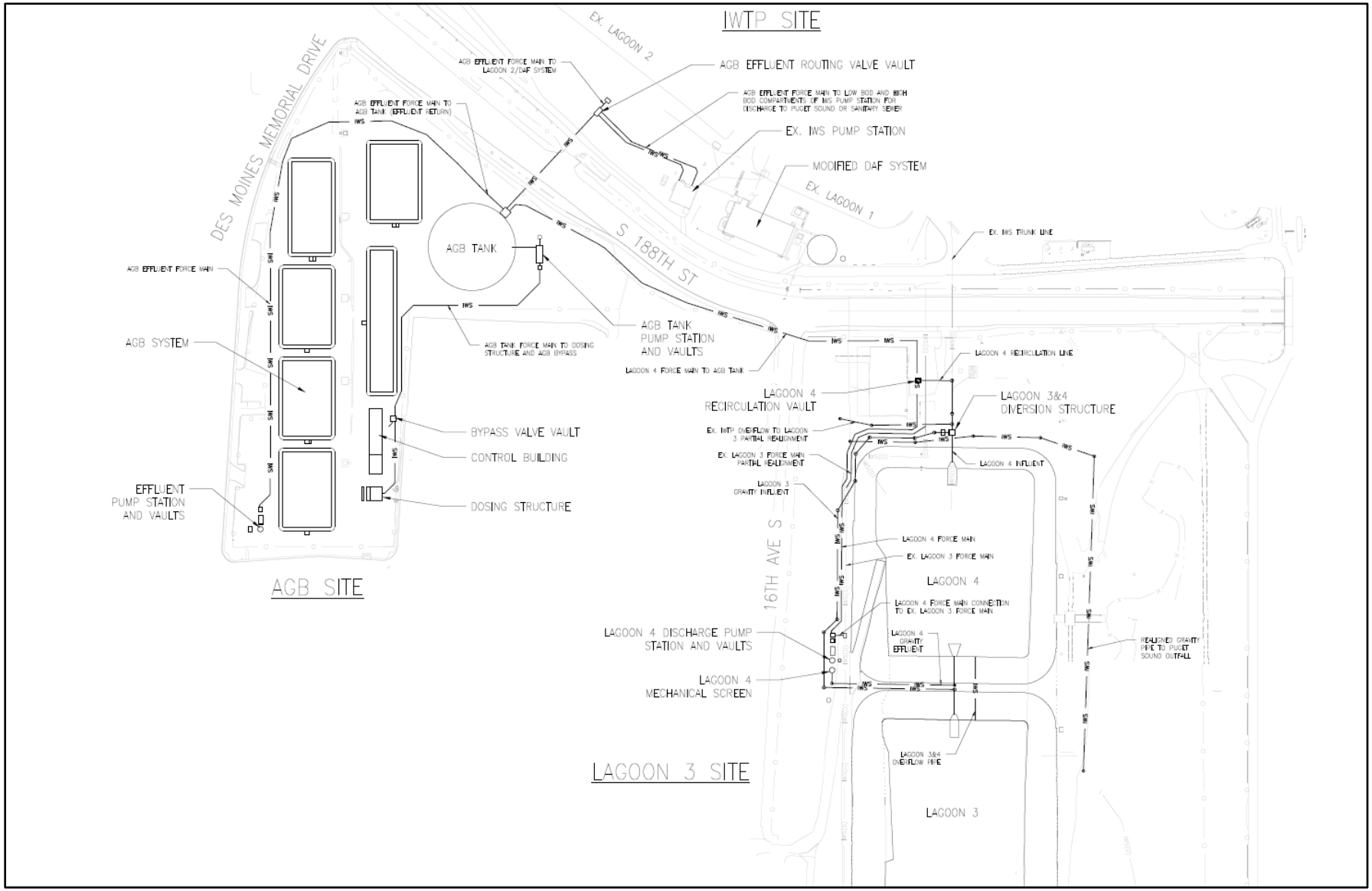

IWTP SITE
EX. LAGOON 2
AGB EFFLUENT FORCE MAIN TO LAGOON 2/DAF SYSTEM
AGB EFFLUENT ROUTING VALVE VAULT
AGB EFFLUENT FORCE MAIN TO AGB TANK (EFFLUENT RETURN)
AGB EFFLUENT FORCE MAIN TO LOW BOD AND HIGH BOD COMPARTMENTS OF IWS PUMP STATION FOR DISCHARGE TO PUGET SOUND OR SANITARY SEWER
EX. IWS PUMP STATION
MODIFIED DAF SYSTEM
EX. LAGOON 1
DES MOINES MEMORIAL DRIVE
S 188TH ST
EX. IWS TRUNK LINE
AGB TANK
AGB EFFLUENT FORCE MAIN
AGB SYSTEM
AGB TANK FORCE MAIN TO DOSING STRUCTURE AND AGB BYPASS
AGB TANK PUMP STATION AND VAULTS
LAGOON 4 FORCE MAIN TO AGB TANK
LAGOON 4 RECIRCULATION LINE
LAGOON 4 RECIRCULATION VAULT
LAGOON 3&4 DIVERSION STRUCTURE
BYPASS VALVE VAULT
EX. IWP OVERFLOW TO LAGOON 3 PARTIAL REALIGNMENT
CONTROL BUILDING
EX. LAGOON 3 FORCE MAIN PARTIAL REALIGNMENT
LAGOON 4 INFLUENT
EFFLUENT PUMP STATION AND VAULTS
LAGOON 3 GRAVITY INFLUENT
DOSING STRUCTURE
LAGOON 4 FORCE MAIN
EX. LAGOON 3 FORCE MAIN
16TH AVE S
LAGOON 4
AGB SITE
LAGOON 4 FORCE MAIN CONNECTION TO EX. LAGOON 3 FORCE MAIN
LAGOON 4 DISCHARGE PUMP STATION AND VAULTS
LAGOON 4 GRAVITY EFFLUENT
REALIGNED GRAVITY PIPE TO PUGET SOUND OUTFALL
LAGOON 4 MECHANICAL SCREEN
LAGOON 3&4 OVERFLOW PIPE
LAGOON 3 SITE
LAGOON 3

Figure 1. Planned IWTP Expansion Facilities Siting

Key components of the expanded IWTP facilities include:

- Revisions of Lagoon 3 including expansion, installation of an earthen berm to partition the lagoon into two compartments, installation of an access road around the lagoon, and various associated above- and below-ground utility structures, pipes, and conduits, etc.
- One partially buried 5 million-gallon stormwater storage tank (Figure 1, "AGB Tank")
- Six individual aerated gravel bed treatment cells (rectangular cells shown in Figure 1,"AGB System")
- Solids removal treatment units
- Pump stations
- Concrete hydraulic structures serving a variety of process needs including those for mixing, hydraulic control, valve vaults, flow control, electrical service, and instrumentation
- Site stormwater control basins and/or structures
- Utility structures and lines
- Electric, control, and instrument panels
- Potentially emergency generators
- Control and utility building
- Above- and below-grade piping
- Access roads and parking areas

Regulatory Approval Matrix

Several permits or approvals will be required to implement the project. An overview of the anticipated permits and approvals is provided in this matrix.

Permit or Approval and Lead Agency	Trigger	Estimated Permit Timeframe	Notes
Environmental Permits			
Industrial Wastewater Discharge Authorization Modification **KC DNR Waste Div.[1]**	Discharge of industrial/commercial wastewater to the King County sanitary sewer system.	Start of Commissioning	The existing IWD permit requires a series of submittals to King County to document the design and construction of the IWTP expansion. A permit mod may not be needed since the next permit renewal is anticipated to account for the IWTP expansion design. The compliance schedule in the current permit may be subject to change. Modification to the permit could include finalization of permit limitations.
Individual NPDES Permit Modification **Ecology[2]**	Proposed changes to the design and operation of the existing IWS system needed to meet permit conditions	Start of Commissioning	The Port's NPDES permit application will need to represent the modified treatment process and the pollutants associated with the discharge of treated effluent to the surface water. It is possible Ecology may require modification to permit conditions, such as monitoring conditions. The revised permit should be in place prior to the start of AGB commissioning to allow discharge to the surface water of treated effluent.
Section 402 National Pollutant Discharge Elimination System (NPDES) Construction Stormwater General Permit **Port of Seattle**	Soil disturbance of one acre or more during construction.	Issued for Bid contract documents	The disturbance threshold may also apply to areas which are currently covered by impervious area but which will have soil disturbance during construction. Permit will trigger need for a construction stormwater pollution prevention plan with a Best Management Practices plan that is linked to erosion and sediment control drawings and specifications in the construction Contract Documents.
Dam Safety Office Review **Ecology**[2]	Construction of a new dam or modification of an existing dam. Other triggers may also apply, related to changes in facilities operations and maintenance.	Prior to construction (15-30% design)	The division of existing Lagoon 3 into two compartments will likely require a new emergency spillway be added as a modification to the dam (ID# WA00671). Need confirmation that the dividing berm itself does not become a new permitted dam. The Ecology response will consist of review comments, approval, or acceptance as appropriate.

[1] King County Department of Natural Resources Industrial Waste Division
[2] Washington State Department of Ecology

Permit or Approval and Lead Agency	Trigger	Estimated Permit Timeframe	Notes
State Environmental Policy Act (SEPA) Review **Port of Seattle**	Any proposal that requires a state or local agency decision to license, fund, or undertake a project, or the proposed adoption of a policy, plan, or program can trigger environmental review under SEPA	Conceptual Design (15-30% design)	A SEPA checklist is anticipated to be prepared by the Port for public review and comment that will provide a project description, conceptual layout drawings and a description of potential impacts from the project. The IWTP Expansion SEPA checklist will also evaluate potential impacts from construction and operation of the planned mitigation at the Port-owned Southwest Tyee Mitigation Site. In addition to details regarding areas of clearing, grading, impervious surface changes and construction methods and sequencing, the SEPA checklist will need to provide specific information on impacts to wetlands and streams and their buffers, as well as account for tree removal and replacement.
National Environmental Policy Act Review **FAA[3] & USACE[4]**	Projects that require FAA approval can trigger environmental review under NEPA.	Conceptual Design (15-30% design)	Early indication from FAA is that the environmental impacts from project would be reviewed and processed as a Documented Categorical Exclusion (CATEX). Note the US Army Corps of Engineers will also complete their own internal NEPA review during the Section 404 Individual Permit process for elements of the project under their jurisdiction—in this case, filling of waters of the US (wetlands).
Endangered Species Act compliance **NMFS[5] & USFWS[6]**	Section 7 review required for actions that may affect any ESA-listed species or their critical habitat	Concurrent with CWA Section 404 review	Anticipate that an ESA “no-effect letter” would be prepared and provided to USACE as part of the Section 404 permit package. The USACE will use this information to support their ESA review process; the need for formal consultation with USFWS or NMFS is not anticipated.

[3] Federal Aviation Administration
[4] United States Army Corps of Engineers
[5] National Marine Fisheries Service
[6] United States Fish and Wildlife Service

Permit or Approval and Lead Agency	Trigger	Estimated Permit Timeframe	Notes
National Historic Preservation Act Section 106 compliance **DAHP[7] & Native American Tribes**	Activities that may affect archaeological, cultural, or historic resources or sites	Concurrent with CWA Section 404 review	Anticipate that a qualified archaeologist prepare a cultural resources memorandum that will be provided to USACE as part of the Section 404 permit package. Preparation of the memo will require a review of the project plans, areas and depth/extent of ground disturbing activities.
Critical Areas Review **Port of Seattle**	Alteration of a site with a critical area or buffer (SMC 15.700.090)	Concurrent with SEPA review	The Port of Seattle administers critical areas review as outlined in the 2018 Interlocal Agreement (with City of SeaTac), Chapter VI, Section 6.2. The City of SeaTac's critical area regulations (SMC 15.700) apply, as written on the date of the ILA. There are two exceptions described in the ILA related to projects with mitigation requirements (ILA 6.2.A).
Clean Water Act Section 404 Individual Permit **USACE**	A discharge of dredged or fill material into waters of the United States, including wetlands.	Conceptual Design (15-30% design)	Since the project requires fill of greater than 0.5 acre of non-tidal waters of the United States, an Individual Section 404 Permit will be required. A JARPA form will be prepared requesting an Individual Permit and would include a mitigation plan with design drawings for wetland mitigation. The mitigation for this project will be provided by the same mitigation project for the Snow Storage Expansion project (joint mitigation). Coordinate with requirements for Endangered Species Act and National Historic Preservation Act.
Clean Water Act Section 401 Water Quality Certification **Ecology**[2]	A 401 Water Quality Certification is required for all projects that require a Corps Individual permit.	Conceptual Design (15-30% design)	Issuance of the 401 Water Quality Certification demonstrates that the Project will comply with state water quality standards and other aquatic resource protection under Ecology's regulatory authority. Procedurally, Ecology issues the 401 Certification before the Corps can issue the Section 404 Individual Permit.
Coastal Zone Management Act (CZMA) Consistency Determination **Ecology**[2]	Triggered by projects that contain a federal nexus proposed within any of Washington's 15 coastal counties.	Conceptual Design (15-30% design)	Issuance of the CZMA Consistency Determination occurs as part of coordination with the USACE and Ecology for the CWA Section 404 and 401 processes described above. No separate application is required.

[7] Washington State Department of Archaeology and Historic Preservation

Permit or Approval and Lead Agency	Trigger	Estimated Permit Timeframe	Notes
Notice of Construction / Order of Approval **Puget Sound Clean Air Agency**	New or modified air pollution source (see links in Notes for details)	Prior to Commissioning Requires process flow diagram, emission estimate, equipment information Requires completed SEPA	Depending upon state regs and design development, it's possible there might be air PTI or PTO required for emergency generators and blowers. The first and second links below provide details on when a permit is required. The third link provides an overview of the Notice of Construction permit process. The fourth link provides the application form for the Notice of Construction permit. https://pscleanair.gov/177/Construction-Permits https://wa-pugetsoundcleanair.civicplus.com/DocumentCenter/View/166/Regulation-I-Section-603-PDF?bidId= https://pscleanair.gov/179/Apply-for-Notice-of-Construction-Permit https://pscleanair.gov/DocumentCenter/View/2979/Notice-of-Construction-Application---Form-P-PDF?bidId=

Permit or Approval and Lead Agency	Trigger	Estimated Permit Timeframe	Notes
Land Use Permits			
Grading Permit **Port of Seattle**	Clearing or grading ≥ 7,000 sq. ft. OR clearing or grading within a sensitive area or its buffer OR impacts which are below these thresholds but don't meet specific performance and restoration requirements (SMC 13.190.050).	Prior to construction	The Port of Seattle grading review is consistent with City of SeaTac municipal code requirements. SMC 13.190 Clearing and Grading Code: https://www.codepublishing.com/WA/SeaTac/html/SeaTac13/SeaTac13190.html Grading permits can be issued for up to two years with the potential for additional two year extensions.
Building Permits			
Building Plumbing Mechanical Electrical Fire Suppression **Port of Seattle**	Construction of Control Building at AGB Site IWTP DAF Building Modifications	Prior to construction	All project elements will occur within the Airport Activity Area (AAA) identified in the 2018 Interlocal Agreement (ILA) between the Port of Seattle and City of SeaTac. Therefore, the Port administers and enforces permitting requirements as described in Chapter V of the ILA. Specifically, this includes building, plumbing, mechanical, electrical, energy conservation, and fire-related permitting requirements.
Right-of-Way (owned by City of SeaTac) **City of SeaTac**	Required for any work within the City of SeaTac right-of-way	Prior to construction	The project will include modifying the access drive around Lagoon 3, constructing a new access road around the AGB site, and work near other access roads on the airport around the IWTP building.Types of Right-of-Way permits potentially required: • Right-of-Way Class B Permit – Short Term Use / Over Legal Load • Right-of-Way Class C – Development • Right-of-Way Class D – Franchise Utility https://www.seatacwa.gov/government/city-departments/public-works/engineering-review-division/right-of-way-permits

Permit or Approval and Lead Agency	Trigger	Estimated Permit Timeframe	Notes
Land Use **Port of Seattle**	Development within AAA Edges Properties	Prior to construction	Per 3.4.B of the ILA, properties within the AAA boundaries are exempt from the development standards and regulations described in Chapter 3 of the ILA and the SeaTac municipal code. However, since the project occurs within AAA Edges Properties as described in 3.4.D of the ILA, there are requirements for aesthetic treatment and screening as described in 3.4.D.2 of the ILA.
Utility Permits			
Sanitary Sewer **Midway Sewer District**	Construction of Control Building at AGB site which will include a restroom facility.	Prior to construction	The project area south of S 188th Street is within Midway Sewer District (3030 S 240th Street, Kent, WA 98032). The project area north of S 188th Street is SEA sewer system which is served with service agreements with the adjacent sewer district). The Control Building on the AGB site will have a restroom which will require sanitary sewer connection.
Water Supply **City of SeaTac**	Construction of AGB yard hydrant and Control Building at AGB Site	Prior to construction	Portions of the site are served by either the SEA water system or the Highline Water District #75 as shown on map at link below: *https://www.seatacwa.gov/home/showpublisheddocument/112/636292344776430000* The Control Building on the AGB site will have a restroom and lab which will require potable water supply. Yard hydrants adjacent to the AGB cells will require potable water supply.
Natural Gas Supply **Puget Sound Energy**	Control Building may use natural gas for heating	Prior to construction	[Need Port Review] The Port reviews and permits natural gas lines within buildings (as part of building permit review – see separate permit). Puget Sound Energy installs the service. Puget Sound Energy does all permitting for service installation.
Utility Connections/Demo Coordination **Utility Agencies TBD**	Construction at AGB site may encounter existing active utilities	Prior to construction	Some existing utilities on the AGB site may still be active. The need for this coordination will be determined.

Permit or Approval and Lead Agency	Trigger	Estimated Permit Timeframe	Notes
Construction Permits			
Soil Handling or Disposal Permit **Lead Agency: Washington State Department of Ecology**	Construction at the AGB site may disturb sites with known prior contamination.	Prior to construction	The need for construction-level permits will be revisited after design has further progressed. These permits have short review timelines and are often obtained by the contractor selected to perform the work.
Asbestos/Demolition Notification Form **Puget Sound Clean Air Agency**	Demolition will require an asbestos survey. Any friable asbestos removal or demolition will require submittal of an Asbestos/Demolition Notification Form if any of the following are exceeded: • 10 linear feet of friable asbestos • 48 square feet of friable asbestos • 120 square feet (project roof area) of friable asbestos	Notification submittal required 10 days before demolition	Modifications within the IWTP DAF Building may trigger this requirement. The need for this permit will be determined.
Well Construction or Decommissioning (includes piezometers) **Ecology**	Drilling activities for well construction Construction on AGB site if wells still exist on-site	Prior to well construction or demolition	[Need Port Review] The need for this permit will be determined, such as if any wells remain active at the construction sites that need to be decommissioned or if any new wells are planned to be constructed for groundwater monitoring.

Permit or Approval and Lead Agency	Trigger	Estimated Permit Timeframe	Notes
FAA Coordination/ Approvals			
Design and Construction Coordination **FAA**[3]	Proposed design and construction nearby FAA-owned utilities	Initiated at start of detailed design	FAA operates the MALSR Lights at end of Runway 34L and 34C. Proposed components in the project will be nearby and require coordination and review by FAA.
Updated Airport Layout Plan (ALP) **FAA**[3]	Proposed design and construction that change the existing approved Airport Layout Plan	Substantial completion of construction	Port airfield operations staff routinely manage ALP updates as needed.
Construction Safety and Phasing Plan **FAA**[3]	Proposed construction on the airfield	Prior to construction	Design consultant typically prepare drafts of this plan for Port review.
7460-1 Notice of Proposed Construction or Alteration **FAA**[3]	Compliance with various criteria in FAA Airspace Protection Guidance Part 77 – Objects Affecting Navigable Airspace	Prior to construction	Need both temporary 7460s for construction (e.g., cranes) and permanent above ground structures. Will likely be multiple applications to submit based on project phasing.

PERMIT ACQUISITION

The Port of Seattle will acquire the following permits for the Project:

- **U.S Army Corps of Engineers Individual Permit**: A Section 404 Individual Permit is required for over 0.5 acre of discharge of dredged or fill material into waters of the United States.
- **Washington State Ecology 401 Water Quality Certification:** A 401 Water Quality Certification is required for all projects that require a Corps Individual permit. Issuance of the 401 Water Quality Certification demonstrates that the Project will comply with state water quality standards and other aquatic resource protection under Ecology's regulatory authority. Procedurally, Ecology issues the 401 Certification before the Corps can issue the Section 404 Individual Permit.
- **Washington State Ecology Coastal Zone Management Act Consistency Determination:** A Coastal Zone Management Act (CZMA) Consistency Determination is required for projects with federal funding – or other federal nexus – within Washington's 15 coastal counties, including King County. Issuance of the CZMA Consistency Determination occurs as part of coordination with the Corps and Ecology for the Nationwide/Individual and water quality certification processes described above.

  King County Wastewater Discharge Authorization: A King County Wastewater Discharge Permit is required for discharge of industrial wastewater to King County's sanitary sewer system. Estimated time for approval of a Wastewater Discharge Permit is 60 to 90 days after submittal of the complete application (60 days is King County's goal once the public notification period begins; 90 days allows for a lag between submittal and public notification and also time for the Port's review of a draft permit). The Control and Utility Building will also have restrooms and sinks that require connection to a sanitary sewer and associated permit authorization.
- **King County Wastewater Discharge Permit:** This permit may be required depending upon specific plans for dealing with construction dewatering water. This permit is used to allow discharge of construction dewatering water to King County's sanitary sewer system. There are different thresholds which can require either a general authorization or an individual authorization. Permit issuance for this permit is typically faster than for the King County Wastewater Discharge Authorization described separately (above). The size of this site and potential groundwater / infiltrated stormwater rates for dewatering make it likely the water

will need to be treated and discharged with site stormwater rather than discharging to the sanitary sewer.

- **Section 402 National Pollutant Discharge Elimination System (NPDES) Construction Stormwater General Permit**: The Project will have over one acre of disturbed soil. Typical issuance occurs within 60 days of a complete permit application. SEPA is required for complete permit application status.
- **Port of Seattle Grading Permit:** A site/grading permit is required for any clearing or grading unless the work meets certain requirements. These requirements include having less than 7,000 square feet of clearing or grading, not having impacts within a sensitive area or its buffer, and meeting specific performance and restoration requirements (SMC 13.090.050).
- **Critical Areas Code Compliance**: Critical areas code compliance will occur as part of the Port's environmental review and permitting processes. Critical area review will be required for alteration on a site with a potential or confirmed critical area or buffer (SMC 15.700.090). A critical area report will likely be required for alteration near wetlands or streams.
    - The project may occur adjacent to or within wetlands and their buffers, depending upon project design near wetlands IWS-A, IWS-B, and WL28.
    - The City of SeaTac Wetlands and Stream map also shows a stream associated with wetland WL28.
    - The project is entirely outside of erosion, landslide, and seismic hazard areas (per maps 9.3, 9.4, and 9.5 from the Chapter 9 Environment Element of the City of SeaTac Comprehensive Plan). The project is entirely outside of flood hazard areas (FEMA flood map service).
- **State Environmental Policy Act (SEPA):** The Port will prepare a SEPA checklist to identify potential environmental impacts from the project. This checklist will undergo public review, and the Port will make a final SEPA determination after consideration of public comments.
- **National Environmental Policy Act (NEPA):** Both FAA and the Corps will review elements of this project and may require environmental review under NEPA as part of those approval processes. The Port will prepare information to support federal agency review under NEPA, as necessary.

- **Endangered Species Act (ESA) Compliance:** As part of the Corps permitting process, an assessment of potential impacts to species listed under ESA will be provided with NEPA CATEX and USACE permitting materials.
- **Section 106 of the National Historic Preservation Act (NHPA) Compliance:** As part of the Corps permitting process, an assessment of potential impacts to cultural resources, including archaeological resources will be provided with NEPA CATEX and USACE permitting materials.

FAA APPROVALS

Approvals from FAA for certain temporary construction activities and installation of certain permanent structures are required through the 7460-1 Notice of Proposed Construction or Alteration process. Particular restrictions on height of cranes and other construction equipment may be applicable, particularly within the Runway Protection Zones for Runways 34L and 34C.

A Construction Safety and Phasing Plan along with safety and phasing drawings incorporated into the construction drawings are required to be completed for certain areas of construction.

With construction occurring near the runway light towers, coordination with FAA will be required that will likely involve a review of drawings and potentially a Memorandum of Understanding to ensure no construction or operational impacts and ensure site access.

KEY ASSUMPTIONS

The Port will seek permits for geotechnical borings, potholing, and excavation work that is performed in support of the design process prior to construction.

Attachment I

Preliminary List of Construction Specifications

Attachment I
Preliminary List of Construction Specifications

Port standard specifications shall be used where available. The above specifications list was cross-referenced against currently available Port F&I standards documents and Port Guide Specifications to align with Port standard specification section names and numbers. Where conflicts were identified, the list was matched to more recent standards rather than the Guide Spec. Referenced documents included:

- SEA F&I Civil System Standards, 2023
- SEA F&I Electrical Standards, 2023
- SEA Mechanical Standards, 2020
- Seattle-Tacoma International Airport Design Guidelines & Standards, 2023
- Port of Seattle Guide Specifications https://www.portseattle.org/page/guide-specifications (accessed June 20, 2023)

PROCUREMENT AND CONTRACTING REQUIREMENTS
DIVISION 00 -- PROCUREMENT AND CONTRACTING REQUIREMENTS
00 0000 - Table of Contents
00 4323 - Alternates Form
REFERENCED SECTIONS

SPECIFICATIONS
DIVISION 01 -- GENERAL REQUIREMENTS
01 1100.1 - Summary
01 2200.1 – Unit Prices
01 7836a - Warranties and Bonds- Appendix A Warranty Requirements
REFERENCED SECTIONS
DIVISION 02 -- EXISTING CONDITIONS (NOT USED)
DIVISION 03 -- CONCRETE
03 3000A - Cast-in-Place Concrete
03 4500 - Precast Architectural Concrete
DIVISION 04 – MASONRY
04 2000 - Unit Masonry
DIVISION 05 -- METALS
05 5000.1 - Metal Fabrications
DIVISION 06 -- WOOD, PLASTICS, AND COMPOSITES
06 1000 - Rough Carpentry
DIVISION 07 -- THERMAL AND MOISTURE PROTECTION
07 2100.1 – Roof and Deck Board Insulation
07 5419 - Polyvinyl-Chloride Roofing
07 7100 - Roof Specialties
07 9200.01- Joint Sealers
DIVISION 08 -- OPENINGS
08 1113 - Hollow Metal Doors and Frames
08 3100 - Access Doors and Panels
08 3113.1 - Access Doors and Frames for Utility Structures
08 3323 - Overhead Coiling Doors
08 4313.1 - Aluminum-Framed Storefronts

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08 7100.1 - Door Hardware
08 8000.1 – Glazing

DIVISION 09 -- FINISHES
09 0561 - Common Work Results for Flooring Preparation
09 2216 - Non-Structural Metal Framing
09 3000.1 - Tiling
09 5100.1 - Acoustical Ceilings
09 6700.1 - Fluid-Applied Flooring
09 9000 - Paints and Coatings

DIVISION 10 – SPECIALTIES
10 1400 – Specialty Signs
10 2113.13 - Metal Toilet Compartments
10 2800 - Toilet, Bath, and Laundry Accessories
10 4400 - Fire Protection Specialties
10 7316 - Canopies

DIVISION 11 -- EQUIPMENT
11 3013 - Residential Appliances
11 5300 - Laboratory Equipment
11 8129 – Facility Fall Protection

DIVISION 12 -- FURNISHINGS
12 3553.13 – Metal Laboratory Casework

DIVISION 13 -- SPECIAL CONSTRUCTION
13 3423 - Pre-Engineered Fiberglass Buildings

DIVISION 14 -- CONVEYING EQUIPMENT (NOT USED)

DIVISION 21 -- FIRE SUPPRESSION

DIVISION 22 – PLUMBING
22 1429 - Sump Pumps

DIVISION 23 - HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)
23 0500.1 - General Mechanical Requirements
23 0514.1 - Variable Frequency Drives
23 0529.1 - Hangers, Sleeves and Supports
23 0548.1 - Vibration Control for HVAC Piping & Equipment
23 0553.1 - Identification for HVAC Piping and Equipment
23 0593.1 - Mechanical Systems Testing, Adjusting & Balancing
23 0700.1 - HVAC Insulation
23 0800.1 – General Commissioning Requirements
23 0900.1 - Instrumentation and Control for HVAC
23 1123 – Natural Gas Distribution System
23 2113.1 - Hydronic Piping
23 2300.1 - Refrigerant Piping
23 3000.1 – Air Distribution System
23 3400.1 - Fans
23 5100.1 - Breeching Chimneys and Stacks
23 8136.1 - Variable Refrigerant Volume (VRV) Air-Conditioning Units

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DIVISION 25 - INTEGRATED AUTOMATION
- 25 1300.1 - Integrated Automation System (IAS)

DIVISION 26 - ELECTRICAL
- 26 0500.1 – Common Work Results for Electrical
- 26 0519.1 – 600 Volt or Less Wire and Cable
- 26 0526.1 - Grounding and Bonding for Electrical Systems
- 26 0529.1 - Hangers and Supports for Electrical Systems
- 26 0533.1 - Raceways and Boxes
- 26 0543.1 - Underground Ducts and Raceways for Electrical Systems
- 26 0548 – Seismic Controls for Electrical and Communications Work
- 26 0553.1 – Electrical Identification
- 26 0573.1 - Arc Flash, Short Circuit, Overcurrent Protective Device Coordination Study
- 26 2200.1 – Dry-Type Transformers (600V and less)
- 26 2413.1 – Low Voltage Switchboards
- 26 2416.1 – Panelboards
- 26 2726.1 – Wiring Devices
- 26 2816.1 – Enclosed Switches and Circuit Breakers
- 26 4113.1 – Lightning Protection for Structures
- 26 4313.1 – Surge Protection Devices for Low-Voltage Electrical Power Circuits
- 26 9155 – Enclosed Motor Starters
- 26 9477 – Overcurrent Protective Device
- 26 9483 – Variable Speed Drive

DIVISION 27 - COMMUNICATIONS
- 27 0513 - Communication Services

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY
- 28 3111.1 - Intelligent, Addressable Fire Alarm System

DIVISION 31 - EARTHWORK
- 31 0516 - Crushed Stone and Gravel
- 31 0519.13 - Geotextile
- 31 0519.17 - HDPE Flex Membrane
- 31 2316.1 - Rock Excavation and Disposal
- 31 2319 - Dewatering
- 31 2333 - Trenching and Backfilling
- 31 3700 - Riprap
- 31 5000 – Trench Safety Systems

DIVISION 33 - UTILITIES
- 33 0519 - Ductile Iron Pipe and Fittings
- 33 0531.19 - Fusible PVC Force Mains
- 33 0533.23 - High Density Polyethylene Force Mains
- 33 0581 - Metallic Castings for Utility Structures
- 33 1000 – Water Distribution System Requirements
- 33 3100 – Sanitary Sewer System Requirements
- 33 4211 – Storm and IWS Piping and Valves

DIVISION 35 - WATERWAY AND MARINE CONSTRUCTION
- 35 2226 - Weir Gates

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DIVISION 40 - PROCESS INTERCONNECTIONS

- 40 0501.1 - Testing of Pipelines and Hydraulic Structures
- 40 0506 - Piping Specialties
- 40 0507 – Hangers & Supports for Process Piping
- 40 0523 – Stainless Steel Process Pipe and Tubing
- 40 0531 - Thermoplastic Process Pipe
- 40 0533 – High-Density Polyethylene Process Pipe
- 40 0551 - Common Work Results for Process Valves
- 40 0557 – Actuators for Process Valves and Gates
- 40 0559 - Process Slide Gates
- 40 0597 - Identification for Piping & Equipment
- 40 4113 - Process Piping Heat Tracing
- 40 4200 - Process Piping & Equipment Insulation
- 40 7010 - Instrument System Basic Requirements
- 40 7010A - Instrument List
- 40 7100 – Flow Measurement
- 40 7113 - Magnetic Flow Meters
- 40 7200 - Level Process
- 40 7302 – Gas Pressure Measurement
- 40 7304 – Liquid Pressure Measurement
- 40 7513 – PH Analyzers
- 40 7543 – DO Analyzers
- 40 7576 - TOC Analyzers
- 40 9123 – Wiring
- 40 9127 – Fiber Optic
- 40 9200 – Control Panels
- 40 9350 – System Integrator
- 40 9400 – Instrument and Control System Startup Testing
- 40 9443 – PLC Hardware and Software
- 40 9500 – Operator Interfaces and Software
- 40 9514 – Uninterruptible Power Supplies

DIVISION 43 - PROCESS GAS AND LIQUID HANDLING, PURIFICATION, AND STORAGE EQUIPMENT

- 43 1133 - Rotary Lobe Blowers
- 43 2313 – End Suction Centrifugal Pumps
- 43 2513 - Submersible Centrifugal Pumps
- 43 2600 – Propeller Pumps
- 43 4143 – Polyethylene Tanks
- 43 4185 - Prestressed Concrete Storage Tank

DIVISION 46 - WATER AND WASTEWATER EQUIPMENT

- 46 2533 - Dissolved Air Flotation Equipment
- 46 3341 - Liquid Chemical Feed System Coordination and Integration
- 46 3344 - Peristaltic Metering Pumps

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Preliminary List of Construction Specifications

46 4123 - Submersible Mixer
46 7113 - Gravity Thickeners

DIVISION 99 – FAA SPECIFICATIONS

99 0002 (D-705) - Pipe Underdrains for Airports
99 0004 (D-752) – Concrete Culverts Headwalls and Misc. Drainage Structures
99 0008 (P-152) - Excavation, Subgrade, and Embankments
99 0012 (P-156) - Temporary Air and Water Pollution, Soil Erosion, and Siltation Control
99 0017 (T-901) - Seeding
99 0200 (T-905) - Topsoiling
99 0021 (T-908) – Mulching

Attachment J

Port Maintainability Notes

Maintainability Notes:

1. Identify and coordinate maintenance access with all disciplines and trades. All equipment requiring any type of inspection or service must, at a minimum, adhere to all OEM clearance requirements, as defined in manufacturer's literature, drawings, and manuals. Use BIM for clash detection and resolution. Common conflicts are with fixed in place FFE, conduits, fire sprinkler piping, light fixtures, ceiling grids, clearance in front of electrical boxes in the ceiling, and access to HVAC equipment. For example:
    a. Route conduit tight to structure for ease of access and maintenance.
    b. HVAC boxes have air filters that slide out – allow room for the removal and insertion of the new filters.
    c. Conveyor systems have end rolls that come out the bottom and bearings that require minimum 12" for use of tools such as bearing pullers for side extraction.
    d. Maintain clear access to valves and cleanouts. Provide access doors in walls and hard ceilings where cleanouts are located.
    e. Fire suppression systems are deferred submittals. The fire system designer and installer shall coordinate maintenance access with all disciplines and trades as noted above.

2. Existing equipment to remain and new installed above ceilings:
    a. Shall be installed such that the ceiling grid does not have to be disassembled for maintenance access and that all service points are no more than 24" above the ceiling grid.
    b. Allow clearance to lift up ceiling panels and move them out of the way without damage – or use swing down panels. Architectural ceiling panels should not exceed 2'x4' and shall not exceed 20 pounds.
    c. The tails of all equipment and grid support wires shall be cut off or wrapped tight to the tension cord so the ends are not a safety hazard for personnel working in the ceiling. In the case of cables or fine wires, the wires need to be coiled and terminated so they cannot injure personnel or impede maintenance work.
    d. All elevated equipment requiring any service shall be safely accessible with a standard device (high lifts, ladders, steps or catwalks), not scaffolding, while maintaining the OEM recommended clearances. This includes access to equipment that is in recessed locations.
    e. Any equipment that is out of reach for servicing by a standard device, needs proper access provisions such as a catwalk without horizontal or vertical obstructions.

3. Access Hatches shall be positioned for maintenance access and shall be 24"x 24" minimum. Overhead access panels shall not exceed 20 pounds and be operable by one person.

4. Threaded rod for supporting equipment, conduits, piping or trapezes shall have double nuts installed under hanger and threaded rod cut to extend no more than 3 threads below the hanger support nut. Cut ends shall be deburred and sharp edges removed. This also applies to strut mounted horizontally, such as at columns. Plastic rod caps may be used. Unistrut also needs to have ends deburred. Provide plastic caps on strut ends from walking surfaces up to 7' above the walking surface. Catwalks are considered walking surfaces.

5. Mechanical chases with wet systems and in janitor/custodial closets with mop sinks: application of a non-slip fluid applied water proofing traffic coating shall be applied with provision to wrap application 4" up vertical surfaces at the area perimeter and at penetrations. Waterproof wainscot shall be installed at mop sink enclosures up to at least 1'-0" above faucets and extend at least 2' beyond either side of the mop sink.

6. Provide hold open time adjustable power operated door openers or electromagnetic hold opens tied to the smoke/fire alarm system for doors which will be used for transit of pallet jack deliveries, carts or cleaning equipment. Coordinate with security requirements to select power openers or electromagnetic hold opens.
    a. Back of house doors
    b. Public doors.
    c. Janitorial room doors shall have hold opens built into the closer unless they are fire rated. If a janitorial room door is fire rated, use magnetic hold open.
7. Use Port Guide Specifications Section 08 70 00 for hardware – including BEST Small Format Interchangeable Core (SFIC) figure 8, seven pin cores and keys to match existing SEA keys. Double doors and double swing gates, which require a center post, shall have a center post which is removable by use of a lock and key compliant with Section 08 70 00. Tenant Point of Sale and other tenant owned and maintained casework does not need to comply with BEST SFIC. Comply with the Port Guide Specification for standard keys.

8. Provide half door height stainless steel kick plates on the push side of doors which will be used for transit of pallets, carts and cleaning equipment.
9. Round or ease edges and corners of surfaces to remove sharp corners and edges which could injure passengers or personnel or snag cleaning cloths. Typically, this would be from floor height to 8' above finished floor.
10. Maintain a minimum 80" headroom and minimum 48" clear width along all pathways. For future removal and replacement of equipment, the doorways, route to and through the rooms, corridors and elevators shall be sized and aligned to accommodate removal and replacement of major equipment without disassembly from factory shipped configuration. The contractor shall field coordinate all trades to install infrastructure and other items to preserve the right of way and working clearances. Doors shall swing nearly 180° unless they strike a permanent object. Show doors on drawings with full swing and provide hardware designed for full door swing.

11. Access and clearance in utility chases shall have 36” clear width from face to face of all infrastructure and attachment devices for walking and working in the length of the chase. To allow service access to utilities, utility chases should not be sheathed with GWB on the side(s) of the chase which have piping. Chases shall be min 25 foot candle illuminated and ventilated. For combination chase/custodial closets, AVM may approve two levels of removable 2x4 on brackets to keep custodial carts from striking exposed piping or accessories.

12. Maintain clear access pathways to get maintenance materials and equipment to and across the roofs. This includes coordination of conduits, piping and expansion joints. Do not install pipes or conduits across walkways without installing permanent low slope crossover ramps, with handrails, and slip resistant walking surface for delivering materials using hand trucks.

13. Access to equipment rooms shall accommodate pallet jack deliveries - including ramp break over angles.

14. In mechanical and electrical rooms, the access to routine lubrication, service and inspection points shall be by walking up to it at ground level without obstruction, otherwise provide stairways and OSHA and Washington State DOSH compliant access platforms or catwalks.

15. LED drivers for lighting shall be accessible for replacement without the use of trades other than electricians and shall have quick disconnecting connectors.

16. No equipment shall be positioned in a confined space. Provisions shall be made to eliminate the Confined Space Requirements by mounting equipment outside any confined spaces. An exception to this may be lift stations and cable vaults.

17. All equipment shall have provisions installed for removing failed components and installation of new components in a safe manner. For components exceeding 50 pounds, this may require built-in lifting points, slides or hoisting systems. Provide complete lifting information on how each component can be removed and replaced while adhering to this requirement. Pathways shall be designed so that equipment does not need to be carried up or down stairs or lifted over obstacles such as expansion joints, conduit, or piping.

18. Fall protection is required for open-sided floors and platforms at four feet or more above adjacent floor or ground level. This requirement also applies to temporary installations where POS personnel will be working. Where railings or parapets do not comply with Washington Administrative Code (WAC), Provide a Personal Fall Arrest System (PFAS). PFAS is a system with components that work together to protect workers when they fall from elevated heights. PFAS components include anchorage, connectors, and a full-body harness, and may include a shock-absorbing lanyard, a retractable lifeline, and/or a deceleration device.
    a. The system shall be designed for fall arrest for a minimum of two concurrent people, 310 lbs. each, and permanently labeled for the lifetime of the system.

b. PFAS components will be marked by the manufacturer with pertinent information specific to the equipment, such as warnings, serial/model number, capacity, and the materials used to make the component (see Figure 14 in the OSHA reference below). Information (e.g., proper use, maintenance, inspection) about fall protection components is typically provided in equipment manuals. The label (signage) shall be designed for the lifetime of the equipment. The label shall be UV resistant and weatherproof. The permanent label(s) shall be installed at the access point(s) to the PFAS. Signage is typically installed inside the building at the doors accessing the fall protection. A drawing may be necessary to be posted to identify the systems.

c. When the fall arrest system is a Horizontal lifeline (HLL), all post shall be equipped with anchor tie-back/tie-off points. This allows for redundancy and added safety in the event of failed inspections or while repairs/inspections are pending on the HLL.

d. References

   i. WAC 296-880-200

   ii. WAC 296-880-20005

   iii. 29 CFR 1926.500(b)

   iv. https://www.osha.gov/dts/osta/otm/otm_v/otm_v_4.html#fall_arrest

19. Fall protection system components requiring periodic inspections shall be selected from systems which do not require qualified personnel for the inspections. Select equipment which, per the manufacturer's instructions, may be inspected by competent personnel.

20. Provide 42" high parapet walls or rails on roofs, bridges and other elevated walk surfaces at 4' or more above the adjacent walk surface. Where not feasible, provide other fall protection system.

21. Provide fall protection tie-offs for service of elevated equipment. An example is for servicing elevated cameras from a ladder. Access must be safe and efficient. Serviceable side of equipment on roofs shall be located facing away from the edge of the roof. Regardless of height, if a worker can fall into or onto dangerous machines or equipment (such as a liquid filled tank or a conveyor belt) provide guardrails and toe-boards to prevent workers from falling and being injured.

22. No asphalt-based products are allowed above or over PVC roof material. All products in contact with the roof system shall be compatible.

23. Galvanized materials exposed to rainwater and installed over hard surfaces, such as but not limited to pavement and roofs, shall be prepared, primed and painted per Port Guide Specification Section 09 97 13 Special Coating - Metal. Coating application as part of the manufacturing process is preferred over painting in the field. Provide surface preparation and two finish coats of materials that have been submitted and

approved by the Port. *(Last sentence included until Section 09 97 13 is updated and includes products.)*

24. Roof clearances:
    a. Curbs for mechanical equipment and other roof penetrations shall have 18" separation from adjacent vertical surface for working clearances.
    b. Curbs and penetrations shall include a minimum of 8" above the insulated roofing material for boots and vertical PVC. Cap and counterflashing shall not be less than 8" above the insulated roof membrane.
    c. Provide adequate vertical clearance between roof surfaces and other objects to allow access for roof repairs and roof replacement. This would typically be 30" or more.
    d. Locate equipment at least 6' from the edge of a roof and provide fall protection from leading edges.

25. Provide 120VAC convenience power outlets on roofs at service points.

26. Demolition: do not abandon equipment or infrastructure in place; remove it back to its source. This includes pipes that penetrate roofs – do not cut them off below the deck and leave the stub up through the roof. Remove it all; patch the holes and surfaces; provide firestops.

27. Prior to any wall or ceiling closure, contractor **Shall** request, through the Engineer, inspection of electrical and mechanical installations by Aviation Maintenance and Facilities & Infrastructure staff.

28. Outdoor equipment subject to damage by freezing shall be heat traced and insulated or installed in a hot box enclosure sufficiently sized to allow full access for maintenance.

29. Spaces, such as interstitials containing equipment that requires maintenance, shall be provided with appropriate lighting; minimum 25 foot candles.

30. Submittal of draft redline as-built project documents and draft Operations and Maintenance Manuals (O&M) including Asset Onboarding Data / Computerized Maintenance Management System (CMMS form) are required prior to final inspections and substantial completion.

31. The Excel CMMS source file, using current template version from AVM, shall be submitted separately at least 90 days prior to Substantial Completion, Partial Substantial Completion, or turnover of any equipment for the Port to maintain. (The following link is internal to the Port of Seattle: https://compass.portseattle.org/node/16441.)

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