

FINAL- REPORT

JUNE 26, 2025

FEL-1 Improvements Project 3535 Engineering Report



Prepared for:

Kaiser Aluminum – Trentwood





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Abbreviations

Units of Measure

°F	Degrees Fahrenheit
μS/cm	microSiemens/cm
lbs/day	pounds per day
mg/day	milligrams per day
mgd	million gallons per day
mg/L	milligrams per liter
mS/cm	milliSiemens per centimeter
pg/L	picograms per liter

Table of Abbreviations

AKART	all known, available, and reasonable methods of prevention, control, and treatment
ANSI	American National Standards Institute
BoD	Basis of Design
BODR	Basis of Design Report
BTU	British Thermal Units
CAPEX	Capital Expense
CBOD ₅	Carbonaceous Biological Oxidation Demand (5-day)
DAF	Dissolved Air Flotation
EPA	Environmental Protection Agency
HDPE	High-density polyethylene
HEM	Hexane Extractable Material
HMI	Human machine interface
HPU	Hydraulic Power Units
I&I	Infiltration and inflow
IDF	Intensity, duration, frequency

MOC	Materials of construction
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
O&G	Oil and grease
O&M	Operations and Maintenance
OPCC	Opinion of probable construction costs
OPEX	Operations and Maintenance Expense
PCB	Polychlorinated biphenyls
POTW	Publicly Owned Treatment Works
RO	Reverse osmosis
TDS	Total dissolved solids
TMDL	Total maximum daily load
TSS	Total suspended solids
UIC	Underground injection control
UVAOP	ultraviolet advanced oxidation process
WSDOE	Washington State Department of Ecology
WSFS	Walnut Shell Filter System

1.0 Introduction

In 2022, the Washington State Department of Ecology (WSDOE) issued the National Pollutant Discharge Elimination System (NPDES Permit) waste discharge permit number WA0000892 to Kaiser Aluminum Washington, LLC (Kaiser). The permit contains several conditions, including lower effluent loading of total PCBs in the discharge to the Spokane River. Therefore, Kaiser has explored several options for improving the site stormwater management and process systems. A facility-wide water reduction evaluation was performed and was summarized in the Basis of Design Report (BODR) – Water Balance and Options Analysis prepared in 2022 by WSP (WSP 2022). The BODR presented a comprehensive water balance model for the entire facility and presented options for increasing water usage efficiency. Options focused on reducing discharge to the Spokane River through a variety of process and water management modifications. In the fourth quarter (Q4) of 2022, Jacobs built on the prior work and evaluated additional options for North Production Area discharges to an on-site wetland/infiltration system as well as to the Publicly Owned Treatment Works (POTW) (Jacobs 2023). In addition, a site stormwater management evaluation was performed—including segregation of stormwater in the North Production Area—and was presented in the BODR for the FEL-1 Stormwater Segregation Project (CDM Smith 2023).

Kaiser is in the process of evaluating treatment alternatives utilizing Washington’s AKART evaluation process. For the Trentwood facility, the AKART process is primarily used to evaluate the prevention, control, and treatment of PCBs. As required by the NPDES Permit, Kaiser has completed some testing of an ultraviolet advanced oxidation process (UVAOP) for treating process water discharge at Outfall-001 (2024).

Table 2: Effluent Limits – Outfall 0001

Latitude: 47.6860445517192 - **Longitude:** -117.223793548856

Parameter	Average Monthly ^a	Maximum Daily ^b
Cadmium (total)	1.3 µg/L	2.2 µg/L
Zinc (total)	75 µg/L	146 µg/L
Lead (total)	7.0 µg/L	12.1 µg/L
Total Polychlorinated Biphenyls (PCBs) ^c	170 pg/L	233 pg/L

Footnotes for Effluent Limits – Outfall 0001 Table:

^a Average monthly effluent limit means the highest allowable average of daily discharges over a calendar month. To calculate the discharge value to compare to the limit, you add the value of each daily discharge measured during a calendar month and divide this sum by the total number of daily discharges measured.

^b Maximum daily effluent limit is the highest allowable daily discharge. The daily discharge is the average discharge of a pollutant measured during a calendar day. For pollutants with limits expressed in units of mass, calculate the daily discharge as the total mass of the pollutant discharged over the day. The average daily measurement does not apply to pH or temperature.

^c 40 CFR Part 136 Method 608 monitoring will be used to evaluate compliance. Any detection using this method is a violation of the permit limit.

Exhibit 1.1 Outfall-001 Effluent Limits (Permit No. WA0000892)

The U.S. Environmental Protection Agency (EPA) established a total maximum daily load (TMDL) for PCBs in the Spokane and Little Spokane Rivers in Washington State in October 2024. A public comment draft of the TMDL report was published on May 15, 2024 (US EPA, 2024). In this document, a TMDL of 5.74 milligrams per day (mg/day) (calculated based on a 1.3 picograms per liter [pg/L] concentration) is presented for the section of the Spokane River from Myrtle Point Natural Area (located just downstream of Kaiser's Outfall-001) to the Cable Creek Confluence. This TMDL may lead to a change in PCB effluent limits.

This FEL-1 evaluation for the North Production Area expands on work already completed by Kaiser; it was compiled in response to the NPDES requirements (**Exhibit 1.2**) and in preparation for the potential future TMDL requirements. As part of this effort, CDM Smith has reviewed the pertinent process water drawings of the North Production Area, the water usage data, and the water quality analyses provided by Kaiser. The following evaluations have also been reviewed as part of this effort to inform the FEL-1 design.

- 1989 Bovay Engineering – Remelt Recirculated Cooling Water – Cooling Water Separation Alternatives and Process Study
- Basis of Design Report – Water Balance and Options Analysis Report, WSP, October 2022 (Water Balance BODR)
- Options Analysis and Basis of Design Report – Water System Engineering Options Analysis, Jacobs, December 2023 (Water Engineering BODR)
- Basis of Design Report – FEL-1 Stormwater Segregation Project, CDM Smith, November 2023 (Permitting BODR)
- Outfall-004 – Process Water and Stormwater Reduction Alternatives, Kennedy Jenks, 2024

	Action	Target Schedule
1.	Complete Conversion to Groundwater Sourced Cooling, estimated average daily reduction in effluent flow of 0.5 mgd	3 rd Qtr. 2020
2.	Underground Injection Phase 2, Non-Contact Cooling, South Production Area, average daily infiltration rate of 0.5 mgd	3 rd Qtr. 2020
3.	Contact Cooling, Heat Treat Systems and South Production Area, estimated average daily reduction in effluent flow of 1.0 mgd	4 th Qtr. 2023
4.	Contact Cooling, South Area Facility Modernization Project	1 st Qtr. 2025
5.	Underground Injection Phase 3, Non-Contact Cooling, Casting Operations, estimated Phase 3 + Phase 4 average daily reduction in effluent flow up to 1.0 mgd	2 nd Qtr. 2025
6.	Underground Injection Phase 4, Miscellaneous Cooling Systems, estimated Phase 3 + Phase 4 average daily reduction in effluent flow up to 1.0 mgd	2 nd Qtr. 2026
7.	Contact Cooling, Casting Operations	1 st Qtr. 2029

Exhibit 1.2 Pollutant Minimization Plan Flow Reduction Actions (Permit No. WA0000892)

This engineering report summarizes the design requirements for reducing discharge and/or reusing water in the North Production Area that currently discharge to Outfall-005. This report has been prepared in accordance with the Basis of Design task requirement for the Kaiser Trentwood North Production Area Engineering FEL-1.

1.1 Engineering Report Requirements

This engineering report was prepared in accordance with Washington Administrative Code (WAC) 173-240-130. **Table 1-1** details the required information to be included in this engineering report and identifies the sections that provide the required information.

Table 1.1 WAC 173-240-130 Requirements

WAC 173-240-130 Requirements		Status	Report Section
a	Type of industry or business	Complete	Section 2
b	The kind and quantity of finished product	Complete	Section 2
c	The quantity and quality of water used by the industry and a description of how it is consumed or disposed of, including:	Complete	Section 3
i	The quantity and quality of all process wastewater and method of disposal	Complete	Section 3
ii	The quantity of domestic wastewater and how it is disposed	NA	NA
iii	The quantity and quality of noncontact cooling water (including air conditioning) and how it is disposed	Complete	Section 3
iv	The quantity of water consumed or lost to evaporation	Complete	Section 3
d	The amount and kind of chemicals used in the treatment process	Complete	Section 6
e	The basic design data and sizing calculations of the treatment units	Complete	Section 6
f	A discussion of the suitability of the proposed site for the facility	Complete	Section 6

WAC 173-240-130 Requirements		Status	Report Section
g	A description of the treatment process and operation, including a flow diagram	Complete	Section 6
h	All necessary maps and layout sketches	Complete	Section 6
i	Provisions for bypass, if any	Complete	Section 6
j	Physical provision for oil and hazardous material spill control or accidental discharge prevention or both	NA	NA
k	Results to be expected from the treatment process including the predicted wastewater characteristics, as shown in the waste discharge permit, where applicable	Complete	Section 6
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	NA	NA
m	Detailed outfall analysis	NA	NA
n	The relationship to existing treatment facilities, if any	Complete	Section 6
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	Complete	Section 3
p	Where discharge is through land application, including seepage lagoons, irrigation, and subsurface disposal, a geohydrological evaluation of factors such as:	Complete	Section 6
i	Depth to groundwater and groundwater movement during different times of the year	NA	NA
ii	Water balance analysis of the proposed discharge area	NA	NA
iii	Overall effects of the proposed facility upon the groundwater in conjunction with any other land application facilities that may be present	NA	NA
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	Complete	Section 6 and 8
r	A discussion of the method of final sludge disposal selected and any alternatives considered with reasons for rejection	Complete	Section 6
s	A statement regarding who will own, operate, and maintain the system after construction	Complete	Section 6
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	NA	NA
u	Provisions for any committed future plans	NA	NA
v	A discussion of the various alternatives evaluated, if any, and reasons they are unacceptable	Complete	Section 4 and 5
w	A timetable for final design and construction	Complete	Section 8
x	A statement regarding compliance with the State Environmental Policy Act (SEPA) and the National Environmental Policy Act (NEPA), if applicable	NA	NA
y	Additional items to be included in an engineering report for a solid waste leachate treatment system are:	NA	NA
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	NA	NA
ii	Discussion of the solid waste site, working areas, soil profile, rainfall data, and groundwater movement and usage	NA	NA
iii	A statement of the capital costs and the annual operation and maintenance costs	Complete	Section 6
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	NA	NA



2.0 Project Objectives

The process water for the entire Trentwood facility is provided via a series of groundwater extraction wells. Spent process water is conveyed via a combined sewer system to the on-site wastewater lagoon. Various process wastewater streams combine in the lagoon and are then pumped through a walnut shell filter system (WSFS) to remove oil and grease (O&G) and PCBs. The NPDES Permit authorizes treated water from the WSFS to discharge to the Spokane River. Kaiser is required to identify, implement, and evaluate projects that focus on flow and PCB loading reduction actions, per the PCB Pollutant Minimization Plan under the NPDES Permit. This FEL-1 effort will focus on both flow and PCB load reduction within the North Area of the plant to evaluate options for reducing wastewater and PCB discharge to the Spokane River.

The North Production Area consists of unit processes that remelt scrap aluminum and cast aluminum ingots for further processing and machining. In addition to the process water, stormwater collected from roof drains and catch basins around the site is routed to the sewer system. Previous projects have examined options for improving stormwater management and process cooling water reuse options. This FEL-1 effort focuses on determining flow and PCB load reduction options for the North Area of the facility and evaluating the efficacy of these options. The project objectives are: (1) to develop alternatives to eliminate or reduce wastewater discharge to the Spokane River with a primary focus on PCB mass loading reduction, (2) to reduce environmental risk, (3) to meet the NPDES Permit requirements, and (4) to ensure operational security.



3.0 Basis of Design

A collection of water quality data, flow data, and permit limitations from 2022 and 2023 were compiled to develop the basis of design (BoD) for the North Area treatment and reuse systems. These data sets included variable sample frequencies and analytes, and thus are presented as the most up-to-date data that CDM Smith has received. The BoD, described in the subsequent sections, is derived from these data. The BoD comprises existing water quality, reuse water quality requirements, existing flow conditions, reuse flow requirements, and site-specific design constraints and considerations.

3.1 Water Quality

The existing site water quality, the reuse requirements, and permitted discharge requirements all comprise the BoD for the treatment and reuse system. The provided sitewide water, Kaiser's internal production requirements, and regulatory limits all contribute to this evaluation and are further discussed in the following sections.

3.1.1 Influent Water Quality

The process water for the Trentwood facility is produced from three on-site extraction wells (WW-EW-01, WW-EW-02, GP-EW-03). **Figure 3.1** details the approximate location for each extraction well. The water quality data from varying sampling efforts were averaged to obtain influent water quality data for process cooling water. These averages, shown in **Table 3.1**, were obtained from historical water sampling data provided by Kaiser spanning the years 2018 through 2023. In addition to averaged chemical contaminant concentrations, parameters such as total dissolved solids (TDS), total suspended solids (TSS), conductivity, pH, temperature, and total PCBs (pg/L) were also compiled.

The average concentration of total PCBs was obtained by utilizing PCB congener analytical summaries (provided by Haley Aldrich) from the years 2022 and 2023. The average conductivity, pH, and temperature readings were obtained by averaging provided water quality sample readings from the years 2022 through 2024, including values presented in previous BoD reports (WSP 2022). The maximum value of each water quality parameter is also presented alongside the average values to quantify the upper limit of historical operation.

Historical water quality data from Outfall-005 as well as GeoEngineers' 2024 sampling of the DC-6 casting pit were compared to the process supply water quality to quantify concentration cycling. Comparison shows that general water chemistry parameters, such as major ions, hardness, chlorides, etc., do not substantially change for contact water in the current single-pass configuration, and concentration cycling is minimal.

Table 3.1 North Area Water Quality Summarization

Parameter	WW-EW-01		WW-EW-02		GP-EW-03		Average Well Blend ⁵		Outfall -005 ⁶	DC-6 ⁶
	Avg	Max	Avg	Max	Avg	Max	Avg	Max	Avg	Avg
Flow (MGD) ¹	3.12	4.09	1.9	2.8	2.42	3.89	7.4	10.8	-	-
Calcium (mg/L) ²	40.5	45.1	41.5	49.5	45.4	58.1	42.3	50.9	41.0	41.7
Magnesium (mg/L) ²	14.9	17.0	14.8	15.4	15.0	16.5	14.9	16.4	15.67	15.7
Potassium (mg/L) ²	2.9	3.1	3.0	3.1	3.8	4.5	3.2	3.6	-	-
Sodium (mg/L) ²	5.0	6.4	5.7	11.0	6.4	8.8	5.6	8.4	4.93	5.1
Silicon (mg/L) ²	5.7	6.6	-	-	-	-	-	-	-	-
Alkalinity, Total (as CaCO ₃) ²	155.0	165.0	156.1	165.0	158.6	165.0	156.4	165.0	160.0	163.3
Carbonate (mg/L as CaCO ₃) ²	3.7	15.0	1.0	1.0	1.0	1.0	2.1	6.3	-	-
Chloride (mg/L) ²	6.4	8.3	6.4	8.1	10.2	27.8	7.7	15.3	8.53	8.6
Hardness ²	162.3	181.1	161.2	170.0	171.4	190.0	164.9	181.4	166.7	170.0
Nitrate (mg/L) ²	1.7	3.4	1.7	1.8	2.0	2.7	1.8	2.7	-	-
Nitrite (mg/L) ²	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.1	-	-
Sulfate (mg/L) ²	11.8	12.4	11.9	12.4	11.8	12.9	11.8	12.6	12.0	11.7
Total Dissolved Solids (TDS) ²	194.6	299.0	196.1	293.0	216.5	284.0	202.1	292.0	-	-
Total Suspended Solids (TSS) ²	6.0	-	15.0	-	14.0	-	10.9	-	8.1	10.0
Conductivity (mS/cm) ³	352.8	386.0	346.5	373.0	362.3	370.0	354.3	376.8	-	-
pH (s.u.) ³	7.6	7.8	7.6	7.8	7.9	8.4	7.7	8.0	-	-
Temperature (°F) ³	49.1	49.3	49.2	49.6	51.3	58.1	49.8	52.6	-	-
Total PCBs (pg/L) ⁴	156.4	716.0	278.0	828.0	2,216.3	7,694	857.5	3,263.1	56,319	13,621.3

1. Flow data was calculated from 2022–2024 historian data.

2. Summary statistics were performed for analyte concentration data provided by Haley Aldrich (sampling efforts from 2018–2023).

3. Analyte values referenced from (WSP 2022).

4. Analyte values were provided by Haley Aldrich for the 2023 semiannual extraction well sampling.

5. Average blend is calculated based a volumetric flow balance for the presented well flow rates.

6. Data averaged over three sampling events (GeoEngineers 2024).

3.1.2 Reuse Water Quality Requirements

To effectively cast and produce aluminum product, Kaiser has identified internal water quality requirements for their production systems. These will include casting specific water quality requirements and temperature requirements for non-contact process cooling water users as described in the following subsections.

3.1.2.1 Casting Reuse

It is essential to maintain water quality for reuse to thereby ensure consistent quenching in the casting process and adequate cooling throughout the North Area. **Table 3.1** summarizes the average well water

quality, which is assumed to be adequate for current casting operations. However, Wagstaff, Inc. provided common alloy and hard alloy quench water quality requirements based on aluminum production industry standards. Additionally, Nalco provided conventional mold requirements for aluminum casting. These guideline requirements are detailed in **Table 3.2**. Kaiser internally reviewed these water quality requirements for their casting process; the treatment system will target the current well water quality (also included in **Table 3.2**).

Table 3.2 Casting Water Quality Requirements

Parameter	General Alloy	Hard Alloy	Conventional Mold	Kaiser Well Water	
				Average	Maximum
Temperature (°F)	68-86	68-86	79-84	49.8	52.5
Alkalinity (mg as CaCO ₃)	75-300	60-170	-	156.4	165
Bacteria (sessile) (cfu)	-	-	<10,000	-	-
Calcium (mg/L)	20-100	19-60	-	42.3	50.9
Chloride (mg/L)	<200	1-3.5	<400	7.7	15.3
Conductivity (µS/cm)	<600	180-350	-	354.3	376.8
Copper (ppb)	-	-	<50	-	-
Free Halogen (ppm)	0.2-0.5	0.5-0.5	0.2-0.5	-	-
Ca Hardness (ppm)	-	-	<250	-	-
Hardness (mg/L)	<400	70-300	<400	164.9	181.4
Iron (mg/L)	<0.5	<2	<0.5	-	-
Magnesium (mg/L)	<15	<20	-	14.9	16.4
Manganese (mg/L)	-	<0.15	-	-	-
Oil & Grease (mg/L)	<15	<5	<10	-	-
pH	7.6-8.2	6.5-8	7.6-8.6	7.7	8
Silica (mg/L)	-	0-30	<50	-	-
Sodium (mg/L)	-	<20	-	5.6	8.4
TDS (mg/L)	<500	50-200	-	202	292
TSS (mg/L)	<10	<20	<10	10.9	-
Total Organic Carbon (mg/L)	-	0.5-3	-	-	-

3.1.2.2 Non-Contact Reuse

Non-contact reuse requirements for specific individual ions have not been specified by Kaiser or third-party chemical vendors. A large volume of the non-contact water is used for hydraulic oil cooling. Kaiser advises that the temperature requirements for the hydraulic fluid differ according to the type of oil—generally, the hydraulic units should operate at approximately 120 degrees Fahrenheit (°F) and not exceed 130°F. In addition, it is required that the non-contact water be neither significantly corrosive nor prone to scaling. **Table 3.3** represents non-contact reuse water quality requirements, as identified in a previous BoD report (WSP 2022) and discussions with Kaiser operations staff. Kaiser has not identified any other non-contact users that require a different, specific water quality. Numerical limits for specific

ions are not listed in **Table 3.3**, but reuse scenarios consider the holistic water quality for corrosion, scaling potential, suspended solids, and O&G.

Table 3.3 Non-Contact Reuse Requirements

Parameter ¹	Value
Temperature	75-80
TSS	<15
LSI	-0.5 to +0.5
O&G (mg/L)	<15

1. Kaiser has not established specific reuse requirements for non-contact cooling water. The majority of the non-contact cooling water is currently used in the hotline hydraulic units. The temperature requirements of the hydraulic oil for each unit are being evaluated by Kaiser.

3.1.3 UIC Water Quality Requirements

The underground injection control (UIC) systems are used to inject non-contact cooling water into the Spokane Valley-Rathdrum Prairie aquifer for various users throughout the facility. The UIC systems were constructed to reduce wastewater treatment and discharge for both the North Area (UIC-1) and South Area (UIC-2) of the plant. The UIC systems generally reduce flux through the WSFS, which improves PCB removal efficiencies. Any additional volumes (or added wells) to the UIC system will require permitting, groundwater monitoring, and a dedicated monitoring program. The UIC systems are classified as Class V wells and can accept non-contact cooling water, but the injected water cannot impair the use and quality of the groundwater. Additionally, WSDOE requires Kaiser to monitor the aquifer temperature around the UIC systems because of the difference between the increased temperature of the cooling water and the aquifer.

As mentioned in previous BoD reports (WSP 2022), the North Area UIC (UIC-1) is the likely option to receive additional non-contact cooling water from the North Area of the plant, depending on the feasibility of routing specific users to the injection well. The UIC-1 existing water quality and flow data was summarized and is presented in **Table 3.4**. If non-contact users are added to the UIC-1 to confirm the water quality meets the permitted limits, then heat balance estimates will need to be performed in future design stages. Current average usage data indicates that UIC-1 has approximately 1.0 mgd of capacity available from the agreed upon discharge rate.

Table 3.4 UIC-1 Existing Flow and Water Quality

Parameter	Value
Flow (mgd) ¹	1.0
Conductivity (mS/cm) ²	333.6
pH (s.u.) ²	7.7
Temperature (°F) ²	56.6
Total PCBs (pg/L) ²	210.3

Notes:

1. 2023 historical data for UIC-1 users (Attachment 1) was used to calculate an average.

2. UIC-1 water quality data were averaged from previous UIC monitoring reports (Haley Aldrich 2022) (Haley Aldrich 2023) (Haley Aldrich 2024).

3.1.4 River Discharge Water Quality Requirements

As previously mentioned in **Section 1.0**, Kaiser operates under an NPDES Permit that allows treated wastewater discharge to the Spokane River. The surface water discharge criteria detailed in **Table 3.5** were provided in the South Area BoD Report (Kennedy Jenks 2024). These limits will apply to end-of-pipe options for the North Area of the plant if Outfall-005 is to be discharged to the River. These limits may be applicable, depending on subsequent alternatives analysis and the preferred alternative to this treatment and reuse evaluation.

Table 3.5 NPDES Surface Water Discharge Limits

Source	Current NPDES Permit Discharge Limits (Surface Water) ^{1,2}	
	NPDES Permit - Monthly Ave	NPDES Permit - Daily Max
Total Metals		
Aluminum	7.5 lbs/day	14.4 lbs/day
Cadmium	1.3 µg/L	2.2 µg/L
Chromium	2.1 lbs/day	5.1 lbs/day
Lead	7.0 µg/L	12.1 µg/L
Zinc	75.0 µg/L	146 µg/L
Anions and Nutrients		
Total Phosphorus (as P)	3.21 lbs/day	-
Ammonia (as N)	9 lbs/day	-
Organics		
PCBs	170 pg/L	233 pg/L
Hexane Extractable Material (HEM) as Oil and Grease	374.7 lbs/day	565.3 lbs/day
General Chemistry Parameters		
Cyanide	0.53 lbs/day	1.27 lbs/day
TSS	406.1 lbs/day	903.9 lbs/day
CBOD ₅	462.7 lbs/day	-

Notes:

1. NPDES Permit limits for ammonia (as N), total phosphorus (as P) and CBOD₅ are given as seasonal averages. Total phosphorus and CBOD₅ have additional stipulations in the NPDES Permit that are dependent on the time of year.
2. NPDES Permit limits for total chromium, cyanide, total aluminum, oil, and grease, and TSS are applicable only to Outfall-006-WSFS Effluent.

3.1.5 Residual Water Quality Requirements

Based on the initial reuse requirements presented in **Section 3.1.2**, treatment will be necessary to meet the water quality requirements for casting closed-loop and reuse non-contact cooling water systems (if employed). Managing and disposing of treatment by-products is an essential consideration. One likely option is to send the residuals to the Spokane County Publicly Owned Treatment Works (POTW). The POTW limits are based on facility loading, and the estimated concentrations for Kaiser are presented in **Table 3.6**. The options evaluation and preferred alternative will identify and design equipment such that any treatment system residuals sent to the POTW will meet the following limits.

Table 3.6 POTW Limits (Kennedy Jenks 2024)

Source	Industry-Specific Pretreatment Standards ¹		Pretreatment Local Limits
	40 CFR 467 Subpart B: Rolling w/Emulsion Core. Max. One-Day	40 CFR 467 Subpart B: Rolling w/Emulsion Core. Max. Monthly Ave.	8.03A.0204 – Spokane County Local Limits
Total Metals			
Aluminum	0.84 lb/million off-lb ²	0.416 lb/million off-lb	-
Arsenic	-	-	0.12 mg/L
Barium	-	-	-
Cadmium	-	-	0.07 mg/L
Chromium	0.057 lb/million off-lb	0.024 lb/million off-lb	5 mg/L
Copper	-	-	0.74 mg/L
Mercury	-	-	0.012 mg/L
Molybdenum	-	-	0.66 mg/L
Nickel	-	-	1.74 mg/L
Lead	-	-	0.32 mg/L
Selenium	-	-	0.4 mg/L
Silver	-	-	0.46 mg/L
Zinc	0.19 lb/million off-lb	0.079 lb/million off-lb	2.59 mg/L
Organics			
Benzene	-	-	0.5 mg/L
HEM as O&G	2.6 lb/million off-lb	1.56 lb/million off-lb	-
General Chemistry Parameters			
Cyanide	0.038 lb/million off-lb	0.016 lb/million off-lb	1.01 mg/L
TSS	5.33 lb/million off-lb	2.53 lb/million off-lb	-

Notes:

1. The units provided for industry-specific pretreatment limits are pounds of pollutant per million off-pounds of aluminum.
2. The term “off-pound,” per 40 CFR 467, means the mass of aluminum or aluminum alloy removed from a forming or ancillary operation at the end of a process cycle for transfer to a different machine or process.

3.1.6 North Area PCB Distribution and Loading

PCB distribution across the site was investigated extensively in prior years by GeoEngineers. The following evaluation reports were reviewed:

- Industrial Wastewater System Sampling Report (GeoEngineers, December 18, 2009)
- Wastewater Sampling (GeoEngineers, May 31, 2017)
- Wastewater Sampling (GeoEngineers, March 9, 2018)
- North Storm Sewer Wastewater Engineering Report (GeoEngineers, December 8, 2021)
- North Storm Sewer 2022 Sampling Report (GeoEngineers, December 12, 2022)
- Stormwater Evaluation (GeoEngineers, October 11, 2023)

■ 2024 Wastewater Sampling (GeoEngineers, July 5, 2024)

These investigations identified two areas of elevated PCB concentrations—the Oil House and the Casting/Remelt area. Initial sampling (2009) determined that MH-17 and MH-20 south of the Oil House contain elevated PCB concentrations in wastewater and sediments. These manholes flow south to Outfall-004 and are currently being investigated as part of the South Area engineering evaluation.

In Remelt, the casting pits and storm (process) sewer sections were identified as PCB contributors. Initial investigations (2009) identified areas to the west and northwest of the melters as PCB sources; however, subsequent investigations (2017 and later) have shown minimal PCB concentrations in the areas north and west of the melters (MH-3). These more recent studies have shown that the sewer east of MH-3 may be a PCB contributor. PCBs may enter this sewer section from the casting pits and other sewer sections from MH-9 to MH-7B and east of MH-7B.

Stormwater has also been shown to contain elevated concentrations of PCBs in certain storm drain downspouts (from the roof). Stormwater concentrations are highly variable by nature. The areas near columns Tx42, Tx52, Tx67, Tx77, Tx87, and Tx92 have shown elevated PCB concentrations that are greater than or equal to (\geq) the storm sewer samples.

PCB sampling and analysis from 2018 and 2024 show that PCB loading increases from MH-3 to MH-5 to Outfall-005. This trend indicates that there may be other PCB contributions, either from wastewater flows downstream of MH-3 (e.g., the hotline users) or residual deposition in the storm sewer. Kaiser is currently working on further PCB sampling along the hotline to confirm previously identified loads.

3.2 Flow

Outfall-005 and the associated sewer system conveys North Area process cooling water users and stormwater to the site wastewater lagoon and WSFS treatment system. To design a treatment and reuse system for the North Area, the existing process and stormwater conditions must be quantified. The following subsections discuss the BoD for process and stormwater flows, and show how the respective data were developed.

3.2.1 Process Water

A previously developed water users inventory list was used as the basis to qualify and quantify process cooling flows in the North Area of the plant. This list is provided in **Attachment 1**, which includes the reference drawing DG-103984-002. The spreadsheet details the users in the North Area, their location in the plant, the user classification, and estimated flow rates.

To quantify the process cooling water demand of the North Area, Kaiser provided metered historian data for select North Area users. Additionally, previous design efforts utilized ultrasonic flowmeters to quantify average flows for other North Area users. This metered data provided a basis to estimate the average flow rates for unmetered users. A velocity of 5 feet per second (fps) and the supply pipe size were used to initially estimate the flows for these users. The estimated flow rates were then further refined via a duty cycle factor to account for infrequent flow, throttled valves, and inconsistent velocities throughout the pressurized supply system. The calculated flow rates for the unmetered users were numerically iterated until the total Outfall-005 flow rate equaled 3.21 mgd. This average

Outfall-005 flow value, which was calculated and measured by GeoEngineers, was utilized to close the volume balance (GeoEngineers 2021). Kaiser has recently replaced the ultrasonic transmitters used to measure outfall flows, and the water balance may be updated in subsequent design phases based on new trended data and current operating conditions.

The expected flow rates throughout the North Area sewer system were then estimated by calculating which users contributed flow to each sewer manhole. The individual users were summed to their respective manholes; the estimated totals are provided in **Table 3.7**.

Table 3.7 North Area Flows – Existing Conditions

Area	Current Flow (mgd)	Current Peak Flow (mgd)
Casting Stations ¹	2.30	3.27
Manhole #3 (MH-3)	2.41	3.42
Manhole #4 (MH-4)	2.63	3.73
Manhole #5 (MH-5)	2.76	3.92
Manhole #6 (MH-6) ²	3.21	4.56
UIC-1	1.03	1.90
Induction Non-contact	0.11	0.16
Hotline Non-contact	0.64	1.06
Stormwater ³	1.57	52.7

Notes:

1. Presented values are based on provided 2023 historian daily average data for each casting station mold flow transmitter.
2. MH-6 is equivalent to Outfall-005 flow and is assumed to be equivalent to the 2021 GeoEngineers measured data via ISCO 2150 flow sensors (GeoEngineers 2021).
3. Stormwater flows are based on a 100-year storm event. "Current Flow" is based on a 24-hour average and the "Current Peak Flow" is based on the time of concentration.

The cooling water for the casting stations is the most crucial to aluminum production and is also the largest general user in the North Area of the plant. After analyzing historical data, Kaiser indicated that the future design scenario for the casting stations is based on pits simultaneously casting and average casting practices. The casting station design flow presented in **Table 3.8** is based on six drops for each station, six casting stations operating, and 140 gpm of cooling water per mold drop. A safety factor of 15% was added, for a total sustained peak flow of 5,800 gpm.

The flows detailed in **Table 3.8** do not account for increased non-contact cooling water flow that may be required if water temperatures increase over the current well water supply temperature. In general, these users will need to be evaluated in subsequent design phases to account for increased cooling water temperature.

Table 3.8 North Area Flows – Design Conditions

Area	Design Flow (mgd)	Design Peak Flow (mgd)
Casting Stations ¹	7.26	8.32
Manhole #3 (MH-3)	7.37	8.48
Manhole #4 (MH-4)	7.59	8.81

Area	Design Flow (mgd)	Design Peak Flow (mgd)
Manhole #5 (MH-5)	7.72	8.99
Manhole #6 (MH-6)	8.17	9.33
UIC-1	Varies ²	
Induction Non-contact	0.12	0.18
Hotline Non-contact	0.70	1.12
Stormwater ⁴³	1.57	52.7

Notes:

1. Presented value based on internal Kaiser decisions regarding number of simultaneous pits casting and average casting practice flow rate.
2. Alternatives evaluation details the options for routing varying flows to the UIC.
3. Stormwater flows are based on a 100-year storm. The current flow is based on a 24-hour average and the peak flow is based on the time of concentration.

3.2.2 Stormwater

A previous BoD report for the site storm sewer system utilized the Soil Conservation Service Runoff Curve Number (SCS-CN) Method to estimate the storm volumes for 100-year events (CDM Smith 2023). The site was parceled into contributing drainage subbasins. The basins contributing to the Outfall-005 sewer system, along with the storm volumes, average daily report, and peak discharge flow rates, are detailed in **Table 3.9**. Subbasin areas are shown in **Exhibit 3.1**.

Table 3.9 100-Year Stormwater Flows

Drainage Basin	Storm Volume (ac-ft) ¹	Flow (mgd) ²	Peak Rate (cfs) ³	Notes	Proposed Modifications
8	1.01	0.33	18.0	Casting Area Roof Drains	None. ⁴
9	0.65	0.21	11.5	Casting Area Roof Drains	Remove select roof drain downspouts from sewer, reroute to existing swales. ⁴
11	1.88	0.61	27.9	Large subbasin northeast of Casting	Remove storm grates from sewer, route to swales, allow general infiltration.
12	-	-	NC	Immediate area to the north of Casting. Has two existing swales. Limited or no connection to sewer.	
13	-	-	NC	Large subbasin to the northwest of Casting. Limited or no connection to sewer.	
14	0.63	0.21	10.8	Area north of Casting, with commingles storm and process sewer connections.	
15	0.65	0.21	13.4	Subbasin northwest corner of hotline area. Discharges to ground with limited storm sewer connection at present.	Oil staining from roof drains, needs sewer connection
25	-	-	NC	Large area to the west of the hotline. There are limited catch basins connected to the storm	None/minor catch basin grading, or replace with solid covers.

Drainage Basin	Storm Volume (ac-ft) ¹	Flow (mgd) ²	Peak Rate (cfs) ³	Notes	Proposed Modifications
				sewer, otherwise mostly general infiltration or swale.	
Total	4.82	1.57	81.6		

Notes:

1. Storm volumes presented are 100-year events for respective drainage basins (CDM Smith 2023).
 2. Presented flow rates are the average of the storm volume over a 24-hour time period.
 3. Presented rates have variable peak durations based on subbasin time of concentration.
 4. The proposed modifications detailed here are select and relevant recommendations excerpted from the stormwater evaluation (CDM Smith 2023). Not listed in the stormwater evaluation table, this approach also involves significant rerouting the roof drains in a common gravity header within the North plant's roof truss system.
- NC – not calculated (does not drain to sewer)

The storm volumes and peak rates were considered in the evaluation of North Area options. Options to segregate stormwater flows from the sewer were evaluated previously (CDM Smith 2023). These options were mechanically complex and costly; however, to ensure consistent water quality is produced from the reuse treatment system, stormwater will be segregated and taken off of the sewer system.

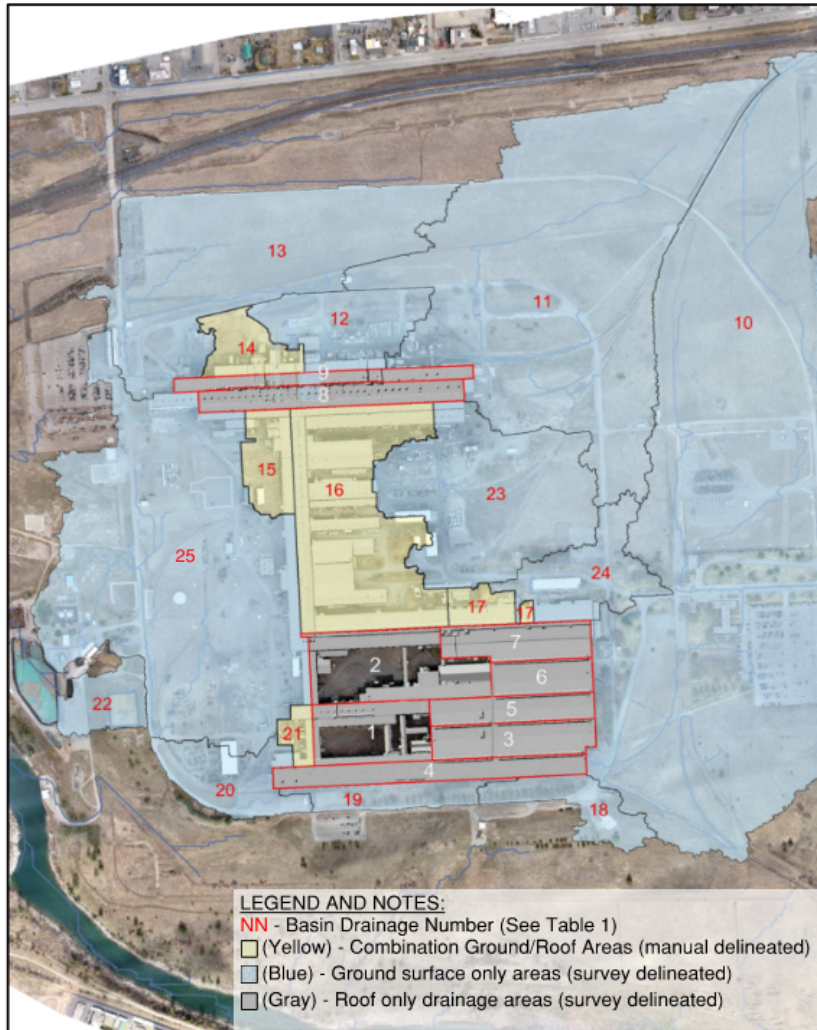


Exhibit 3.1 Stormwater Drainage Subbasins (CDM Smith 2023)

3.3 Site Constraints and Design Considerations

There are several site constraints that will impact design and construction sequencing of any North Area treatment and reuse systems. The following subsections describe these high-level considerations; these will be further developed during subsequent design phases.

3.3.1 Existing Utility Conditions

The North Area of the plant contains critical infrastructure that supports production, including utility systems, structural columns, casting stations, and crane systems. Coordination with existing site utility drawings and locates will be critical for construction work performed within the plant. Treatment or mechanical equipment must be designed such that little to no impact is made on existing or future production equipment.

Three-phase electrical service is supplied to the site and readily available across the plant. Current electrical supply is assumed to be adequate for treatment and reuse equipment that will be installed,

specifically in the area west of the hotline. Power requirements for the treatment system will be further defined in subsequent design phases, and load studies will confirm power adequacy.

3.3.2 Production Impact During Construction

The North Plant's casting area is congested, so work within the North Area must be precisely scheduled and aligned with the Kaiser team to avoid disrupting production. Construction sequencing will be such that production downtime and impacted casting stations are minimized, or planned during scheduled casting station outages. Depending on the preferred alternative chosen, bringing the treatment and reuse equipment online will be phased to test the casting performance on one station (initially). Additionally, future capital upgrade projects (e.g., pit expansion) may coincide with close looping efforts.

3.3.3 Permitting

Water treatment and reuse implementations will include a variety of permitting, depending upon the preferred options that are implemented. The following permits will likely be needed and/or modified to implement a reuse system:

- NPDES Permit – increasing the capacity of the UIC-1 system may require permitting and notification efforts, as the UIC is incorporated into the plant's NPDES permit and associated UIC Maintenance Plan.
- Air Operating Permit –the casting closed-loop treatment system should not emit any hazardous air pollutants and there are no expected volatile components. Kaiser Aluminum Trentwood is required to operate under an Air Operating Permit. A review of the permit and coordination with existing operations should be completed to ensure the Trentwood facility is in compliance, specifically with the inclusion of a backup electrical generator to service the treatment facility.
- Industrial Stormwater Permit – currently, North Area stormwater is commingled with process wastewater and discharged to the lagoon, as well as infiltrating generally across the north yard and in localized infiltration basins and drywells. A portion of the stormwater will continue to discharge to the lagoon, but a significant portion will be redirected to infiltration, discussed in detail in this report. It is anticipated that increased infiltration in the North must comply with the State of Washington industrial stormwater general permit conditions, enforced by Ecology.
- Industrial Pretreatment Discharge Standards – disposal of residual waste from the reuse treatment systems will be required. This includes process water blowdown, RO concentrate, and filter backwash water. Additionally, Kaiser is investigating the potential to forgo onsite sanitary treatment and discharge untreated sanitary waste directly to the local POTW, the Spokane County Regional Water Reclamation Facility (SCRWRF). Kaiser is also upgrading the existing on-site Industrial Wastewater Treatment Plant (ITWP) as outlined in the Industrial Water Treatment System Upgrades Engineering Report, approved by Ecology on May 21, 2025. Treated effluent from the IWTP may also be considered for discharge to the SCRWRF in the future.

The discharges described above would require the construction of a new combined sanitary and industrial wastewater lift station to convey this wastewater to the SCRWRF collection system, located to the East of the facility, at Sullivan Road and East Euclid Avenue. This connection

would require upfront connection fees as well as a recurring monthly rate. Discharge would also need to comply with the following:

- Spokane County Industrial Pretreatment Program
- Industrial Pretreatment Program (40 CFR 467, Subpart B – Aluminum Forming Point Source Category).

The SCRWRF operates at near design capacity. Multiple expansion phases are planned, but the facility may limit the volume it will accept on an average and instantaneous basis. As such, discharges from Kaiser will need to be minimized as much as feasible for compliance and cost purposes.

- Agreed Order – discharge from the Kaiser facility is subject to requirements laid out in the Agreed Order, finalized January 2020 and incorporated into the current NPDES permit. This requires Kaiser to prepare, update, and execute a PCB Pollution Minimization Plan (PMP).
- State Waste Program – discharge to groundwater of process wastewater under the State Waste Program (WAC 173-200-040) may also be pursued for if certain treatment requirements can be met, primarily for metals.

3.3.4 Equipment Redundancy

The treatment and reuse system will include redundant equipment to provide system uptime during process failures and maintenance outages. The treatment system will be critical to production operations in the North Area of the plant; and, as such, the treatment system will contain partial equipment redundancy. The equipment detailed in the major equipment list specify redundant units, and these unit numbers were derived based on both equipment capacity and economic consideration.

3.3.5 Electrical Hazard Classification

At this time, Kaiser has not identified any electrical classification requirements for a treatment and reuse system. If a classification is identified, all electrical equipment and components will be designed and suitable for operation in that classification. This classification will be applicable for all wastewater treatment equipment and any associated sumps/pumps in the vicinity of the main plant area.

3.3.6 Sewer Condition

Previous investigations have inspected and reviewed the integrity of the North Area sewer system (GeoEngineers 2021). The sewer system that will convey the majority of the spent cooling water, in general, is in adequate condition and readily available for reuse. Deposits of oil, trash, and debris were observed, but initial jetting efforts cleaned portions of the pipe without physical damage. Additionally, previous slip-lining efforts have been performed from MH-9 to MH-7B and from MH-3 to MH-3B. As future design phases progress, the sewer condition, along with evaluations for lining and repair, should be considered to effectively convey wastewater for a treatment and reuse system.

3.3.7 Treatment System Location

In general, the spent process cooling water intended for reuse will need to be collected and conveyed to the treatment process from the North Area of the plant. A specific location for the North Area treatment system has not yet been decided at the site; however, the general area west of the hotline has been

identified by Kaiser as being suitable. The civil drawings included in **Appendix A** show the general area selected for the treatment system. Future designs must coordinate with Kaiser Engineering to confirm location availability and permitting compliance.



4.0 Options Analysis and Screening

Prior to the project onset, a FEL-0 evaluation was performed. A variety of options were identified to comply with the reduction of water and PCB loading in discharge to the Spokane River, as required by the NPDES Permit.

4.1 Water Reduction Options

Water reduction activities are outlined in the NPDES Permit separately for non-contact and casting water. Specific targets are outlined for phased non-contact cooling water reduction by Q1 of 2025 and 2026, and contact water in casting by Year 2029. Options to achieve permit-required reductions were collaboratively identified during a FEL-0 evaluation. The following subsections detail the FEL-0 evaluation.

4.1.1 Casting Contact Cooling Water

Several options for managing spent casting cooling water were considered. All options considered consist of closed-loop operation of the casting process, such that most cooling water is recycled within casting, and discharge from the system is limited or eliminated.

In all closed-loop casting options, as detailed below, the recycled contact water must be treated for several specific parameters to be deemed suitable for reuse as casting cooling water. The treatment processes are the same for each option, and include the following:

- Equalization Tank/Hotwell
- Dissolved Air Flotation (DAF)
- Adiabatic Cooling Tower
- Heat Exchanger
- Treated Water Storage Tank
- Reverse Osmosis for Makeup Water
- Residuals Waste Collection and Management System

A high-level treatment process description is provided in **Section 6**, and is not repeated here.

4.1.1.1 Option 1. Casting Pit Lift Stations

Option 1 consists of installing or retrofitting each of the existing nine casting pits with dedicated lift stations. This would essentially isolate all casting contact cooling water from the existing sewer, and prevent comingling with process non-contact wastewater as well as stormwater.

Independent lift stations would transfer spent cooling water from the respective casting pit to a centralized treatment system located outside, to the west of the facility.

From a process perspective, this approach resolves many potential challenges in segregating the casting contact water from other wastewaters; however, the casting pits are extremely congested, and implementation of this approach is very complex.

Treated water would be stored in a large, treated water storage tank and then pumped back to the casting pits via a new supply header installed on the casting building roof. The existing well water supply header would remain in place for contingency.

4.1.1.2 Option 2. Common Lift Station

Option 2 consists of installing a new lift station outside of the casting building, upstream of existing MH-5. Spent casting cooling water would flow by gravity (shallow pits) or be pumped out (deep pits) into the existing below-grade process and storm sewer, as is done currently. No changes to the current casting pits would be required.

Combined casting contact cooling water would comeingle in the sewer with some upstream non-contact cooling water as well as stormwater from the North Area. To reduce the impacts to water quality consistency, much of the stormwater and non-contact cooling water must be removed from the existing sewer system, which is achieved in the following manner:

- Induction – Induction cooling water is provided to several miscellaneous cooling systems as well as the induction furnaces, all located in the basement of the northeast corner of the casting building. These users currently discharge to the process and storm sewer, which is upstream of the casting stations. Removing these streams from the sewer (and commingling with casting) requires pumping the combined discharges to the UIC system or to an alternate downstream sewer tie-in location.
- Hotline Users – Various hotline users discharge to the process and storm sewer at MH-4, MH-5, and MH-6. Removing these users from the sewer to prevent inclusion in the casting closed-loop would require minor replumbing of several users such that they discharge downstream of the new proposed lift station, and not to MH-4.
- Miscellaneous – Several additional non-contact cooling water sources include the following:
 - Induction Stirrers
 - Air Compressors
 - Boiler House
 - Induction Cooling Towers
- Roof Stormwater – The casting building contains 14 roof drains that run in an array east–west at the low point between the casting and high-bay building roof lines. Additionally, gutters run east–west on the north eave of the casting building and associated building bump-outs. These gutters eventually drain to grade level, with some tied directly to the process and storm sewer. These roof drains must be removed from the sewer to prevent rapid changes to the closed-loop casting water during storm events.

- Yard Stormwater – Stormwater in the North Area that falls in the yard areas partially enters the process and storm sewer system through a variety of storm grates in the North Area, as well as suspected infiltration and inflow (I&I). Much of the yard stormwater infiltrates to the ground or is captured by a series of dedicated stormwater collection systems. To the extent feasible, yard stormwater will be removed from the sewer by replacing existing storm grates with solid covers.

The new lift station would be installed outside and to the west of the hotline. It would be constructed over the existing process and storm sewer, immediately upstream of MH-5. This would be a deep concrete lift station, approximately 30 feet deep, to intercept the existing sewer. The lift station would overflow into MH-5 such that excess process water would flow to the lagoon through the existing sewer system.

4.1.1.3 Option 3. End-of-Pipe

For Option 3, essentially all contact cooling and non-contact water would remain in the existing process and storm sewer. A new lift station would be installed to convey all wastewater to the new treatment process for reuse. The lift station would be constructed immediately downstream of MH-6, the last manhole in the sewer system that accepts process water. This location would capture all water that currently flows to Outfall-005, which is the “end-of-pipe.”

Casting water would be processed through the same treatment process as described above, but an additional non-contact cooling water treatment component would also be required to address the non-contact water fraction. Non-contact treatment for reuse is simpler because the only requirements are that it be cooled, be free of debris/solids/oil, and be noncorrosive. The treatment process would consist of the following:

- Coarse Filtration, such as a sand filter or WSFS
- Cooling Tower – adiabatic cooling towers would be needed to remove the heat load

Casting water would be resupplied to casting, as described previously, though a new roof-mounted supply header. The non-contact water would be supplied to the various non-contact users through much of the existing supply header piping. The existing well water supply header would be modified at Valve Pit A and adjacent to EW-03 to isolate the South Area well water supply header from the North Area header. The South Area would remain on well water, while the North Area would be supplied with treated reuse water.

4.1.2 Non-Contact Water and Miscellaneous Users

There are a variety of non-contact water users in the North Area. These users are organized into the following general categories:

- Casting Induction Stirrers – A pair of induction stirrers utilize non-contact cooling water at the DC-7 and DC-8 melters. This water enters the common process and storm sewer.
- Air Compressors – A pair of water-cooled air compressors are located to the north of the casting building, and supply plant air throughout the North Area. This spent non-contact cooling water drains into the process and storm sewer outside, and mingles with the casting water at MH-3.

- **Boiler House** – The boiler house is fed from the on-site reverse osmosis (RO) system under normal operations, but can utilize softened well water as a contingency. The boiler is blowdown, as needed, (approximately daily) to maintain water quality in the boiler.

The boiler is currently in the early stages of replacement with a new boiler house. This system will be relocated to the southwest area of the facility, downstream of MH-6, and downstream of any future casting collection and treatment system.

- **Induction Furnace Cooling Towers** – A pair of adiabatic cooling towers provide cooling to the induction furnaces. The induction furnace circulates a glycol fluid to the cooling towers to extract heat from the system. The cooling towers utilize well water to wet the cooling tower evaporative pads. The well water does not contact the process fluid (glycol), but is open to atmosphere, and mildly cycles up dissolved constituents as a portion of the well water evaporates within the tower. Blowdown from the system is minimal.
- **Air Handling Units (AHUs)** – There are ten large AHUs in the hotline, as well as a variety of smaller AHUs throughout the North Area. The ten hotline AHUs are already connected to UIC-1, with two remaining units plumbed for future UIC connection; these are currently defunct, but may be replaced in the future. The remaining smaller AHUs discharge to the process and storm sewer.
- **Hydraulic Power Units (HPUs)** – The hotline has numerous large HPUs, and additional smaller HPUs are utilized at the induction furnace. The HPUs use single-pass water-cooled heat exchangers which discharge to the process and storm sewer.
- **Floor Sumps** – In the induction furnace basement, a single sump pump discharges spills and leaks into the process and storm sewer, as needed. In the hotline basement area, a series of floor sumps pump spills and leaks to the oil recovery building. In both locations, water and the surrounding area is extremely oily.

4.1.2.1 Option 4 – Air Cool Hotline Users

Option 4 consists of converting the large hotline HPU units to air-cooling. The individual HPU units are aligned generally along the west edge of the hotline building, allowing for a relatively simple piping arrangement to pipe the hydraulic oil to the exterior of the hotline building.

Hot hydraulic oil from each HPU would be routed through a series of fan-cooled oil coolers and then circulated back to the HPU.

By placing the coolers outside, no additional heat load would be added to the building interior. Air-coolers would be placed on a concrete containment pad to collect any leaks, and the bank of coolers would be covered to protect the coolers from the elements and reduce any stormwater collected in the containment pad.

4.1.2.2 Option 5 – Discharge

Option 5 consists of discharging the majority of non-contact cooling water to the lagoon, as is currently done.

Water continuing to discharge consists primarily of hotline users (totaling approximately 0.64 mgd). A variety of the upstream non-contact users (e.g., the induction furnace users) might be removed from the sewer in its current configuration to prevent comingling with the casting cooling water, as described above.

If Option 2 is selected, several hotline users that discharge to MH-4 must be rerouted to MH-5 to avoid comingling with casting closed-loop water, when implemented.

Likewise, Option 2 would require sending upstream users, such as the induction furnace, to the UIC-1 system for injection, or piping these users around the casting pits to tie-in downstream of any casting lift station.

4.1.2.3 Option 6 – Non-Contact Reuse

Option 6 consists of providing a separate non-contact treatment system (not associated with an end-of-pipe treatment) dedicated for the treatment and reuse of the North Area non-contact water.

Non-contact water would flow through the existing process and storm sewer to a centralized location adjacent to the casting closed-loop treatment system. Non-contact water treatment would be largely separate from any casting reuse processes, but would share some infrastructure for efficiency (e.g., building, makeup water treatment system, residuals waste management). Treatment for non-contact cooling water is quite simple and would consist of:

- Non-contact cooling water lift station
- Equalization tank
- Filtration
- Cooling tower (adiabatic)
- Treated water storage tanks and distribution pumps

4.1.2.4 Option 7 – Non-Contact Users to UIC

Option 7 consists of converting the non-contact water users to UIC discharge. For the induction area users, a common lift station would be installed at grade where the current scupper drain pan is located. A booster pump would transfer spent non-contact cooling water to the UIC system via a new dedicated below-grade pipeline routed to the north exterior of the casting building.



5.0 Alternative Analysis

Of the options identified above, a collaborative evaluation, screening, and selection of preferred options was performed. This procedure and the decided results are presented in the following subsections.

5.1.1 Methodology

First, all reasonable options were identified and placed in an evaluation matrix for initial discussion and scrutiny. Options considered reasonable were short-listed for further evaluation, while those considered to be unreasonable or not feasible were not analyzed further.

A set of ranking and evaluation criteria were established to provide an objective means of comparing options. These criteria were:

- **Reliability** – the ability of the alternative to operate without downtime or upsets while achieving treatment or process requirements.
- **Maintainability** – the ability to access, maintain equipment, source parts, and minimize disruption to other processes or production.
- **Effectiveness** – the ability of the alternative to achieve the treatment or process requirements and/or reducing discharge volume and PCB mass loads to the Spokane River.
- **Ease of Construction** – the ease or difficulty of construction required to implement the option.
- **Complexity** – the sum of the unit operations, moving parts, and process variables that will impact the difficulty in operations.
- **Impacts to Production (Operations)** – the potential risk to impact operations/plant production during normal operations of the alternative.
- **Impact on Quality** – the impact of the alternative to affect aluminum product quality.
- **Public Perception** – the perceived impacts of the alternative on the community and environment.
- **Permitting Viability** – the likelihood of regulatory approval and ease of permitting for the alternative. Alternatives that require pilot-testing, permit submittals, or extensive modifications to existing permits will receive lower scores.
- **Sustainability** – the alternatives impact on the environment. Alternatives that require high energy consumption, materials, intensive operations, or produce greater emissions will be scored lower.
- **Schedule** – the timeframe required to implement the alternative, including lead times for equipment and permitting.
- **Cost (Capital and O&M)** – Total estimated cost of installation for the alternative (CAPEX) and operations costs (OPEX). Scores are evaluated based on cost relative to volume of discharge removed, not just raw cost alone.

5.1.2 Alternative Evaluation and Selection

Utilizing the criteria established in Subsection 5.1.1, each option was scored. Results are provided in **Table 5.1**.

Each option was assigned a score for each criterion. Each criterion was weighted. From this approach, a total score was calculated for each option, as provided in **Table 5.1**.

Table 5.1 Options Scoring

Criterion	Weight	Casting			Non-Contact Water			
		Opt 1	Opt 2	Opt 3	Opt 4	Opt 5	Opt 6	Opt 7
Reliability	2X	2	4	3	4	4	3	4
Maintainability	3X	3	4	3	4	4	3	4
Effectiveness	3X	4	3	3	4	3	3	4
Ease of Construction	3X	1	3	3	4	5	5	2
Complexity	2X	4	3	3	4	5	3	4
Impact to Production	3X	4	3	3	4	4	4	4
Impact to Quality	2X	4	3	3	4	4	4	4
Permitting Viability	1X	4	4	4	4	3	3	4
Public Perception	1X	3	3	3	4	3	4	3
Sustainability	2X	4	4	4	4	3	4	3
Schedule	1X	1	4	4	4	4	2	3
CAPEX	3X	2	3	4	4	5	3	4
OPEX	2X	2	3	3	3	5	2	3
Total (Weighted)	140	84	93	91	110	115	86	103
Cost per Benefit		1.1	0.6	0.6	0.02	0	0.13	0.07

1. Options were rated on a scale of 1 to 5, with 5 being the highest or most impactful score.

A total “cost per benefit” was also calculated and provided in **Table 5.1**. Cost per benefit is a “bang for buck” metric that shows which options provide for the most water discharge reduction per capital cost.

5.1.3 Recommended Alternatives

From the FEL-0 evaluation, the following preferred alternatives were selected to carry forward for further consideration and design.

5.1.3.1 Casting Contact Cooling Water

Option 2 has the highest cumulative score for casting, as summarized in **Table 5.1**, above. Option 2 also has several qualitative benefits:

- Option 2 can be phased in by completing casting closed-loop in phases, then reevaluating the need for non-contact water management separately (continue to discharge remainder of flow to Outfall-005 as additional pits are converted to closed-loop).
- Directly removes PCBs from the water circuit through oil removal in the DAF.
- It does not commingle casting and non-contact waters (some upstream non-contact water users must be removed from system) to allow for a more consistent water quality for casting supply, a critical requirement to maintain production at the facility.
- It does require the removal of stormwater from the casting loop to eliminate water quality variability, however this can be phased in after initial pits are converted to closed-loop operation.

5.1.3.2 Non-Contact Cooling Water

Option 5 has the highest cumulative score for non-contact water, as summarized in **Table 5.1**, above. Option 5 generally refers to the hotline water users, as several of the non-contact water users in the immediate area of the casting pits and induction furnaces will be addressed individually, due to location. Option 5 has the following benefits:

- Provides for approximately 0.64 mgd reduction in discharge volume
- Mostly independent of other options—piping modifications and air-coolers are not tied to other plant operations or sewer system
- Removing casting water from the discharge will result in a reduction in PCB loading in the discharge, and will also remove heat from the remaining discharge streams.

Option 7 will be employed for the induction area water users. Because of the location of these users, upstream of all casting pits, it is most feasible to utilize UIC-1 to inject this non-contact water.



6.0 Treatment System Design

6.1 Process Design

The contact and non-contact process cooling water that is collected will be conveyed and reused within the North Area production processes. To effectively reuse spent process water, a Kaiser owned and operated treatment system will be required to meet the temperature and water quality requirements outlined above. The following bullets provide a high-level description of the major equipment and treatment processes that will be implemented to meet the process requirements. The major equipment noted is not an exhaustive list, but this equipment will provide a general approach and inform subsequent design phases. The FEL-1 design drawings are included in **Appendix A**.

- **Lift Station** – a lift station will be designed to collect and convey casting water to the reuse treatment system. The lift station will be installed adjacent to the existing Outfall-005 and will be designed to overflow to Outfall-005 during abnormal high flow events.
- **Equalization Tank** – an upfront tank will be installed to provide equalization for the treatment process and will be designed for manual neat oil decanting.
- **Dissolved Air Flotation** – a DAF system will be used to remove oil and solids from the reuse water. The DAF residuals (float and bottom sludge) will be routed to a series of storage tanks for either offsite disposal, dewatering via a dedicated sludge management system, and conveyance to the site wastewater sludge management system. Chemical addition (coagulant, flocculant, de-emulsifier) may be necessary to assist in oil and solids removal. Chemical consumption and residual generation rates will be further informed during pilot testing.
- **Cooling Tower** – an adiabatic cooling tower system will be installed to remove the bulk heat load from the casting reuse water. Seasonally, RO permeate will be used to lower the ambient air dry-bulb temperature to provide efficient cooling. Chemical addition of antiscalant and biocide may be necessary for proper cooling tower operation.
- **Reverse Osmosis** – a reverse osmosis system will be utilized to provide permeate to the cooling towers and to provide clean water makeup to the reuse casting cooling water. The RO skid will have an antiscalant dosing system, and the skid will generate an RO reject residual stream.
- **Filtration** – a dedicated filtration system for solids removal may not be needed; however, pilot testing will inform this design basis. If post DAF filtration is warranted, this unit process will generate a backwash residual stream.
- **Heat Exchangers** – a heat exchanger system will be installed after the cooling towers to provide tight temperature control and heat load trim if necessary, during summer months. The heat exchanger system will utilize well water as the heat sink. Single pass well water will be routed to the UIC-1.

- **Reuse Storage Tank** – a storage tank will be installed to provide capacity for the casting to account for process swings within the treatment system and production facility.

6.2 UIC-1 Expansion

The existing UIC-1 system consists of two installed injection wells, with a design that allows for a full build-out of four total installed wells, with a combined hydraulic capacity of 5.0 mgd. Current operations of the UIC average approximately 1 mgd of injected water. Annual reports from 2022 through 2024 show very little temperature or hydraulic impacts to groundwater as measured by downgradient monitoring wells.

Multiple additional flow streams will be sent to UIC as part of the closed-loop design, which include:

- Induction Furnace Area non-contact flows
- Additional AHUs from casting area
- The casting closed-loop treatment system heat exchanger non-contact cooling water

To accommodate these increased flows, additional injection wells will be required for UIC-1. The existing once-through non-contact cooling water picks up minimal heat is not likely to have a noticeable impact on combined UIC water temperature or groundwater temperature.

Non-contact water necessary for final temperature control in the casting closed-loop process will carry a much larger relative heat load, and will require further hydrogeologic modeling to determine the quantity and location of the additional injection wells needed to support the future facility upgrades.

6.3 Design Considerations

6.3.1 Electrical Design

The electrical distribution system has spare capacity at the hotline 6.9 kilovolt (kV) switchgear to provide power for the treatment system. Additionally, an emergency generator and automatic transfer switch will also be installed to provide emergency backup power to select closed-loop treatment components. If the closed-loop treatment facility loses electrical power, it is almost certain that other production operations in the North Area are also without power. As such, only critical components will be on generator power. These include:

- lift station pump(s)
- treated water supply pump(s)
- DAF unit(s) (complete system)
- Cooling tower(s) (complete system)

Other small electrical loads will also be included, such as building lighting, HVAC, sump pump and similar equipment.

6.3.2 Structural Design Considerations

The following outlines structural design criteria that will be used for the North Area design. These design criteria (**Table 6.1**) provide minimum requirements and will be used as a guide in the design and construction of all facilities. The treatment plant will be a high bay design with considerations for maintenance crane installation and equipment access doors. The building will be designed for corrosion resistance due to the potential for moisture generation as a result of the treatment equipment.

Table 6.1 Structural Design Criteria

Codes and Standards	
Building Code	2021 Washington State Building Code (based on 2021 International Building Code [IBC], effective date: March 15, 2024)
Loading	ASCE 7-16, Minimum Design Loads for Buildings and Other Structures
Deflections	2021 Washington State Building Code
Steel Design	AISC 360-16 AISC Manual of Steel Construction, 15th Edition
Steel Deck	SDI RD-2017 SDI QA/QC-2017
Concrete	Building Code Requirements for Reinforced Concrete: ACI 318-19 ACI 117-10 ACI 301-20 ACI 302.1R-15
Material Standards	
Steel	New structural steel wide flange members: ASTM A992, $F_y=50$ ksi New structural steel members other than wide flanges: ASTM A36, $F_y=36$ ksi Structural steel tubing: ASTM A500, Grade B Welded and seamless steel pipe: ASTM A501 or ASTM A53, Type E or S, Grade B High strength bolts: ASTM F3125, Grade A325 Anchor bolts and threaded rods: ASTM F1554, Grade A36 Welding electrodes: AWS E70XX
Concrete	$f'_c = 4500$ psi (foundations and slab-on-grade) $f'_c = 5000$ psi (environmental structures, lift stations, sumps) Deformed steel reinforcing bars: ASTM A615, Gr 60
Summary of Design Loads	
Dead Loads (ref. PIP STC01015 October 2023)	Actual weight of material forming the building, structure, foundation, and all permanently attached appurtenances (lighting, instrumentation, HVAC, sprinkler system, insulation, fireproofing). Weight of fixed process equipment and machinery, piping, valves, electrical cable trays, and contents of these items.
Live Load	Stairs and exit ways = 100 psf Access platforms and walkways = 100 psf Control, I/O, HVAC room floors = 100 psf Light manufacturing floors and storage areas = 125 psf and 2,000 lb. Heavy manufacturing floors and storage areas = 250 psf and 3,000 lb. Ground-supported tank roof = 25 psf Roof live load = 20 psf
Snow Load	Ground snow load $P_g = 39$ psf (City of Spokane Const, Std.) Minimum roof snow load = 30 psf (City of Spokane Const, Std.)

Codes and Standards	
Wind Load	Risk category: II Basic wind speed: $V = 110$ mph (City of Spokane Const, Std.) Exposure category: C
Seismic Data	Risk category: II Importance factor: $I_e = 1.0$ Site soil class: D Mapped spectral response accelerations: $S_s = 0.314$ $S_1 = 0.112$ Spectral response coefficients: $S_{ds} = 0.325$ $S_{d1} = 0.177$ $T_L = 16$ Seismic design category: C (City of Spokane Const, Std.)
Ice Data	Ice thickness = 0.5 in. Concurrent temperature = 15°F Gust speed = 40 mph
Flood Data	Flood zone category: Zone X (Area determined to be outside the 0.2-percent-annual-chance [or 500-year] flood) based on FEMA FIRM map.
Foundation Design Data	
Shallow Footing Allowable Bearing Pressure	Assumption per existing foundation drawings (DWG No. DPC-F-2 through DPC-F-7) Bearing capacity of soil = 6,000 psf
Frost Depth	24 in. (City of Spokane Const, Std.)

6.3.3 Civil Design Considerations

Supplemental to Kaiser design requirements, the primary documents that will be used for the civil design are detailed below. The references, codes, and standards that will guide the civil design include the following:

- EPA standards, including NPDES, as appropriate
- Washington State Department of Transportation Standard Specifications for Road, Bridge, and Municipal Construction (WSDOT)
- Washington State Department of Ecology (WSDOE)
- ASTM International (ASTM)
- American Water Works Association (AWWA)
- American National Standards Institute (ANSI)
- American Association of State Highway and Transportation Officials (AASHTO)
- USDA Natural Resource Conservation Center (NRCS)
- Spokane Regional Stormwater Manual

Civil infrastructure will be designed for a 30-year life and calculations for respective infrastructure will be per the following unless noted otherwise.

- Heavy-duty concrete pavement (truck access roads):
 - AASHTO 1993 Rigid Pavement Design Method
 - AASHTO HS-20 (32k axle load), 20 (TBD) vehicles per day
 - Initial serviceability = 4.5, terminal serviceability = 2.5, standard deviation = 0.39
- Hot-mix asphalt pavement (employee parking):
 - AASHTO 1993 Flexible Pavement Design Method
- Light-duty traffic (passenger cars and pick-up trucks)
 - Reliability level = 80%, standard deviation = 0.49
- Stormwater management:
 - Rainfall IDF (intensity, duration, frequency) Curves – *Spokane Regional Stormwater Manual*
 - Utilize Rational Method for drainage areas less than 20 acres
 - Storm sewer – 10-year storm event
 - Drainage swales – 10-year storm event
 - Storm culverts – 25-year storm event
 - Stormwater retention – post-developed discharge less than or equal to pre-developed discharge for 2-year to 100-year storm frequencies (utilize NRCS Technical Release TR-55 for reservoir sizing with regards to retention)

6.4 Estimated Implementation Cost

An Opinion of Probable Cost (OPCC) was prepared for the FEL-1 design. The opinion of probable construction cost for this work includes allocated and unallocated expenses. According to the current design, the OPCC for this project is estimated at approximately \$74,400,000 (-30% / +50%) in 2025 United States dollars (USD). The annual operations and maintenance (O&M) costs for the system is estimated at \$3,500,000 USD per year.



7.0 Execution Plan and Schedule

Kaiser Aluminum's NPDES Permit and associated Pollution Minimization Plan (PMP) identify several milestones regarding wastewater management, treatment and discharge. For the North Area, these include:

- Q2 2025 – UIC Phase 3 identifies a contact and/or non-contact water reduction sitewide, with a target of up to 1 MGD reduction in discharge to the Spokane River (a combined total with Phase 4, below).
- Q2 2026 - UIC Phase 4 identifies reduction of contact and/or non-contact water reduction sitewide, with a target of up to 1 MGD reduction in discharge (a combined total with Phase 3, above).
- Q1 2029 – Contact cooling water reduction for casting operations. The permit does not specify a volume reduction.

In addition, the Permit also notes several milestones related to river discharge, previously referred to as “end of pipe” treatment. These include:

- Q1 2025 – Complete bench scale testing and submit a proposal for on-site pilot testing.
- January 1, 2029 - Pilot Testing Completion and Final Report
- January 1, 2030 – Completion of end-of-pipe treatment system design and submission of Engineering Report to Ecology
- January 1, 2031 – Installation of the approved end-of-pipe treatment system

As summarized in Section 4.0 and Section 5.0, a front-end loaded (FEL-0) level evaluation and design of options were completed in 2024 to identify options for addressing the permit milestones listed above. From that effort, and in conjunction with similar separate efforts in the South Area, it was determined that the UIC Phase 3 reduction required by the permit has been satisfied for Q2 2025.

To address the UIC Phase 4 reduction targets, additional work is being pursued in the South Area. Continued work in the North Area during 2025 and 2026 may help further reduce discharge water volumes to bolster compliance with the UIC Phase 4 milestones, but it is not considered a requirement.

The FEL-1 level design presented in this Engineering Report has been prepared to complete a closed-loop treatment and reuse process for the casting operations in the North Area to meet the target date of Q1 2029. Based on the large scope of this requirement and the major deviation from current operations, Kaiser plans for a phased implementation of the closed-loop casting process with the objective of converting Casting Pit No. 7 to closed-loop operation by Q1 2029. The remaining 8 pits will be phased in over a longer period of time. The phased approach for closed-loop operation is required for several reasons. First, closed loop operation will result in a significant change in water quality supplied to casting; as discussed in Section 3 above, this change necessitates a complete revision to casting procedures to preserve product quality, plant production, and safety. Operation of a single pit in closed-loop operation will allow Kaiser to develop the necessary casting protocols. This operational data will

allow for subsequent pits to be converted to closed loop operation safely and efficiently, over time. A complete conversion from current operations to closed-loop operation of all pits simultaneously is not realistic. Secondly, the size, complexity, and impacts to other plant operations mandate a sequential construction approach.

The following subsections outline a general phased construction approach to implement the closed-loop system, as well as the myriad of associated and prerequisite tasks needed to successfully transition the plant from current operations to fully closed-loop operations.

7.1 Current NPDES Compliance Actions

PCB loading and water discharge requirements are targeted for Q2 of 2025. To achieve this target, the following steps have already been completed in the North Area:

- Four AHUs in the casting area have been removed from the storm sewer (discharge to Outfall 005) and connected to the UIC-1 system.
- Two water-cooled air compressors have been retrofitted with thermostatic control valves to regulate the volume of cooling water used to cool the compressors. Cooling water remains on the storm sewer for discharge.

7.2 Current Operations

Design, construction, and operation activities must minimize interference with existing production activities. The FEL-1 design was tailored to minimize impact to the facility's production while also prioritizing pollutant minimization and permit compliance.

The casting pits are currently supplied from a well water supply header, which is dedicated to the pits. The existing supply header will remain in place and operational throughout construction. A new supply header will be installed on the roof of the Casting and Hotline buildings to avoid physical interferences and production interruptions. When an individual casting pit is converted to closed-loop operations, it will be plumbed from the current well supply header to the new closed-loop reuse header without impacting the other operating pits.

The closed-loop lift station will be "dog-housed" over the existing process and storm sewer or constructed immediately adjacent to it. This will allow for the sewer to continue to operate during lift station construction.

The casting supply header and the lift station bookend the existing casting process, and the remaining treatment system components can be constructed independent of any plant production operations.

7.3 Demolition

The casting system design was specifically tailored to limit demolition of existing facilities as much as feasible. Localized demolition will be required for piping interconnections, specifically in the hotline non-contact water users. Additional demolition may be required for site preparation, but no large-scale demolition of existing facilities or components has been identified as a requirement to install the closed-loop reuse system.

7.4 Future Operations

There is significant interdependency between implementing closed-loop systems in casting and managing non-contact water and stormwater.

The project objective is to convert Casting Pit DC-77 to closed loop as an initial step to both satisfy the PMP requirements and limit the impact to operations, as the new configuration will require significant operational changes and data-based revisions to operational practices.

Initially, Pit DC-7 will be the only closed-loop station while the remaining pits will continue to operate in the current configuration; thus, Pit DC-7 reuse water will be only a slip stream of the process sewer. The remaining spent cooling water will continue to discharge to the lagoon via Outfall-005. Due to this initial configuration, there will be limited cycling up in the reuse water quality as the majority of cooling water will continue discharging to the lagoon. This strategy allows for many of the non-contact water modifications to be deferred until additional casting pits are brought online for closed-loop conversion, which enables the casting closed-loop efforts to proceed on a streamlined schedule.

7.5 Schedule

From ongoing engineering, site evaluation, and data collection, Kaiser has identified closed-loop operation of the casting system as a priority in reducing PCB loading, temperature impacts and wastewater discharge to the Spokane River. Closed loop of casting water appears to provide a significant improvement based on the current site understanding and current site operations. Treatment of other, non-casting wastewater streams, either by internal dedicated treatment or using a combined end of pipe treatment, do not appear to provide the same degree of benefit for PCB, temperature, and volume reduction in the discharge.

Converting casting to a closed-loop operation is a complex and large-scale undertaking, requiring careful design and execution. Therefore, a focus on pursuing the target S8.3 milestone outlined in the PMP is prioritized among the various targets and milestones listed in sections S8 and S10 of the NPDES permit. Achieving casting closed-loop operation also indirectly satisfies several requirements of Table 18 (S10), in that Casting wastewater currently discharged will be treated and removed entirely from Outfall 005 (and Outfall 001) obviating the need for end of pipe treatment for that portion of wastewater discharge.

The proposed conceptual schedule is as follows:

- Q2 2025 (S8.A Table 16, No. 5): Casting Area AHUs – Four total users in the Casting area were removed from sewer and sent to the UIC-1 header. Work was completed DATE.
- Q2 2025 (S8.A Table 16, No. 5): Casting Area Compressed Air Systems – two compressors in the Casting area were retrofitted with thermostatic control valves to regulate cooling water flow through the compressors, reducing the daily volume discharged to the lagoon. Work was completed DATE.
- Q1 2029 (S8.A Table 16, No. 7): Complete the design and construction of Casting Pit DC-7 closed loop operation. This requires the following:

- Submit the North Area Engineering Report to Ecology for review, comment and approval – June 2025.
- Complete design documents and submit construction documents to Ecology for approval – 2026 through 2028.
- Construct the closed-loop reuse system with sufficient capacity to support Pit DC-7. This includes casting wastewater lift station, closed-loop treatment equipment, reuse supply header and piping, UIC-1 connection, bulk tanks, partial dissolved air flotation (DAF) and makeup water treatment system.
- The remaining Casting pits will be phased in over time, after successful operation of Pit No. 7 in closed loop fashion. Final expansion to include all Casting pits is anticipated to take until 2036, or beyond.
- Bench Scale Testing for end of pipe treatment at Outfall 001 (S10, Table 18, No. 1): Bench scale testing of Outfall 001 discharge was performed in August 2020, with findings provided in a 2021 Technical Memorandum (CDM Smith). Results from the bench-scale informed subsequent pilot scale testing.
- Pilot Scale Testing for end of pipe treatment at Outfall 001 (S10, Table 18, No. 2): UVAOP Pilot scale testing at Outfall 001 was performed March through June 2024. Pilot test results were compiled and presented in a December 9, 2024, Technical Memorandum (CDM Smith).

Additional pilot testing is in-progress for Outfall 004 and planned to be completed in 2025. Subsequent pilot testing for Outfall 005 is likely to be performed in 2026. Based on the results of these test efforts, and the results of other data collection work across the site, additional pilot testing may be planned for the future.

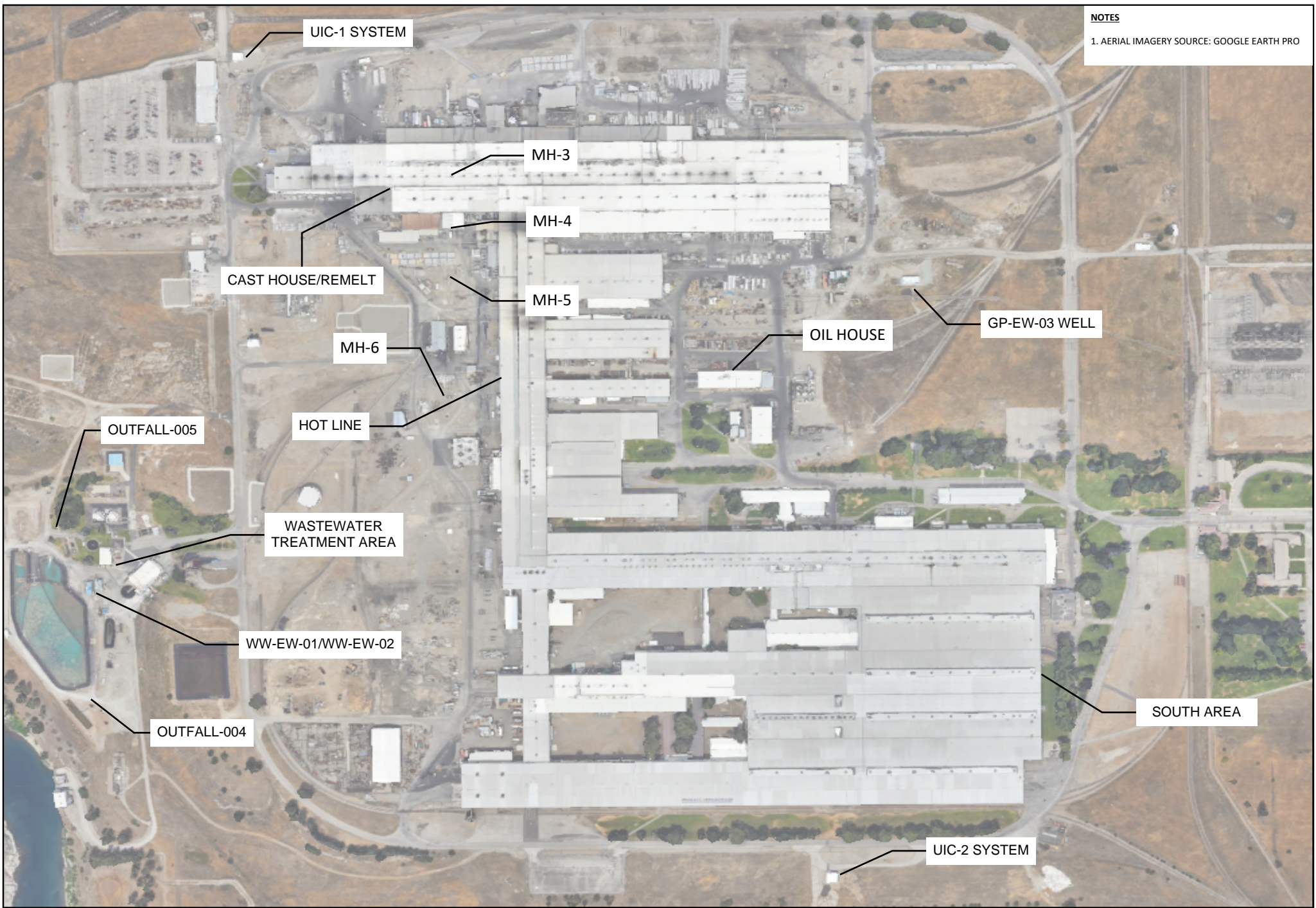


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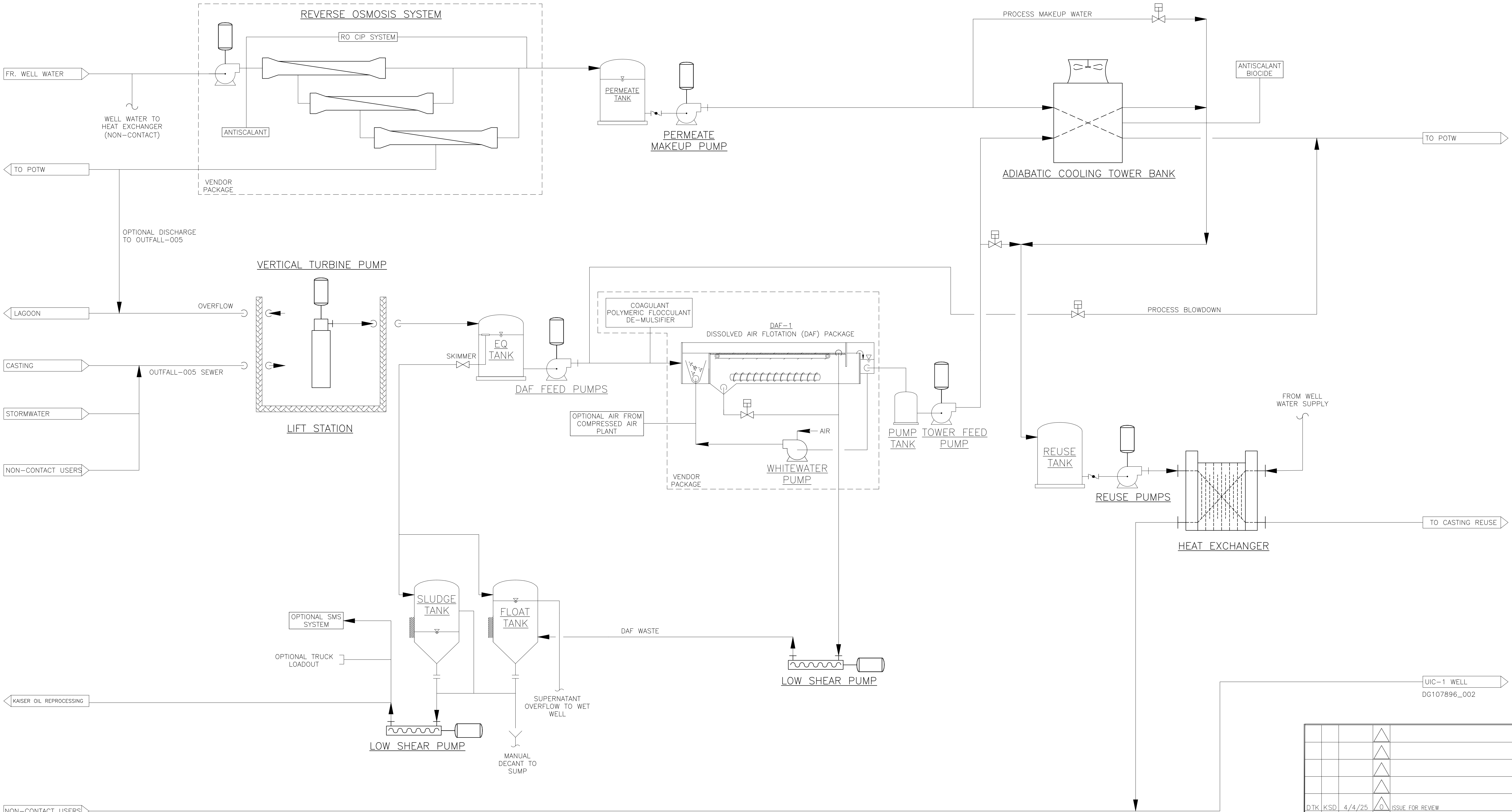
Figures



NOTES
1. AERIAL IMAGERY SOURCE: GOOGLE EARTH PRO



Appendix A FEL-1 Drawings



NOTES

1. DAF EFFLUENT PUMP SHOWN AS INDEPENDENT TANK FOR CLARITY, BUT MAY BE INCORPORATED INTO THE DAF PACKAGE DEPENDING ON FINAL DAF MAKE AND MODEL SELECTED.

2. CHEMICAL DOSING EQUIPMENT NOT SHOWN FOR CLARITY. PER DISCUSSIONS WITH WATER TREATMENT VENDORS, CHEMICAL DOSING LIKELY NEEDED FOR BOTH RO SYSTEM AND TREATMENT SYSTEM.

3. ONLY PRIMARY EQUIPMENT DEPICTED, REDUNDANT AND PARALLEL PROCESS EQUIPMENT NOT SHOWN FOR CLARITY.

4. ONLY SELECT INSTRUMENTATION AND PROCESS MONITORING EQUIPMENT SHOWN FOR CLARITY.

5. UIC-1 WELL AND SYSTEM CAPACITY TO BE EXPANDED AS NEEDED.

6. SELECT NON-CONTACT USERS TO BE LEFT ON OUTFALL-005 SEWER.

7. FLOAT AND SLUDGE TANKS TO BE CONFIGURED SUCH THAT ONE TANK MAY BE DEDICATED TO COLLECTING AND STORING NEAT CASTOR OIL.



PROJECT NO:	302903
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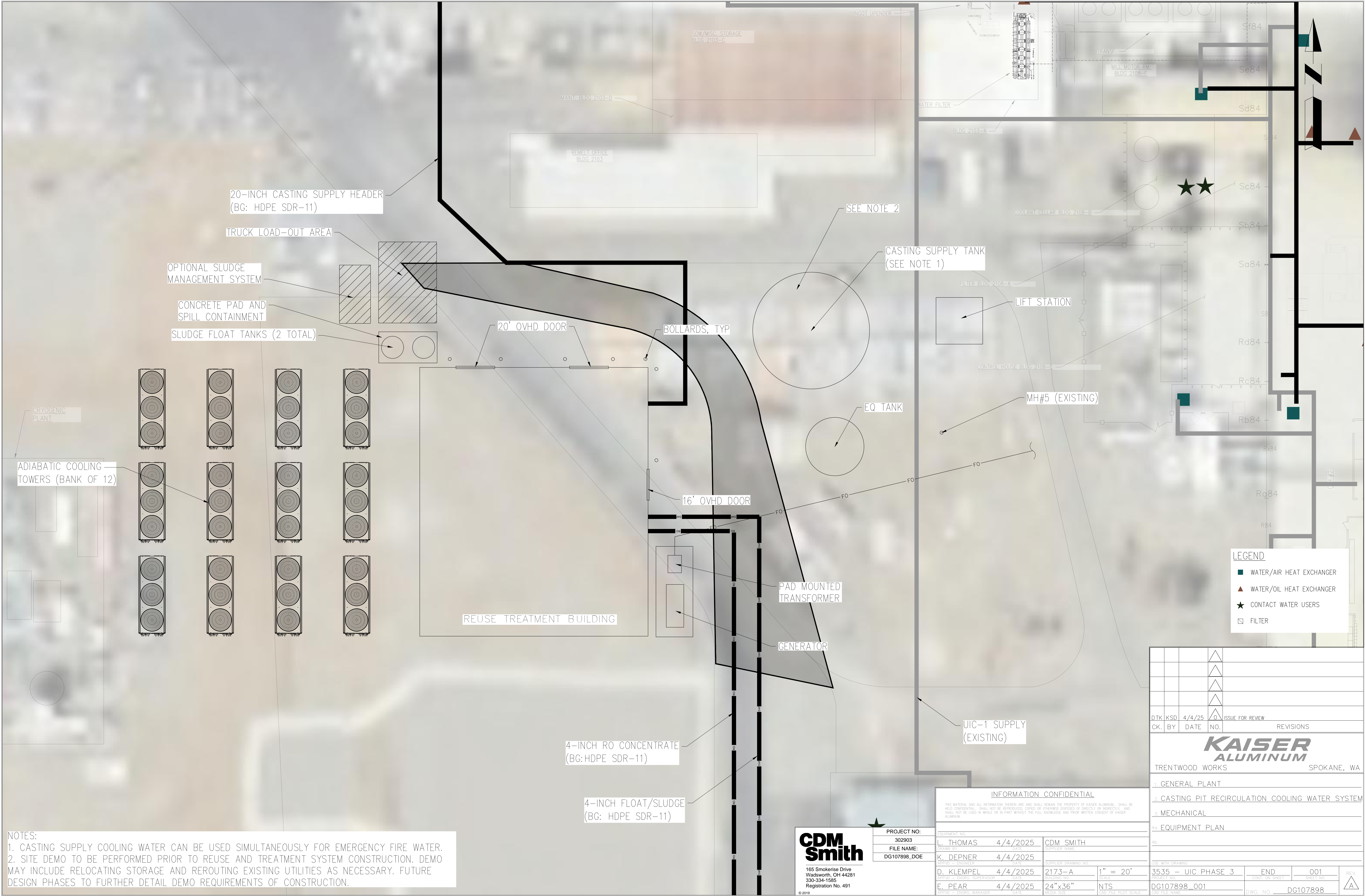
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FUTURE			
EQUIPMENT NO.			
D. THOMAS	4/4/2025	CDM SMITH	
DRAWN BY	DATE	SUPPLIER NAME	
K. DEPNER	4/4/2025		
APPROVED - ENGINEER	DATE	SUPPLIER DRAWING NO.	
D. KLEMPER	4/4/2025	TBD	1" = 1'
APPROVED - ENGRG. SUPERVISOR	DATE	BUILDING NO.	SCALE
E. PEAR	4/4/2025	24"x36"	NTS
APPROVED - ENGRG. MANAGER	DATE	MEDIA SIZE	CAD FILE PLOT SCALE

				
				
				
				
DTK	KSD	4/4/25	 0	ISSUE FOR REVIEW
CK,	BY	DATE	NO.	REVISIONS
<div><div>KAISER</div><div>ALUMINUM</div></div> <div>TRENTWOOD WORKSSPOKANE, WA</div>				
1. GENERAL PLANT				
2. CASTING PIT RECIRCULATION COOLING WATER SYSTEM				
3. PROCESS				
4a. TREATMENT SYSTEM PROCESS FLOW DIAGRAM				
4b.				
USE WITH DRAWING				
3535 -- UIC PHASE 3		002	001	REV. 
PROJECT NO.		CONT. ON SHEET	SHEET NO.	
DG107896_001		DWG. NO.	DG107896	
CAD FILE NAME				



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FUTURE			
EQUIPMENT NO.			
L. THOMAS	4/4/2025	CDM SMITH	
DRAWN BY	DATE	SUPPLIER NAME	
K. DEPNER	4/4/2025		
APP'D - ENGINEER	DATE	SUPPLIER DRAWING NO.	
D. KLEMPER	4/4/2025	TBD	1" = 1'
APP'D - ENG. SUPERVISOR	DATE	BUILDING NO.	SCALE
E. PEAR	4/4/2025	24"x36"	CDS
APP'D - ENG. MANAGER	DATE	MEDIA SIZE	NAT FILE PLOT SCALE

[illegible]



NOTES:
1. CASTING SUPPLY COOLING WATER CAN BE USED SIMULTANEOUSLY FOR EMERGENCY FIRE WATER.
2. SITE DEMO TO BE PERFORMED PRIOR TO REUSE AND TREATMENT SYSTEM CONSTRUCTION. DEMO MAY INCLUDE RELOCATING STORAGE AND REROUTING EXISTING UTILITIES AS NECESSARY. FUTURE DESIGN PHASES TO FURTHER DETAIL DEMO REQUIREMENTS OF CONSTRUCTION.

CDM Smith
165 Smokerise Drive
Wadsworth, OH 44281
330-334-1585
Registration No. 491
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302903
FILE NAME:
DG107898_DOE

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EQUIPMENT NO.			
D. THOMAS	4/4/2025	CDM SMITH	
DRAWN BY	DATE	SUPPLIER NAME	
K. DEPNER	4/4/2025		
APPROV - ENGINEER	DATE	SUPPLIER DRAWING NO.	
D. KLEMPER	4/4/2025	2173-A	1" = 20'
APPROV - ENGRS. SUPERVISOR	DATE	BUILDING NO.	SCALE
E. PEAR	4/4/2025	24"x36"	NTS
APPROV - ENGRS. MANAGER	DATE	MEDIA SIZE	CAD FILE PLOT SCALE

DTK	KSD	4/4/25	0	ISSUE FOR REVIEW	
CK.	BY	DATE	NO.	REVISIONS	
<div>KAISER ALUMINUM</div>					
TRENTWOOD WORKS				SPOKANE, WA	
1. GENERAL PLANT					
2. CASTING PIT RECIRCULATION COOLING WATER SYSTEM					
3. MECHANICAL					
4a. EQUIPMENT PLAN					
4b.					
USE WITH DRAWING					
3535 — UIC PHASE 3			END	001	REV.
PROJECT NO.			CONT. ON SHEET	SHEET NO.	<div>▲</div>
DG107898_001			DWG. NO.		
CAD FILE NAME			DG107898		