DRAFT

OPERATION AND MAINTENANCE DATA

WYCKOFF GROUNDWATER TREATMENT PLANT
(Volume I)

Wyckoff/Eagle Harbor Superfund Site
Kitsap County, Washington

Prepared for

U.S. Army Corps of Engineers
Seattle District
4735 East Marginal Way South
Seattle, Washington 98134

Contract Number W912DQ-04-D-0017
Task Order EC01

March 2009

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I hereby certify that the enclosed *Draft Operations and Maintenance Data*, shown and marked in this submittal, is that proposed to be incorporated with the Contract No. W912DQ-04-D-0017, Task Order EC01, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington. This manual is in compliance with the contract drawings and specifications, and is submitted for government approval.

Reviewed by:

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Project Manager **Date**

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Quality Control System Manager **Date**

Accepted By:

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USACE Contracting Officer **Date**

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ATTACHMENTS OF MANUFACTURER'S INFORMATION

List of Abbreviations and Acronyms

ABS	acrylonitrile butadiene styrene
AFD	Adjustable Frequency Drive
AHP	high pressure process air
AI	instrument air
ALP	low pressure air
ASME	American Society of Mechanical Engineers
BWE	Backwash Effluent
BWR	Backwash recycle
BWS	Backwash Source
BYP	Bypass
cfm	cubic feet per minute
DAF	Dissolved Air Flotation
DC	Direct Current
DE	DAF Effluent
DI	DAF Influent
DO	Dissolved Oxygen
DR	DAF Recycle
DNAPL	dense non-aqueous phase liquids
EPA	United States Environmental Protection Agency
EQ	Equalization
EW	Extraction Well
^{O}F	degrees Fahrenheit
FE	Filter effluent
FFE	Forward Flush Effluent
FFS	Forward Flush Supply
FI	Filter influent
FRE	Froth effluent
FRI	Froth influent
FRP	fiberglass reinforced plastic
ft	feet
GAC	Granular Activated Carbon
gph	gallons per hour
gpm	gallons per minute
GWTP	Groundwater Treatment Plant

List of Abbreviations and Acronyms (continued)

HAZWOPER	Hazardous Waste Operations Emergency Response
HDBF	Hydromation Deep Bed Filter
HDPE	high density polyethylene
HMI	human/machine interface
HP	horsepower
HVAC	heating, ventilation, and air conditioning
Hz	hertz
kW	kilowatts
LCS	Local Control Stations
LNAPL	light non-aqueous phase liquids
LP	lighting panel
MDP	Main distribution panel
MB	megabyte
mg/L	milligrams per liter
ml/min	milliliters per minute
mm	millimeter
MOV	metal oxide varistor
NAPL	non-aqueous phase liquids
NFPA	National Fire Protection Association
NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List
NTU	Nephelometric Turbidity Units
O&G	Oil and Grease
O&M	Operations and Maintenance
OF	Overflow
OIT	operator interface terminal
OMI	CH2M Hill OMI
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
P&ID	Process and Instrumentation Diagram
PAH	polynuclear aromatic hydrocarbons
PCPs	pentachlorophenols
PE	pressure gauges
PLC	Programmable Logic Controller
PLE	Plant effluent
PLI	Plant Influent
ppb	parts per billion
PPE	personal protective equipment
ppm	parts per million
PRG	preliminary remediation goal
psi	pounds per square inch
psid	pounds per square inch differential
psig	pounds per square inch gauge
QAPP	Quality Assurance Project Plan

List of Abbreviations and Acronyms (continued)

RCRA	Resource Conservation and Recovery Act
RCY	recycle
ROD	Record of Decision
rpm	revolutions per minute
scfm	standard cubic feet per minute
SF	square feet
SP	Sampling Port
SS	Filter Press Feed Tanks
SSHP	Site Safety and Health Plan
STW	Storm water
TDH	total dynamic head
TDS	total dissolved solids
TEFC	Totally Enclosed Fan-Cooled
TSP	Tri-sodium phosphate
TSS	total suspended solids
TVSS	Transient Voltage Surge Suppressor
μg/L	microgram per liter
UL	Underwriters Laboratories
UPS	Uninterrupted Power Supply
USACE	United States Army Corps of Engineers
V	volts
VSS	volatile suspended solids
W	watts

1.0 INTRODUCTION

This *Draft Operation and Maintenance Data, Wyckoff Groundwater Treatment Plant, Wyckoff/Eagle Harbor Superfund Site, Kitsap County, Washington (Volumes I through XII)*, herein referred to as the Operations and Maintenance (O&M) Manual, is a combination of descriptions, tables, figures, and manufacturer's data for the operation, maintenance, repair and other operational activities associated with the Wyckoff/Eagle Harbor Superfund Site (Wyckoff) replacement Groundwater Treatment Plant (GWTP) constructed by ECC during 2007, 2008 and 2009 on Bainbridge Island, Washington.

This project was performed for the United States Army Corps of Engineers (USACE) Seattle District, under Contract Number W912DQ-04-D-0017, Task Order EC01 for the United States Environmental Protection Agency (EPA).

This O&M Manual is written to assist personnel in successfully operating the groundwater extraction, treatment, and discharge system at the Wyckoff GWTP on Bainbridge Island, Washington. The manual serves as a resource for:

- Equipment Information (one-stop for manufacturer-supplied catalog cut sheets and O&M manuals);
- Start-up, Operating, and Shut Down Procedures;
- Inspections and Maintenance;
- Repairs;
- Parts; and
- Recordkeeping.

This O&M manual is to be used in conjunction with the following companion documents prepared by OMI, the O&M contractor:

- Site Safety and Health Plan (SSHP) for O&M of the Wyckoff GWTP; and
- Quality Assurance Project Plan (QAPP) for O&M sampling of the Wyckoff GWTP.

These documents will be on file in the treatment plant office at all times. A set of construction record drawings also will be on file in the treatment plant office.

1.1 Site History

Before 1904, the Wyckoff Facility site was occupied by two mining operations and a brick mill. Wood treating operations at the site began in 1905 and continued until 1988 under several owners. The wood treatment operations included wood preservation; storage of treated and untreated wood; use and storage of fuel oil, creosote, pentachlorophenol (PCP), solvents, gasoline, antifreeze, waste oil, and lubricants; and management of process wastes. These chemicals were stored in above-ground storage tanks, conveyed through above-ground and below-ground piping, disposed in sumps, spilled, and buried onsite. Wood preservative chemicals were delivered to the facility by barge and ship and stored in tanks on the property.

Spills and leaks from tanks and piping entered the ground directly or through unlined sumps. The practice of storing treated pilings and timber in the water continued until the late 1940s.

The EPA began an investigation of the property in 1971. In August 1984, EPA issued an order under Section 3013 of the Resource Conservation and Recovery Act (RCRA) requiring the Wyckoff Company to conduct environmental investigation activities. Data collected at the time revealed the presence of significant soil and groundwater contamination.

The Wyckoff Site was proposed to be listed on the National Priority List (NPL) in September 1985 and the site was subsequently placed on the NPL in 1987. In 1988, the Wyckoff Company ceased all operations on the property. In 1989, a groundwater extraction and treatment system was installed and began operation in 1990. The treatment system continues to pump product and process contaminated groundwater at the site. Groundwater is obtained from several extraction wells (EWs) located within the Groundwater Operable Unit (OU). These EWs are screened in the shallow, unconfined aquifer, and the groundwater was treated at the existing on-site Wyckoff GWTP. Treated effluent from the existing GWTP is discharged via a single pipe outfall that extends in an easterly direction from the Wyckoff facility towards the entrance channel to Eagle Harbor. A physical barrier comprised of sheet piling was installed around the OU site boundary to provide containment of the contaminated groundwater and prevent the spread of contamination from the site into Eagle Harbor or Puget Sound. In 1993, the EPA assumed management of the Soil and Groundwater OUs.

1.2 Site Description

The Wyckoff Site is situated on the southeast side of Eagle Harbor on the eastern shore of Bainbridge Island. Bainbridge Island is located in central Puget Sound, directly across and due west of Seattle, Washington. The Wyckoff Site location is shown on Figure 1-1. The existing layout of the Wyckoff Site is shown on Figure 1-2. The property is approximately 40 acres in size, which includes approximately 16 acres of generally flat and open terrain at the entrance to Eagle Harbor. This flat area comprises the Soil and Groundwater OUs defined in the Record of Decision (ROD) for the Superfund project and the average ground surface elevation is approximately 10 feet (ft) above mean sea level. The southern portion of the Wyckoff Site consists of a steep tree-covered slope. Offsite to the south, the topography rises toward the island's interior and elevations exceeding 200 ft. Approximately 2,000 people live within one mile of the site. The nearest residence is located less than 1/4 mile to the south. Land use in the area is mostly residential and commercial. The harbor is used by recreational boaters, "live-aboards," and ferry transport to and from Seattle.

1.3 Nature and Extent of Contamination

The nature and extent of contamination present at the Wyckoff Soil and Groundwater OUs have been evaluated using data on non-aqueous phase liquids (NAPL), soil, groundwater, and surface water collected during Expedited Response Actions and site characterization, monitoring, and cleanup activities. The evaluation of the nature and extent of contamination focused on the presence of NAPL in soil and groundwater and on those chemicals detected in one or more environmental media at concentrations exceeding preliminary remediation goals (PRGs), which are established by the EPA to protect human health and the environment.

Chemicals detected in NAPL at the Wyckoff Site are consistent with the products historically used onsite (i.e., creosote, PCP, and aromatic carrier oils). The light NAPL (LNAPL) and dense NAPL (DNAPL) at the site generally contain varying concentrations of polynuclear aromatic hydrocarbons (PAHs), PCP, other semi-volatile organic compounds (dibenzofuran, 3,5-dimethylphenol, 2-methylnaphthalene, carbazole, and 1-methylnaphthalene), and volatile organic compounds (methylene chloride, ethylbenzene, toluene, and xylenes). NAPL is primarily restricted to the marine sand and gravel units. The maximum thickness of mobile LNAPL and DNAPL is approximately 13 and 9 ft, respectively. Mobile NAPL is present in all units, including the glacial aquitard.

Site personnel potentially could contact NAPL during performance monitoring at the extraction wells, sampling of the upper aquifer groundwater wells, maintenance activities (wells, extraction system piping, and other equipment that comes into contact with the NAPL), trenching and excavation, and at the groundwater treatment plant. The primary potential exposure routes anticipated to site personnel from NAPL are dermal contact, and possible inhalation of organic vapors from out-gassing of NAPL exposed to the atmosphere. In near-surface soil, detected contaminants exceeding PRGs include PCP, nine PAHs, two other semi-volatile organic compounds (carbazole and dibenzofuran), one volatile organic compound (styrene), one pesticide (dieldrin), and dioxin (as total 2,3,7,8-TCDD equivalents). The extent of contamination is generally represented by the approximate lateral extent of PAH contamination.

1.4 Treatment System Description

The ROD requires treatment of the contaminated groundwater to meet the effluent limits presented in Table 1-1. Table 1-1 is taken from Table 25 of the ROD and is also provided under Appendix A.

Table 1-1
Summary of Effluent Limitations and Monitoring Requirements
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

Effluent Characteristics	**Discharge Limitation**		**Monitoring Requirements**		
	Daily Maximum (µg/L)	Monthly Average (µg/L)	Measurement Frequency	Sample Type	Reported Value(s)
Total of 16 PAHs	20	--	Once per week	24-hour composite (c)	Maximum daily
Individual PAHs					
Naphthalene	4	--	Once per week	24-hour composite	Maximum daily
Acenaphthylene	4	--	Once per week	24-hour composite	Maximum daily
Acenaphthene	4	--	Once per week	24-hour composite	Maximum daily
Fluorene	2	--	Once per week	24-hour composite	Maximum daily
Phenanthrene	2	--	Once per week	24-hour composite	Maximum daily
Anthracene	2	--	Once per week	24-hour composite	Maximum daily
Fluoranthene	2	--	Once per week	24-hour composite	Maximum daily
Pyrene	2	--	Once per week	24-hour composite	Maximum daily
Benzo(a)anthracene	2	--	Once per week	24-hour composite	Maximum daily
Chrysene	2	--	Once per week	24-hour composite	Maximum daily
Benzo(b)anthracene	2	--	Once per week	24-hour composite	Maximum daily
Benzo(k)anthracene	2	--	Once per week	24-hour composite	Maximum daily
Benzo(k)pyrene	2	--	Once per week	24-hour composite	Maximum daily
Dibenzo(a,h)anthracene	2	--	Once per week	24-hour composite	Maximum daily
Benzo(g,h,i)perylene	2	--	Once per week	24-hour composite	Maximum daily

Table 1-1 (Continued)
Summary of Effluent Limitations and Monitoring Requirements
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

Effluent Characteristics	**Discharge Limitation**		**Monitoring Requirements**		
	Daily Maximum (µg/L)	Monthly Average (µg/L)	Measurement Frequency	Sample Type	Reported Value(s)
Indeno(1,2,3-cd)pyrene	2	--	Once per week	24-hour composite	Maximum daily
Pentachlorophenol (d)	6	--	Once per week	24-hour composite	Maximum daily
Discharge Flow (gpm) (e)	NA	--	Continuous	Recording	
TSS (mg/L)	NA	--	Once per week	24-hour composite	Maximum daily
TDS (mg/L)	NA	--	Once per week	Grab	Maximum daily
Temperature [ºC]	NA	--	Once per week	Grab	Maximum daily
Dissolved Oxygen (mg/L)	NA	--	Once per week	Grab	Maximum daily
pH	6.0 - 9.0	--	Once per week	Grab	Maximum daily
Metals					
Zinc	95	47	Once per week	24-hour composite	Maximum daily
Lead	140	70	Once per week	24-hour composite	Maximum daily
Mercury	2.1	1	Once per week	24-hour composite	Maximum daily
Nickel	75	37	Once per week	24-hour composite	Maximum daily
Cadmium	43	21	Once per week	24-hour composite	Maximum daily
Chromium (Total)	1100	548	Once per week	24-hour composite	Maximum daily

gpm = gallons per minute
µg/L = microgram per liter (ppb)
mg/L = milligrams per liter (ppm)

The major process components of the treatment system are:

- Groundwater extraction from a cluster of EWs;
- Equalization (EQ) Tank;
- Dissolved Air Flotation (DAF) Unit with a Polymer Injection System;
- Hydromation Deep Bed Filter (HDBF) System;
- Granular Activated Carbon (GAC) Adsorbers;
- Process pumps to process streams;
- Effluent Tank; and
- Discharge to Outfall.

Additional side-stream components are:

- Tank Farm Containment Area and Equalization Skim Sumps;
- Digester, Storm water and Dirty Backwash Settling Tanks;
- Product and Froth Tanks (for removal of free product);
- Filter Press (for sludge handling); and
- Filtrate Tanks (for separation of solids).

The treatment equipment, along with appurtenances such as flow meters, level sensors, valves, and pressure gauges, are located either inside the (41 ft by 127 ft) treatment building or within the (33 ft by 119 ft) tank farm containment area, which is south of and adjacent to the treatment building (Figure 1-2). The treatment system utilizes a Programmable Logic Controller (PLC) to facilitate automated system operation for treating contaminated water. The treatment building PLC, located inside the treatment building, communicates with and controls the process equipment associated with treatment of contaminated water. The controls either allow the system to be operated automatically from the treatment building or manually controlled at local control stations located near specific equipment.

1.5 Discharge Requirements

The treated effluent from the Wyckoff GWTP is discharged to Eagle Harbor through the existing outfall. The effluent is treated to comply with the same substantive National Pollutant Discharge Elimination System (NPDES) standards presented in the ROD (Appendix A).

If effluent water quality exceeds the discharge criteria for one or more of the parameters in Table 1-1, then the EPA must be notified in writing within 24 hours of discovery of the exceedence. Actions to correct effluent quality exceedances and achieve the required effluent concentrations must be implemented immediately. If the required actions are considered to be outside the scope of work for plant operations, then the system will be shut down pending further direction from the EPA. The contact person at the EPA is Mary Jane Nearman (206) 553-6642. If the main EPA contact is not available, then plant operators will contact other USACE personnel by phone or email. A contact list is provided as Table 1-2.

1.6 Contact List

Wyckoff GWTP key O&M personnel and their contact information are provided in Table 1-2.

Table 1-2
Project Contact List
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

Contact Name	Title	Organization Affiliation	Email, Address, and Phone Number
Mary Jane Nearman	Project Manager	EPA	Nearman.maryjane@epa.gov 1200 Sixth Avenue Suite 900, ECL113 Seattle, WA 98101 (206) 553-6642
Matthew Satter	Contracting Officer	USACE - Seattle	Matthew.satter@usace.army.mil 4735 East Marginal Way South Seattle, WA 98134 (253) 966-4360
James Parker	Project Engineer	USACE - Seattle	James.r.parker@usace.army.mil 4735 East Marginal Way South Seattle, WA 98134 (253) 966-4380
Dennis Fitzpatrick	On-Site Representative	USACE - Seattle	Dennis.E.Fitzpatrick@nws02.usace.army.mil 4735 East Marginal Way South Seattle, WA 98134
Ken Scheffler	Design Project Engineer	CH2M Hill	kscheffler@ch2m.com (425) 453-5000
Krystal Perez	Field Engineer	CH2M Hill	krystal.perez@ch2m.com (425) 233-3304
Dr. Ganesh Subramaniam	Project Engineer	ECC	gsubramaniam@ecc.net 1125 Route 22 West Bridgewater, NJ 08807 (908) 595-1777
Brady Bigelow	Project Manager	ECC	bbigelow@ecc.net 1746 Cole Blvd. Bldg. 21 Suite 350 Lakewood, CO 80401 (303) 298-7607
Stan Warner	Plant Operations Project Manager	OMI	Stanley.Warner@ch2m.com (206) 780-1711
Stan Warner	Lead Plant Operator	OMI	Stanley.Warner@ch2m.com (206) 780-1711
To be provides later	Backup Plant Operator	OMI	
Kirk Payne/John Hartman	Project Manager	Holmes Mechanical	10890 Old Frontier Rd NW Silverdale, WA 98383 (360) 698-1977
Roger Wagner	Project Manager	Drury Construction	19302 Powder Hill Place, Suite 100 Poulsbo, WA 98370 (360) 394-6000
Sean Muldoon	Project Manager	Ahearn Electric	4843 Auto Center Way Bremerton, WA 98312 (360) 373-1900
Riley Lowthian	Project Manager	TSI	2303 196th Street SW, Lynwood, WA 98036 (425) 775-5696

2.0 HEALTH AND SAFETY

The foremost priority in operating the Wyckoff GWTP is to ensure the health and safety of the operators, visitors, and nearby residents. CH2MHill OMI (OMI) has developed an SSHP that is used in conjunction with this O&M Manual and other documents required for O&M operation.

A copy of the SSHP must be kept in the Wyckoff GWTP office for reference. Operation of the Wyckoff GWTP includes the following potential hazards:

- Contact with contaminated (untreated) groundwater;
- Confined space entry;
- Electrical hazards;
- Hazards associated with rotating equipment (pump shafts, vent fans, etc);
- Release of stored energy (mechanical and pressurized systems);
- Slip/trip/fall hazards;
- Lifting heavy objects and;
- Heat and cold stress.

The operators must be familiar with the SSHP and its requirements, including training (project orientation, Occupational Safety and Health Administration [OSHA], Hazardous Waste Operations Emergency Response [HAZWOPER], confined space entry, fall protection), medical monitoring, personal protective equipment (PPE), confined space entry procedures, fall protection measures (required for any activity having a potential fall greater than 6 ft), air monitoring, hazard communication, emergency response plan, hospital route, and the site control log. The plant operators will provide a safety briefing for visitors to the plant and well locations. There will be a sign-in sheet for visitors posted at the office plant treatment.

Treatment plant operations may normally be conducted in Level D PPE, which includes nitrile gloves, protective footwear, coveralls, standard work clothing, hard hats, and protective eye wear (safety glasses). Noise monitoring will be performed within all treatment building locations, and depending upon data obtained during the initial O&M, hearing protection requirements will be evaluated.

3.0 DESCRIPTION AND OPERATION OF GROUNDWATER TREATMENT PLANT SYSTEM AND COMPONENTS

The purpose of this section is to familiarize plant operators with basic information regarding the various systems and components. Pertinent catalog information from the equipment manufacturers are provided in the form of attachments (Volume II through Volume XII) to this O&M Manual. A detailed table of contents for each volume is provided at the beginning of each volume to facilitate location of specific component information. The text of this section is intended to provide an overview to the manufacturer's information and to provide an overview of the system operation. Manufacturer information in Volumes II through XII primarily consist of the manufacturers typical O&M package which includes but is not limited to product data, performance curves (for pumps), materials of construction, operation of the equipment, equipment maintenance, troubleshooting, and spare parts inventories. Major process equipment warranty information is provided under Appendix B. Individual associated product warranties are provided in Volumes II to XII.

Except during initial startup of each individual process system (DAF, HDBF and pumps), the operator will be located at the east end of the treatment plant to operate the system from the touch screen on the panel also called the operator interface terminal (OIT) or the human/machine interface (HMI). The touch screen is also located next to the DAF Control Panel and the six Adjustable Frequency Drives (AFDs) for the pumps (DAF feed, filter feed and decant).

In addition to the DAF local control panel, local control panels for the HDBF and, polymer system, and the motor starter and disconnect for the well pumps are located inside the treatment building process area. The rotary blower local control panel is located inside the treatment building mechanical room and the sump pumps control panel is located outside the tank farm. If needed, the operator can be present at local control panels for operation of specific equipment.

O&M sampling schedules detailing the sampling frequency and parameters at each sampling port are provided in the project QAPP.

3.1 Groundwater Treatment System Description

The Wyckoff GWTP is designed to treat contaminated groundwater extracted from beneath the site to levels specified by the ROD. Extracted groundwater is pumped into an EQ tank from which the water is drawn and processed through three separate treatment units arranged in series. The treatment units (in order) are the DAF System with polymer injection; the HDBF system; and the GAC units. The DAF and HDBF system are designed to remove oil and grease (O&G), total suspended solids (TSS), and PAHs. The GAC units are designed to remove PCP and PAHs.

Figure 3-1 (Process Flow Diagram) presents a schematic diagram of the entire process, including several "side streams" for process water recycling and waste removal and recovery. The side streams include product recovery from the EQ tank and the DAF System; backwash for the

HDBF and GAC Systems; solids recovery (Filter Press) from the backwash streams; and storm water, spill containment, recycled water streams; polymer; water; and air. Figure 3-2 (Simplified Process Flow Diagram) presents a simplified diagram with flow directions showing both main and recycle streams. Figure 3-3 (Treatment System Layout) show the layout of the treatment equipment and piping inside the treatment building and the adjacent outside tank farm. Figures 3-4 to 3-14 are discussed in the following unit process sections. Sheets 1 and 2 provide instrumentation and control legends explaining the symbols, letters, and numbers used on these figures. Applicable treatment system drawings are provided in Appendix C. Appendix D includes PLC screen captures that summarize each unit process operation. Manufacturer information for the process valves is provided in Volume VII – Attachment 7.4.

Table 3-1 provides a list of sampling ports for the entire process system. Tables 3-2 and 3-3 provide a list of flow meters and level sensors for the entire process system. Tables 4-1 through 4-9 identify and explain the valve settings and/or positions for normal operation of individual process units. These valves are referenced under this Section 3.0 and should be cross-referenced with startup and shut down procedures from Section 4.0.

Each unit process described in Sections 3-2 through 3-11 focus on the following topics:

1) A system description;
2) An operational description;
3) Instrumentation and controls; and
4) Design criteria.

In addition, references to troubleshooting procedures are provided for DAF, HDBF, and GAC systems under Sections 3.3.5, 3.4.5, and 3.5.8 respectively. Optimization for DAF system is provided in Section 3.3.6.

Under design criteria, reference to manufacturer information manual (Volumes II to XII) and corresponding figure numbers are provided. In addition, refer to Figure 3-3 for location and layout of the specific process equipment discussed in Sections 3.2 to 3-11.

3.2 Groundwater Extraction and Storage

This section provides a system description, operational description, a description of groundwater extraction and storage system. Specific information related to the EQ Tank and EQ skim sump are provided in Section 3.2.4. Figure 3-3 illustrates the layout of the treatment system and shows the EQ tank and EQ skim sump.

3.2.1 Groundwater Extraction and Storage System Description

The extraction system and influent storage system includes the following major components:

- EWs and associated pumps (not addressed in this manual);
- EQ Tank; and
- EQ Skim Sump.

The purpose for groundwater extraction is to maintain hydraulic containment within the confines of the existing sheet pile wall and to transfer contaminated groundwater to the Treatment Plant. The Wyckoff EW network includes several EWs. To verify that adequate hydraulic containment is being achieved, a groundwater monitoring system will be established as part of the O&M. The monitoring system will measure groundwater levels and pumping flow rates. The groundwater levels are analyzed to determine the extent of hydraulic containment.

O&M procedures related to groundwater EW's and their pumps are available on site and are not included in this manual. Operation of the EWs will be performed manually, with automation anticipated at a future date.

The EW pumps discharge contaminated groundwater into the EQ tank (40T1010) located within the Tank Farm through the 3-inch diameter FRP via pipeline labeled plant influent or "PLI" in Figure 3-4. The design flow from the EW network is 70 gallons per minute (gpm). The EQ tank provides equalization of flow and contaminant concentrations to the DAF System. The EQ tank is sized to provide more than 2 days of retention time at an influent flow of 11 gpm, which is the expected future peak flow rate after installation of the site cap and up-gradient hydraulic isolation wall.

Some separation of non-aqueous phase oil and suspended solids also occurs within the EQ tank. The EQ tank has a vertical baffle to reduce short-circuiting between the water influent and effluent points. The EQ tank has an overflow weir for removal of LNAPL and a sloped floor to facilitate the removal of DNAPL and settled solids. Hoses are connected to the EQ tank to remove LNAPL and DNAPL where the product discharges to the EQ skim sump. The EQ skim sump allows further separation of LNAPL, DNAPL, and water where it is manually removed with the use of digester/skim pump 50P1120 (separately discussed under Section 3.9). The EQ tank and EQ skim sump are shown on Figure 3-4. The physical location of the EQ Tank is shown in Sheet 49 with details shown in Sheets 55 and 65 in Volume I, Appendix C "Applicable Project Drawings". The location of the EQ Skim Sump is also shown in Sheet 49.

3.2.2 Groundwater Extraction and Storage System Operational Description

1) Groundwater is pumped into the EQ tank from the Wyckoff EW network with valve PLE-01 open. The total flow rate is monitored by Plant Influent flow meter FE/FIT-1009 (Figure 3-4 and Table 3-2).
2) The liquid level in the EQ tank is monitored by level transmitter LE/LIT-1011 (Figure 3-4 and Table 3-3) and will be maintained by the process control system at approximately one half of the tank capacity under normal operating conditions. This maintained liquid level will provide storage capacity in case treatment processes are temporarily shut down for maintenance or repair and pumping from the EWs must be maintained.

Sampling port (SP) SP-0, flow meter 1009, and level transmitter 1011 are shown on Figure 3-4. Sampling port SP-0 (Table 3-1) is located on the plant influent (PLI) pipeline between the EWs and EQ tank.

In addition to the influent flow from wells, the EQ tank receives recycle water from following streams:

- Treated plant effluent (PLE) from carbon adsorbers designated as PLE/ (recycle)RCY (cross reference with Figure 3-10) - associated valve PLE/RCY-01;
- Backwash recycle water from Dirty Backwash Tank designated as BWR (cross reference with Figure 3-11) - associated valve BWR/FI/RCY-01;
- Recycle from DAF Effluent (DE)/Filter Feed Pumps designated as FI/RCY (cross reference with Figure 3-7) - associated valve BWR/FI/RCY-01;
- Decant recycle from Decant Pumps/Froth Tank designated as FRE (cross reference with Figure 3-13) - associated valve FRE-07; and
- Recycle from the storm water recycle pump designated as STW (cross reference with Figure 3-14) - associated valve STW-13.

3.2.2.1 Influent Piping from Wells to Equalization Tank

A 3-inch high density polyethylene (HDPE) pipeline from the extraction well field is connected to a new 3-inch diameter fiberglass reinforced plastic (FRP) pipeline using a 3-inch plug valve. The purpose of the 3-inch plug valve (PLI-00) that connects the HDPE pipeline from well field to the FRP pipeline, is to direct contaminated water to the Wyckoff GWTP Tank Farm (EQ tank). Valve PLI-01 isolates the influent line from EQ tank and valve PLI-00 located in the exclusion zone isolates the line from the existing plant. The PLI pipeline is shown on Figure 3-15.

3.2.2.2 LNAPL Recovery from Equalization Tank

1) Periodically (anticipated frequency once a week), the water level in the EQ tank will be raised to the top of the working volume to decant floating oil (LNAPL) that accumulates on the water surface through the overflow weir.
2) Water level in tank to reach overflow weir will be measured and checked to match the level indicated on LE/LIT-1011. This action is achieved by slowing down the effluent flow from the EQ tank by adjusting the DAF feed pump parameters or shutting down the plant during the weekend and maintaining well pump flow into the EQ tank.
3) At this point the flow to the EQ tank is higher than flow from the EQ tank to the DAF Unit thereby increasing the level in EQ tank.
4) The LNAPL is removed by connecting a hose to a 2 inch FRP pipe that connects to the valve NAPL-01 on the LNAPL outlet.
5) Decanted LNAPL discharges by gravity flow to the EQ Skim Sump.

3.2.2.3 DNAPL Recovery from Equalization Tank

1) The bottom of the EQ tank slopes toward a bottom outlet to facilitate removal of DNAPL and settled solids.
2) DNAPL and heavy solids will be drawn off periodically (anticipated frequency, once per week) by connecting a hose to a 2-inch FRP pipe that connects to the valve NAPL-02 on the DNAPL outlet.
3) DNAPL and heavy solids discharge by gravity flow to the EQ skim sump. The use of a sump allows gravity flow of LNAPL and DNAPL, as well as visual verification that oil being removed.

3.2.3 Instrumentation and Controls

Piping and instrumentation for influent storage and EQ sump are depicted schematically on Figure 3-4. This figure also should be cross referenced with Figures 3-7, 3-10, 3-11, 3-13 and 3-14 for recycle streams (description of streams are described in Section 3.2.2) entering the EQ tank in addition to the influent from the EWs.

The following are the instrumentation and control steps:

1) The well field flow rate, influent to the EQ tank (FE/FIT-1009), is monitored by the PLC.
2) The liquid level in the EQ tank is monitored (LE/LIT-1011) and alarmed by the PLC. The DAF feed pump (described in Section 3.3) speed is controlled based on the liquid level in the EQ tank. Under normal operating conditions, the DAF feed pump speed is controlled to maintain a constant level in the EQ tank at about half-depth (that is, half of the water working volume). Alternately, the operator will be able to set the DAF feed pump speed and the pump will shut off automatically when the EQ tank level reaches a low-level or high-level set point.
3) Decanting LNAPL and DNAPL from the EQ tank is performed manually. The operator manually opens and closes valves on the LNAPL (NAPL-01) and DNAPL (NAPL-02) outlets to draw off oil. When decanting DNAPL, the operator visually inspects the discharge continuously at the EQ Skim Sump to determine when to close the valve and avoid decanting water.

3.2.4 Equalization Tank and Skim Sump Design Criteria

The major components of the Equalization Tank System are provided in this section with their specifications, manufacturer, and location within the Wyckoff GWTP.

Equalization Tank (40T1010) – Figure 3-4

Capacity: 51,400 gallons
Dimensions: 18 ft diameter x 27 ft high
Anticipated contents: groundwater contaminated with PCPs, PAHs, O&G, and total dissolved solids (TDS)
Material of Construction: FRP
Manufacturer: Ershigs
Location: Tank Farm
Manufacturer Information and As-built Drawing: Volume VI of this O&M Manual

Equalization Skim Sump – Figure 3-4
Dimensions: 5 ft long x 5 ft wide x 5 ft deep
Capacity: 935 gallons
Location: Tank Farm

Plant Influent Flow Meter (FE-1009) – Figure 3-4
Model: Optiflux 4000 Series
Capacity/Characteristics: Optiflux Mag Inductive Flow Meter measures the flow from EQ tank with 2 inch Teflon lining and an operating range of 0 to 100 gpm.
Manufacturer: Krohne
Location: Tank Farm
Manufacturer information: Volume VIII – Attachment 8.1.

Level Transmitter Equalization Tank (LE/LIT-1011) – Figure 3-4
Model: Hydroranger 200
Characteristics: Calibrated at 0 to 40 ft of water with the level element XPS-15 and 10m cable
Manufacturer: Miltronics
Location: Tank Farm
Manufacturer information: Volume VIII – Attachment 8.1.

3.3 Dissolved Air Flotation System

This Section provides a system description, operational description, a description of instrumentation and controls for the DAF and the design criteria for the DAF and polymer systems, troubleshooting procedure and optimization. Specific information related to DAF equipment is provided under Section 3.3.4. Figure 3-3 illustrates the layout of the treatment system and shows the DAF System located in the treatment building process area. Information related to detailed description of the DAF components, installation instructions of the DAF system, safety instructions, torque control and maintenance and emergency procedures can be found under Volume III of Westech's manufacturer manual – Attachment 3.1.1.

3.3.1 Dissolved Air Flotation System Description

The DAF System follows the EQ tank (40T1010) and precedes the HDBF System in the Wyckoff GWTP. The DAF System (M1121) removes suspended solids and non-aqueous-phase oil (LNAPL and DNAPL) from the groundwater. The principal removal mechanism in the DAF Unit and its air saturation system is flotation of oil and settleable solids will be removed as sludge. A polymer is injected into the DAF influent to improve the oil removal efficiency.

The DAF System components include the following:

- DAF Unit (M1121),
- Supplemental Components of DAF System consisting of skimmer, auger, mixer, recirculation pump, air saturation tank and DAF control panel.
- DAF Polymer System, and
- DAF Feed Pumps (2).

The DAF System consists of a flotation chamber, a motor-driven float drag skimmer (M1121C) and a float collection chamber, an effluent chamber, a motor-driven sludge auger (M1121B), a recycle pressurization system (Recirculation Pump 50P1135, Air Saturation Tank 50T1138), Mixer (M1121A), and Local Control Panel (50LCP1121). The DAF unit is protected from corrosion with eighteen (18) zinc anodes placed on the walls. In addition, the air saturation tank also has two (2) zinc anodes mounted on the inner tank wall, and the recirculation piping. A four (4) inch rupture disc is located in the north side of the DAF unit. The DAF Polymer System consists of a neat polymer pump (50P1611), polymer mixer, an in-line mixer, a polymer blend tank (40T1620), and a polymer feed pump (50P1640).

The DAF process is important to ensure that non-aqueous phase oil is effectively separated from the water, which is critical to prevent fouling and allow proper operation and performance of the HDBF and GAC processes.

The function of the DAF Polymer System is to prepare a polymer solution and inject the solution into the DAF Influent (DI) (prior to the DAF System). Polymer addition via the DAF Polymer System improves the oil and solids removal performance of the DAF System. Polymer will be obtained from the manufacturer in drum quantities. Non-potable Water (W2) is supplied from the Plant Water Storage Tank (50T1570). Polymer and water are mixed in the Polyblend System and the solution is stored in the Polymer Blend Tank (40T1620). Polymer solution is injected into DI piping by the Polymer Feed Pump (50P1640). The DAF System, Polymer System and DE are shown on Figures 3-4, 3-5, 3-6 and 3-7 (Equalization Tank and Skim Sump, Dissolved Air Flotation, Polymer System and DAF Effluent) respectively. The physical location of the DAF unit is shown in Sheet 48 with details shown in Sheets 51 and 62 under Appendix C “Applicable Project Drawings” of Volume I. The physical location of the polymer system is shown in Sheet 48 with details in Sheet 61. The location of the DAF Feed pumps is also shown under Sheet 48.

3.3.2 Dissolved Air Flotation System Operational Description

1) Water is pumped via pipeline labeled DI from the EQ tank (40T1010) to the DAF System by the one of the two DAF Feed Pumps (50P1101 and 50P1102) with the opening of valves DI-02 and DI-04 associated with 50P1101 or DI-05 and DI-07 associated with second pump (50P1102). The second pump is installed as a redundant, which will increase the lifespan of each pump as their use will be cycled.
   Refer to Figures 3-4 and 3-5.
2) Flow Rate from the EQ tank is measured using DAF Influent Flow Meter (FE/FIT-1110) as illustrated in Figure 3-4.
3) The froth and effluent levels are measured using Level Transmitters LE/LIT-1131 (for froth) and LE/LIT-1211 (for DAF effluent) respectively (Figure 3-5). Both these level transmitters are located inside the DAF unit.
4) DI enters a flocculation zone with an AFD mixer for chemical conditioning and exits the compartment to a main flotation area. This chemically conditioned contaminated waste water and the pressurized recycle flow will be mixed in the first section of the DAF near the flocculation zone of the tank.
5) The skimmer system has two strands of chain running above the liquid surface over two sets of sprockets, and evenly spaced flights to conduct floated material over the dewatering beach and into the float hopper. Settled solids are removed from the bottom of the tank and the remaining effluent will flow over an adjustable weir. Part of the DE will be withdrawn from the effluent end of the flotation compartment and directed through a recirculation pump (50P1135).
6) Automatic controls maintain the flow to the saturation system (Figure 3-5) at a flow rate of 75 gpm measured by DAF air saturation tank flow meter (FE/FIT-1137) by varying the flow control valve (also called as Break-Out valve designated as DR-03).
7) A portion of this flow is recycled back to the DAF Unit with the operation of the pressure sustaining valve DR-04 (also labeled as PSV1134).
8) High pressure air (AHP-operated through valves AHP-09 through AHP-14) piped to the Air Flow Meter (FI-1133) is injected into the discharge of the recirculation pump directly before the saturation system. In the air saturation tank, air is dissolved into the liquid at approximately 110 psi. Excess air is expelled from the saturation system through an air bleed valve DR-V01 from the top of the tank that is recycled back to the DAF unit
9) The air-saturated liquid will exit the saturation system and directed toward the break-out valve DR-03. Flow from the recirculation pump to the air saturation tank is monitored using flow meter 1137.
10) As water passes into the flotation chamber and the pressure is released, minute gas bubbles form and rise to the surface, carrying suspended solids and oil droplets that adhere to the bubble surfaces. This material forms a “float” or froth at the liquid surface, which is removed by the skimmer to the float collection chamber.
11) Polymer (refer to Figure 3-6) is injected into the DI (prior to DAF Unit) to enhance flotation performance. Heavy materials such as dense oil and solids settle out in the V-bottom section of the DAF, with the sludge auger rotates in one direction only, and is fabricated of right hand screws on one half and left hand screws on the other half.

As the auger rotates, it draws sludge from the two ends toward the 2 inch solids suction connection at the center.

12) Treated water flows under a baffle and over a level-control weir into a collection launder, and discharges through the DAF effluent (pipeline labeled as DE). DE discharges by gravity flow to the DAF effluent chamber (DE Tank).
13) The DE Tank has over/under baffles to facilitate oil retention and minimize the amount of oil Pumped to the HBDF Unit. The DE is pumped to the HBDF Unit by opening the valve DE-01 (refer to Figure 3-7).
14) A portion of the DAF effluent (Figure 3-7) is checked for turbidity online with use of a Turbidimeter AE/AIT-1245 and opening the valves FI/SA-01 and 02. The turbidity meter continually monitors the turbidity of the effluent of the DAF, it digitally displays a real time value, and the values are stored and monitored by the PLC. These values are used to both warn the operator of water quality to monitor and optimize the performance of the DAF. This DAF effluent from the turbidimeter is discharged to a drain in the building which eventually goes to the decon pad sump and ultimately to the containment sump in the tank farm.

SP-1 (Figure 3-4 and Table 3-1) is located immediately upstream from the DAF feed pumps to sample the influent to the DAF Unit. Sampling Port SP-2 (Figure 3-5 and Table 3-1) is located after the DAF Unit to sample processed water from the DE chamber. All DAF sampling ports, flow meters, valves, and level transmitters are shown on Figures 3-4, 3-5, and 3-6.

In addition to the DAF System process stream, the system receives recycle water from the following process streams:

- Vent from the HDBF system (Cross reference with Figure 3-8), and
- Vent from the air saturation system through valve DR-V01.

3.3.3 Dissolved Air Flotation System Instrumentation and Controls

The Local Control Panel (50LCP1121) of the DAF Unit monitors the following, which is transmitted to the Main Process Control Panel 50CP1001:

- On/Off, alarm, and speed status for Mixer 1121A;
- On/Off and run status for auger 1121B;
- On/Off, alarm, and speed status for Skimmer 1121C; and
- On/Off and run status for Recirculation Pump 50P1135.

The Local Control Panel (50LCP1601) of the polymer system monitors the following, which are transmitted to the Main Process Control Panel (50CP1001):

- On/Off/auto status of the polymer mixer (M1601); and
- On/Off and run status of the polymer feed pump (50P1640).

Piping and instrumentation for the DAF System, Polymer System, and DAF Effluent System are depicted schematically on Figures 3-5, 3-6 and 3-7 respectively. The following are the instrumentation and control steps:

1) DI-01 (FCV-1021 – Figure 3-4) is a pneumatic valve located on the EQ tank outlet that relays to the HMI showing open/close status.
2) The DI flow (FE/FIT-1110) is monitored by the PLC, which will be used to set the DAF polymer feed rate.
3) The DAF Unit has a dedicated Local Control Panel 50LCP1121, and the DAF Polymer System has dedicated instrumentation and controls. DAF System operation (recycle and compressed air flows) and DAF Polymer System operation (polymer feed rate) will be monitored and controlled by the PLC.
4) The froth level (LE/LIT-1131) in the float collection chamber of the DAF Unit is monitored and alarmed at the PLC. The froth pumps (described under Section 3.9) will be operated manually, either locally or remotely at the HMI based upon a set timer.
5) The water level in the DAF effluent (DE) Tank will be monitored (using LT-1211) and alarmed for high and low level by the PLC. One of the two adjustable-speed filter feed pumps (described under Section 3.4) will be controlled to maintain a constant level in the DE Tank.
6) An online turbidimeter (AE/AIT 1235) is located to monitor turbidity of the DE, as an indicator of TSS. The turbidity meter signal will be monitored.
7) Polymer feed rate will be monitored and controlled by the PLC based upon the DAF influent feed flow rate.

3.3.4 Dissolved Air Flotation System and Polymer Design Criteria

The following chart provides the DAF Performance criteria.

DAF Performance Criteria

Parameter	Design Influent Concentration	Design Effluent Concentration
TSS (mg/L)	28	14
O&G (mg/L)	20	10
PCP (µg/L)	405	360
PAH (µg/L)	17,955	8,977

The major components of the DAF System and Polymer System are provided in this section with their specifications, manufacturer, and location within the Wyckoff GWTP.

Dissolved Air Flotation Unit (M1121) – Figure 3-5

Model: DAFR6S/618-2
Capacity: 8,500 gallons (approximate)
Dimensions: 18 ft long and 6 ft wide
Anticipated contents: PCPs, PAHs, O&G and TSS
Design Flow Rate: 11 to 90 gpm
Material of Construction: Stainless Steel 316SS (Main Body)
Manufacturer: Westech Inc.
Location: Treatment Building Process Area
Manufacturer Information and As-built drawings: Volume III (Attachment 3.1) of this O&M Manual. As-built drawings for the DAF System are provided under Attachment 3.1.7.

Supplemental Components for Dissolved Air Flotation System

a) Skimmer Drive (M1121C) – Figure 3-5
Model: SK32100-AZB-56C-71L/4
Capacity: 0.5 horsepower (HP) with inverter duty alternate frequency drive and 1750 rpm
Manufacturer: Nord UNICASE
b) Auger Drive (M1121B) – Figure 3-5
Model: CNH-M03-6125DBY-AV-1003
Capacity: 0.33 HP and 1750 rpm
Manufacturer: Nord UNICASE
c) Flotation Mixer (M1121A) – Figure 3-5
Model: SK20282NB/AZBN56C
Capacity: 0.5 horsepower (HP) with inverter duty alternate frequency drive and 1750 rpm
Manufacturer: Nord UNICASE
d) ASME Air Saturation Tank (50T1138) – Figure 3-5
Capacity: 2.5 scfm at 140 psig
Manufacturer: Westech/Van Aire Incorporated
e) Effluent Chamber/Tank (Part of DAF unit Figure 3-5)
Capacity: 400 gallon capacity
Manufacturer: Westech Inc.
f) DAF Control Panel (50LCP1121) – Figure 3-5
Manufacturer: Westech
g) Recirculation Pump (50P1135) – Figure 3-5
Model:12-1
Capacity: 15- HP motor
Manufacturer: Sulzer Pump and Reliance Motor

Location (Items a to g): Treatment Building Process Area
Manufacturer Information (Items a to f): Volume III (Attachment 3.1) of this O&M Manual
Manufacturer Information (Item g): Volume II (Attachment 2.10) of this O&M manual

Dissolved Air Flotation *Polymer System (Figure 3-6)*

a) Neat Polymer Solution Supply Tank
Capacity: 100 gallons
b) Polymer Blend Tank (40T1620)
Dimensions: 6 inch diameter by 21.75 inches tall
Manufacturer: US Filter
c) Static In-line Mixer:
Dimensions: 1.5 inch diameter
Manufacturer: Koflo Corporation
d) Neat Polymer Pump (50P1611)
Capacity: 1 HP; 1,725 revolutions per minute (rpm); 90 volts (V), 3 phase
Manufacturer: GE
e) Polymer Feed Pump (50P1640)
Capacity: 8 gallons per hour (gph) flow; 60 pounds per square inch (psi) max discharge pressure
Manufacturer: LMI Milton Roy
f) Polymer System Control Panel (50LCP1601)
Manufacturer: Ashland Chemical

Location (all items above): Treatment Building Process Area
Manufacturer Information (all items above): Volume III (Attachment 3.2) of this O&M Manual

Dissolved Air Flotation *Feed Pumps (50P1101 and 50P1102) and AFDs (50AFD1101 and 50AFD1102) (Figure 3-4)*

Model: Pump - NM053SY01L07V, Motor – 00318ST3QIE182T
Capacity/Characteristics:
  80 gpm at 5 ft head (260 rpm)
  Motor: 3 HP, 460V, 3-phase, 1.15 square ft (SF), 1800 rpm
Manufacturer: Netzsch Inc./Weg
Location: Treatment Building Process Area
Manufacturer Information: Volume II of this O&M Manual (Attachment 2.8)
AFDs: 50AFD1101/1102
AFD Model: ACH550PC-06A9-4, 3 HP, 480V
Manufacturer: ABB
Location: Treatment Building Process Area
Manufacturer Information: Volume VIII of this O&M Manual (Attachment 8.2)

Dissolved Air Flotation *Influent Flow Meter (FE-1110) – Figure 3-4*

Model: Optiflux 4000 Series
Capacity/Characteristics: Optiflux Mag Inductive Flow Meter measures the flow from EQ tank with 2 inch Teflon lining and an operating range of 0 to 100 gpm.
Manufacturer: Krohne
Location: Treatment Building Process Area
Manufacturer information: Volume VIII – Attachment 8.1.

Dissolved Air Flotation Air Saturation Tank Flow Meter (FE-1137) – Figure 3-5

Model: S0723016
Capacity/Characteristics: Optiflux Mag Inductive Flow Meter measures the flow at the recirculation system and an operating range of 0 to 130 gpm.
Manufacturer: Krohne
Location: Treatment Building Process Area
Manufacturer information: Volume III – Attachment 3.1.

Turbidimeter (AE/AIT-1245) – Figure 3-7

Model: 7121000 for unit and 4028400 for flow meter
Capacity:
Turbidimeter range - 0 to 9999 Nephelometric Turbidity Units (NTUs)
Flow meter range - 100-1,600 milliliters per minute (ml/min)
Location: Treatment Building Process Area
Manufacturer information: Volume VIII – Attachment 8.3.

Level Transmitters DAF System (LE/LIT-1211for DAF effluent and LE/LIT-1131 for DAF froth) – Figure 3-5

Model: Multiranger 200
Characteristics: Calibrated at 0 to 40 ft of water with the level element XPS-15 and 10 meter cable
Manufacturer: Miltronics
Location: Treatment Building
Manufacturer information: Volume III – Attachment 3.1.

3.3.5 Dissolved Air Flotation System Troublshooting

For troubleshooting DAF components, please refer to Volume III – Attachment 3.1.1 under Maintenance and Parts.

3.3.6 Dissolved Air Flotation Optimization

1) During O&M, adjustments may be necessary for Break-Out Valve DR-03 to allow optimization of the system, by changing the recycle flow rate and pressure of the pressurization system. The higher the flow rate, the more air will be required in the system. The higher the pressure, the smaller the bubble size.
2) The rotational speed of the skimmer drive is also a point of optimization. The speed should be high enough to remove the solids after they reach the surface of the water to keep the effluent as clean as possible.

3.4 Hydromation Deep Bed Filtration System

This Section of the O&M Manual provides a system description, operational description, a description of instrumentation and controls for the HDBF System, the design criteria for the HDBF systems, and troubleshooting procedures. Specific information related to HDBF system is provided under Section 3.4.4. Figure 3-3 provides the layout of the treatment system and shows the HDBF System located in the treatment building process area.

3.4.1 Hydromation Deep Bed Filtration System Description

The HDBF System follows the DAF System in the Wyckoff GWTP and precedes the Carbon Adsorption System. The principal function of filtration system is to remove suspended solids from DAF System effluent. This protects the carbon beds from fouling. As this filter is designed to remove solids, the system will also remove some non-aqueous phase oil (LNAPL and DNAPL) that is not removed by the DAF System. If removal of non-aqueous phase oil becomes excessive, then fouling of the filter is possible. An automatic backwash cycle is incorporated into the HDBF System to remove the build up of solids in the filter media. The HDBF System and backwash cycle are shown on Figure 3-8 (HDBF System).

HDBF System components include the following:

- Deep Bed Filter,
- Filter Feed Pumps (2), and
- Backwash Pumps (2).

Backwash supply water is provided from the Effluent Tank and transferred to the filter for backwashing. After completing the backwashing procedure, the cleaned media filter is placed on-line for regular filtration.

The physical location of HDBF unit is shown in Sheet 48 with details shown in Sheet 54 under Appendix C “Applicable Project Drawings” of Volume I. The locations of the DAF Feed pumps and backwash pumps are also shown under Sheet 48.

3.4.2 Hydromation Deep Bed Filtration System Operational Description

The operational description for the HDBF System is as follows:

1) DE is pumped through the filter system by filter feed pumps (50P1241 and 50P1242) by opening valves DE-02, 04, 05 and 07 (Figure 3-7). The second pump 50P1242 (associated valves DE-05 and 07) is installed as a redundant, which will increase the lifespan of each pump as their use will be cycled. The designation of DE changes to filter influent (pipeline labeled as FI) after the two filter feed pumps (Refer to Figure 3-7).
2) The filter feed pumps transfers DAF effluent to the filter with opening of the valve AV-1261. The filter discharge valve AV-1262 will also open. The liquid enters the filter vessel, flows through the media, and discharges from the vessel as filter effluent (pipeline labeled as FE) to carbon adsorbers. This is the filtration process. Refer to Figure 3-8.
3) After the filter operates in filtration mode for several minutes, the filter vent valve (AV-1266) will open. The filter vent valve cycles open and closed throughout the rest of the filtration cycle. The vent valve prevents the build up of air or gas in the vessel. The filter vent valve discharge is directed back to the DAF Unit.
4) The filter requires backwashing on a frequent basis. When the resistance to flow reaches a pre-determined level, the filter backwash sequence is initiated. The filtration cycle is currently set to work for 12 hours before it automatically switches to a backwash cycle mode. This pre-determinant level is also dependent on the differential pressure which will set once the plant is fully operational and operator will adjust to the demands/needs of the backwash cycle. The source for backwashing is provided by Effluent Tank with the use of backwash pumps. As part of a initial pre-startup, the discharge valves BWS-04 or 07 associated with the backwash pumps were throttled so that they provide 80 gpm flows for backwash operation of the HDBF unit. This setting will remain constant during normal operation with the exception of the higher flow requirement for GAC backwash. As the dirt loading increases, the resistance to flow also increases. The backwash sequence is initiated by one of the three actions: a differential pressure set point (set at 20 psi), filtration timer timing out (set at 12 hours), or by pressing of the manual index button whichever occurs first.

    a) The first cycle in the backwash sequence is the agitation cycle. The preset time for the agitation cycle is 1 minute. During the agitation cycle, the backflow valve (AV-1267) opens while all other valves are closed. The media agitator starts and fully agitates the media bed, turning the vessel volume into homogeneous slurry. The agitation cycle continues for the preset time to assure both the fluidization of the media bed and the separation of the captured oil and solids from the media.

b) When the agitation timer has timed out, the backwash valve (AV-1263) is opened and the filter enters the backwash cycle. The agitator continues to agitate and scrub the media and to rotate the backwash scrubber basket. During the backwash cycle, liquid flows into the filter vessel through both the dirty inlet and the backflow valve (AV-1267).

   The liquid, which flows through the backflow valve (AV-1267), flows up through the clean discharge screens. The very concentrated dirty liquid in the vessel flows out through the slots in the rotating wedge wire scrubber basket and out through the backwash valve (AV-1264). The oil and solids captured in the media bed during the filtration cycle is carried out with the backwash liquid. The backwash flow rate is controlled by the backwash discharge orifice (RO-102 in Figure 3-8). The backwash discharge orifice creates a back pressure on the filter. The wedge wire slots in the media scrubber basket allow the oil and solids to pass through the backwash screen and out the backwash discharge. The wedge wire slots are sized to prevent the walnut shell media from escaping the closed loop. The process water required during the backwash cycle is filtered water obtained from the Effluent Tank after filter and carbon adsorption processes, no dirty backwash water will be used.

c) When the backwash cycle timer times out, the delay cycle begins. The backwash valve (AV-1263) and the backflow valve (AV-1267) close. The agitator continues to operate for a period of time after the backwash valve (AV-1263) has closed. The backwash scrubber basket must continue to rotate whenever the backwash valve (AV-1267) is open. When the agitator has stopped, the filter media will settle and cover the clean wedge wire discharge plenum. Without this delay, the media would be pulled into the wedge wire slots with sufficient velocity to cause plugging of the clean discharge screens.

In summary, the backwash operation steps include the following:

- Backwash source (BWS) from backwash pumps (50P1351/1352);
- Backwash pump valves throttled to 80 gpm flow;
- BWS enters the bottom of the HBDF Unit; and
- Dirty backwash water comes out of the top of the HBDF Unit and enters the dirty Backwash Tank (Figure 3-11) as Backwash Effluent (BWE).

d) After the delay cycle has timed out, the recirculation cycle starts. During the recirculation cycle, the recirculation valve (AV-1265) opens and liquid flows through the filter media bed. The filter bed is set or compressed and any residual dirty liquid in the media bed is transferred back to the dirty backwash tank (40T1440). When the recirculation timer has timed out, the recirculation valve (AV-1265) closes, and the clean discharge valve (AV-1262) opens. The filter is again ready for filtration.

In summary, the recirculation (forward flush) operation steps include the following:

- The BWS enters the top of the HBDF Unit; and
- Leave the bottom of the HBDF Unit as forward flush effluent (FFE) and discharges into the Dirty Backwash Tank.

In addition to the influent flow from the DAF Unit, the HDBF Unit receives recycle water from the by-pass (BYP) filter influent recycle from GAC#1 designated as FI/RCY/BYP (cross reference with Figure 3-9).

Sampling port SP-3 (V-106 from Filtra Systems manual) is located (Figure 3-8 and Table 3-1) to sample contaminated water from the DAF System prior to entering the HDBF System. Sampling port SP-4 (V-105 from Filtra Systems manual) is located (Figure 3-8 and Table 3-1) to sample filtered water from the filter system prior to entering the GAC System. Sampling ports SP-15 and SP-16 are located (Figure 3-8 and Table 3-1) on the backwash effluent side to determine the clarity of water and shut down backwash operations. Figure 3-8 shows the details of components inside the system.

Following steps provide the sequence to operate the HDBF system. All operation cycles for the HDBF System are automatic and will be run by the PLC. Once the pre-start procedures are complete, the function of the HDBF filter is fully automatic.

1) Pre-Start

a. Insure instrument air (85 psi) is on to the system (All valves are closed at this point. All valves closed when solenoids are de-activated).

b. Place the Agitator 217SS Selector Switch in the auto position, otherwise the filter will not run.

c. Press Master Start/Fault Reset Push Button 215PB-2 to energize:
   i. Master Control Relay;
   ii. Manual Controls;
   iii. Sensors; and
   iv. Power on Pilot Light 216LT is on.

d. Clear any faults by pressing the Master Start/Fault Reset Push Button 215PB-2.

Filter will not start with any faults present.

2) Start-Up and Run

a. When Agitator 217SS Selector Switch is in the Auto Position:
   i. Filter Feed (Influent) Pump is energized.
   ii. Initial Recirculation Cycle Timer (T1).
   iii. Filter Supply (Influent) valve Solenoid FV1261 energizes. Filter Supply (Influent) valve AV1261 opens.

iv. Recirculation (Forward Flush Effluent) valve Solenoid FV1265 energizes. Recirculation (Forward Flush Effluent) valve AV1265 opens.
v. Filter Running Pilot Light 264LT is on.
vi. Recirculation Cycle Pilot Light 269LT is on.

b. Initial Recirculation Cycle Timer (T1) times out:
i. Recirculation (Forward Flush Effluent) valve Solenoid FV1265 de-energizes
ii. Recirculation (Forward Flush Effluent) valve AV1265 closes.
iii. Recirculation Cycle Pilot Light 269LT de-energizes.
iv.
v. The following are energized:
(1) Filtration Cycle Minute Counter (C1) begins counting minutes.
(2) Filtration Vent Minute Counter (C2) begins counting minutes.
(3) Clean Discharge (Effluent) valve Solenoid FV1262 energizes. Clean Discharge (Effluent) valve AV1262 opens.
(4) Filter Cycle Pilot Light 265LT is on.
vi. All Backwash Sequence Timers are reset.

At this point the Filter is now in operation. Filtration continues until a backwash sequence is initiated or the filter is halted for reasons described in Step 8. The filtration flow rate and the recirculation flow rate are to be controlled by the system flow control valve. Separate valve set points are to be used when switching between recirculation and filtration. The filtration minute counter (C1) is to be adjustable.

3) Filtration Cycle

a. Filtration Vent Minute Counter (C2) counts out:
i. Vent valve Solenoid (FV1266) is energized. Vent valve (AV1266) opens.
ii. Re-vent Timer (T2) begins timing.
iii. Filtration Vent Minute Counter (C2) is reset.

b. Re-vent Timer (T9) times out:
i. Filtration Vent Minute Counter (C2) begins counting minutes.
ii. Vent valve Solenoid (FV1266) is de-energized. Vent valve (AV1266) closes.
iii. Steps 3a and 3b are repeated throughout the filtration cycle.

The vent valve should be open only during the filtration cycle or the filtration with vent cycle. If the vent valve is open in any other cycle, it is a fault.

4) Backwash Cycle

a. The filter remains in Filtration Cycle until one of the following occurs:
i. The Differential Pressure Indicating Transmitter-1281 across the filter media bed reaches 20 pounds per square inch (differential).
ii. The Filtration Cycle Minute Counter (C1) counts out.
iii. The Operator presses the Manual Backwash Push Button (351PB).

b. The Filtration With Vent Cycle:

i. Filtration Cycle Pilot Light (265LT) energizes.

ii. Filter Vent valve Solenoid (FV1266) energizes.

(1) Filter Vent valve (AV1266) opens.

(2) Backwash Cycle Pilot Light (267LT) flashes during venting.

iii. Filtration With Vent Delay Timer (T2) begins timing.

iv. Filtration With Vent Delay Timer (T2) times out.

v. The Filter Clean Discharge (Effluent) valve Solenoid (FV1262) is de-energized. The Filter Clean Discharge (Effluent) valve (AV1262) closes.

vi. The Filter Supply (Influent) valve Solenoid (FV1261) is de-energized.

vii. The Filter Supply (Influent) valve Solenoid (AV1261) closes

viii. The Filter Vent valve Solenoid (FV1266) is de-energized. The Filter Vent valve (AV1266) closes.

ix. Delay One, Filter Clean Discharge (Effluent) valve Closed Delay Timer (T5), starts and times out.

x. Delay Cycle Pilot Light (268LT) is energized.

xi. Backwash Cycle Pilot Light (267LT) energizes.

xii. Filter Supply (Influent) Pump is de-energized and Backwash Supply is energized.

xiii. Backwash Supply valve Solenoid (V1263) is energized. Backwash Supply valve (AV1263) opens.

During filtration with vent, the filter remains in filtration, processing liquid. The filter discharge (effluent) valve (AV-1262) and the process inlet (influent) valve (AV-1261) remain open and the filter feed (influent) pump remains on.

c. Agitation Cycle

i. Agitation Cycle Timer (T3) begins timing.

ii. Filtration Cycle Minute Counter (C1) is reset.

iii. Filtration Vent Minute Counter (C2) is reset.

iv. The following are energized:

(1) Agitator Motor (M1260) is energized.

v. Delay Cycle Pilot Light (268LT) is de-energized.

vi. Agitation Cycle Pilot Light (266LT) is on.

vii. Agitation Cycle Timer (T3) times out.

d. Backwash Cycle

i. Backwash Cycle Timer (T4) begins timing.

ii. Agitation Cycle Pilot Light (266LT) is de-energized.

iii. The following are energized:

(1) The Backflow valve Solenoid (FV1267). The Backflow valve (AV1267) opens.

(2) The Backwash Cycle Pilot Light (267LT).

(3) Backwash Discharge (Effluent) valve Solenoid (FV1264). Backwash Discharge (Effluent) valve (AV1264) opens.

iv. Backwash Cycle Timer (T4) times out.

e. Delay Cycle

i. Delay Two Cycle Timer (T6) begins timing.
ii. Delay Cycle Pilot Light (268LT) is energized.
iii. Agitator Stop Delay Timer (T7) begins timing.
iv. The Following Are De-Energized:
  (1) Backwash Discharge (Effluent) valve Solenoid (FV1264). Backwash Discharge (Effluent) valve (AV1264) Closes.
  (2) Backwash Cycle Pilot Light (267LT)
  (3) Backflow valve Solenoid (FV1267). Backflow valve (AV1267) closes.
v. Agitator Stop Delay Timer (T7, 15 Sec.) times out.
vi. Agitator Motor (M1260) is de-energized.
vii. Backwash Supply valve Solenoid (FV1263) is de-energized. The Backwash Supply valve (AV1263) closes.
viii. Backwash Supply Pump is de-energized and Filter Supply is energized.
ix. Delay three cycle timer (T6, 45 sec.) times out.

f. Recirculation Cycle

i. Recirculation Cycle Timer (T8) begins timing.
ii. Delay Cycle Pilot Light (268LT) is de-energized.
iii. Filter Supply (Influent) valve Solenoid (FV1261) is energized. Filter Supply (Influent) valve (AV1261) opens.
iv. Recirculation (Forward Flush Effluent) valve Solenoid (FV1265) is energized. Recirculation (Forward Flush Effluent) valve (AV1265) opens.
v. Recirculation Cycle Pilot Light (269LT) is energized.
vi. Recirculation Cycle Timer (T8) times out.

The Recirculation Timer (T8) is to be adjusted with an initial setting to be three (3) minutes.

g. Resume Filtration Cycle

i. Filter operation resumes as described in Step 3 unless filter shutdown (Step 6) has been initiated.

5) Agitator Control

a. The Operator places the Agitator Selector Switch (217SS) in the Hand Position.
i. The Agitator will run but all other functions will be de-activated.

With the Agitator in Manual Mode, by using the Manual Overrides on the Solenoids, the Filter can be temporarily operated in any cycle. The Filter should be operated using this method only under emergency condition with proper supervision.

6) Filter Shutdown

a. When the Filter completes a backwash sequence as described in Steps 4.a.i through 4.g.
i. The Operator may push the Master Stop Pushbutton (215PB-1) de-energizing:
  (1) Master Control Relay;

(2) Agitator Controls;
(3) Sensors; and
(4) Power On Pilot Light (216LT).

ii. Re-start the filter as described, beginning with Step 1.

The Filter should always be backwashed prior to a shutdown. An automatic shutdown function is programmed into the PLC where the filter is automatically backwashed, returned to filtration, and then shutdown.

7) Master Stop, Power Interruption, Or Filter Fault

a. Master Stop
Push Master Stop Push Button (215PB-1).

b. Power Interruption
i. All Solenoid valves will de-energize. All valves will close.
ii. The Filter PLC will de-energize (the cycle status is retained during a power outage).

c. Major Filter Fault
i. A major Filter fault will halt the Filter.
ii. The Filter PLC will retain the Filter Cycle Status.
iii. All Solenoid valves will de-energize. All valves will close.

d. Restarting the Filter
i. After correction of a stop condition, power loss, or filter fault, the Operator must manually restart the Filter as described, beginning with Step 1.
ii. If the Filter was stopped in the Filtration Cycle, the Filter will restart in the Recirculation Cycle, and then resume the Filtration Cycle, as described in Step 4.f.
iii. If the Filter was stopped while in a Backwash Sequence, the Filter will restart the entire Backwash Sequence, as described in Step 4.

8) Fault Circuit Operation

a. Fault Conditions Major:
(1) Filter Agitator Motor Phase Monitor tripped.
(2) Filter Agitator Motor Overload tripped.
(3) Filter feed pump not running.
(4) Backwash pump is not running.

If the backwash pump is not running, the Media Agitator will be stopped, in addition to the alarm being annunciated.

b. Fault Circuit Operation:
i Any of the above listed faults till energize the "Filter Fault" Pilot Light.
ii The Filter Fault Pilot Light will remain on until the fault condition is corrected and the Master Start/Fault Reset Push Button 215PB-2 is pressed.

For additional information on start up, operations (including controls) and shut down, refer to Section 4 and other sections of the Filtra Systems Manual under Volume IV of this manual.

3.4.3 Hydromation Deep Bed Filtration System Instrumentation and Controls

Piping and instrumentation for the HDBF System is depicted schematically on Figure 3-8. This figure is to be used in conjunction with Figures 3-7, 3-9 and 3-10. This system is automated and functions are controlled through the PLC. Theory of operations falls into the troubleshooting and repair of the unit. The following are the instrumentation and control steps:

1) Effluent from the DAF Unit is pumped to the HDBF System by one of the two filter feed pumps. The pump speed will be controlled to maintain the liquid level (LE/LIT-1211) in the DE Tank. Water level in the DE Tank will be monitored at the PLC and have high-level and low-level alarms.
2) Influent to and effluent from the filter will be controlled by electrically actuated valves AV-1261 and AV-1262 respectively (Figure 3-8).
3) Differential pressure across the filter (DPIT-1281) will be measured continuously and can be monitored through the PLC to determine when backwashing is required. High differential pressure alarm set-points are set and can be changed, monitored at the PLC.
4) Filter backwashing cycles are automatic; the operator will assure that the backwash pumps are throttled down to 80 gpm during normal operation of the plant. Refer to Figure 3-10 for backwash pump location. Backwash flow rate will be measured and indicated at the PLC. The PLC can be used to allow the backwash pump to be stopped automatically on a time basis. A sample tap (SP-16) is provided on the backwash effluent line to allow operators to visually monitor when the water is clean, indicating that backwashing is complete and can be halted. In addition, the filter can also be manually backwashed. Backwash operation includes the agitation cycle, backwash cycle, three delay cycles and the recirculation cycle as referenced in Figure 3-8.
5) When backwashing is completed, the backwash pump will automatically stop and the HDBF valves re-configured automatically to place the filter in the normal filtering operating mode.

3.4.4 Hydromation Deep Bed Filtration System Design Criteria

The major components of the HDBF System are provided in this section with their specifications, manufacturer, and location within the Wyckoff GWTP.

Hydromation Deep Bed Filtration System 50M1260 – Figure 3-8

Model: FDB-7P
Capacity: 207 gallons
Dimensions: 3 ft feet diameter x 11 ft high

Anticipated contents: PCPs, PAHs, O&G and TSS
Material of Construction: Stainless Steel 316L
Filter Media: 12/20 mesh black walnut shells
Manufacturer: Filtra Systems
Location: Treatment Building Process Area
Manufacturer Information and As-built Drawings: Volume IV of this O&M Manual. As-built drawings for the HDBF System are provided under Sections 7, 8, 9 and 10.

Filter Feed Pumps (50P1241 and 50P1242) and AFDs (50AFD1241 and 50AFD1242) – Figure 3-7
Model: Pump – 811S1.5x1-8, Motor – 00736ST3QIE213T
Capacity/Characteristics:
  70 gpm @ 158 ft head
  Motor: 7.5 HP, 460V, 3-phase, 1.15 SF, 3600 rpm
Manufacturer: Griswold/Weg
Location: Treatment Building Process Area
Manufacturer Information: Volume II of this O&M Manual (Attachment 2.3)

AFD's: 50AFD1241/1242
AFD Model: ACH550PC-015A-4, 10 HP, 480V
Manufacturer: ABB
Location: Treatment Building Process Area
Manufacturer Information: Volume VIII of this O&M Manual (Attachment 8.2)

Backwash Pumps (50P1351 and 50P1352) – Figure 3-10
Model: Pump – 811-4x3-10
Capacity/Characteristics:
  330 gpm at 69 ft of head
  15 HP, 460V, 3-phase, 1.15 SF, 1800 rpm
Manufacturer: Griswold/Weg
Location: Treatment Building Process Area
Manufacturer Information: Volume II of this O&M Manual (Attachment 2.4)

3.4.5 Hydromation Deep Bed Filtration System Troubleshooting Procedures

For troubleshooting the HDBF system, please refer to Volume IV - Section 5 – Troubleshooting.

3.5 Granular Activated Carbon System

This Section of the O&M Manual provides a system description, operational description, a description of instrumentation and controls for the GAC System, the design criteria for the GAC system and troubleshooting procedures. Specific information related to GAC system is provided under Section 3.5.7. Figure 3-3 illustrates the layout of the treatment system and shows the GAC System located in the treatment building process area.

3.5.1 Granular Activated Carbon System Description

The GAC System follows the HDBF System in the Wyckoff GWTP and precedes the Effluent Tank. The principal function of the GAC System is to remove aqueous-phase PAHs and PCPs from solution via adsorption. The GAC System may also remove some non-aqueous-phase oil and suspended solids, although this is not its primary function. The DAF and HDBF Systems are included in the treatment train to remove these constituents and avoid fouling the GAC. The GAC System is the last treatment process in the sequence; therefore, PAH and PCP levels in the GAC System effluent should be lower than the discharge limits (See Table 1-1). A backwash cycle is incorporated into the GAC System to remove the build up of solids in the carbon. The GAC System and Backwash cycles are shown on Figure 3-9 (GAC System).

GAC System components include five GAC adsorbers. For simplicity these adsorbers will be identified as GAC-1, GAC-2, GAC-3, GAC-4 and GAC-5. Backwash supply water is provided from the Effluent Tank using backwash pumps and is transferred to the GAC Adsorbers.

The physical location of GAC system is shown in Sheet 48 under Appendix C "Applicable Project Drawings" of Volume I.

3.5.2 Granular Activated Carbon System Operational Description

1) The GAC System (Figure 3-9) consists of five GAC adsorbers of which three of the adsorbers are in service at any given time and operated in series. The fourth and fifth adsorbers are on stand-by. HDBF effluent (FE) enters the first of the three GAC adsorber system.
2) Piping and valves are installed to allow the different possible sequencing permutations for operating three GAC adsorbers in series. Tables 4-4 a to e provide five combinations for operating any of three GAC adsorbers in series. GAC effluent (labeled as PLE) from the three adsorber system enters the effluent tank described under Section 3.6.
3) GAC adsorbers may be backwashed occasionally, although backwashing should be minimized and restricted to the active lead GAC adsorber under normal conditions.
4) Backwashing will be performed if the pressure drop across the adsorber becomes too high – in our case 5 pounds per square inch differential [psid] above clean carbon differential pressure [typically around 4 psi] or when complete breakthrough occurs, in an effort to extend carbon service time. The clean carbon differential pressure is typically around 4 psi, which means that the high differential pressure will be 9 psi. Typical GAC applications do not encounter this high differential set point. Pressure gauges PE/PI/PT-1311 to 1315 record the pressures in each of the individual adsorbers.
5) ECC recommends performing backwash of the adsorbers in series once a month until operational conditions during O&M warrant an increased or reduced frequency.
6) Backwashing will also be performed after the installation of new carbon to remove carbon fines. Details on backwash procedures are provided under Section 3.5.4 and 4.7.4.

7) Backwash water is provided from the Effluent Tank (Figure 3-10) and conveyed by the backwash pumps 50P1351/1352 to the GAC System; and both backwash pumps will be operated to provide a 600 gpm flow measured by Backwash flow meter FE/FIT-1371 (Figure 3-10) for GAC adsorber backwashing.
8) Dirty backwash water will be discharged to the dirty backwash tank (Figure 3-11).

Sampling Ports SP-05, SP-06, SP-07, SP-08, SP-09 and SP-10 (Figure 3-9 and Table 3-1) are located to sample treated water from each of the five carbon adsorbers and from the common effluent to ensure that contaminant levels are below discharge levels and to determine when carbon change out is warranted. All GAC System sampling ports are shown on Figure 3-9. Sampling Port SP-16 (cross reference with Figure 3-8) is located on the backwash effluent side to determine the clarity of water and shut down backwash operations.

In addition to the influent flow from the HBDF Unit (FE), the GAC adsorber receives recycle water from following streams:

- Forward flush a water source from backwash pumps entering the top of the carbon unit of the HBDF Unit designated as BWE/ Forward Flush Supply (FFS) (cross reference with Figure 3-8 and 3-10) – however, this is an option which will be used during spent carbon removal;
- FI bypassing the HBDF Unit designated as FI/BYP (cross reference with Figure 3-7); and
- Filter influent recycle by-pass to the HBDF Unit designated as FI/RCY/BYP.

3.5.3 Detailed Carbon Change-Out Procedures

When it becomes necessary to replace the carbon in the lead bed, that adsorber will be taken off-line for change-out. The adsorber sequence will be modified so that the former GAC-2 becomes GAC-1, the former GAC-3 becomes GAC-2, and the former standby bed (GAC-4) containing fresh carbon becomes GAC-3 in the series. Carbon will be changed out as described below with uncontaminated water in the adsorber. Spent carbon saturated with water will be removed out of the adsorber into a tank truck located on the decontamination pad, using methods specified below. Once in the truck, excess water will be drained from the spent carbon using air pressure to accelerate the process. Drained water will be returned either to a tank for treatment (Dirty Backwash Tank – Figure 3-11 or Storm-water Recycle Tank – Figure 3-14), or to a floor drain (for subsequent treatment). Virgin/re-activated carbon will be conveyed from a truck to the carbon adsorber using methods as described below.

If one or both of the following conditions are met, a carbon change-out will be initiated.

1) PCP or PAH concentrations from the middle carbon effluent exceeds the discharge limit (refer to Table 1-1).
2) The lead carbon effluent PCP or PAH concentration is greater than 90 percent of the lead carbon influent PCP or PAH concentration.

If neither of the above conditions is met but the effluent concentration from the lag carbon adsorber is above the non-qualified detection limit (no U or J flag qualifiers) for either PCP or any individual PAH, the lag carbon adsorber will be re-sampled and analyzed to verify the originally reported laboratory results. If the lag carbon adsorber effluent concentration is verified, a carbon change-out shall be initiated.

When contaminant saturation has been identified in an adsorber, the adsorber will be taken off-line and isolated from the process stream as identified in the previous paragraph. The carbon in the adsorber must then be removed and replaced with fresh carbon. When it is determined that carbon should be removed from an adsorber, the procedure discussed below should be followed.

There are two options to remove the carbon as slurry. One option is to use air as the motive force. The other is to use water as the motive force. Due to piping pressure limitations, carbon will be transferred using water. The air change out method incase planned to be used in the future is provided under Tigg's O&M manual listed under Volume V – Section 7.1.2.1.

For this size adsorber the container is usually a bulk trailer. The container should have a drain for removing the excess water from the carbon (prior to transportation).

To ensure a proper transfer of carbon from the adsorber, it is necessary to isolate the adsorber from the process stream and to close any vent valves. This is required for pressurization of the adsorber vessel. Valves needed to isolate the adsorbers are provided under Tables 4-5a to 4-5e.

To initiate the carbon transfer process for an adsorber, follow the steps detailed below:

1) Verify availability of water in the effluent tank – the tank should be at full capacity.
2) Prepare for carbon removal by closing all valves and any other sample or flush valve.
3) Complete a backwash of the adsorber to be backwashed as described in Sections 3.5.4 and 4.7.4. To accomplish this, a routine 15-minute backwash process is performed.
4) Ensure one of the backwash pumps (50P1351 or 50P1352) setting on the BWS-04 or BWS-07 valves will provide 100 gpm of water.
5) Complete the following sequence:
    a. Ensure the adsorber is full of water.
    b. Open the BWE/FFS-01 and the corresponding 6 inch valve (BWE/FFS-#) for the GAC to be backwashed and push approximately 100 gpm of clean or treated water through the adsorber. # here is designated as 02 to 06 for adsorbers GAC-1 to GAC-5 depending upon which adsorber the spent carbon will be removed.
    c. A pressure of 10 - 20 psi at this flow rate should transfer the carbon to the bulk trailer.
    d. The carbon discharge valves CD-01 to 05 will need to be opened after the pressure on the tank has been allowed to build to this level or slightly higher.

e. Carbon will usually be pushed out at a rate of 1-3 pounds of carbon per gallon of water. However, there must be continuous flow.

f. Once all the carbon is out of the adsorber, an inspection through the manway may result in a wash down of any hanging carbon and a repeat of this step to push the remaining carbon back to the bulk trailer.

g. During this carbon removal process, the bulk trailer will need to be drained at a rate similar to the fill of 100 gpm. Usually the draining will require frequent stopping and starting of the feed to the 3-inch discharge line. This stopping and starting can be accomplished by closing the CD-01 to CD-05 valves. When this occurs, the discharge pressure on the backwash pump must be either maintained so as not to rupture the pressure disk or it must be shut down to avoid over pressurization.

h. When the carbon removal process is completed, close the carbon discharge valves CD-01 to CD-05 and all the process valves and prepare to add fresh carbon as described in below.

<u>Note</u>: After completing steps 1 through 5 there is still the possibility of a portion of spent carbon remaining in the bottom head. Therefore, open the manway to inspect the adsorber. Depending on the quantity and location of the carbon, it may be necessary to use a hose to wash it into the bottom of the head and/or repeat the above backwashing/air pressure steps after closing the manway.

The following procedure will be used to transfer fresh carbon from a truck trailer into a adsorber after the spent carbon is removed.

1) Fresh carbon will arrive in bulk trailers, each containing 10,000 pounds of carbon for the fill of two adsorbers. Each truck will have to be filled with water prior to carbon transfer into the adsorber.
2) The quantity of water required for 10,000 pounds of dry, fresh carbon is approximately 5,500 gallons, and for wet reactivated carbon is approximately 4,300 gallons.
3) Most trucks are not designed as American Society of Mechanical Engineers (ASME) code pressure adsorbers; therefore, an air supply of 100 standard cubic feet per minute (scfm) and a relatively low pressure approximately 15 pounds per square inch gauge (psig) will be required as the motive force for the transfer of carbon. Typically the carbon change out vendor provides air that comes with the truck or plant air line will be required to be connected to the bulk trailer.
4) Upon arrival of the truck, 3 inch hoses should be connected to the carbon inlet line on the adsorber to be filled.
5) During the carbon fill process, air within the adsorber needs to be vented as the carbon slurry is introduced. To vent the adsorber during fill operations, open valves GAC1-V01 to GAC5-V01 on the city water inlet line.
6) **WARNING - However, a venting must occur for efficient transfer of GAC from the bulk trailer to the adsorber**. It should be noted that the FRP piping associated with the GAC adsorbers can handle only 10 psi maximum pressure. Care should be taken to ensure that proper venting takes place during transfer of carbon to the adsorber.

7) As the end of the carbon transfer nears, it may be necessary to vent excess water from the adsorber. Water discharged from the vent or GAC1-V01 to GAC5-V01 valve (being used as a vent), should be directed to the appropriate treatment area for processing – this water will drain to the building trench drain and to the decontamination pad sump and eventually to the tank farm containment sump.

The following two actions must be taken prior to placing an adsorber online:

1) The carbon particles have been classified/segregated (Section 3.5.4); and,
2) All of the air has been removed from the carbon pores (Section 3.5.5).

If these steps are not completed, premature breakthrough of the contaminants can occur and thus there may be poor utilization of the carbon.

3.5.4 Backwashing to Segregate Carbon Procedures

The carbon should always be segregated by backwashing in each bed prior to the adsorbers being placed online. It is performed in order to segregate the carbon particles, loosening them up and lift the bed. Backwashing is to reverse water flow through the carbon bed to remove sediment and to fluff the carbon. This is important so that the carbon particles will always return to their same relative position in the bed after each backwashing operation. If the bed is not segregated, the carbon particles will change position and the adsorption zone (where adsorption is occurring) will be disturbed resulting in channeling, turbulence and poor utilization of the carbon and early breakthrough of organics.

Initial backwashing (after a carbon change out) should be performed at a rate of 600 gpm for 45 minutes. Water from effluent tank will be used for this and all subsequent backwashing operations. Valve BWS/FFE-01 need to be closed and BWE/FFS-01 need to be open in order to initiate backwash operations.

During the backwashing process, samples can be taken from the dirty backwash piping sampling port (Port #SP-16) at intervals of 3-5 minutes until visibly clean water from the backwashing filter appears. The routine backwash process is expected to take 15 minutes, confirmation samples will be taken to verify the clarity of backwashed water.

Subsequent to backwashing, the system is ready to be de-aerated/pre-wetted as described in the following section. This is performed only on adsorbers after a carbon change-out and not during a regular backwash operation.

3.5.5 De-aerating and Pre-wetting Procedures

As discussed previously, it is necessary to ensure that the carbon bed is properly de-aerated prior to placing the unit in service. This is required to ensure proper flow through the bed to eliminate channeling, reduce pressure drop, and prevent premature breakthrough. This is performed only after a carbon change out and a 45 minute backwash is performed not after a routine 15 minute backwash.

A bed of carbon consists of the following:

Void volume - 40%,
Pore volume - 40%, and
Carbon skeleton - 20%.

A relatively long time is required for water to enter the pores and displace the air since the pores in dry carbon are filled with air and some adsorbed oxygen. Approximately 90% of the pores may be filled with water after 24 hours at ambient temperature of 70 degrees Fahrenheit (° F). In order to have the carbon pre-wetted, the adsorber should remain filled with water for at least 24-48 hours with the carbon fill line open CF-01 to 05 (which is located in the front of the adsorber and runs up the side and empties into the top). Refer to Tigg's as-built drawings showing locations of the carbon fill lines (Section 2 - Volume V of this manual). Having this valve open will permit trapped air to escape. Air can be in trapped within the carbon, so in order to remove all the trapped air, the bed should be backwashed for 10 to 15 minutes after the carbon is pre-wetted, prior to being placed on-line. The backwash cycle should be repeated after 2 or 3 days operation in order to remove any remaining air which collects in the bed.

3.5.6 Granular Activated Carbon System Instrumentation and Controls

Piping and instrumentation for the GAC System is depicted schematically on Figure 3-9 of this O&M Manual. The following are the instrumentation and control steps:

1) Influent (FE) will be pumped to the GAC System by the filter feed pumps (after passing through the HDBF).
2) Differential pressure across the active carbon adsorbers will be monitored manually to determine when backwashing is required. High differential pressure (5 psid above clean carbon differential pressure [typically around 4 psi]) is an indication for performing backwash operation.
3) Backwashing will be a manual operation. The entire plant will be shut down while backwashing the GAC adsorbers. This is done by shutting down the DAF feed pumps, filter feed pumps, DAF unit and the HDBF unit from the HMI. The operator will set manual valves to configure flow for backwashing and manually start the backwash pumps. Refer to Figure 3-8 and 3-10 in addition to Figure 3-9. Backwash flow rate will be measured continuously at FE/FIT-1371 and indicated at the PLC. The HMI will be used to allow the backwash pumps to be stopped automatically on a timed basis (15 minutes for routine backwash and 45 minutes for backwash after carbon change out).
4) When backwashing is completed, the backwash pumps will be stopped and the valves reconfigured manually to place the carbon adsorber back in normal service operation.
5) Carbon change-out will be a manual operation. The operator will set manual valves to take the spent bed off-line and configure the new flow sequence through the three active adsorbers. Exchange of spent and fresh carbon will be manual.

3.5.7 Granular Activated Carbon System Design Criteria

The GAC System Performance criteria is presented in the following chart.

GAC System Performance Criteria

Parameter	Design Influent (ppb)	Effluent
Total PAHs	7,000	Less than 1 ppb
PCP	300	Less than 0.1 ppb
Oil and Grease	10	Less than 1 ppm

ppb = parts per billion
ppm = parts per million

The major components of the GAC System are the GAC adsorbers provided in this section with their specifications, manufacturer, and location within the Wyckoff GWTP.

Granular Activated Carbon-50M1301, 50M1302, 50M1303, 50M1304 and 50M1305 Adsorbers (Figure 3-9)
Dimensions: 8 ft diameter x 7.5 ft bed height
Capacity: 10,000 pounds of GAC
Empty Adsorber Weight: 4,655 pounds
Material of Construction: Carbon Steel – epoxy/poly-urethane lined
Head Type: 2:1 Elliptical ASME
Carbon Type: Tigg 5DR 0830
Manufacturer: Tigg Corporation
Estimated carbon life – 30 days to breakthrough per adsorber
Location: Treatment Building Process Area
Manufacturer Information and As-built Drawings: Volume V of this O&M Manual. GAC as-built drawings are located under Section 2.0.

3.5.8 Granular Activated Carbon System Troubleshooting Procedures

For troubleshooting GAC system, please refer to Volume V - Section 4.9 – Troubleshooting.

3.6 Effluent Storage System

This Section of the O&M Manual provides a system description, operational description, a description of instrumentation and controls for the Effluent Storage System , and the design criteria for the Effluent Storage system. Specific information related to Effluent system is provided under Section 3.6.4. Figure 3-3 illustrates the layout of the treatment system and shows the effluent system located in the tank farm with the exception of the backwash pumps which are located in the treatment building process area.

3.6.1 Effluent Storage System Description

The Effluent Tank follows the GAC System in the Wyckoff GWTP. A sampling station in the form of a composite sampler is located after the Effluent Tank to collect final effluent samples. Treated water in the Effluent Tank that meets the discharge criteria is discharged to the outfall by gravity flow. Water stored in the Effluent Tank is used for backwashing of the HDBF and GAC Systems. The Effluent Storage System is highlighted on Figure 3-10 (Effluent Storage System).

3.6.2 Effluent Storage System Operational Description

1) GAC System effluent (labeled as PLE – Figures 3-9 and 3-10) is pumped to the Effluent Tank.
2) Flow to the Effluent Tank is monitored by Plant Effluent Flow Meter FE/FIT-1321 (Figure 3-10 and Table 3-3).
3) The Effluent Tank discharges by overflow so that the tank remains full except when stored effluent is being used for backwashing.
4) Backwash flow is monitored using Backwash Flow Meter FE/FIT-1371 (Figure 3-10 and Table 3-3). The water level in the Effluent Tank is monitored by Level Transmitter LE/LIT-1331 (Figure 3-10 and Table 3-3).
5) Isolation valve PLE-09 is manually opened for treated water from carbon adsorbers to enter the Effluent Tank and valve PLE-11 is manually opened for treated water to discharge (limits identified in Table 1-1) to the Eagle Harbor Outfall.
6) Discharge from the Effluent Tank (labeled as PLE) to the Eagle Harbor Outfall is by gravity flow.
7) Final effluent samples are collected (24-hour composite samples and grab samples via opening valve PLE-12) as required by the discharge limit criteria.
8) Effluent Tank influent and backwash flows are monitored continuously. Final effluent flow to the outfall is determined as the difference between the two measured flows (on a daily average basis).
9) Backwash operations using backwash pumps 50P1351 and 1352 are performed by opening valves BWS-01, 02, 04, 05 and 07.

Sampling Port SP-10 (Figure 3-9 and Table 3-1) is located prior to the Effluent Tank (Figure 3-9) immediately after water is treated from the GAC System. Sample Port SP-11 (Figure 3-10 and Table 3-1) is located on the effluent line after the Effluent Tank to sample treated water using the composite sampler. All effluent storage system sampling ports, flow meters, and level transmitters are shown on Figures 3-9 and 3-10.

The physical location of Effluent Tank is shown in Sheet 49 with details shown in Sheets 55 and 59 under Appendix C “Applicable Project Drawings” of Volume I.

3.6.2.1 Effluent Piping from Effluent Tank to Outfall

The 6-inch diameter FRP pipeline on the Effluent Tank connects to the existing 6-inch diameter ductile iron pipeline. The DI pipeline terminates at the outfall. The 6-inch FRP pipeline is connected to the 6-inch ductile iron pipeline through a 6-inch diameter ductile iron flanged spool.

The effluent pipeline is shown on Figure 3-15.

3.6.3 Effluent Storage System Instrumentation and Controls

The piping and instrumentation for effluent storage and pumping is depicted schematically on Figure 3-10 to this O&M Manual. The following are the instrumentation and control steps:

1) The liquid level (measured by LE/LIT-1331) in the effluent tank will be monitored and alarmed by PLC. The PLC monitors for effluent tank high level and low level alarms.
2) Flow rates for effluent tank influent and backwash will be monitored by PLC with flow meters FE/FIT-1321 (plant effluent) and FE/FIT-1371 (backwash source), respectively.

3.6.4 Effluent Storage System Design Criteria

The major components of the Effluent Storage System are provided in this section with their specifications, manufacturer, and location within the Wyckoff GWTP.

<u>Effluent Tank (40T1330) – Figure 3-10</u>
Dimensions: 16 ft feet diameter x 22 ft high
Material of Construction: FRP
Manufacturer: Ershigs
Capacity: 33,090 gallons
Location: Tank Farm
Manufacturer Information: Volume VI of this O&M Manual

<u>Composite Sampler (50M1335) – Figure 3-10</u>
Manufacturer/Model: ISCO 3710FR
Dimensions: 47 inches x 26 inches x 26 inches
Accessories: Software and Controller
Weight: 170 pounds
Location: Tank Farm (next to Effluent Tank)
Manufacturer Information: Volume VII of this O&M Manual (Attachment 7.7)

<u>Backwash Pumps (50P1351 and 50P1352) – Figure 3-10</u>
Model: Pump – 811-4x3-10
Capacity/Characteristics:
  330 gpm at 69 ft of head
  15 HP, 460V, 3-phase, 1.15 SF, 1800 rpm

Manufacturer: Griswold/Weg
Location: Treatment Building Process Area
Manufacturer Information: Volume II of this O&M Manual (Attachment 2.4)

Plant Effluent Flow Meter (FE-1321) – Figure 3-10
Model: Optiflux 4000 Series
Capacity/Characteristics: Optiflux Mag Inductive Flow Meter measures the flow to EQ tank with 2 inch Teflon lining and an operating range of 0 to 100 gpm.
Manufacturer: Krohne
Location: Tank Farm
Manufacturer information: Volume VIII – Attachment 8.1.

Backwash Source Flow Meter (FE-1371) – Figure 3-10
Model: Optiflux 4000 Series
Capacity/Characteristics: Optiflux Mag Inductive Flow Meter measures the flow to effluent tank with an operating range of 0 to 625 gpm.
Manufacturer: Krohne
Location: Treatment Building Process Area
Manufacturer information: Volume VIII – Attachment 8.1.

Level Transmitter Effluent Tank (LE/LIT-1331) – Figure 3-10
Model: Hydroranger 200
Characteristics: Calibrated at 0 to 40 ft of water with the level element XPS-15 and 10m cable
Manufacturer: Miltronics
Location: Tank Farm
Manufacturer information: Volume VIII – Attachment 8.1.

3.7 Solids Processing System

This Section of the O&M Manual provides a system description, operational description, a description of instrumentation and controls for the Solids Processing System , and the design criteria for the Solid Processing system. Specific information related to Solids Processing system is provided under Section 3.7.4. Figure 3-3 illustrates the layout of the treatment system and shows the solids processing system located in the tank farm with the exception of the backwash recycle pump which is located in the treatment building process area and the rotary blower which is located in the treatment building non-process area.

3.7.1 Solids Processing System Description

The function of the Solids Processing System is to separate solids from the backwash effluent water, recycle clarified backwash water to the EQ tank, transfer settled solids to the Digester Tank and aerobically digest the backwash solids. The Solids Processing System is shown on Figure 3-11 (Solids Processing System).

Solids Processing System components include the following:

- Dirty Backwash Tank,
- Backwash Recycle pump,
- Digester Tank,
- Digester and Skim Pump,
- Digester Sludge mixers,
- Filter Press Feed Tanks (2), and
- Rotary Blower.

The physical location of the Dirty Backwash Tank and Digester Tank is shown in Sheet 49 with details shown in Sheet 56 under Appendix C "Applicable Project Drawings" of Volume I. The location of the backwash recycle pump and rotary blower is shown in Sheet 48 and the filter press feed tanks in Sheet 49.

3.7.2 Solids Processing System Operational Description

1) Used backwash water from HDBF (Figure 3-8) and GAC system (Figures 3-8 and 3-9), both labeled as BWE/FFE is pumped to the Dirty Backwash Tank (40T1440) as illustrated in Figure 3-11 by the backwash pumps (cross-reference to Figure 3-10).
2) Occasionally, the Dirty Backwash Tank also receives water from the Containment Area Sump (labeled as STW – Figure 3-14, when it contains relatively high solids; otherwise, the sump discharges are directed to the Storm-Water/Recycle Tank) and filtrate from the filter press when solids are dewatered. The level in the dirty backwash tank is monitored using level transmitter (LE/LIT-1441) as specified in Figure 3-11.
3) After allowing the solids to settle in the dirty backwash tank, supernatant backwash recylce (labeled as BWR) is pumped by the backwash recycle pump (50P1461) to the EQ tank for treatment or, alternately, to the storm water recycle tank for temporary storage with the opening of the valves BWR-01 to BWR-07. Manual valve (BWR-01) on the side of the dirty backwash tank is used to set the supernatant draw-off point.
4) After sufficient solids have accumulated in the cone bottom of the dirty backwash tank, and after supernatant has been decanted, the solids (labeled as TS) are pumped to the digester tank (40T1420) using the filter press/digester feed pump (50P1460) with valves configured to bypass the filter press; and opening of valves TS-01 and TS-02.
5) Low pressure air (labeled as ALP) from the rotary blower through the inline silencer (cross-reference with Figure 3-12) is pulled to the Digester Tank where solids undergo aerobic digestion in the cone-bottom digester tank using the valves ALP-02 through ALP-07. This is performed to biodegrade organic material associated with the solids so that they are adequately stabilized for storage in drums for disposal. A coarse-bubble aeration system installed as part of the digester tank and operates to maintain aerobic conditions and thereby mixes the tank contents. The digester air pressure blower provides positive displacement through an AFD, and will deliver a designed volume up to the designated pressure in which to overcome the water levels present in the system.
6) After the solids are sufficiently digested, a portion of the solids is withdrawn from

the bottom of the digester tank for dewatering with the opening of the valves DS-01 through DS- 03. Sufficient digestion is defined as a 30% reduction in volatile suspended solids (VSS) as tested once a week. The level in the digester tank is monitored using level transmitter (LE/LIT-1421) as shown in Figure 3-11.

7) Solids are pumped from the bottom of the digester tank (labeled as DS) by the digester/ skim pump (50P1120) and discharged into the filter press feed tanks using valves DS-05 and 06.
8) pH of the solids solution in the filter press feed tanks is measured. If the pH is less than 11, dry quicklime (calcium oxide) is added to the sludge in the filter press feed tanks (40T1431 or 40T1432) and mixed using impeller-type mixers (40M1431 or 40M1432). Lime is added to the solids to enhance dewatering and stabilize the sludge. Lime will be added in quantities until the pH reads 11.

In addition to the transfer of solids mixture from the digester tank to the filter press feed tanks, the digester/skim pump also is used to convey non-aqueous phase liquid removed from the EQ tank to the Oil Processing System (as described under Section 3.9 – Figures 3-4 and 3-13).

In addition to the dirty backwash water from HDBF and GAC Systems, the dirty backwash tank receives recycle water from the containment area sump designated as STW (Cross reference with Figure 3-14).

Sampling Port SP-17 (Figure 3-11 and Table 3-1) is located to facilitate sampling of backwash recycle from the Dirty Backwash Tank prior to recycling to the EQ tank and Storm Water Recycle Tank. Levels in the Dirty Backwash Tank and the Digester Tank are monitored by Level Transmitters LE/LIT-1441 and LE/LIT-1421, respectively as shown in Figure 3-11 and Table 3-3. Sampling Port SP-17 and Level Transmitters 1441 and 1421 are shown on Figure 3-11.

3.7.3 Solids Processing System Instrumentation and Controls

Piping and instrumentation for the Solids Processing System is depicted schematically on Figures 3-11 and 3-12 of this O&M Manual. The following are the instrumentation and control steps:

1) BWR-02 (FCV-1451-Figure 3-11) is a pneumatic valve located on the dirty backwash tank outlet that relays to the HMI showing open/close status.
2) The rotary blower (ALP system – Figure 3-12) is controlled through a local REMOTE/STOP switch located on the blower control panel, operated manually by the operator, with an AFD. A relief valve is located in the blower bottom which relieves pressure at 12 psi. The blower controls are operated by an on/off switch. A pressure transducer is incorporated into the system which is connected to the PLC for monitoring.
3) The discharge pressure is set at 5 psi locally at positions contingent upon the dissolved oxygen (DO) in the digester tank which is 5-6 parts per million (ppm).

4) Decanting of the dirty backwash tank, transfer of settled solids from the dirty backwash tank to the digester tank, and transfer of digested solids from the digester tank to the filter press feed tank(s) will all be manual operations.
5) Liquid levels in the dirty backwash tank (measured by LE/LIT-1441) and digester tank (LE/LIT-1421) will be monitored by the PLC and have high and low level alarms.
6) The digester sludge mixers associated with the filter press feed tanks are controlled manually through a start and stop control using the local control stations 40LCS1431 and 40LCS1432 respectively.
7) The operation of the backwash recycle pump can be performed from HMI by setting the local control station (50LCS1461) in “REM” position.

3.7.4 Solids Processing System Design Criteria

The major components of the Solids Processing System are provided in this section with their specifications, manufacturer, and location within the Wyckoff GWTP.

Dirty Backwash Tank (40T1440) – Figure 3-11
Dimensions: 18 ft feet diameter x 14 ft high
Capacity: 32,360 gallons
Anticipated contents: PCPs, PAHs, O&G and TDS
Material of Construction: FRP
Manufacturer: Ershigs
Location: Tank Farm
Manufacturer Information and As-built drawing: Volume VI of this O&M Manual

Backwash Recycle pump (50P1461) – Figure 3-11
Model: Pump – 811-3x2-6
Capacity/Characteristics:
115 gpm at 28 ft of head
2 HP, 460V, 3-phase, 1.15 SF, 1800 rpm
Manufacturer: Griswold/Weg
Location: Treatment Building Process Area
Manufacturer Information: Volume II of this O&M Manual (Attachment 2.6)

Digester Tank (40T1420) – Figure 3-11
Dimensions: 10 ft feet diameter x 23.5 ft high
Capacity: 8,790 gallons
Anticipated contents: PCPs, PAHs, O&G and TDS
Material of Construction: FRP
Manufacturer: Ershigs
Location: Tank Farm
Manufacturer Information: Volume VI of this O&M Manual

Digester Skim Pump (50P1120) – Figure 3-11
Model: AOD3
Capacity/Characteristics: 230 gpm at 125 psig maximum air inlet pressure
Mechanism: Air-Operated diaphragm
Manufacturer: Price Pump
Location: Tank Farm
Manufacturer Information: Volume II (Attachment 2.11) of this O&M Manual

Filter Press/Digester Feed Pump (50P1460) – Figure 3-11
Model: AOD1.5
Capacity/Characteristics: 75 gpm at 125 psig maximum air inlet pressure
Mechanism: Air-Operated Diaphragm
Manufacturer: Price Pump
Location: Tank Farm
Manufacturer Information: Volume II of this O&M Manual (Attachment 2.12)

Filter Press Feed Tanks (40T1431 and 40T1432) – Figure 3-11
Dimensions: 4 ft feet diameter x 4 ft high
Capacity: 350 gallons
Anticipated contents: Primarily O&G and TDS
Material of Construction: Open Top Fiber Glass Tank
Manufacturer: Raven
Location: Tank Farm
Manufacturer Information: Volume VII of this O&M Manual (Attachment 7.9)

Digester Sludge Mixers (40M1431 and 40M1432) – Figure 3-11
Model: Neptune 2.0 Mixer with Leeson Motor
Capacity/Characteristics: 0.75 HP, 230V, 1750 rpm
Manufacturer: Neptune
Location: Inside the two Filter Press Feed Tanks located in the tank farm
Manufacturer Information: Volume VII of this O&M Manual (Attachment 7.1)

Rotary Blower (50M1551) – Figure 3-12
Model: 32-URAI
Capacity/Characteristics:
100 scfm @ 93/50F and 3,357 rpm
Motor: 7.5 HP, 460V, 3600 rpm, Inverter Duty
Inlet and Discharge Pressures: 14.7 psig and 10 psig
Blower Manufacturer: Roots Blower
Motor Manufacturer: Toshiba
Local Control Panel: 50LCP1551
Location: Treatment Building Non-Process Area
Manufacturer Information: Volume VII of this O&M Manual (Attachment 7.3)

Level Transmitters Digester Tank (LE/LIT-1421) and Dirty Backwash Tank (LE/LIT-1441) – Figure 3-11
Model: Hydroranger 200
Characteristics: Calibrated at 0 to 40 ft of water with the level element XPS-15 and 10m cable
Manufacturer: Miltronics
Location: Tank Farm
Manufacturer information: Volume VIII – Attachment 8.1.

3.8 Filter Press System

This Section of the O&M Manual provides a system description, operational description, a description of instrumentation and controls for the Filter Press System, and the design criteria for the Filter Press system. Specific information related to the Filter Press system is provided under Section 3.8.4. Figure 3-3 is the layout of the treatment system and shows the filter press system located in the tank farm with the exception of the filter press which is located in the treatment building process area.

3.8.1 Filter Press System Description

The function of the filter press system is to transfer amended sludge to the filter press, dewater the sludge, neutralize the filtrate, and recycle the filtrate to the dirty backwash tank or storm water recycle tank through the containment sump. The filter press system is shown on Figure 3-12.

Filter Press System components include the following:

- Filter Press Feed Pump,
- Filter Press,
- Filtrate Tank, and
- Filtrate/Product Disposal Pump.

The physical location of the filter press is shown in Sheet 48 with under Appendix C "Applicable Project Drawings" of Volume I. The location of the filtrate tank is shown in Sheet 49.

3.8.2 Filter Press System Operational Description

The operational description of the Filter Press System is as follows:

1) After the lime and sludge are well mixed and the Filter Press is prepared, the sludge mixture is pumped by the Filter Press/Digester Feed Pump (50P1460) to the Filter Press (Figures 3-11 and 3-12), and the Filter Press run is initiated. Solids from the filter press feed tanks (labeled as SS) are sent to the filter press with the operation of the valves SS-01, SS-02, SS- 03, TS/SS-01, and AHP-16; and the use of the filter press/digester feed pump.

2) The press run continues until the Filter Press/Digester Feed Pump reaches a maximum discharge pressure, and dewatering is completed. At that time, the Filter Press Feed Pump is turned off.
3) During the press run, filtrate water (labeled as F) squeezed from the solids is discharged by gravity flow to the Filtrate Tank.
4) After completion of the press run, the filter press plates are separated and the filter cake removed from the press falls through a chute into the collection bin (55-gallon drum).
5) The filtrate pH is manually adjusted to near-neutral in the filtrate tank by addition of sodium bisulfite, and mixed with an impeller-type mixer (50M1480), and the pH measured with a hand-held meter.
6) The neutralized filtrate is pumped from the filtrate tank by the filtrate/product disposal pump (50P1490) to the containment sump.
7) Alternately, the neutralized filtrate can be discharged via flexible hose to the process floor drain and ultimately returned to the EQ tank for treatment. The filtrate/product disposal pump will be used for two functions: the one described above, and transfer of oil from the Product Tank to a tank truck for disposal. Both the functions are expected to occur infrequently.

3.8.3 Filter Press System Instrumentation and Controls

Piping and instrumentation for the Filter Press System is depicted schematically on Figure 3-12 to this O&M Manual.

The controls on the filter press include one switch, which is on/off and open/close level switch to open/close plates. All filter press system operations will be manual, batch processes.

3.8.4 Filter Press System Design Criteria

The major components of the Filter Press System are provided in this section with their specifications, manufacturer, and location within the Wyckoff GWTP.

Filter Press/Digester Feed Pump (50P1460) – Figure 3-11
Model: AOD1.5
Capacity/Characteristics:75 gpm at 125 psig maximum air inlet pressure
Mechanism: Air-Operated Diaphragm
Manufacturer: Price Pump
Location: Tank Farm
Manufacturer Information: Volume II of this O&M Manual (Attachment 2.12)

Filter Press (50M1470) – Figure 3-12
Dimensions: 12 ft by 3.5 ft by 5.1 ft
Capacity: 10 cubic ft, 35-60% of cake (dry weight solids)
Number of Chambers: 1 head, 19 intermediate and 1 tail
Filter cake thickness: 1.25 inches
Plate weight: 53 pounds

Plate size: 800 millimeters (mm)
Shipping weight: 5000 pounds
Manufacturer: Alantes Chemical Systems, Conroe, Texas
Location: Treatment Building Process Area
Manufacturer Information: Volume VII of this O&M Manual (Attachment 7.8)

Filtrate Tank (50T1480) – Figure 3-12
Dimensions: 4 ft feet diameter x 4 ft high
Capacity: 350 gallons
Anticipated contents: Primarily O&G and TDS
Material of Construction: Open Top Fiber Glass Tank
Manufacturer: Raven
Location: Tank Farm
Manufacturer Information: Volume VII of this O&M Manual (Attachment 7.10)

Digester Sludge Mixer (50M1480) – Figure 3-12
Model: 1.0 Mixer with Leeson Motor
Capacity/Characteristics: Motor: 0.5 HP, 230V, 1750 rpm
Location: Inside the Filtrate Tank located in tank farm
Manufacturer Information: Volume VII of this O&M Manual (Attachment 7.1)

Filtrate/Product Disposal Pump (50P1490) – Figure 3-11
Model: P400
Capacity/Characteristics:20 gpm at 28 ft of head
Mechanism: Air-Operated Diaphragm
Manufacturer: Wilden
Location: Treatment Building/Tank Farm
Manufacturer Information: Volume II of this O&M Manual (Attachment 2.9).

3.9 Oil Processing System

This Section of the O&M Manual provides a system description, operational description, a description of instrumentation and controls for the Oil Processing System, and the design criteria for the Oil Processing System. Specific information related to the Oil Processing system is provided under Section 3.9.4. Figure 3-3 is the layout of the treatment system and shows the Oil Processing system located in the treatment building process area with the exception of the product tank and the digester/skim pump which are located in the tank farm.

3.9.1 Oil Processing System Description

The function of the oil processing system is to separate, manage and remove NAPLs from groundwater by the DAF System, the skimming/decanting in the EQ tank and froth pumps from DAF operation. The oil processing system is shown on Figure 3-13 (Oil Processing System).

Oil Processing System components include the following:

- Froth Tank,
- Decant Pumps (2),
- Oil Pump,
- Product Tank,
- Froth Pumps (2),
- Digester/Skim Pump, and
- Filtrate/Product Disposal Pump.

The physical location of froth tank is shown in Sheet 48 with details shown in Sheet 63 under Appendix C "Applicable Project Drawings" of Volume I. The location of the decant pumps and froth pumps is shown in Sheet 48 and the product tank in Sheet 49.

3.9.2 Oil Processing System Operational Description

The description of the Oil Processing System operation is as follows:

1) Oily froth and sludge from the DAF unit (Figure 3-5) is pumped to the froth tank (Figure 3-13) (labeled as FRI) by one of the two froth pumps (50P1251 and 50P1252) as shown in Figure 3-7 with the opening of valves FRI-01through FRI- 08 and FRI-10. Valve FRI-01 is for removal of froth and FRI-02 is for removal of sludge. Valves FRI-03, 04 and 06 isolate froth pump 50P1251 and FRI-07, 08 and 10 isolate froth pump 50P1252. The pumps are cycled often to increase their life span. These pumps operate on a set timer (60 minutes) with pump speeds set to 5%.
2) LNAPL, DNAPL, and solids skimmed from the EQ tank that accumulate in the EQ skim sump (operation described under Section 3.2 and Figure 3-4) will be pumped either directly to the product tank (using isolation valve NAPL-06) or to the froth tank (using isolation valve NAPL-05) by the digester/skim pump (50P1120). Both the product tank and the froth tank are shown in Figure 3-13. This line is labeled as NAPL. The digester/skim pump (50P1120) using high pressure air through valves AHP-15 to either the Product Tank (40T1400) or Froth Tank (50T1380) by opening valves NAPL-03 and NAPL-04. If the fluid is predominantly oil, it will be pumped directly to the product tank. If the fluid contains an appreciable amount of water, it will be pumped to the froth tank for further separation.
3) The froth tank generates contact time and surface area for release of air from the froth generated by the DAF System. The froth tank is a three-compartment tank designed to trap LNAPL and DNAPL. The compartments are formed by an overflow weir, an underflow weir, and a final overflow weir to control water level in the first two compartments of the tank. DNAPL is trapped in the first compartment, and LNAPL is trapped in the second compartment of the froth tank.
4) Periodically, NAPLs are drawn off from these compartments using the Oil pump 50P1410, which conveys them to the Product Tank as shown in Figure 3-13 using valves NAPL-07 through NAPL-12. The oil pump uses high pressure air with the opening of valve AHP-18.

5) The product tank provides oil storage and further phase separation. The tank has outlets at multiple depths to allow decanting of separated water.
6) Decanted water from the product tank is discharged by gravity to the containment area sump (and recycled back to the EQ tank for treatment) by opening overflow (OF) valves OF/DC-1 to OF/DC-7. Periodically, oil from the product tank is transferred to a tanker truck for disposal with operation of valve NAPL-13. This is accomplished using either the filtrate/product disposal pump (50P1490) or by a vacuum pump provided by the tank truck.
7) Froth tank effluent (labeled as FRE) is recycled from the third compartment of the froth tank back to the EQ tank by the two decant pumps 50P1391 and 1392 (associated valves FRE-01, 03, 04 and 06) as shown in Figure 3-13. These decant pumps are operated on AUTO controlled by the AFDs through the level (LIT-1381) set in the froth tank. The liquid level in the third compartment is monitored and used to control the speed of the decant pump. Level in the froth tank is measured using Level Transmitter LE/LIT-1381.

The filtrate/product disposal pump also is used to transfer filtrate generated by the filter press during sludge dewatering to the containment sump as described in Section 3.8. The digester/skim pump is also described in Section 3.7 because it is also used to periodically transfer digested solids from the digester tank to the filter press feed tank(s) for dewatering.

Sampling Port SP-12 (refer to Figure 3-7 and Table 3-1) is provided for sampling of the froth from DE. Sampling Port SP-13 (Figure 3-13 and Table 3-1) is located to sample FRE (decant water) from the froth tank prior to recycling to the EQ tank. Sampling Port SP-14 (Figure 3-13 and Table 3-1) is located to sample product NAPL from the Froth Tank prior to entry to the product tank. .

3.9.3 Oil Processing System Instrumentation and Controls

Piping and instrumentation for the Oil Processing System is depicted schematically on Figure 3-13 to this O&M Manual and described as follows:

1) The liquid level in the overflow (third) compartment (measured by level transmitter LE/LIT-1381) of the froth tank will be monitored through the PLC and used to control the speed of the decant pumps. Decant pumps are operated on AUTO controlled by the AFDs through the level (1381) set in the froth tank.
2) All other operations described in this section will be manual, including transfer of LNAPL and DNAPL from the Froth Tank to the Product Tank via the oil pump, decanting of water from the Product Tank, transferring oil from the product tank to a tanker truck and transfer of NAPLs from EQ skim sump to froth or product tanks.
3) The oil, digester/skim and filtrate/product disposal pumps are air diaphragm pumps controlled manually by varying air pressure with the use of the air pressure regulator located on the high pressure process air (AHP) line at the tank farm.

3.9.4 Oil Processing System Design Criteria

The major components of the Oil Processing System are provided in this section with their specifications, manufacturer, and location within the Wyckoff GWTP.

Froth Tank (50T1380) – Figure 3-13
Dimensions: 4 ft wide x 13 ft long x 6 ft high
Capacity: 2,330 gallons
Anticipated contents: PCPs, PAHs, O&G and TDS
Material of Construction: FRP
Manufacturer: Ershigs
Location: Treatment Building Process Area
Manufacturer Information and As-built drawing: Volume VI of this O&M Manual

Decant Pumps (50P1391 and 50P1392) and AFDs (50AFD1391 and 50AFD 1392) – Figure 3-13
Model: Pump – 811LF1.5x1-8, Motor – 00118ST3QIE143T
Capacity/Characteristics:
  10 gpm @ 29 ft head
  Motor: 0.75 HP, 460V, 3-phase, 1.15 SF, 1800 rpm
Manufacturer: Griswold/Weg
Location: Treatment Building Process Area
Manufacturer Information: Volume II of this O&M Manual (Attachment 2.5)

AFDs: 50AFD1391/1392
AFD Model: ACH550PC-03A3-4, 1 HP, 480V
Manufacturer: ABB
Location: Treatment Building Process Area
Manufacturer Information: Volume VIII of this O&M Manual (Attachment 8.2)

Oil Pump (50P1410) – Figure 3-13
Model: P400
Capacity/Characteristics:
  15 gpm at 11 ft of head
Mechanism: Air-Operated Diaphragm
Manufacturer: Wilden
Location: Treatment Building Process Area
Manufacturer Information: Volume II of this O&M Manual (Attachment 2.9).

Product Tank (40T1400) – Figure 3-13
Dimensions: 10 ft wide x 29 ft long
Capacity: 8,315 gallons
Anticipated contents: PCPs, PAHs, O&G and TDS
Material of Construction: Carbon Steel with Epoxy Lining with FRP cover lid
Manufacturer: Selway Corporation – Tank and Cover Lid - Ershigs
Location: Tank Farm

Manufacturer Information: Volume VII of this O&M Manual (Attachment 7.11)

Filtrate/Product Disposal Pump (50P1490) – Figure 3-13
Model: P400
Capacity/Characteristics:20 gpm at 28 ft of head
Mechanism: Air-Operated Diaphragm
Manufacturer: Wilden
Location: Treatment Building/Tank Farm
Manufacturer Information: Volume II of this O&M Manual (Attachment 2.9).

Froth Pumps (50P1251 and 50P1252) – Figure 3-7
Model: Milroyal C
Capacity/Characteristics:
780 gph at 75 psig discharge pressure
Motor: Baldor/Reliance VEM3558/P56X-1536 - 2 HP, 460V, 3-phase, 1.15 SF, 1725 rpm
Manufacturer: Milton Roy
Location: Treatment Building Process Area
Manufacturer Information: Volume II of this O&M Manual (Attachment 2.1)

Digester Skim Pump (50P1120) – Figure 3-4
Model: AOD3
Capacity/Characteristics: 230 gpm at 125 psig maximum air inlet pressure
Mechanism: Air-Operated diaphragm
Manufacturer: Price Pump
Location: Tank Farm
Manufacturer Information: Volume II (Attachment 2.11) of this O&M Manual

Level Transmitter Froth Tank (LE/LIT-1381) – Figure 3-13
Model: Hydroranger 200
Characteristics: Calibrated at 0 to 40 ft of water with the level element XPS-15 and 10m cable
Manufacturer: Miltronics
Location: Treatment Building Process Area
Manufacturer information: Volume VIII – Attachment 8.1.

3.10 Containment Area and Sump

This Section of the O&M Manual provides a system description, operational description, a description of instrumentation and controls for the Containment Area and Sump, and the design criteria for the Containment Area and Sump. Specific information related to the Containment Area and Sump System is provided under Section 3.10.4. Figure 3-3 is the layout of the treatment system and shows the Containment Area system located in the tank farm with the exception of the storm water recycle pump which is located in the treatment building process area.

3.10.1 Containment Area and Sump Description

Containment pads are provided for outdoor tank equipment (Tank Farm Containment Pad) and for a truck decontamination area (Decontamination Pad) at the Wyckoff GWTP. The containment pads will contain and collect storm water, decontamination (decon) water, and spills. Secondary containment is provided for the outdoor process tanks and equipment. The Tank Farm Containment Pad provides secondary containment for the tanks and process equipment located in the outdoor containment area. The decontamination pad/sump provides containment and collection of water from truck decontamination, wash-down water from spills during truck loading/unloading, as well as water from spills/washdown water in the treatment building. Storm water and decontamination water will be collected at a combined Containment Area Sump.

The Storm Water Recycle Tank will store relatively clean water (storm water) from outdoor containment areas and filter backwash water after solids sedimentation. This tank will provide temporary storage of this water before it is pumped back to the EQ tank for treatment in conjunction with influent groundwater.

The Containment Area and Sump are shown on Figure 3-14 (Containment Area and Sump).

Containment Area and Sump components include the following:

- Tank Farm Containment Pad,
- Containment Area Sump,
- Containment Area Sump Pumps (2) with Control Panel,
- Decon Pad,
- Storm Water Recycle Tank, and
- Storm Water Recycle pump.

The physical location of Storm water Recycle Tank is shown in Sheet 49 with details shown in Sheet 58 under Appendix C “Applicable Project Drawings” of Volume I. The location of the sump pumps is shown in Sheet 49, the storm water recycle pump in Sheet 48.

3.10.2 Containment Area and Sump Operational Description

1) Water from storm water runoff and wash-down water from both the Tank Farm Containment and Decon Pads, plus wash water and spills from the treatment building, discharge by gravity flow (labeled as STW) to the Containment Area Sump (Figure 3-14).
2) Valves STW-01 and STW-02 are opened to discharge the water from the existing Decontamination Pad and the Tank Farm Containment Pad. Both the Containment Area Sump Pumps shown in Figure 3-14 (40P1501 - associated valve STW-04 and 40P1502 - associated valve STW-06) will be cycled and operational in order to increase the overall life of each pump. These pumps pump water from the Containment Area

Sump to either the Storm Water Recycle Tank or the Dirty Backwash Tank (Figure 3-11) for treatment.

3) Water that is relatively free of solids is directed to the Storm-Water Recycle Tank with open/close of the STW-07 valve.
4) Water containing relatively high solids is directed to the Dirty Backwash Tank (cross reference with Figure 3-11) by open/close of the STW-08 valve.
5) The sump pumps are mounted on rails to facilitate removal and maintenance. Wash-down water inside the treatment building is collected in trench drains and conveyed to the containment area sump. A backflow prevention device is installed to prevent backflow into the building in the event of a tank failure in the tank containment pad area.
6) The water level in the Storm Water Recycle Tank will be maintained as low as possible to maximize the available storage capacity and is measured using level transmitter LE/LIT-1521 (Figure 3-14 and Table 3-3).
7) Clarified backwash water is pumped from the Dirty Backwash Tank to the Storm Water Recycle Tank when necessary, but normally it will be returned directly to the EQ tank.
8) The storm water recycle pump 50P1541 shown in Figure 3-14 (associated valves STW-10 and 12) pumps water from the Storm Water Recycle Tank back to the EQ tank for treatment (cross reference with Figure 3-4).
9) Pneumatic valve STW-09 controls the flows from the storm water/recycle pump and directs it to the EQ tank.

Sampling Port SP-18 (Figure 3-14 and Table 3-1) is located to sample effluent from the storm water recycle tank prior to recycling to the EQ tank.

3.10.3 Containment Area and Sump Instrumentation and Controls

Piping and instrumentation for the Containment Area and Sump are shown on Figure 3-14 of this Manual. Directions for use of the instrumentation and controls include:

1) The Sump Pump Control Panel (40LCP1500) has a breaker that is set to the “ON” position. The panel also has two separate switches for pump #1 and pump #2 with options for auto/off/hand. The sump pumps are placed in “AUTO” position.
2) STW-09 (FCV-1531 – Figure 3-14) is a pneumatic valve located on the Storm water Recycle tank outlet that relays to the HMI showing open/close status.
3) The operation of the storm water/recycle pump can be performed from HMI by setting the local control station 50LCS1541 in “REM” position.

3.10.4 Containment Area and Sump Design Criteria

The major components of the Containment Area and Sump are provided in this section with their specifications, manufacturer, and location within the Wyckoff GWTP.

Containment Area Sump (Figures 3-4, 3-10, 3-11, 3-12, 3-13, and 3-14)
Dimensions: 4 ft long x 70 ft wide x 5.7 ft high
Capacity: 11,880 gallons
Location: Tank Farm

Sump Pumps (40P1501 and 40P1502) – Figure 3-14
Model: NP3102X-643
Capacity/Characteristics:
215 gpm at 35 ft head
Motor: 5 HP, 460V, 3-phase, 1800 rpm
Manufacturer: Flygt/Triangle Pump
Control Panel: 40LCP1500
Location: Tank Farm
Manufacturer Information: Volume II of this O&M Manual (Attachment 2.2)

Storm water Recycle Tank 40T1520 – Figure 3-14
Dimensions: 13 ft diameter x 18 ft high
Capacity: 17,870 gallons
Anticipated contents: Storm water and filter backwash water
Material of Construction: FRP
Manufacturer: Ershigs
Location: Tank Farm
Manufacturer Information and As-built drawing: Volume VI of this O&M Manual

Storm-water Re-cycle Pump (50P1541) – Figure 3-14
Model: Pump – 811-3x1.5-6
Capacity/Characteristics:
70 gpm at 26 ft of head
Motor: 1 HP, 460V, 3-phase, 1.15 SF, 1800 rpm
Manufacturer: Griswold/Weg
Location: Treatment Building Process Area
Manufacturer Information: Volume II of this O&M Manual (Attachment 2.7)

Level Transmitter Storm water Recycle Tank (LE/LIT-1521) – Figure 3-14
Model: Hydroranger 200
Characteristics: Calibrated at 0 to 40 ft of water with the level element XPS-15 and 10m cable
Manufacturer: Miltronics
Location: Tank Farm
Manufacturer information: Volume VIII – Attachment 8.1.

3.11 Plant Air and Water Systems

Manufacturer information on Volume VII of the entire manual include the mixers, air receiver, rotary blower, process valves, air compressors, air dryer, automatic composite sampler, filter press, filter press feed tanks, filtrate tank and product tank. This section covers only air compressed systems, which include the air receiver, air compressors and air dryer and the water. All the other equipment mentioned in Volume VII is distributed through out the Sections 3.2 to 3.10. Manufacturer information on the plant water systems is described under Non-Process equipment Volume IX. Specific information related to this section is provided under Section 3.11.2. Figure 3-3 is the layout of the treatment system and shows the Plant water and air systems located in the treatment building process and non-process area locations respectively with the exception of the air receiver, plant water storage tank and W-2 well water pump which are located outside west of the treatment building.

3.11.1 Plant Air and Water Systems Description

The following two sections describe the compressed air and water supply requirements integral to the overall operation of the groundwater treatment plant. The air compressors are located in the mechanical room of the treatment building shown in Sheet 69 in Appendix C "Applicable Project Drawings" in Volume I. The plant water system is located in the west end of the process area as shown in Sheet 69.

3.11.1.1 Plant Air System

Two air systems, AHP and instrument air (AI), provide air for plant operations. The air for both air systems is provided by Air Compressors 50M1651 and 50M1652. AHP is supplied to the DAF System for air saturation; the HDBF System to operate pneumatic valves; the Air Diaphragm Pumps to operate the Solids Processing System and the Oil Processing System; and to the Turbidity Meter panel and Filter Press. Quick-connect fittings for the AHP system are located in the Tank Farm and Treatment Building that the operator can tap into. Air Compressors 50M1651 and 50M1652 provide AHP to Air Receiver Tank 50T1465. The Air Receiver Tank provides high pressure process air for operations in the plant. Compressed air provided through the Air Dryer as AI is regulated through a valve AI-04 which is used to operate valves DI-01 (FV1021), BWR-02 (FV1451), and STW-09 (FV1531) located on the discharge from the EQ Tank (40T1010), Dirty Backwash Tank (40T1440), and Storm Water Recycle Tank (40T1520), respectively. AI also is used to operate the hydraulic pump for the Filter Press (50M1470) and to operate the Extraction Well Field through a regulator and isolation valve (AI-03).

Valves AHP-02, AHP-04, AHP-05, AHP-06, and AHP-20 serve as open/close function when transferring air originating from Air Compressors (50M1651 and 50M1652) and Air Receiver (50T1465) to process equipment under consideration.

The compressors have a capacity of approximately 80 scfm at 120 psig. The air is stored in the receiver at 120 psig and the pressure is reduced, as required for the specific application. An after-cooler moisture separator and coalescing air filter for oil removal is installed in the discharge piping connecting the compressors to a 3,000-gallon air receiver. The air is passed through a regenerative desiccant air dryer, which removes moisture in the compressed air to a minus 40-pressure dew point followed by a particulate filter. Downstream of the dryer, the air is distributed for supply of instrument air.

The two air compressors are located in the process mechanical room, and operate in parallel to provide the required air flow for plant operations. Both compressors feed into the 3,000-gallon air receiver and operate automatically based on receiver pressure. These compressors will cycle according to the setup in the manufactures controls (#1 loads at 115psi and unloads at 125 psi and #2 loads at 110 psi and unloads at 120 psi).

The DAF System requires a continuous flow of compressed air at a flow rate of 1.5 scfm and a pressure of 120 psig. Additionally the air operated diaphragm pumps that require AHP air include the digester/skim pump, filter press/digester feed pump, oil pump, and filtrate/product disposal pumps.

The air compressor system is provided in Figure 3-6 and Figure 3-12 and are cross referenced to system operations requiring compressed air in Figures 3-4, 3-5, 3-8, 3-11, 3-12, 3-13 and 3-14.

3.11.1.2 Plant Water Supply System

The potable and non-potable water supply systems are discussed in this section of the O&M Manual.

Potable Water Systems
Potable water is provided by the City through an 8 inch line and enters the building through a 2-inch line. A flow meter located just inside the building mechanical room meters the water usage. This water is used to feed the electric water heater located in mechanical room, domestic hot water pump, safety equipment like eye wash showers and toilet facilities. A backflow preventer (50BFP05) is located after the flow meter. An annual inspection of the backflow preventer and flow meter will be required by a certified technician.

Non-Potable Water Systems
The Water Supply System (Figure 3-6) consists of the Water Well (W2) equipped with a Submersible Pump and an existing 4-inch diameter buried pipeline from the well to the GWTP building. Source of W2 water comes from the well located at the southwest corner of the building. Well W2 is 815 ft deep with 16-inch diameter casing set to a depth of 420 ft. A 4-inch diameter drop pipe conveys water from the submersible pump to the surface. The well operates based upon the level in Water Storage Tank (50T1570).

The Water Storage Tank (50T1570), Pressure Tank (50T1575) and Water Pumps (50P1581 and 50P1582) are used to provide non-potable water to the process system, which includes supply to the Polymer System, mechanical seals of process pumps and supply of non-potable water to the tank farm. The Pressure Tank provides constant pressure for the water to the process system. The Well Pump is controlled by a level control system in the Water Storage Tank.

Operation of the Water Pumps is controlled by a pressure switch at the pump discharge that controls the on and off setting of the pumps. This pressure switch is connected to a local control station located at the southwest corner of the treatment building with two selector switches – "pump1/pump2" and "Hand/Off/Auto".

3.11.2 Plant Air and Water Systems Design Criteria

The major components of ancillary equipment are provided in this section with their specifications, manufacturer, and location within the Wyckoff GWTP.

3.11.2.1 Plant Air System

Air Compressors (50M1651 and 50M1652) – Figure 3-6
Model: 20D
Capacity/Characteristics: 125 psig at 80 scfm
Motor: 20 HP, 460V, 3-phase
Conditions: Temperature 155F, 50M1651 loads at 115 psig, unloads at 125 psig, 50M1652 loads at 110 psig and unloads at 120 psig, oil differential pressure – 0 psi and separator differential pressure – 5 psig
Manufacturer for compressor: Sullivan Palatek

Air Dryer Model: ICE 100
Capacity/Characteristics: Dew point set at 34 degrees ^{0}F and ice demand at 37^{0}F
Manufacturer: Motivair

Location: Treatment Building Non-Process Area
Manufacturer Information: Volume VII (Attachment 7.5) of this O&M Manual

Air Receiver (50T1465) – Figure 3-12
Capacity/Characteristics: 3000 gallons/165 psig at 400F
Dimensions: 66 inches outer diameter x 214 inches long
Weight: 7000 lbs
Manufacturer: Manchester Tank
Location: Outside West of Treatment Building
Manufacturer Information: Volume VII (Attachment 7.2) of this O&M Manual

3.11.2.2 Plant Water Supply System

Water Well Submersible Pump – Figure 3-6
Model Number: 6-T15-200
Capacity/Characteristics: Design Flowrate: 225 gpm at 200 ft total dynamic head (TDH)
Motor: 15 HP
Manufacturer: Berkley
Location: Well W2 (outside south of Treatment Building)

Water Storage Tank (50T1570) – Figure 3-6
Dimensions: 61 inches outer diameter x 141 inches overall height
Capacity: 1,500 gallons
Manufacturer: Poly Processing
Location: Outside West of Treatment Building
Manufacturer Information: Volume IX (Attachment 9.1) of this O&M Manual

Plant Water Pressure Tank (50T1575) – Figure 3-6
Model: WX-456-C
Capacity/Characteristics: 422 gallons/ASME Rated, 125 psig
Dimensions: 4 ft diameter x 6.75 ft high
Manufacturer: Amtrol
Location: Treatment Building Process Area
Manufacturer Information: Volume IX (Attachment 9.2) of this O&M Manual

Water Transfer Pumps (50P1581 and 50P1582) – Figure 3-6
Model: VM06B Series
Capacity/Characteristics: 88 gpm at 112 ft head with maximum pressure at 48 psig
Manufacturer: Taco Pumps
Location: Inside west of Treatment Building Process Area
Manufacturer Information: Volume IX (Attachment 9.3) of this O&M Manual

Electric Water Heater WH-1
Model: DVE-250
Capacity/Characteristics: 250 gallons/ ASME 150 psig rated, 60 kilowatts (kW), 480V
Dimensions: 93 inches x 36 inches x 43 inches, vertical orientation
Manufacturer: A.O. Smith
Location: Treatment Building Non-Process Area
Manufacturer Information: Volume IX (Attachment 9.4) of this O&M Manual

Domestic Hot Water Circulating Pump (HWCP-01)
Model: LR-15BWR
Characteristics: 5 gpm at 10 ft head, 150 psig/225F, 125 watts (W), and 2950 rpm
Hot water Circulating Pump Manufacturer: Bell-Gossett

Expansion Tank
Model: ST-30V-C
Capacity/ Characteristics: 14 gallons/150 psig/2000F
Manufacturer: Amtrol
Location: Treatment Building Non-Process Area
Manufacturer Information: Volume IX (Attachment 9.4) of this O&M Manual

3.12 Control System Equipment

Following is a list of major control equipment and instrumentation used in the treatment system. Manufacturer information and operation procedures on the control panel and instrumentation are provided under Volume VIII of the O&M Manual Attachment 8.1. Table 3-8 provides a panel to equipment crosswalk.

3.12.1 Process Control Panel

The Process Control Panel (50CP1001) is a 72 inch wide by 72 inch by 18 inch deep A-type with a NEMA-12 enclosure manufactured by Hoffman located in the east end of the treatment building process area. The model number for the enclosure is A727218FSD and for the back panel is A72P72F1.

3.12.2 Programmable Logic Controller

PLC 50 PLC1001 is an Allen Bradley Type Model 1769-L35E with a 64 megabyte (MB) non-volatile memory, one RS-232 port and an ethernet port. The OIT is a Versa-View heavy duty computer Type 200R, Allen Bradley Model 6155-NPXPH. Process Control Panel 50CP1001 is connected to the Master Control Panel MCC-1. There are two locations where the Wyckoff treatment plant can be operated – one is the PLC operated through a touch screen located in the treatment plant east of the DAF unit. The other location is the in the control room non-process area called the HMI (also called the OIT).

The operator can monitor the following equipment from HMI or through the local control panels:

- Operation of pneumatic valve (DI-01) from HMI.
- Operation of DAF Feed Pumps (50P1101 and 50P1102) through AFD 1101 and AFD 1102, respectively, with speed, run and auto controls.
- Operation of DAF Unit 1121 – Mixer and Skimmer operated through AFDs with speed, run and auto functions and Auger and Recirculation Pump (50P1135) with run and auto functions. These functions can be performed from the main PLC or HMI through the local control panel (50LCP1121).
- Operation of Polymer System capable of operating from HMI and through local control panel (50LCP1601).
- Operation of W2 well pump with auto and run functions through a motor starter and disconnect on local control panel (40LCP1561).
- Operation of Filter Feed Pumps (50P1241 and 50P1242) through AFD 1241 and AFD 1242, respectively, with speed, run and auto controls.
- Automated HDBF operation performed from HMI and local control panel (50LCP1260).
- Automatic backwash operation of HDBF unit without operator intervention, based upon timed set cycles.

- Operation of Backwash Pumps (50P1351 and 50P1352) through local control stations (50LCS1351 and 50LCS1352), respectively, based upon a set time of operation. This operation can be performed from HMI when the Local Control Station (LCS) is placed in "REM" position.
- Operation of Froth Pumps (50P1251 and 50P1252) through local control stations (50LCS1251 and 50LCS1252), respectively, and based upon a set time of operation. This operation can be performed from HMI when the LCS is placed in "REM" position.
- Operation of Pneumatic Valve (BWR-02) from PLC or HMI
- Operation of Backwash Recycle Pump (50P1461) through local control station (50LCS1461). This operation can be performed from HMI or PLC when the LCS is placed in "REM" position.
- Operation of Rotary Blower (50M1551) equipped with an AFD operated from main PLC in auto mode through local control panel (50LCP1551).
- Operation of Digested Sludge Mixers (40M1431 and 40M1432) through local control stations (50LCS1431 and 50LCS1432), respectively, through a "START/STOP" button for Filter Press Feed Tanks (40T1431 and 40T1432). Operation of Filtrate Mixer (50M1480) through local control station (50LCS1480) through a "START/STOP" button for Filtrate Tank (50T1480).
- Operation of Decant Pumps (50P1391 and 50P1392) with AFDs 13911 and 1392, respectively, with speed, run, and auto controls for transfer of decant water from Froth Tank (50T1380).
- Operation of Pneumatic Valve (STW-09) from PLC or HMI
- Operation of Storm Water Recycle Pump (50P1541) through local control station (50LCS1541). This operation can be performed from the HMI when the LCS is placed in "REM" position.

A list of PLC Inputs/Outputs showing device #, description, corresponding Process and Instrumentation Diagram (P&ID) Figure and PLC address is provided under Table 3-4. A table showing the list of alarms and its troubleshooting is provided under Table 3-5. Table 3-6 provides a list of operator set points as entered in the HMI.

3.12.3 Pressure Gauges/Transmitters/Switches

All pressure gauges (PE) are Model Ashcroft 45 1279ASL 04L 0-100 psig. Pressure gauges are installed at DAF feed pumps (1111/1112), filter feed pumps (1291/1292), froth pumps (1251/1252), filter feed pumps to carbon adsorbers (1282), influent to carbon system (1310), five carbon adsorbers (1311-1315), backwash pumps (1361/1362), decant pumps (1391/1392), backwash recycle pump (1461), filter press digester feed pump (1464), digester skim pump (1465), sump pumps (1504), storm water recycle pump (1544), plant water pumps 1591 and polymer feed pump (1641). Pressure gauges for supply of high pressure air from air compressors for air receiver 1466 and air dryer 1650.

All pressure elements are Model Ashcroft 50 201SS 04T XCG with a diaphragm seal and have viton O-rings. They are located where ever the gauges are located mentioned above.

All pressure transmitters are Model Rosemount 3051TG2A2B21AB4BM5 with a 0-100 psig range. These are installed for tag numbers 1282, 1310, 1311, 1312, 1313, 1314, 1315, 1591, 1466, 1555 (from rotary blower) and 1650.

All pressure switches are Model Ashcroft B4-24-b-XCH-X07 at 80 psig and 100 psig ratings. These are installed for tag numbers 1111, 1112, 1251, 1252 and 1641.

Manufacturer information on pressure gauges, switches are provided under Volume VIII – Attachment 8.1.

3.13 Electrical System Equipment

Following is a list of major electrical equipment and instrumentation used in the Wyckoff groundwater treatment system. Detailed procedures showing sequence of operations is provided in Volume XI of this O&M Manual.

3.13.1 Fire Alarm System

A Fire Alarm System with a phone dialer is installed inside the Treatment Building. Manual pull stations, heat detectors, smoke detectors, horns and strobes are provided as part of the system. The fire alarm is a Gamewell-FCI 7100 series multi processor based analog addressable system. In the event of a fire, the Fire Alarm System alerts the monitoring company who in turn will contact the fire department in dispatching fire fighters. All operations are performed from the fire alarm control panel where the fire alarm panel controls the fire suppression system. The matrix below provides the sequence of operations.

Manufacturer information on Fire Alarm System components, sequencing and operation drawings are provided in Attachment 10.1 of Volume X of the O&M Manual.

3.13.2 Fire Suppression System

A fire agent suppression system is installed inside the Treatment Building. The fire suppression system is a Fike SHP PRO series control system and is a conventional detectable system for use with clean agent extinguishing. The suppression system works with the building Fire Alarm System which starts the fire alarm signals and alerts the fire alarm monitoring company. The SHP PRO is designed for use with Fike Clean Agent Suppressant HFC-227 ea. The main controller contains all electronics required for a complete detection and control system suitable for most applications. The SHP PRO provides 10 Status LEDs (Air Conditioning Normal, Alarm, Pre-Discharge, Release, Supervisory, Trouble, Panel Silenced, Abort, Release Disabled, Ground Fault) for instant feed back. The system has been designed to comply with National Fire Protection Association (NFPA) standards.

Table 3-7 illustrates the sequence of operation is as follows:

1) Upon detection of 2% smoke by the photo/ion smoke detector, heating, ventilation and air conditioning (HVAC) equipment will be shut down.
2) This will signal the fire alarm system.
3) The fire alarm system will sound fire alarm evacuation signals.
4) This will in turn signal central station and dispatch fire fighters.
5) Also upon detection of 2% smoke from the smoke detector (Step 1), the 2nd alarm will be produced from the horn, strobes followed by a bell.
6) Also upon detection of 2% smoke, a 30 second count down to clean agent discharge will be initiated.
7) The panel will also request to operator whether to prevent discharge of clean agent.
8) If chosen by the operator to prevent discharge of fire agent, the abort switch will be pushed and held which in turn will bypass the HVAC interlock.
9) If the operator chooses to discharge clean agent, clean agent will be discharged and discharge strobes operate.

Manufacturer information on its components, sequencing and system operation drawings are provided in Attachment 10.2 of Volume X of the O&M Manual.

3.13.3 Power Distribution Panel Boards

Main distribution panel (MDP) and lighting panel (LP) boards provide electrical distribution services for the project. MDP components are connected directly through the Motor Control Center (MCC-1) in turn controlled by the Manual Transfer Switch (MTS-1). There are four MDP components including MDP-1, 2, 3 and 4. The MCC-1 is an Allen Bradley Model Series M capable of providing 480V service. LP components are interconnected and feed off the LP-1 Panel which in turn feeds from MCC-1 through the T-2 Transformer. There are four LP components including LP-1, LP-1A, LP-2 and LP-3. LP Models are provided by Seimens. Table 3-8 lists which equipment is fed by which panel. Manufacturer information on the panel boards can be found in Attachment 11.2 of Volume XI of the O&M Manual.

Table 3-7
Fire Alarm System Sequence of Operation

		CONTROL UNIT ANNUNCIATION								NOTIFICATION										SUPPLEMENTRY								
		ACTUATE COMMON ALARM SIGNAL	ACTUATE AUDIBLE	ACTUALTE COMMON SUPERVISORY SIGNAL INDICATOR	ACTUATE AUDIBLE SUPERVISORY	ACTUATE COMMON TROUBLE SIGNAL INDICATOR	ACTUATE AUDIBLE COMMON TROUBLE	ACTUATE ZONE ALARM INDICATOR	ACTUATE DACT TROUBLE SIGNAL	ACTUATE EVACUATION SIGNAL	DISPLAY/PRINT	ACTIVATE DACT	ACTUATE ALARM SIGNAL TO CONTROL PANEL	ACTUATE SUPERVISORY	ACTUATE TROUBLE SIGNAL TO CONTROL PANEL					ACTUATE	ACTUATE PANEL	ACTUATE DACT –						
SYSTEM INPUTS		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	
1	SMOKE DETECTOR	•	•					•	•	•	•									•	•	•						1
2	PULL STATIONS	•	•					•	•	•	•									•	•	•						2
3	LOOP OPEN/SHORT CIRCUIT					•	•		•		•									•	•							3
4	LOOP GROUND FAULT					•	•		•		•									•	•							4
5	LOOP FAILURE					•	•		•		•									•	•							5
6	NAC OPEN/SHORT CIRCUIT					•	•		•		•									•	•							6
7	NAC GROUND FAULT					•	•		•		•									•	•							7
8	NAC FAILURE					•	•		•		•									•	•							8
9	LOSS OF AC POWER					•	•		•		•									•	•	•						9
10	LOSS OF AC POWER (>8 HR)					•	•		•		•									•	•	•						10
11	BATTERY CHARGER/FAILURE					•	•		•		•									•	•	•						11
12	LOW BATTERY					•	•		•		•									•	•	•						12
13	HEAT DETECTOR	•	•					•	•	•	•																	13
14	FIRE SUPPRESSSION CONTROL PANEL ALARM	•	•					•	•	•	•																	14
15	TROUBLE CONDITION														•													15
16	SUPERVISORY CONDITION													•														16
17	ALARM CONDITION												•															17
18																												18
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	

Table 3-8
Panel to Equipment Crosswalk

Panel ID	Equipment
MCC-1	MDP-1, 2 ,3 and 4, LP-1A and TVSS Backwash recycle pump 50P1461 Storm water recycle pump 50P1541 Backwash Pumps 50P1351 and 1352 Froth Pumps 50P1251 and 1252
MDP-1	Plant water pumps 50P1581 and 1582
MDP-3	DAF Feed Pumps 50P1101 and 1102 Filter Feed Pumps 50P1241 and 1242 DAF Control Panel 50LCP1121 HDBF Unit 50M1260 Decant Pumps 50P1391 and 1392 Sump Pumps control panel 40LCP1500 Rotary Blower control panel 50LCP1551 Air Compressors 50M1651 and 1652
LP-1	Process Rooms Electrical Room Air receiver solenoid valve Exterior Lights
LP-1A	Phone Dialer Tank Mixers 40M1431/1432 and 50M1460 Level transmitters Hot water recirculation Pump LP-3 Main LP-1 Air Dryer Exhaust fans in process room Flow meters Turbidimeter Connex Boxes Water Heater WH-1
LP-2	Process Control panel 50CP1001 Fire alarm control panel Control room UPS by-pass switch
LP-3	Decon pad lights and receptacles Air conditioner ACU-1 Composite sampler 50M1335 Polymer System 50CP1601 Water Heater WH-2 Heater UH-5 Exhaust Fan EF-3 Locker and control room lights

3.13.4 Local Control Stations

Local Control Stations (LCS) are installed on pumps that do not have AFDs. Froth pumps, backwash pumps, backwash recycle pump and storm water recycle pump all have the LCS. These stations when placed in "REM" position, the pumps can be started and stopped from the HMI. Also these stations have local START/STOP buttons to operate the pumps. LCS are designated 50LCS1251/1252, 50LCS1351/1352, 50LCS1461 and 50LCS1541, respectively. These LCSs are connected to the MCC-1. In addition, the tank mixers for the Filter Press Feed Tanks (40LCS1431/1432) and the Filtrate Tank (50LCS1480) have the local controls. These LCS's are connected to Panel Board LP-1A. Manufacturer information along with wiring diagrams on the LCS components are in Attachment 11.3 of Volume XI of the O&M Manual.

3.14 Support Systems

The support system includes other equipment and devices that indirectly support the Wyckoff GWTP, but are not an integral part of the process (e.g., exhaust fans, building heaters, air conditioner, etc.). HVAC systems like the exhaust fans, louvers, air conditioner, wall heaters, UPS and safety shower units were provided under Volume XII. Locations of the devices shown under this section are shown in Sheets 69, 71, 72 and 73 in Appendix C "Applicable Project Drawings" in Volume I.

3.14.1 Electric Room Ventilation Fan

The Treatment Building's electric room is equipped with a ventilation fan (SF-1), motorized louver and dampers with operators (MD-5, 6, 7 and 8), and a thermostat. When the temperature exceeds the thermostat set point, a switch will automatically open the motor-activated louvers and start the fan motor to circulate air through the building. SF-1 is a Cook 195SQN-B which delivers 2,800 cubic ft per minute (cfm) of room air. The fan includes a belt drive with a 1 HP, 460 volt, 60 hertz, 3 phase, and Totally Enclosed Fan-Cooled (TEFC) motor. The intake louvers are Ruskin, Model ELF375DX, variable size (18 inches by 30 inches high and 36 inches by 36 inches high) and are controlled by Belimo Models AF-120 and NF-120, 120 volt, single phase, 60 hertz actuator motors. Manufacturer's information is included in Attachments 12.1 and 12.2 of Volume XII of the O&M Manual.

3.14.2 Process Mechanical Room Ventilation Fans

The Treatment Building process mechanical room is equipped with two ventilation fans (EF-1 and EF-2), motorized louvers and dampers with operators (MD-1, 2, 3 and 4), and a thermostat. When the temperature exceeds the thermostats set point, a switch will automatically open the motor-activated louvers and start the fan motor to circulate air through the building. Fan EF-1 is tied to dampers MD-1 and MD-3 and Fan EF-2 is tied to dampers MD-2 and MD-4. The ventilation units feed off panel LP-1A.

The fans (EF-1 and EF-2) are a Cook 24XMW which deliver 2,400 cfm. Each fan includes a belt drive and a 0.5 HP, 115 volt, 60 hertz, 3 phase, and TEFC motor. The intake louvers are Ruskin, Models ACL845 and ELF375DX (see manufacturer information) and are operated by Belimo Models AF-120 and NF-120, 120 volt, single phase, 60 hertz actuator motors. Manufacturer's information is included in Attachments 12.1 and 12.2 of Volume XII of the O&M Manual.

3.14.3 Locker, Shower, Restroom Ventilation Fan

The locker/shower/restroom is equipped with a cabinet fan (EF-3). Exhaust fan EF-3 will start automatically when the lights are turned on in the locker or rest room.

EF-3 is a Cook GN-320 which delivers 150 cfm. Manufacturer's information is included in Volume XII, Attachment 12.1 of the O&M Manual.

3.14.4 Air Conditioner

The Treatment Building's Control Room 102 is heated and cooled by a Friedrich, Model ES12L33 wall-mounted air conditioner (ACU-1). The air conditioner is located on the north side of the building. The unit feeds off panel LP-3. Manufacturer's information is included in Volume XII, Attachment 12.3 of the O&M Manual.

3.14.5 Safety Shower Systems and Thermostatic Mixing Valves

The plant is equipped with combination shower and eye/face wash features. Two systems, one SSH-1 located in treatment building and second SSH-2 located in tank farm. Water for the systems is fed by W1 potable water from the City.

SSH-1 is a Haws Model 8346 which features a 10 inch acrylonitrile butadiene styrene (ABS) plastic showerhead and a stainless steel receptor with twin ABS plastic. The unit also comes with a tempered water blending system Model TWBS.SH (thermostatic mixing valves) to mix hot and cold water and provide tempered water up to 40 gpm for emergency shower and eyewashes. Manufacturer information is provided under Volume IX, Attachment 9.4.

SSH-2 is a Haws Model 8300FP freeze-proof combination which features a 10.62 inch ABS plastic showerhead and a stainless steel receptor with twin ABS plastic. The model is supplied with two self-draining valves that are installed below the frost line that prevents the supply water from freezing. The unit also comes with a tempered water blending system Model TWBS.SH to mix hot and cold water and provide tempered water up to 40 gpm for emergency shower and eyewashes. Manufacturer information is provided under Volume IX - Attachment 9.4.

3.14.6 Electric Wall Heaters

The Treatment Building has two wall-mounted electric heaters (WH-1 and WH-2): one located in Locker Room 103 and another located in Restroom 105. The wall heaters are QMARK, Model CWH3404, 4 kW and 2 kW capacities, and each delivers an air flow of 100 cfm. The units feed off panel MDP-3 and LP-3. Manufacturer's information is included in Volume XII, Attachment 12.4 of the O&M Manual.

3.14.7 Gasoline Engine Generator

A portable 20 HP Honda Model EB11000 standby generator with 24 AH/5 hours lead acid batteries are installed at the Wyckoff GWTP that will provide capacity for the lighting loads and limited non-process loads such as fire alarm, 120 VAC convenience outlets, and limited HVAC located within the building if a power failure occurs. The existing power system has a manual transfer switch just downstream of the main service meter that enables the entire plant to be connected to this mobile generator at 480 volts. The unit is connected to the Manual Transfer Switch (MTS-2) through an inlet box (120/240V, 50A). This generator will be able to run for approximately 8 hours using its integral fuel tank. Upon a normal (utility) power failure, the Wyckoff GWTP will shut down.

The small generator will be rolled outdoors from storage, plugged into an electrical receptacle, and started manually. The Manual Transfer Switch will allow switching lighting and other backed-up loads between utility and generator power. These loads will all be fed from a 120/240 V 1-phase panel board fed through the Manual Transfer Switch. A detailed, step-by-step procedures showing how to connect and operate the generator is provided below:

1) Move generator and cord set from mechanical room to south east corner of building.
2) Plug-in cord to generator and generator inlet on side of building.
3) Assure that main breaker on generator is in "off" position.
4) Start generator.
5) Allow generator to warm-up.
6) Turn generator breaker to the "on" position.
7) In LP-3, turn off all breakers EXCEPT circuits 6, 8, 9, 12, 18, 22 and 38.
8) Inside mechanical room, realign transfer switch on MTS 2 from utility position to generator position.
9) In LP-3, close desired breakers (one at a time) to add load to generator.
10) Monitor fuel level. NOTE: one tank of fuel in generator is adequate for approximately 4 hours of operation.

Upon return of normal power, the panel board and its loads will be manually transferred back to normal power. The generator will be manually shut down and rolled back into storage. The plant will be manually restarted after utility power returns.

Manufacturer information on the generator can be found in Attachment 12.5 of Volume XII of the O&M Manual.

3.14.8 Transient Voltage Surge Suppressor

The Transient Voltage Surge Suppressor (TVSS) for the Treatment Building is a Service Track ST240 Model TK-ST240-3Y-480-L from Total Protection Solutions. The TVSS is located next to the MCC bus in the electrical room to reduce random, high energy, short duration electrical power anomalies. The TVSS is connected directly with the MCC-1. Manufacturer information on the TVSS can be found in Volume XII (Attachment 12.6) of the O&M Manual.

3.14.9 Uninterrupted Power Supply

The Powerware 9170 + Uninterrupted Power Supply (UPS) located in the treatment building is a 10 KVA, 120V, single phase modular UPS that contains battery modules and power modules. These modules plug into a rack cabinet structure containing additional control, communication and display functions that enable integrated control of all power modules. The UPS is housed in a single cabinet, with extra battery capacity housed in auxiliary battery cabinets.

The UPS is designed to provide years of trouble free operation. Its internal control system checks the batteries and inverter periodically to ensure reliable operation. Maintenance of the UPS includes the following items

- Check operating environment for clean, cool, dry conditions.
- Inspect and clean the unit.
- Check operation of fans.
- Check and tighten all connections.
- View and record the alarm and inverter logs.
- Check the batteries.
- Check the displayed UPS readings against actual measurements and recalibrate if necessary.
- Perform a system test.
- Check and record the values if the parameters in the system status menu 1 online and on battery.
- Check the metal oxide varistor (MOV) surge suppression pack.

Manufacturer information on the UPS is provided under Volume XII Attachment 12.7.

4.0 TREATMENT PLANT STARTUP AND SHUTDOWN PROCEDURES

This Section of the O&M Manual includes the following procedures for startup and shut down of the Wyckoff GWTP:

1) Overall Treatment Plant Startup and Shut down Procedures under Sections 4.1 and 4.2 respectively – This is performed typically after a short term shut down of the plant (less than a day)
2) Treatment Plant Pre-Startup Requirements – Section 4.3
3) Compressed Air and Plant Water Systems shut down – Section 4.4 – Performed only if there is extended shut down period and/or maintenance of these systems
4) Treatment Plant Startup, Normal Operations and Shut down Procedures – Sections 4.5 to 4.11. These are normal operating procedures for startup and shutdown
5) Plant startup and shutdown procedure before and after a weekend and winter freeze protection shutdown – Sections 4.12 and 4.13 respectively.

CAUTION: Equipment warning and safety information presented under Sections 5.13 and 5.14 need to be adhered to prior to startup and shutdown of the treatment system.

4.1 Overall Wyckoff Treatment Plant Startup

The procedure presented below is for a quick plant startup (not for extended startup).

1) Prior to performing any startup activities, ensure that all valves are positioned in accordance with the following tables:
   - EQ Tank, DAF, Polymer and Effluent System – Table 4-1;
   - HDBF Unit - Table 4-2;
   - HDBF Backwash Operation – Table 4-3;
   - GAC systems – Tables 4-4 a thru e;
   - Plant Effluent system Table 4-6; and
   - Valves for the side stream operations – Tables 4-7 to 4-9.

2) Ensure all the pre-startup requirements mentioned in Section 4.3 are met. The sequence of startup activities is as follows:

3) Open EQ tank valve (PLI-01):
   - From control screen pneumatic valve DI-01 will need to be opened.
   - Start Extraction Wells if not already running. EQ tank will reach pre-determined level - 12 ft.

4) Start DAF and Air Saturation System:
   - Turn on skimmer from the local DAF control panel, set speed to 50%.
   - Turn on mixer from the local DAF control panel.
   - Turn on the auger from the HMI

- (Ensure that skimmer, auger and mixer are running smoothly, check for un-usual noises or vibration).
- (Ensure valves DI-02 and DI-04 for DAF feed pump 50P1101; and DI-05 and DI-07 DAF feed pump 50P1102 are open. (These valves should be open according to the tables referenced above). Ensure the seal water (non-potable) for the mechanical seals for the pumps are on).
- Ensure that W2 water valve W2-11 is open. Make sure that the water in the DAF has reached the top of the flat weir and is overflowing into the DAF effluent chamber.
- Turn on Air Inlet valve AHP-09 to14. Confirm that air pressure at regulator is 120 psig.
- Turn on recirculation pump 50P1135, pump from the HMI.
- Start DAF feed pumps (50P1101 or 50P1102). Pumps are started and placed into "AUTO" from HMI.
- Ensure that switch on local control of Polymer system is in the "AUTO" position.
- Turn on polymer system from the local control panel 50LCP1601.
- Ensure that filter feed pump valves are open, DE-02 and DE-04 for 50P1241, and DE-05 and DE-07 for 50P1242 (Redundant as these valves should be open according to the tables referenced above). Ensure the seal water (non-potable) for the mechanical seals for the pumps are on.

5) Start HDBF filter
   - Ensure that all manual valves associated with HDBF unit are open.
   - Ensure the seal water (non-potable) for the mechanical seals for the backwash pumps are on.
   - Ensure that backwash pumps have been throttled to 80 gpm and are in the "REM" position on the HMI and backwash pump valves are open accordingly.
   - Depress Start/Alarm reset button on local control panel of filter or from HMI.
   - Start filter feed pumps in "AUTO" from control computer. (50P1241 or 50P1242).

6) GAC Startup
   - Ensure that GAC adsorbers are valved in order to have plant flow enter the lead adsorber (determined by operator) and flow through the middle and lag adsorbers.

7) Effluent Tank Startup
   - Ensure that effluent tank inlet valve (PLE-09) and tank effluent valve (PLE-11 and 12) are open. Valve PLE-10 should be closed.
   - Ensure the composite sampler is operational

8) Start Froth pumps (50P1251 or 1252) and froth tank decant pumps (50P1391 or 50P1392) from HMI.

9) Monitor plant operations.

4.2 Overall Wyckoff Treatment Plant Shutdown

The procedure presented below is for a quick plant shutdown (not for extended shutdown).

The sequences of events for plant shutdown are as follows:

1) Shut down EWs manually.
2) Shut down DAF feed pumps from HMI.
3) Shut down polymer feed to the DAF system from its local control panel.
4) Shut down filter feed pumps from HMI.
5) Shut down HDBF system from HMI (perform manual backwash from local control or HMI).
6) Shut down DAF unit from the local control panel after approximately 30 minutes of operation to ensure all froth is removed from the unit.
7) Shut down decant pumps from HMI.

For long term shut downs, ensure the drains on both process lines and non-potable water lines are open and drained to the sump. Also refer to the Winter Freeze Protection Shutdown Procedures in Section 4.13.

4.3 Treatment Plant Pre-Startup Requirements

Prior to Plant Startup, pre-startup procedures must be followed. These include compressed air systems, plant water systems and GAC valve positioning.

4.3.1 Compressed Air Systems Startup Procedures

Start-up procedures for the compressed air systems are as follows:

1) Inspect and check compressors in accordance with the manufacturers' manuals prior to start up (e.g., check oil). Refer to Section 5.6.4; and
2) Verify that valves AHP-02, AHP-04, AHP-05, AHP-06, AHP-20 and AI-01 are open. AHP-20 is located on the west wall of the treatment building near GAC-5.

CAUTION: Do not start the compressors until the valves mentioned above are open.

3) Verify that valve AHP-19 (located inside building by louver/filter press on the southwest wall) is closed. This feeds valves AHP-15, AHP-16 and AHP-17 that are not required for normal plant operation of the Air Diaphragm Pumps in the tank farm for oil and solids processing system. AHP-19 should be opened for transfer of solids (Figure 3-11) and NAPL (Figure 3-4).
4) Ensure that the compressor disconnect switches are in the "ON" position.

5) Verify that the inlet and outlet valves associated with the Air Dryer are open and the bypass valve is closed.
6) Turn the Air Dryer on by pressing “ON/OFF” button.
7) The compressors will be placed in “AUTO” by a switch located in their panels.
8) Verify that instrument air for operation of the pneumatic valves is set at 62 psi (regulator located in the south wall by the Decant Pumps).
9) Verify that air pressures are correct by monitoring Pressure Gauge 1651 (Air Compressor 50M1651) and Pressure Gauge 1652 (Air Compressor 50M1652).
10) The AHP from the compressor goes to Air Receiver Tank 50T1465, which supplies AHP to process system.
11) Verify AHP air pressure (120 psi) at the HMI through Pressure Transmitter PI/PT-1466.
12) The AI will be online when valve AI-01 is open - verify system pressure at PI/PT-1650.
13) Verify that AI-04 (located by south wall near the Decant Pumps) is open for the operation of the 3 pneumatic valves (DI-01, BWR-02 and STW-09) in the Tank Farm.

4.3.2 Plant Water Systems Startup Procedures

CAUTION: The plant water pumps cannot be started prior to suction and discharge valves associated with it are open. In this case W2-01, 02, 05, 06, 09, 10 and 11.

The following sequence of activities will be followed for plant water system startup:

1) Verify that the local disconnects and breakers for both Plant Water Pumps (50P1581/1582) are in the “ON” positions.
2) Verify that valve W2-01 (located outside by the Plant Water Storage Tank) is open.
3) Verify that valves W2-02, W2-05, W2-06 and W2-09 (all located by the Water Pumps) are open.
4) Open valves W2-11 and W2-12 and close W2-13 (located by the Polymer System).
5) Place Water Pump #1 or #2 in “AUTO” position.
6) Open valve W2-10 to Plant Water Pressure Tank (50T1575).
7) Plant water is pumped by the Plant Water Pumps into the plant water system and into the Plant Water Pressure Tank (50T1575).
8) Pressure switch controls the pumps at the following settings: 50 pounds psi – pump on; 65 psi – pump off.
9) The PLC monitors the system for water pressure from pressure gauge (PI/PE/PT-1591).
10) At this point, plant water is available for distribution for process operations.

4.3.3 Granular Activated Carbon Adsorber Valve Positioning

Reference Figures – Figures 3-8 and 3-10

1) Verify that valve PLE-10 (Figure 3-10) is closed. This valve is located by the Effluent Tank in the Tank Farm.
2) Open valve PLE-09 (Figure 3-10). This valve is located near the Storm water/Recycle Pump (50P1541) by the south wall of the treatment building.
3) Verify whether the GAC adsorbers are filled to the top with water.
4) Set valve open and close positions for normal operations depending upon which adsorbers are in lead, middle and lag configuration (Refer to Tables 4-4 a to e).

4.4 Compressed Air Systems and Plant Water Systems Shutdown Procedures

Compressed air system and plant water system shut downs are performed only when the plant is shut down for extended period and/or maintenance performed these systems.

4.4.1 Compressed Air Systems Shutdown Procedures

Shut down is performed only if the entire plant is shut down. The following sequence of activities will be followed for compressed air systems shutdown:

1) The air compressor is shut down by placing the knob in “OFF/RESET” position.
2) Verify the pressure reads zero on pressure transmitter PI/PT-1650.
3) Turn off Air dryer by pressing the “ON/OFF” button for 3-4 seconds.
4) The valves can be left open as is from the startup.
5) Turn the disconnect switches off for the air compressors.

4.4.2 Plant Water Systems Shutdown Procedures

CAUTION: The plant water pumps must be shut down prior to suction and discharge valves associated with it are closed. In this case W2-01, W2-02, W2-05, W2-06, W2-09, W2-10, and W2-11.

The following sequence of activities will be followed for plant water system shutdown:

1) Shut down the plant water pumps locally by placing the knob in the “OFF” position depending on which pump is in operation.
2) The valves can be left open as is from the start up procedure.

4.5 Extraction Wells, Equalization Tank, and Dissolved Air Flotation Startup and Shutdown Procedures

The following sections describe the startup and shutdown procedures for the EWs, EQ Tank and the DAF system.

4.5.1 Startup and Shutdown Procedures for the Equalization Tank

Refer to valve open/close positions mentioned under Table 4-1. Reference Figures 3-4 and 3-15.

4.5.1.1 Equalization Tank Normal Operations Startup Procedure

1) Open valve PLI-01 located at EQ Tank 40T1010.
2) Open pilot study valves for operation of the wells from the well field.
3) Open valve STW-13 (located at the EQ tank).
4) Verify valve PLI-00 is open directing contaminated water to the EQ tank.
5) Start EWs manually.

Under normal conditions the tank level is maintained at half full (12 ft) by the DAF feed pumps which are controlled by a AFD and ultrasonic level detector 1011 that is inside of the EQ tank. The DNAPL will settle to the bottom of the tank and the LNAPL will float to the top. Under normal conditions pneumatic valve DI-01 (to DAF feed pumps) will be open; and valves NAPL-01 and NAPL-02 will be closed.

4.5.1.2 Shut down for Equalization Tank

The following sequence of activities will be followed for EQ Tank shutdown:

1) Shut off the EW wells.
2) Close valve PLI-01.

4.5.2 Dissolved Air Flotation Pre-Startup Procedure

DAF initial Pre-startup and initial start-up activities were performed during GWTP commissioning to determine the polymer dosage for the DAF system. Refer to startup plan and test logs for details. It may be necessary to perform them after extended plant shut down time and any drastic changes observed in water influent characteristics

The following pre-startup steps must be performed and checked prior to DAF System startup:

1) Set up the plant air and water systems in accordance with Sections 4.3.1 and 4.3.2. This includes water for the polymer solution and air for the DAF System operation. The pressure for the plant air system should be set between 110 and 125 psig. Set the pressure for the air filter/regulator (located between AHP-10 and AHP-11) at 110 psig. Valve AHP-10 and 11 are located by the DAF unit air saturation system.

2) Verify that the disconnect switches for the DAF Feed Pumps 50P1101 and 50P1102, and Filter Feed Pumps 50P1241 and 50P1242 are set to the "ON" position.
3) Ensure adequate water is provided to the mechanical seals of the DAF feed pumps and the filter feed pumps.
4) Confirm all the polymer system components are setup and working properly. This includes filling in the polymer blend tank by mixing the neat polymer with W2 water and polymer feed pump ready to feed polymer into the DAF influent line. See Section 4.5.3 for Polymer system Startup procedures.

4.5.3 Polymer System Startup

Reference Figure 3-6

The polymer system is turned on after turning on both the DAF feed pump and the recirculation pump (Step #16 of Section 4.5.4). The polymer system is designed to make a batch of dilute polymer mixture which is fed to the DAF influent. The polymer system automatically prepares batches of dilute polymer at a concentration of 0.16%. Batches of dilute polymer are automatically prepared using W2 water and neat polymer and mixed using polymer mixer 50M1601 and sent to a polymer blend tank 40T1620. This is fed to the DAF influent line at a rate of 94 milliliters per minute (ml/min) using the polymer feed pump 50P1640. At a DAF feed flow rate of 41 gpm, the polymer dosage will be at 0.96 ppm. If the DAF feed flow rate changes the polymer flow rate will be adjusted automatically the PLC logic.

Following is the startup procedure for the polymer system:

1) Ensure W2 water is available and ready to be used by verifying valves W2-11 and 12 as open.
2) Verify Ball Valves (PO-01 and PO-02) are closed.
3) Open Ball Valves (PO-03, PO-04, and PO-05) associated with the polymer solution and polymer feed pump 50P1640.
4) Liquid raw polymer is sent through a metering pump into a mixing unit where W2 water enters and the mixture is mixed with mixer 50M1601.
5) Water pressure from W2 flow will send the mixed contents to the mixed polymer storage tank 40T1620.
6) Level in the tank 40T1620 is maintained with a level sensor 1631.
7) Contents from the tank 40T1620 are pumped by a LMI metering pump 50P1640 into the DAF unit. The stroke and speed of the pump are controlled locally by the pump and the PLC respectively.
8) The metering pump is controlled by the PLC and is placed in external operations mode. A switch on the polymer control panel 50LCP1601 allows the operator to place the system in "AUTO" mode (See Step 16 under Section 4.5.4).

4.5.4 Dissolved Air Flotation System Normal Operations Startup Procedure

Refer to valve open/close positions specified in Table 4-1 along with Startup activities.

Reference Figures – 3-4, 3-5, 3-6 and 3-7

Polymer dosage and performance tests were performed during initial facility startup. The operator does not need to perform initial startup procedures every time the plant is shut down (for example during GAC backwash or HDBF backwash operations or routine maintenance operations).

NOTE: It is important that while starting up the DAF unit as described below, startup of the HDBF described in Section 4.5.1 will need to be performed concurrently.

CAUTION: The DAF feed pumps and filter feed pumps cannot be started until the suction and discharge valves associated with these pumps are open. In this case DI-01, 02, 04, 05, 07 and valves downstream DI-08, 09 and 10 for the DAF feed pumps and DE-01, 02, 04, 05, 07 and valves downstream DE-08 and FI-01 for the filter feed pumps.

1) Turn the auger on from the HMI. The skimmer speed should be at 50% of full speed. The mixer and skimmer are started from the local control panel.
2) The DAF recycle (DR) break out valve DR-03 should be at its correct set point set during startup.
3) Verify the inlet and outlet valves DR-01 and DR-02 are open associated with the DAF recirculation pump.
4) Verify that water is present in the effluent chamber of the DAF unit at half the level before starting the recirculation pump 50P1135.
5) Start Recirculation Pump from the HMI.
6) At this point, the Air Saturation Tank will fill with water.
7) The valve DR-V01 mounted on top of the Air Saturation Tank allows a small continuous flow of water and air to bleed off back to the DAF Unit.
8) Verify that the air pressure to valve DI-01 (located at the EQ Tank) is sufficient (62 psi) for proper operation.
9) Open pneumatic valve DI-01 from the HMI and open valves DI-02, DI-04, DI-05, DI-07, DI-08, DI-09 and DI-10.
10) Open valves DE-01, DE-02, DE-04, DE-05, DE-07, and DE-08, which are downstream of the DAF Unit.
11) Open valve FRI-01 (froth) and close valve FRI-02 (sludge) at the DAF Unit.
12) Ensure adequate W2 water is provided to the mechanical seals of the DAF Feed Pumps and the Filter Feed Pumps.

13) Before proceeding to steps below, complete HDBF startup procedure steps 1 to 12 from Section 4.6.1.
14) Place DAF Feed Pump AFDs in “AUTO”. Set the EQ Tank PID level controller in “AUTO” at the HMI. Select DAF Feed Pump 50P1101 from the HMI by clicking “START”.
15) Place Filter Feed Pump AFDs in “AUTO”. Set the DAF Unit PID level controller in “AUTO” at the HMI. Select Filter Feed Pump 50P1241 from the HMI by clicking “START”.
16) Start the Polymer System by placing in “AUTO” at the local control panel.
17) Transition to Section 4.6.1 for HDBF startup procedure step # 13 so that effluent water from DAF unit enters the HDBF system.

4.5.5 Dissolved Air flotation and Polymer System Shutdown Procedures

The following sequence of activities will be followed for DAF and Polymer systems shutdown:

1) The polymer system should be shut down by placing the polymer control panel switch in “OFF” position and turning off the metering pump.

CAUTION: The DAF feed pumps and filter feed pumps must be shut down prior to suction and discharge valves associated with these pumps are closed. In this case DI-01, DI-02, DI-04, DI-05, DI-07 and valves downstream DI-08, DI-09, and DI-10 for the DAF feed pumps and DE-01, DE-02, DE-04, DE-05, DE-07 and valves downstream DE-08 and FI-01 for the filter feed pumps.

2) Shut off the feed to the DAF Unit from the HMI by selecting the screen from the HMI and press the “STOP” button. Pressure switches located at the pumps have an automatic safety shut off at 30 psi.
3) Select the filter feed pump screen from the HMI and press the stop button.
4) The auger, skimmer and flocculator(mixer) are stopped from the local DAF control panel after approximately 30 minutes of DAF feed pumps and filter feed pumps shutdown.
5) Shut off the seal water to the DAF feed and filter feed pumps.
6) Shut off air flow to the pressurization tank (air saturation tank) by closing the air inlet valves (AHP-12 to 14) and allow the pressurization tank air pressure gauge 1138 to read zero before turning off the recirculation pump. (Note - The pressurization tank carries a large volume of compressed air during operation. If the recycle stream is shut down before the air volume is bled off, the air will evacuate the Pressurization Tank and enter the DAF Tank. This large release of air can cause surface turbulence inside the flotation area of the DAF Tank).
7) Shut off the recirculation pump at the HMI by operator selecting the recirculation pump screen and pressing the “STOP” button.
8) Close pneumatic valve DI-01 from HMI.

4.6 Hydromation Deep Bed Filter Startup and Shutdown Procedures

Verify that the valve positions listed in Tables 4-2 and 4-3 are in met for normal and backwash operations of the HDBF unit. Reference Figure 3-8.

4.6.1 Hydromation Deep Bed Filter Normal Operations Startup Procedures

The following sequence of activities will be followed HDBF startup:

1) Verify that Backwash Pump disconnects are in “ON” position.
2) Ensure adequate water is provided to the mechanical seals of the Backwash Pumps.
3) Verify air is available at 85 psi to operate the pneumatic valves of the HDBF unit (Part of the pre-startup air system requirements). This can also be verified by checking air regulator pressure gauge at the HDBF instrument panel.
4) All valve open/close positions associated with HDBF operations are automatic. Refer to Figure 3-8 for the different cycles.
5) Verify that plug valves V-111, V-112, V-113, V-114 and V-115 for the HDBF unit are open.
6) Verify that valve FI/BYP-02 is closed.
7) Turn the disconnect switch of the HDBF unit to “ON” position.
8) Verify that valve BWE/FFS-01 is closed to ensure backwash effluent from filter system enters the Dirty Backwash Tank.
9) Verify that valves BWS-04 and BWS-07 associated with Backwash Pumps 50P1351 and 50P1352 are set in a partially closed position (position determined during plant initial startup). Flow rate of the backwash supply water must be 80 gpm, as read at FE/FIT-1371 (Backwash Pumps set to remote at LCS).
10) Close valves BWS/FFE-01 and BWS-08 (located by GAC-1).
11) Open valve FI-01.
12) Close valve FI/RCY-01.
13) On the HDBF System control panel, turn on power and press the “Master Reset” button. The start feature can also be initiated from the HMI.

Note – Steps 11, 12 and 13 will be performed concurrently along with Steps #14, 15 and 16 of Section 4.5.4.

14) HDBF now should be operational in filtration mode and it will automatically cycle to backwash mode. Filtration cycle is set at 12 hours and is operator adjustable.
15) When the HDBF is ready for backwash, the system will send a signal to the HMI which will automatically start the backwash pump based upon either a high differential pressure of 20 psid recorded at DPIT-1281 or a filtration cycle of 12 hours – whichever occurs first.

16) After backwash cycle is complete (15 minutes), the system will return to filtration mode.

4.6.2 Hydromation Deep Bed Filter Shutdown Procedures

The following sequence of activities will be followed for HDBF shutdown:

1) The filter has to be backwashed prior to shutdown. Follow the steps above for backwash – There are two options
   a) The system is programmed to perform backwash prior to initiating shutdown through the HMI.
   b) Or the system can be backwashed manually from the local panel or from HMI and then shutdown
2) Push the stop button from the local control panel if manual backwashing is performed or from HMI.

4.7 Granular Activated Carbon System Startup, Shutdown and Backwash Procedures

Valve reference tables for each GAC adsorber series configuration is provided under Tables 4-4 a to e. Tables 4-5 a to e is for backwash operation of all five GACs. Wherever the "#" associated with a GAC ID is mentioned in this section it refers to GAC units GAC-1 through GAC-5. Reference Figures 3-8, 3-9 and 3-10.

4.7.1 Granular Activated Carbon Normal Operations Startup Procedures

Depending upon which adsorbers are in lead, middle and lag configuration (Refer to Tables 4-4 a to e), the following sequence of activities will be performed.

1) Water should be flowing from the HDBF unit.
2) Verify that valve PLE-09 (located by south wall near Stormwater/Recycle Pump) is open to ensure storage of treated water in the Effluent Tank (40T1330) – This will branch to the Effluent Tank Unit Process described next.
3) Monitor pressures on Pressure Gauges 1310 to 1315.
4) Verify flow to the Effluent Tank by checking flow registered on FE/FIT-1321.

4.7.2 Short Term Shutdown of Granular Activated Carbon Adsorber Procedures

A short-term shutdown is most likely to occur during weekend shutdown or routine maintenance of the system. During a short-term shutdown, the adsorbers may remain filled with water unless work is being performed on the adsorbers themselves.

During this period, the entire plant will be shut down which means shut down of DAF feed pumps and the filter feed pumps. It may be necessary to close the inlet and outlet (GAC#I-01 and GAC#E-01) to prevent any siphoning or drainage from the adsorbers where # refers 1 to 5.

4.7.3 Long Term Shutdown of Granular Activated Carbon Adsorber Procedures

A long-term shutdown is most likely to occur during spent carbon change-out, changes in the system configuration, major maintenance, etc. During a long-term shutdown, the adsorbers should be completely drained to minimize potential for biological growth and septic bed condition. The adsorbers will have to be backwashed and air eliminated before they are re-started. During this period the entire plant will be shut down. The long term shutdown is any period of time greater than 3 days depending upon operation status of the other process equipment.

The step-by-step, sequential procedures for long-term shutdown are provided as following:

1) The adsorbers are drained of excess water by “blowing down” the adsorbers, with compressed air, into the drain line. Care must be taken to prevent high pressure situations that could cause failure of the pressure relief device (rupture disk).
2) Open valve CAV-01 to 05 on the compressed air supply line while making sure the adsorber drain valve GAC1-D01 to GAC5-D01 (DV-01 to 05 of Tigg Manual) are open.
3) It may be required to push treated water out the process valve GAC#E-01 prior to opening valves GAC1D-01 to GAC5-D05 depending on the required results.

4.7.4 Backwashing of Granular Activated Carbon Adsorber Procedures

The following sequence of activities is used during a routine backwashing process:

1) Shut down the plant by turning off DAF feed pumps, filter feed pumps, DAF unit and HDBF unit from HMI.
2) Verify valve BWS-01 is open.
3) Verify valves BWS-02, 04, 05 and 07 associated with both backwash pumps 50P1351/1352 are completely open.
4) Verify backwash pumps disconnects are in “ON” position.
5) Ensure adequate water is provided to the mechanical seals of the backwash pumps.
6) Note level reading in the effluent tank 40T1330. Ensure that effluent tank is at least half full (11 ft) to ensure backwash process can be completed.
7) Follow valve positioning tables for backwash identified in Tables 4-5 a to e for GACs 1 to 5 depending upon which adsorber is backwashed. To isolate the adsorber, close the treated water respective effluent valves and the influent valves for GAC units [GAC1-E01 and FE-01 for GAC-1; GAC2-E02 and FE-03 for GAC-2; GAC3-E01 and FE-05 for GAC-3; GAC4-E01 and GAC4-I01 for GAC-4; and GAC5-E01/02 and GAC5-I01 for GAC-5]. Open the backwash discharge valve for the adsorber to be backwashed, valve BWE/FFS-#. Open the backwash supply valve for the adsorber to be backwashed using valve BWS/FFE-#.
8) Verify valve BWS-08 is closed.
9) Place 50LCS1351 and 50LCS1352 in “REM” position.
10) Turn the backwash pumps 50P1351 and 50P1352 on from HMI by selecting run time of 15 minutes.

11) One of the valves BWS-04 and 07 will need to be wide open and the other valve will need to be adjusted so that the total flow registered at FE/FIT-1371 reads 600 gpm after starting the backwash pumps.
12) Backwash effluent flows into the dirty backwash tank. The operator needs to monitor dirty backwash tank level and flow from the carbon adsorber.
13) Once backwash is complete, the backwash pumps will automatically shut down based upon the run time selected at the HMI.
14) Close the backwash supply valve BWS/FFE-01 and the corresponding BWS/FFE-#, and close the backwash discharge valve BWE/FFS-01.
15) The operator will follow valve open/close position (Tables 4-4) for normal GAC operations.

4.8 Effluent System Startup and Shutdown Procedures

Refer to valve configuration listed in Table 4-6 for startup.
Reference Figure – Figure 3-10

4.8.1 Effluent System Normal Operations Startup Procedures

The following sequence of activities is to be used during the effluent system startup process:

1) Verify that valve PLE-10 (located by effluent tank) is closed.
2) Open valve PLE-11 for discharge of treated effluent from EQ tank to Eagle Harbor Outfall.
3) Verify that the automatic composite sampler is in place. Relocation, installation, and calibration of the composite sampler was conducted under **Pre-Startup of the Plant**.
4) Verify that valve PLE-12 is in the open position.
5) Start composite sampler by turning the unit on.
6) Verify discharge flow to Eagle Harbor Outfall by observing constant level in the Effluent Tank and no flow from the overflow vent.

4.8.2 Effluent System Shutdown Procedures

The following sequence of activities is to be used during the effluent system shutdown process:

1) Verify no flow registered on flow meter 1321.
2) Shut down composite sampler.

4.9 Solids Processing and Filter Press System Startup and Shutdown Procedures

General – Open valve AHP-19 (located inside the building by South wall near the plant water pumps) that feeds valves AHP-16 and 17 to operate the digester/ skim pump and filter press/digester feed pump.

Reference Figure – 3-11 and Table 4-7

4.9.1 Startup Procedure for Supernatant from Dirty Backwash Tank

CAUTION: The backwash recycle pump cannot be started prior to suction and discharge valves associated with it are open. The backwash recycle pump must be shut down prior to suction and discharge valves associated with it are closed. In this case BWR-01, 02, 03, 05 and 06.

1) Verify the availability of air for the operation of the valve BWR-02.
2) Close valve BWR-07.
3) Verify that the local disconnect for the Backwash Recycle Pump is in the “ON” position.
4) Verify that water supply is adequate for Backwash Recycle Pump mechanical seals.
5) Verify that the Backwash Recycle Pump local control station (50LCS1461) is in the “REM” position.
6) Check the water level in the Dirty Backwash Tank - water level should be at the top of the conical base.
7) Open valves BWR-03 and BWR-05 associated with Backwash Recycle Pump (50P1461). With valve BWR-06 open, the water will be sent to the EQ Tank. The operator has the option of sending the water to storm water recycle tank by opening the valve BWR-07 and closing BWR-06.
8) Open valve BWR-01.
9) Open Pneumatic Valve BWR-02 from the HMI.
10) Start Backwash Recycle Pump from HMI.
11) Observe the level in the Dirty Backwash Tank as monitored by LE/LIT1441.

4.9.2 Shutdown Procedure for Supernatant from Dirty Backwash Tank

1) The Low Level Switch will shut down the Backwash Recycle Pump, after the level reaches 1.5 ft, as read by the LE/LIT-1441 at the HMI.
2) Verify that valve BWR-02 is closed as shut down of the backwash recycle pump should automatically close the valve BWR-02.

4.9.3 Startup Procedure for Solids from Dirty Backwash Tank

1) Set the Filter Press/Digester Feed Pump 50P1460 for operation.
2) Connect the suction hose from the Filter Press/Digester Feed Pump to valve TS/SS-01 (camlock fitting attached) and connect the discharge hose from the Filter Press/Digester Feed Pump to valve DS-02 (camlock fitting attached).
3) Attach the air line (located in the Tank Farm) from AHP-16 to the air attachment on the Filter Press/Digester Feed Pump and set air pressure regulator to 50 psig.
4) Adjust the air pressure regulator to approximately 50 psi or operator based adjustment.
5) Open valves TS-01, TS-02, TS/SS-01, DS-01, and DS-02.
6) A mixture of solids and water is removed from the Dirty Backwash Tank conical base.

7) Transfer the contents (solids/liquid mixture) from bottom of the Dirty Backwash Tank to the Digester Tank.

4.9.4 Shutdown Procedure for Solids from Dirty Backwash Tank

1) Once transfer is accomplished, shut off the air feed to the Filter Press/Digester Feed Pump.
2) Close valves TS-01, TS-02, DS-01, and DS-02.
3) Disconnect hoses (if necessary)

4.9.5 Startup Procedure for Solids from Digester Tank

1) Open valves ALP-01, ALP-02, ALP-03, ALP-04, ALP-05, ALP-06, and ALP-07.
2) Place the Rotary Blower disconnect switch in the “ON” position.
3) Set the frequency of the Rotary Blower at 30 hertz (Hz).
4) The Rotary Blower is turned on through a local REMOTE/STOP switch manually by the operator with a AFD. Pressure monitors are installed in the lines to monitor air pressure.
5) The Rotary Blower AFD maintains the dissolved oxygen level by slowing the air volume to the Digester Tank.
6) Check the VSS (volatile suspended solids) reduction. When it reaches 30% reduction, set the Digester/Skim Pump 50P1120 for operation.
7) Verify that valves DS-01, DS-02, DS-03, and DS-04 are closed.
8) Open valves DS-05 and DS-06.
9) Connect the suction hose from the Digester/Skim Pump to valve DS-02 valve (camlock fitting attached) and connect the discharge hose from the Digester/Skim Pump to valve DS-03 (camlock fitting attached) to direct solids to Filter Press Feed Tank #1 (40T1431) via valve DS-05.
10) Perform Step #8 with DS-06 valve for solids feeding the Filter Press Feed Tank #2 (40T1432).
11) Attach the air line (located in Tank Farm) from AHP-17 to the air attachment on the Digester/Skim Pump.
12) Adjust the air pressure regulator to approximately 50 psi or operator based adjustment.
13) Open valves DS-01, DS-02, and DS-03.
14) Contents from the Digester Tank are transferred to the two Filter Press Feed Tanks.

4.9.6 Shutdown Procedure for Solids from Digester Tank

1) Once contents are transferred, shut off the air feed to the Digester/Skim Pump.
2) Close valves DS-01, DS-02, and DS-03.
3) Disconnect hoses (if necessary).

4.9.7 Startup and Shutdown Procedure for Solids Mixture from Filter Press Feed Tanks to Filter Press

Reference Figures 3-11 and 3-12

1) Turn the Hydraulic Control Valve to the "CLOSE" position. Turn the air on to the Hydraulic Pump by opening valve AI-02. The cylinder will push the filter plates forward.
2) After the press has closed, turn the Hydraulic Control Valve to the "CLAMP" position. Allow the hydraulic pressure to build to a maximum of 4,000 psi.
3) Open the filter center feed valve and the four filtrate discharge valves (these valves are associated with the Filter Press and are not shown in Figures 3-12 and 3-13).
4) Open valve F-01 to the Filtrate Tank (50T1480).
5) Place a 55-gallon drum under sludge hopper of the Filter Press.
6) Turn on Mixer #1 through the digester mixer local control station (40LCS1431) (by placing the switch to the "ON" position to mix contents in Filter Press Feed Tank #1 and condition the digester sludge to a pH of 11.0 with the addition of lime. Repeat this step for Mixer #2.
7) Connect a 2-inch suction hose from Filter Press Feed Tank #1 through valve TS/SS-01 (camlock fitting) to the suction side of the Filter Press/Digester Feed Pump (50P1460) and connect a 2-inch discharge hose from the discharge side of the Filter Press/Digester Feed Pump to valve SS-03 leading to the inlet piping on the Filter Press.
8) Open valves SS-01 andTS/SS-01 and valves SS-03 and SS-04 to the Filter Press.
9) Connect air pressure regulator and air supply hoses through valve AHP-16 to the Filter Press/Digester Feed Pump. Adjust air pressure regulator to 25 psi.
10) Start the Filter Press/Digester Feed Pump at 25 psi and start filling the Filter Press at low pressure so that the solids coat the chambers evenly, without blinding the cloths.
11) CAUTION: Maximum Pressure Should Not Exceed 100 psi. As the Filter Press fills with sludge, a decrease in filtrate leaving the Filter Press should be observed, and the Filter Press/Digester Feed Pump will slow down. Increase the pressure to the Filter Press/Digester Feed Pump in increments of 10 to 15 psi to obtain a maximum pressure of 100 psi to maintain a clear flow of filtrate from the Plate Press.

Note: The overall cycle time is very dependent upon the concentration of the inlet sludge. Higher concentrations reduce the cycle time. Typical cycle time is from two to four hours.

12) The cycle is usually complete when the Filter Press/Digester Feed Pump is operating between 95 and 100 psi, with a count of fifteen to eighteen seconds between strokes.
13) STOP the Filter Press/Digester Feed Pump, and drain excess pressure off the system by opening the drain valve to the inlet piping.
14) CLOSE discharge valve SS-01 from Filter Press Feed Tank #1, and CLOSE inlet piping valve SS-04 to the Filter Press.

15) CLOSE filter center feed valve, and CLOSE the 4 filtrate discharge valves.
16) OPEN one filtrate discharge valve, and OPEN the air valves on the blow down stand pipe (AHP-07 and 08).
17) When free water is no longer being discharged, OPEN the second filtrate discharge valve, and CLOSE first filtrate discharge valve.
18) Continue this process until all free water has been discharged from all four filtrate discharge valves.
19) CLOSE air valve AHP-08 on the blow down standpipe and bleed off all air pressure.
20) CLOSE all filtrate discharge valves.
21) Ensure the liquid valves and all air inlet valves are CLOSED.
22) Turn the hydraulic valve control switch to the "OPEN" position.
23) Filter plates can be separated manually one at a time, or the system is equipped with a pneumatic plate spreader.
24) To operate the plate spreader, the filter press must be in the "OPEN" position.
25) Position the spreader arm between the two plate handles, which are at the end of the plate stack (toward the hydraulic ram end). Once the spreader arms are in position, pull the actuator lever and the plate spreader arms will lift between the plates then spread the plates apart.
26) After separating the plates, retract plate spreader by pushing lever toward plate stack. Sludge can now be cleaned from the plates.
27) Use a non-abrasive nylon or wood paddle to remove any cake that does not fall free.
28) Continue this sequence until all filter plates have been emptied of cake.
29) Thoroughly clean filter with a brush and soapy water when sludge begins to cake on the plates or after pressing operations are completed.
30) Thoroughly inspect the o-ring sealing surfaces of the gasketed plates. The gasket should remain seated in the gasket grove and be thoroughly cleaned. Residues left in this area may prevent proper sealing of the plates.
31) Transfer portable Mixer 50M1480 to the filtrate tank.
32) Start the Mixer through Filtrate Tank local control station (50LCS1480) by pressing the "START" button.
33) Add sodium bi-sulfite until a pH of 7 is maintained in the tank.
34) Connect hose to valve F-02 and drain neutralized filtrate to the sump.

4.10 Oil Processing System Startup and Shutdown Procedures

Refer to the valve configuration listed in Table 4-8 for startup. Reference Figures 3-4 and 3-13

4.10.1 Startup and Shutdown Procedure for Froth and Decant Water Recovery - Froth Tank

CAUTION: The decant pumps and froth pumps cannot be started prior to suction and discharge valves associated with it are open. The decant pumps and froth pumps must be shut down prior to suction and discharge valves associated with it are closed. In this case FRE-00, 01, 03, 04 and 06 for the decant pumps and FRI-01, FRI-02, FRI-03, FRI-04, FRI-06, FRI-07, FRI-08, and FRI-10 for the froth pumps.

1) Valve FRI-01 (froth) with DAF Unit should be open from the DAF startup.
2) Ensure adequate water is provided to the mechanical seals of the Decant Pumps.
3) Verify that the Decant Pumps (50P1391 and 50P1392) and Froth Pumps (50P1251 and 50P1252) local disconnects are in the “ON” position.
4) Ensure that valves associated with the Froth Pumps are open – FRI-03, FRI-04, and FRI-06 for pump #1 and FRI-07, FRI-08, and FRI-10 for pump #2.
5) Level in Froth Tank will be checked through the Level Sensor LS1131.
6) Place Froth Pumps #1 and #2 local control stations 50LCS1251 and 50LCS1252 in the “AUTO” position.
7) Select a run time of 60 minutes for Froth Pumps #1 and #2 from the HMI and set the pump speeds to 5% at the pumps.
8) Turn Froth Pump #1 on from the HMI.
9) Froth flows into the Froth Tank (50T1380).
10) Level in the Froth Tank is read from Level Sensor LS1381.
11) The froth pumps will shut down based upon the run time selected from Step #7. If the LCS is placed in LOCAL mode, shut down the froth pump from the STOP button on the LCS
12) Repeat above step #8 for Froth Pump #2 with pump #1
13) Once a day open valve FRI-02 and close FRI-01 to remove sludge and operate the froth pumps as described above.
14) Open valve FRE-00 and verify that valves associated with the Decant Pumps (FRE-01 and FRE-03 for Decant Pump #1 and FRE-04 and FRE-06 for Decant Pump #2) are open.
15) Place the PID level controller for the Froth Tank in the “AUTO” position from the HMI. Set the level at 50%.
16) Decant Pump #1 will turn on in “AUTO” and is controlled by AFD with level in the Froth Tank.
17) Repeat step #16 with Decant Pump #2.

4.10.2 Procedure for DNAPL Recovery from Equalization Tank

1) Verify that valves NAPL-01 and NAPL-02 are closed.
2) Connect one end of hose to valve NAPL-02, placing the other end of the hose in the EQ Skim Sump
3) Open valve NAPL-02.
4) DNAPL contents will be transferred to the EQ skim sump.

5) Disconnect hose from valve NAPL-02.

4.10.3 Procedure for LNAPL Recovery from Equalization Tank

The following procedure will be utilized for recovery of LNAPL from EQ tank. Refer to procedure mentioned in Section 4.12 for startup and shut down over a weekend. In order to perform this, the operator will shut down the plant on a Friday while the well pumps are running. This will raise the water level to the top in order to perform the LNAPL recovery on Monday morning.

1) LNAPL collected in the EQ Tank is transferred by first connecting a hose to valve NAPL-01 and placing the other end of the hose in the EQ Skim Sump.
2) For LNAPL recovery from the EQ tank, adjust the setting of the DAF feed pump level controller set point at the HMI to bring the level in the EQ tank reach close to the overflow weir (23.5 ft). This is done at the HMI by selecting DAF feed pump icon, selecting PID tuning from the drop down menu and select the desired set point.
3) Open valve NAPL-01.
4) The last few inches (on top of the tank) place the DAF feed pumps in manual mode by placing the level controller in manual.
5) The operator will be able to determine by visually looking at the contents to see if water is mixed with product and stop transfer once he determines the contents are mostly water.
6) Close valve NAPL-01.
7) Disconnect hose from valve NAPL-01.
8) Adjust the DAF Feed Pump flow rate setting back to 80 gpm (set point to 50%) in order to bring the level down to 12 ft or to the set point set in the EQ Tank for normal operation of the main plant.

4.10.4 Startup and Shutdown Procedure for NAPL Transfer from Equalization Skim Sump to Froth Tank

1) Allow the NAPL contents (from procedure performed from Sections 4.10.2 and 4.10.3) in the EQ Skim Sump to settle for at least approximately one hour.
2) Connect the suction hose from the Digester/Skim Pump to valve NAPL-03 (camlock fitting attached) and connect the discharge hose from the Digester/Skim Pump to valve NAPL-04 (camlock fitting attached) to direct NAPL to froth tank.
3) Verify valves FRE-00, NAPL-06, NAPL-07, 08, 09 and 10 are closed.
4) Attach the air line (located in the Tank Farm) from AHP-15 to the air attachment on the Digester/Skim Pump and set air pressure regulator to 50 psig.
5) Open valve NAPL-05.
6) Transfer NAPL contents to froth tank.

7) Once contents are transferred, shut off the air feed to the Digester/Skim Pump.
8) Close valves NAPL-03, 04 and 05.
9) Disconnect hoses (if necessary).

4.10.5 Startup and Shutdown Procedure for NAPL Transfer from Equalization Skim Sump to Product Tank

1) Allow the NAPL contents (from procedure performed from Sections 4.10.2 and 4.10.3) in the EQ Skim Sump to settle for at least approximately one hour.
2) Connect the suction hose from the Digester/Skim Pump to valve NAPL-03 (camlock fitting attached) and connect the discharge hose from the Digester/Skim Pump to valve NAPL-04 (camlock fitting attached) to direct NAPL to froth tank.
3) Verify valves FRE-00, NAPL-05, NAPL-07, NAPL-08, NAPL-09, and NAPL-10 are closed.
4) Attach the air line (located in the Tank Farm) from AHP-15 to the air attachment on the Digester/Skim Pump and set air pressure regulator to 50 psig.
5) Open valve NAPL-06.
6) Transfer NAPL contents to product tank
7) Once contents are transferred, shut off the air feed to the Digester/Skim Pump.
8) Close valves NAPL-03, NAPL-04, NAPL-05, and NAPL-06.
9) Disconnect hoses (if necessary)

4.10.6 Startup and Shutdown Procedure for NAPL Transfer from Froth Tank to Product Tank

1) Verify valves associated with the froth tank NAPL-05, 06, 07, 08, 09, 10 and 11 and FRE-00 are closed.
2) AHP should be available for the operation of the Oil Pump (50P1410).
3) Set the Oil Pump for operation.
4) Connect the suction hose from the Oil Pump to valve NAPL-10 and connect the discharge hose from the Oil Pump to valve NAPL-11.
5) Attach the air line (located in Tank Farm) from AHP-18 to the air attachment on the Oil Pump and set air pressure regulator to 50 psig.
6) Open valves NAPL-07, NAPL-08, NAPL-09, NAPL-10, NAPL-11, and NAPL-12.
7) Transfer NAPL contents from froth tank to product tank.
8) Once contents are transferred, shut off the air feed to the Oil Pump
9) Close the corresponding valves NAPL-10 and 11.
10) Disconnect hoses.
11) Close valves NAPL-07, NAPL-08, NAPL-09, and NAPL-12.

4.10.7 Startup and Shutdown Procedure for NAPL Transfer for Load Out and Decant Water Removal from Product Tank

1) Product contents from the product tank are transferred to a tanker load out by opening valve NAPL-13.
2) Overflow/decant water at different levels in product tank can be removed by opening any one of the seven valves OF/DC-1 to OF/DC-7 and discharging the contents to the containment sump by gravity.

4.11 Containment System Startup and Shutdown Procedures

Refer to the valve configuration listed in Table 4-9 for startup. Reference Figure 3-14.

CAUTION: The storm water/recycle pump cannot be started prior to suction and discharge valves associated with it are open. The storm water/recycle pump must be shut down prior to suction and discharge valves associated with it are closed. In this case STW-09, STW-10, and STW-12.

1) Verify storm water recycle tank is at a minimum level of 5 ft.
2) Open valves STW-01 and STW-02 associated with the Decontamination Pads.
3) Open valves STW-04 and STW-06 associated with Sump Pumps #1 and #2.
4) Open valve STW-07 and close STW-08. This will direct the water to enter the storm water recycle tank. The operator has the option of sending the water from the sumps directly to the dirty backwash tank by opening valve STW-08 and closing valve STW-07.
5) Ensure adequate water is provided to the mechanical seals of the Storm water/recycle pump.
6) Place the Storm Water/Recycle Pump local control station (50LCS1541) in the “REM” position.
7) Visually check contents of the Containment Sump for the presence of water.
8) Sump Pumps #1 and #2 will be placed at “AUTO” position and they will turn on based upon the water level in the sump.
9) Water will be sent to the Storm Water Recycle Tank.
10) Open pneumatic valve STW-09 from the HMI.
11) Open valves STW-10 and STW-12 so that contents from the Storm Water Recycle Tank are sent to the EQ Tank for treatment or open valve STW-D04 to send the contents to the containment sump depending upon the level in the containment sump. STW-10 and 12 are located at the storm water recycle pump inside the building. Verify that valve STW-13 is open – this valve should be open from the EQ tank/DAF Unit Process startup steps.
12) Vent by opening valves STW-V01 and STW-V02 to clear the lines of any air. These valves are located by the storm water recycle pump inside the building.

13) Operate the Storm Water/Recycle Pump (50P1541) by starting from the HMI.
14) Transfer contents from the Storm Water Recycle Tank until the low level switch turns off the Storm Water Recycle Pump (which is 1 ft – LOLO alarm).
15) Vent again by opening valves STW-V01 and STW-V02 to clear the lines of any air.
16) Verify that valve STW-09 is closed as shut down of the storm water/recycle pump should automatically close the valve STW-09.

4.12 Startup and Shutdown Procedures Before and After Weekends

Refer to overall plant startup and shut down procedures for shut down and re-start of plant before and after a weekend.

1) The goal is to shutdown the plant but keep the well field online over the weekend. The EQ tank will be drained down on a Friday to 4.5 ft, as that is the lowest level at which the tank will be operated.
2) The long term goal at the site is to eventually get to a point of pumping out an estimated 11gpm out of the extraction wells onsite. So eventually, the wells will only be pumping in 11gpm to the EQ tank, but have the ability to pump out at 80 gpm from the EQ tank, so that the contents on the EQ tank level can be brought down while keeping the well field online.
3) During re-start of the plant on the following Monday, the operator would need to turn off the well field pumps for a few hours after LNAPL is skimmed off to allow the DAF Feed pumps to bring the EQ tank level back down to the normal operating level of 12 ft.

4.13 Winter Freeze Protection Shutdown Procedures

The step-by-step, sequential procedures for shutdown due to special operating conditions, such as winter freeze, protection shutdowns are provided as following:

1) The 1.5 inch buried ball valve located between the building and tank farm will be closed (See drawing Sheet #71 shown under Appendix C of Volume I).
2) All water from the valve above will be drained by opening valves in the sump of the tank farm. This includes the HV-1 valves.
3) Ensure valves that don't get flowing water into and out of the tanks are closed.
4) Water on other process lines located in the sump and above ground in tank farm will be drained. The valves and vents associated with these lines are F-D01, BWS-D01, PLE-D01, STW-D01, ST-D02, STW-D03, DI-D01, BWS-D01, STW-D04, BWR-D01, PLI-D01, STW-D05, NAPL drains and SS.

5) During severe cold weather (temperatures falling below 32 ^{O}F), all product lines and W2 water lines need to be drained and lines to the process equipment that are non-operational (like the solids processing system, oil system, sump system) need to be drained. If there is an event that requires operation of the equipment that is non-operational the valves associated will be turned on, the operation performed, the water drained again and valves closed.
6) Process water flowing through the lines will be monitored to ensure treatment of contaminated water through the system in tank farm.

5.0 TREATMENT PLANT MAINTENANCE MANAGEMENT AND SAFETY WARNINGS

This section covers the maintenance requirements for the process pumps, DAF unit, DAF Polymer system, HDBF unit, GAC systems, FRP Tanks, Plant Air Systems, Control System Equipment, Non-Process Equipment, Fire Alarm and Suppression systems and Panel Boards. The order in which these are arranged in this section is the same order the individual manufacturer information volumes are listed. **Maintenance Summary Forms for the major process equipment listed in sub-sections below are provided under Appendix E of Volume I**. These forms include a summary of equipment data, manufacturer's local representative contact, maintenance requirement, lubricant list (if any) and any recommended spare parts. A list of local spare parts supply vendors is provided in Appendix F.

This section also covers information sheet on operator warnings in operating equipment and safety aspects related to it.

5.1 Pumps Inspection and Maintenance Requirements

Maintenance and Inspection requirements for all pump types are provided in this section.

5.1.1 Froth Pumps Maintenance and Inspection Requirements

For Froth Pumps (50P1251 and 50P1252), preventative maintenance includes the following:

PREVENTATIVE MAINTENANCE REQUIREMENTS	INTERVAL
Hydraulic oil replacement	Semi-annually
Check drive gear oil level	Monthly, add as needed
Change gear drive lubricant and clean magnetic filter below crosshead chamber	Every 6 months or 2500 service hours whichever occurs first. Recommended after initial 90 days in service.
Lubricate drive motor	Annually
Check valves self cleaning pump hot detergent solution for 15 minutes, follow with water flushing.	As needed
Supply tank and piping clean and flush	Annually
Suction line strainer cleaning	As required or needed
Ball check valves, flush with clean liquid	As often as necessary for accurate metering.
HPD liquid end displacement chamber	Every 6 months, 2500 service hours
Hydraulic oil strainer replacement	Annually

Corrective maintenance includes the following:

- Relief valve assembly,
- Re-fill valve assembly, and
- Diaphragm replacement.

Additional details on maintenance information for the froth pumps are provided in Section 4.0 under Attachment 2.1 of Volume II of this O&M Manual.

5.1.2 Sump Pumps Maintenance and Inspection Requirements

For Sump Pumps (40P1501 and 40P1502) preventative maintenance includes the following:

PREVENTATIVE MAINTENANCE REQUIREMENTS	INTERVAL
Inspect visible parts on pump, pump casing and impeller for wear	Annually
Check lubricant/coolant level and condition, change as necessary	Annually
Check cables and cable entry for wear and tightness	Annually
Inspect pump voltage draw and meggar readings	Monthly
Check function of level sensors, starter and monitoring equipment	Annually
Check rotation direction of pump	When reconnecting
Check pipes, valves peripheral equipment	Annually
Check cooling system	Annually

5.1.3 Centrifugal Pumps Maintenance and Inspection Requirements

For Filter Feed Pumps – (50P1241/1242), Backwash Pumps – (50P1351 and 50P1352), Decant Pumps – (50P1391 and 50P1392), Stormwater Recycle Pump – (50P1541) and Backwash Recycle Pump – (50P1461), preventative maintenance includes the following:

PREVENTATIVE MAINTENANCE REQUIREMENTS	INTERVAL
Assembly/disassembly of pump and impeller	Weekly
Bearing and lubricant condition	Weekly
Shaft seal condition	Weekly
Pump vibration and lubrication.	Weekly
Pump discharge pressure	Weekly
Assembly/disassembly of pump and impeller	Weekly
Checking foundation and hold down bolts for tightness	Quarterly
Oil should be changed every 3 months or 2000 operating hours whichever comes first	Quarterly
Shaft alignment should be checked	Quarterly
Pump performance verification.	Annually
Establish performance benchmarks during early stages of pump operation while parts are in new and installation adjustments are correct. The data includes pump developed head, flow rate, motor ampere draw and vibration	Annually

Maintenance information for all the centrifugal pumps are provided in routine and Preventative maintenance section under Griswolds Installation and Operation manual provided under Volume II. In addition, maintenance summary forms for the above mentioned pumps are provided under Appendix E of this manual.

5.1.4 Dissolved Air Flotation Feed Pumps Maintenance and Inspection Requirements

For Dissolved Air Flotation Pumps (50P1101 and 50P1102), preventative maintenance includes the following:

PREVENTATIVE MAINTENANCE REQUIREMENTS	**INTERVAL**
Pumps – should be flushed or cleaned	As needed to remove buildup of medium deposits
Pump Lubrication	Quarterly
Lubricating the pin joint with SM-Pin Seals – It is advisable to change the oil and check the seals of the pin joints.	When replacing worn joints When disassembling the pump Amount: 1.22 fl oz. per joint
Shaft Sealing through single mechanical seal – If excessive leaks occur the spring tension and the seal surfaces should be checked,	Replace seal as necessary.
Motor Cleanliness – motor should be kept clean and free from dust, debris and oil. A jet of compressed air can be used to remove non-abrasive dust from the fan cover and any accumulated grime from the fan and cooling fins. Terminal boxes should be cleaned and their terminals free from oxidation, in perfect mechanical condition and all unused space dust free.	Monthly or as required by conditions
Motor Lubrication: Motor noise should be measured to check for unusual noises. A uniform hum is a sign that the bearing is running perfectly.	Periodically when motor is overhauled or disassembled
V-Belt lining Inspection	Quarterly
V-Belts drives, sheave alignment and bearing wear – Inspection	Quarterly

Detailed maintenance information for the DAF feed pumps are provided in routine and Preventative maintenance section under Netzsch Installation and Operation manual provided under Volume II – Attachment 2.8.

5.1.5 Air Operated Diaphragm Pumps Maintenance and Inspection Requirements

For Air-Operated Diaphram Pumps: Oil Pump – (50P1410), Filtrate/Product Disposal Pump – (50P1490), Digester/Skim Pump – (50P1120) and Filter Press/Digester Feed Pump – (50P1460), preventative maintenance includes the following:

Preventative maintenance includes the following:

PREVENTATIVE MAINTENANCE REQUIREMENTS	INTERVAL
Inspect visible parts for wear	Quarterly
Insure proper air pressure	As need to control discharge flow rate.
Check pipes, valves and equipment	Annually

These pumps are pre-lubricated and do not require in-line lubrication. Additional lubrication will not damage the pump.

5.1.6 Dissolved Air Flotation Recirculation Pump Maintenance and Inspection Requirements

For the Dissolved Air Flotation Recirculation Pump (50P1135), preventative maintenance includes the following:

PREVENTATIVE MAINTENANCE REQUIREMENTS	INTERVAL/ INSTRUCTIONS
Grease lubrication	See Tables 2, 3 and 4 for Sulzer CPT Chemical Process Pumps of Attachment 2.10 of Volume II
Oil lubrication	See Table 5 for Sulzer CPT Chemical Process Pumps of Attachment 2.10 of Volume II
Noise and vibration analysis	See instructions in Section 5 for Sulzer CPT Chemical Process Pumps of Attachment 2.10 of Volume II
Discharge pressure	See instructions in Section 6 for Sulzer CPT Chemical Pro of Attachment 2.10 of Volume II
Corrosion and wear	See instructions in Section 7 for Sulzer CPT Chemical Process Pumps of Attachment 2.10 of Volume II
Shaft seal monitoring	See instructions in Section 8 for Sulzer CPT Chemical Process Pumps of Attachment 2.10 of Volume II
Pump washdown	See instructions in Section 9 for Sulzer CPT Chemical Process Pumps of Attachment 2.10 of Volume II
Maintenance of shaft seals	See instructions in Section 10 for Sulzer CPT Chemical Process Pumps of Attachment 2.10 of Volume II
Clearance of open impeller	See instructions in Section 11 for Sulzer CPT Chemical Process Pumps of Attachment 2.10 of Volume II

Note: During operation, observe for surface temperatures on volute casing, bearing housing, shaft seal (measure on case cover and motor).

For delivery in the event of pump replacement, the bearing housing of this pump has to be emptied of oil. Be sure to fill the housing with hydraulic oil that has a viscosity of ISO VG 46. Pay attention to the sight glass on the side of the bearing housing, the housing is full of oil when the level is half of the sight glass. After filling the housing, re-secure filler vent plug. Always check oil level before operating pump. After the initial 100 hours of use, the oil in this unit should be replaced. From that point on, oil changes will vary between 6 months, if bearing housing temperature is 170 degrees ^{O}F, up to 1 year if below 170 ^{O}F.

Corrective maintenance include:

- Following safety procedures before any repairs;
- Using necessary equipment/tools;
- Disassembly procedures; and
- Re-assembly procedures.

Details on maintenance information and procedures for the DAF Recirculation Pump is provided under Sulzer's Installation and Operation manual provided under Volume II – Attachment 2.10.

5.2 Dissolved Air Flotation System Inspection and Maintenance Requirements

For the Dissolved Air Flotation System, (M1121) preventative maintenance includes the following:

PREVENTATIVE MAINTENANCE REQUIREMENTS	INTERVAL
Drain and replace drive oil	10,000 hours
Inspect anodes for loss of material	Quarterly
Zinc anodes (loss of material)	Quarterly
Grease shaft bearings	Monthly
Check drive oil levels	Monthly
Lubricate skimmer tracks	Monthly
Strainer cleaning	Bi-Weekly
Oil torque box plunger	Weekly

Inspection activities include:

INSPECTION REQUIREMENTS	INTERVAL
Inspect / repair paint	Annually
Inspect torque control device	Annually
Drain, clean and inspect tank internals	Semi-annually
Check sprocket wear	Semi-annually
Inspect chain for wear	Semi-annually
Inspect wear shoes and strips (1/4” min.)	Semi-annually
Check sprocket alignment	Semi-annually
Inspect condition of flight wipers	Monthly
Inspect fasteners for tightness	Monthly
Visually inspect skimmer mechanical for wear	Weekly
Test torque box limit switches	Weekly
*Inspect recirculation pump	Weekly
*Inspect drive mechanisms	Weekly
Inspect smooth operation of skimmers	Daily
Listen for unusual mechanical noises	Daily
Zinc anodes (loss of material)	Quarterly

*See individual component under Volume III Attachment 3.1 for details.

For detailed maintenance information procedures, refer to Westech’s Maintenance information for the DAF System under Volume III – Attachment 3.1.1.

5.3 Hydromation Deep Bed Filtration System Inspection and Maintenance Requirements

HDBF Filter maintenance requirements are detailed in Section 6 of the Filtra Systems Manual under Volume IV of this O&M Manual.

For the HDBF System (50M1260), preventative maintenance includes the following:

PREVENTATIVE MAINTENANCE REQUIREMENTS	INTERVAL
Venting of air out of the vessel	Performed after prolonged shutdown (1 week and more) or after addition of media
Inspection of the wedge wire basket for wear	Annual or earlier if conditions warrant
Cleaning of the media scrubber basket	Annual or earlier if conditions warrant
Inspection of the clean discharge wedge wire plenum	Performed only if continual evidence of media is seen in the discharge line or high pressure differential across the filter immediately after backwash is observed)
Media removal from vessel	Based upon frequent observance of high differential pressure
Media charging and media control	Perform monthly

5.4 Granular Activated Carbon System Inspection and Maintenance Requirements

The fixed bed Carbon System is designed to require minimal maintenance. The following inspection activities should be performed with regard to the carbon adsorbers, ancillary piping, valves and gauges:

For GAC Systems 50M1301, 50M1302, 50M1303, 50M1304, and 50M1305, preventative maintenance includes the following inspection activities:

PREVENTATIVE MAINTENANCE REQUIREMENTS	INTERVAL
Internal inspection of an adsorber should be performed	After spent carbon removal
Inspect the lining to verify it has not been damaged	After spent carbon removal
Inspect the underdrain laterals in the collector to insure they are intact and not plugged	After spent carbon removal
Pressure gages should be checked periodically to insure proper operation	Monthly
Piping and valving should be periodically inspected for signs of wear and/or leakage	Monthly

For additional information, refer Volume V of this O&M manual.

5.5 Fiberglass Reinforced Plastic Tanks Inspection and Maintenance Requirements

Prior to first time on-line service of FRP tanks and after any system maintenance, the following equipment inspection and operational checks shall be conducted.

For the Fiberglass Reinforced Plastic Tanks (40T1010, 40T1330, 40T1440, 40T1420, 40T1520 and 50T1380), preventative maintenance includes inspection of the following:

PREVENTATIVE MAINTENANCE REQUIREMENTS	INTERVAL
Inspect vent lines, overflow lines and the tank for foreign debris and loose materials which could cause pluggage and removal.	Monthly
Inspect all fasteners on piping, for proper tightness	Monthly
Inspect for obvious structural damage (e.g., broken or fractured fittings or attachments, punctures, cuts, de-laminations, etc).	Monthly
Inspect for impact damage, particularly on inside surfaces. These may appear as white areas, with star shaped surfaced cracks or crazes.	Monthly

5.6 Other Process Equipment Inspection and Maintenance Requirements

The following six sections describe maintenance activities recommended for other process equipment not described above.

5.6.1 Mixers Maintenance Requirements

For Mixers (40M1431, 40M1432 and 50M1480), preventative maintenance includes the following:

PREVENTATIVE MAINTENANCE REQUIREMENTS	INTERVAL
Inspection	Quarterly
Cleaning	Quarterly
Lubrication of the motor	Semi-annually

Maintenance information for digester sludge mixers is provided under Attachment 7.1 – Volume VII of the O&M manual.

5.6.2 Rotary Blower Maintenance Requirements

For Rotary Blower (50M1551), preventative maintenance includes the following:

PREVENTATIVE MAINTENANCE REQUIREMENTS	INTERVAL
Lubrication	Weekly
Checking for hot spots	Weekly
Vibration and measurement of pressures and temperatures	Weekly

5.6.3 Filter Press Maintenance Requirements

For Filter Press (50M1470), periodic maintenance is summarized below:

PREVENTATIVE MAINTENANCE REQUIREMENTS	INTERVAL
Lubricant - check reservoir level	Bi-weekly
Filter Press - inspect condition of plates	Monthly
Clean - excessive dirt, grease, etc.	Monthly
Filter Press - clamp pressure	Monthly
Filter Press - cylinder boot	Monthly
Filter Press - plumbing	Monthly
Leakage - seals, seams, flanges, etc.	Monthly
Filter Press - relief valve, proper adjustment	Monthly
Filter Press - replace hydraulic oil	Semi-annually

5.6.4 Air Compressors Maintenance Requirements

For Air Compressor s(50M1651 and 50M1652), periodic maintenance is summarized below:

Follow the maintenance schedule as provided below:

PREVENTATIVE MAINTENANCE REQUIREMENTS	INTERVAL
Lubricant Level – Palasyn 45	Once Daily
Drain condensate from auxiliary receiver	Once Daily
Instrument pressure gauges	Once Daily
Change compressor lubricoolant filter	Once every 1,000 hours
Sample analysis of lubricoolant	Once every 1,000 hours
Inspect air filter element	Once every 1,000 hours
Lubricant Palasyn 45 – Drain lubricoolant and replace with fresh charge. Inspect interior of tank	Once every 4,000 hours or once a year
Replace oil filter	Delta P exceeds 15 psid or once every 1,000 hours
Replace air filter	Once every 1,000 hours
Air/oil separator	Differential pressure exceeds 8 psid
Clean or Replace air filter element upon inspection	Once every 1,000 hours
Clean - Excessive Dirt, Grease, Etc.	Once a Week
Motor - Excessive Vibration	Once a Week
Replace Filter Bag	Once a Week
Operation - Proper Operation	Once a Week

Follow the maintenance actions as listed in Section 6 - Maintenance of the Sullivan Palatek Model 20D compressor under Attachment 7.5 of Volume VII.

5.6.5 Air Receiver Maintenance Requirements

For the Air Receiver (50T1465), follow the maintenance schedule as provided below:

PREVENTATIVE MAINTENANCE REQUIREMENTS	INTERVAL
Record Pressure gauge	Once Daily
Drain condensate	Once in 3 days

5.6.6 Air Dryer Maintenance Requirements

Follow the maintenance schedule as provided below:

PREVENTATIVE MAINTENANCE REQUIREMENTS	INTERVAL
Visual inspection for proper condensate drain operation	Weekly
Release pressure by isolating the dryer from compressed air system by closing inlet and outlet valves	Monthly
Clean or replace condensate drain trap filter	Monthly

5.7 Turbidimeter Maintenance Requirements

For the Turbidimeter (AE/AIT-1245), the sequential steps for the calibration of the online Turbidimeter are provided below:

The manufacturer recommends calibrating the Surface Scatter 7 sc instrument at least every three months or any time the light source is replaced or adjusted. Following are the sequential steps:

1) From the main menu, select SENSOR SETUP and confirm.
2) If multiple sensors are attached to the controller, choose SELECT SENSOR>SS& SETUP and confirm.
3) Select CALBRATE and confirm.
4) Select PERFORM CAL and confirm. Select the available Output mode (Active, Hold or Transfer) and confirm. In this case it will be Active.
5) Enter the STD VALUE and confirm. Confirm to continue.
6) Follow the display prompt and place formazin standard into the calibration cup. Close the sensor door and confirm to continue.
7) The TURB value displayed is the standard value determined using the gain from the previous calibration. Confirm to accept and continue with the calibration.

8) If no selection is made for a set period of time, the screen will prompt to remix the standard to avoid a change in the value of the standard.
   a) Open the SS7 sc and remix the standard.
   b) Close the door and confirm to continue.
9) Confirm to calibrate. When the calibration is completed successfully, confirm to accept the calibration.
10) Enter the initials of the user performing the calibration and confirm.

Refer to Hach manual for the calibration cylinder method, which is located in Volume VIII Attachment 8.3.

Scheduled periodic maintenance requirements of the SS7 sc turbidimeter are minimal. Standardization checks and calibration are the primary requirements. Other scheduled maintenance includes removing a sensor from the system, installing a sensor on the system and cleaning of the turbidimeter.

Unscheduled maintenance includes lamp replacement, light source assembly maintenance and detector assembly replacement

Detailed maintenance on the above scheduled and unscheduled tasks is provided under Volume VIII Attachment 8.3.

5.8 Fire Alarm System Maintenance Requirements

To keep the fire alarm system in excellent working order, ongoing maintenance is required per the manufacturer's recommendations and Underwriters Laboratories (UL) and NFPA standards, and applicable state and local codes. At a minimum, the requirements of Chapter 7 of NFPA, the National Fire Alarm Code shall be followed. Environments with large amounts of dust, dirt or high air velocity require more frequent maintenance. A maintenance agreement should be arranged through the local manufacturer's representative. Maintenance should be scheduled monthly or as required by National and/or local fire codes and should be performed by authorized professional fire alarm installers only.

The general maintenance activities for fire alarm systems are provided below:

- Test and calibrate alarm sensors, such as flame and smoke detectors, per manufacturer specifications. This requires knowing about the different sensors and their testing requirements, failure modes, and re-installation requirements.
- Simulate inputs and test the annunciators. This requires specific knowledge of the system under test.
- Set sensitivity. This requires an understanding of the particular system, the specific application, and fire detection theory.

- Coordinate with fire department to test the input to their system.
- Check the battery for corrosion and expiration date, then take appropriate action, if necessary.

5.9 Motor Control Center/Panel Board Inspection and Maintenance Requirements

Monthly Inspection

- Inspect all Motor Control and panel board installations.
- Perform a visual inspection, front and rear, to see that there is no evidence of loose parts, warping, or undue vibration. Take steps to remedy any deficiencies of this nature that may appear.
- Keep the assembly dry. Cover to prevent moisture from dripping on equipment.
- Do not block vents or flaps.

Semi-Annual Inspection

At least twice yearly, perform a through inspection of the lineup. Emphasize the following checks:

- Perform an overall visual inspection.
- Check all indicators, meters and instruments for proper operation. Make sure all bolted connections are secure.
- Verify operation of heaters and thermostats, if used.
- Check for undue noise and vibration that might loosen bolted connections.
- Look for evidence of moisture in the switchgear; and
- Note unusual amount of ozone odor.

Annual Inspection

In addition to the semi-annual inspection, perform the following recommended inspection and maintenance once a year, or sooner, if required by local conditions or regulations.

- Bolted connections should be tight. Discoloration, excessive corrosion, embrittled or discolored insulation may indicate an overheated connection.
- Inspect all cables for tight connections and ample support.
- Inspect control wiring for signs of wear and damage. Replace wire wherever doubtful.
- Examine resistors and other devices prone to over heating.
- Open all hinged doors and remove bolted panels.
- Clean insulation thoroughly.
- Withdraw and clean all drawout components.
- Clean the stationary portion of the switchgear by wiping with a clean cloth. Use dry, compressed air in inaccessible areas.
- Remove the covers of all panel devices where possible. Check wiring for secure connections. Clean contacts on relays and switches wherever necessary. Replace covers.

- Remove air filters when used. Flush with clean water if necessary. Coat filters with Super Coat Adhesive or equivalent. Inspect the gearing of lift devices, if used. For normal operation use a heavy gear lubricant. In very dirty or gritty conditions, use a dry lubricant.
- Follow the recommendations of any individual device instructions furnished for maintenance of the device.
- Perform maintenance of Contactors as recommended in instructions furnished with the unit.

<u>*24-Month Inspection*</u>

In addition to the annual inspection, perform the following recommended inspection and maintenance at 24 month intervals, or sooner, if required by local conditions or regulations.

- Perform maintenance of Contactors as recommended in instructions furnished with the unit.
- Inspect secondary wiring bundles for signs of discoloration because of heat or chafing. Check for cracked or embrittled insulation. Replace wire whenever doubtful.
- Inspect primary insulation system for accumulated contamination. Clean insulation with a dry cloth, dry-air, vacuum, or if necessary with an OSHA approved solvent.
- Check the calibration of protective relays approximately every two years.
- Follow the recommendations of any individual device instructions furnished for maintenance of the device.

5.10 Adjustable Frequency Drive Maintenance Requirements

AFD maintenance requirements fall into three basic categories:

- Keep it Clean - Dust on AFD hardware can cause a lack of airflow, resulting in diminished performance from heat sinks and circulating fans. Dust on an electronic device can cause malfunction or even failure. Dust absorbs moisture, which also contributes to failure. Periodically spraying air through the heat sink fan is a good Preventative maintenance measure. Discharging compressed air into a AFD is a viable option in some environments, but typical plant air contains oil and water. To use compressed air for cooling, use air that is oil-free and dry.
- Keep it Dry.
- Keep Connections Tight.
- As part of a mechanical inspection procedure, don’t overlook internal AFD components. Check circulating fans for signs of bearing failure or foreign objects - usually indicated by unusual noise or shafts that appear wobbly.
- Inspect DC bus capacitors for bulging and leakage. Either could be a sign of component stress or electrical misuse.

- Take voltage measurements while the AFD is in operation. Fluctuations in DC bus voltage measurements can indicate degradation of DC bus capacitors. Measurements more than 4VAC may indicate a capacitor filtering problem or a possible problem with the diode bridge converter section (ahead of the bus). If there are such high voltage levels, consult ABB before taking further action. With the AFD in START and at zero speed, the output voltage should read 40VAC phase-to-phase or less. If it's more than this, there is a possible transistor leakage. At zero speed, the power components should not be operating. If your readings are 60VAC or more, you can expect power component failure.
- Store spare AFDs in a clean, dry environment, with no condensation allowed. Place this unit in the Preventative maintenance system so it can be powered up every 6 months to keep the DC bus capacitors at their peak performance capability.
- Regularly monitor heat sink temperatures. Most AFD manufacturers make this task easy by including a direct temperature readout on the Keypad or display. Verify where this readout is, and make checking it part of a weekly or monthly review of AFD operation.

5.11 Building Concrete Coating System Maintenance Requirements

Proper maintenance will increase the life and maintain the appearance of a new floor coating. The frequency of maintenance will depend on the work environment and the amount of dirt and debris that accumulates on the floor. Dirt and dust are abrasive and quickly dull the finish and decrease the life of the coating, and liquids can stain and damage the finish. The greater the accumulation of dirt and debris and the more harsh the environment the more frequent the need to clean.

A. Develop a regular floor care maintenance program to include the following maintenance tips:

- Sweep the floor each day with a broom or mechanized cleaning equipment.
- Scrub the floor at least once a week using the correct brush and detergent.
- Clean up spills immediately before they have a chance to damage the finish.
- Place mats near entryways to minimize dirt and moisture.
- Repair any large gouges or scratches as soon as possible.
- Do not slide heavy machinery or materials across the floor without protection. This will scratch and gouge the floor coating.
- Avoid dropping heavy or pointed items on the floor.
- Don't allow spills to remain on the floor.
- Don't use stiff bristle brushes and caustic cleaning solutions on the coatings as this dulls the surface.

B. Care for a coated floor CARE FOR A COATED FLOOR

Because of the non-porous nature of the coating, a coated floor will require less maintenance than an uncoated concrete floor. To maximize the life of a new flooring investment, a daily maintenance program should be established. Routine sweeping and scrubbing will minimize scratching from abrasive dust, limit dirt and debris buildup, and extend the appearance life of the floor.

- SWEEPING - Sweep floors daily with a broom or mechanized sweeping equipment to prevent dust and dirt from accumulating. If using a mechanized sweeper, be sure to use a soft bristle brush. Stiff brushes may scratch the coating causing a loss of gloss.
- SCRUBBING - The frequency of scrubbing depends on the amount and type of dirt and debris; however, all floors should be scrubbed at least once a week. High traffic areas such as aisle ways should be scrubbed daily. Use a mop and bucket, or for greater productivity, use a mechanized scrubber. Areas where oil and grease are prevalent require daily attention. Any liquid spill can cause a slip hazard and should be cleaned immediately.
- SPILLS - Any liquid spill is a safety hazard and should be cleaned up immediately. Spills of caustics, acids, and solvents should be cleaned up immediately to prevent damage to the floor coating. Harsh liquids which are allowed to remain on the floor may soften, discolor, or completely remove a coating or sealer. If chemicals are prevalent in the area, consult your Plasite Technical Sales Representative for a guide to the chemical resistance properties of the floor coating.
- SCRATCHES AND GOUGES- Avoid scraping and sliding heavy machinery, pallets, or sharp objects across the floor, as this can cut and gouge the coating. In a coating, deep cuts or gouges result when heavy or sharp items are scraped or dropped on the surface. These damaged areas allow moisture to seep under the coating and can result in peeling..
- To repair damaged areas follow these steps:
- Clean the area of any grease, oil, and dirt and debris using tri-sodium phosphate (TSP) detergent.
- Sand the scratched or gouged area by hand using 100 grit sandpaper and feathering the edges until smooth.
- Rinse well and allow to dry.
- Repair the damaged area using the original coating material per instructions.
- STAIN PREVENTION AND REMOVAL - If stains do occur, begin removal with a mild solution, progressing to stronger removers until the stain disappears. For your protection, always wear rubber gloves and eye protection when working with chemicals.
    a) Grease and oil stains - Grease and oil may stain the coating, particularly if allowed to remain on the floor over 24 hours. Scrub the area with TSP. Follow instruction on detergent labels.
    b) Dried spills and stubborn stains.

If a spill is not caught in time, it may dry, leaving film or stain, which is difficult to remove. Take the following steps:

1) If the spill has dried, use a plastic tool to remove any residue, taking care not to scratch the coating.
2) Wet a clean cloth with an ammonia household cleaner and wipe the stained area to remove the stain.
3) If the stain persists, wet a cloth with TSP and wipe the area.
4) If the stain still remains, try lightly sanding the area with 0000 steel wool.
5) If the above steps are unsuccessful, consult the Plasite Technical Sales Representative for assistance.

RUBBER BURNS - Fork lift and other vehicle tires often leave rubber burns in the coating.

To remove these burns, follow the steps below:
1) Spot the stained area with Citric Clear and agitate with a stiff brush or mechanical scrubber. (NOTE: waste must be disposed of in a sanitary sewer or in accordance with local regulations. Do not dispose of waste in storm sewers. Follow label directions carefully.)
2) Add TSP or detergent and water to form an emulsion.
3) Scrub thoroughly.
4) Rinse the area completely with water.

5.12 Uninterrupted Power Supply Maintenance Requirements

Maintenance of the UPS includes the following items:

- Check operating environment for clean, cool, dry conditions.
- Inspect and clean the unit.
- Check operation of fans.
- Check and tighten all connections.
- View and record the alarm and inverter logs.
- Check the batteries
- Check the displayed UPS readings against actual measurements and recalibrate if necessary.
- Perform a system test.
- Check and record the values if the parameters in the system status menu 1 online and on battery.
- Check the MOV surge suppression pack.

5.13 Operator Warning Information

This section provides information on warning conditions and activities that can be avoided and prevented while operating equipment. This section is to be used in parallel with Section 5.14 which discusses safety warnings related to unit processes described under Section 3.0 and 4.0.

5.13.1 Pumps

The warning information for pumps include Centrifugal Pumps and Progressing Cavity pumps– (filter feed, backwash, decant, storm water recycle, backwash recycle pumps and DAF Feed pumps):

- Always assure the seal water is on and flowing. Damage to the seals, shaft or shaft sleeve can occur.
- Never run pump with discharge valve closed. Excessive heat can be created in the pump causing damage to impeller, bearings and casing. Pumps can explode if they get too hot or are not allowed to cool properly. Do not operate the pump below the minimum rated flows.
- Never exceed manufacturer's allowable rotational speed. Pump is designed to run at a maximum speed, if that speed is exceeded the pump can come apart.
- Operating procedure, practice, etc which if not followed, could result in personal injury or loss of life or destruction of equipment.
- Serious injury or damage to the equipment could result unless care is taken properly to lift and support equipment.
- Never apply heat to remove an impeller. Trapped liquid, when heated, may cause an explosion.
- Never use heat during the dis-assembly of the pump.
- Never operate the pump without the coupling guard in place.
- Always start the pump with proper prime.
- Never operate the pump without the suction valve fully open.
- Never operate the pump with safety devices disengaged.
- Always lock out the driver before performing maintenance on the pump.
- Sever damage can occur if the pump is operated in reverse direction.
- Swapping any 2 leads can change the rotation direction.
- Standard lube oil is flood oil. Prior to initial operation and at regular intervals, fill with flood oil.
- Never mix greases of different consistencies or types.
- Never allow pump to run dry or without liquid in the seal chamber. Pumps must be primed before operation.
- NEMO pumps (DAF feed pumps) are positive displacement progressing cavity pumps and have the potential to generate very high pressure capable of bursting vessels or pipes. Excessive pressure can overload the drive train or exceed the pressure limitations of the housings and their connections, resulting in damage or breakage

5.13.2 Granular Activated Carbon Adsorbers

- Never exceed manufactures pressure ratings or disable any safety devices. GAC adsorber can rupture if it is filled with excessive pressure. Never replace rupture discs with ones greater than manufacturer's recommendations or replace with any other device.
- Activated carbon can reduce oxygen levels in confined spaces. Use and comply with all applicable confined space entry procedures when entering adsorbers containing carbon, or from which carbon is removed.

5.13.3 Fiberglass Reinforced Plastic Tanks

- Never pressurize FRP storage tanks. These tanks are designed for atmospheric pressure, never pressurize or tank can fail.

5.13.4 Rotary Blower

- Never exceed manufacturer's pressure settings or ratings. Never exceed pressure ratings re-adjust or bypass manufacturer's settings or safety bypass. Excessive pressure can cause damage to blower and/or electric motor.

5.13.5 Air Diaphragm pumps.

- Never exceed manufacturer's maximum operation pressure which is 125 psig. Excess operation pressure can cause damage to or destruction of the pump and/or damage to delivery system due to excessive pressure building up in system.

5.13.6 Air Compressors

- Never exceed manufacturer's pressure ratings. Never exceed manufacturer's maximum recommended pressure settings. Never bypass manufactures safety devices. Excessive pressure can cause damage to equipment and injury or death to personnel.

5.13.7 Froth Pumps

- Do not start the pump drive motor before filling gear box with oil or serious damage will occur.
- The pressure relief valve is factory set to open at a pressure slightly above the pump maximum operating discharge pressure; never set the valve at any greater pressure.
- Keep hands away from reciprocating plunger and crosshead.
- Do not leave pump operating unattended with shut off valve closed. Excessive pressure can build quickly, possibly causing severe damage to pump and/or piping.
- Before any maintenance and disassembly procedures, relieve all pressure from system, isolate liquid end from all sources of process liquid with appropriate valving, and purge liquid end of all process liquid.

5.13.8 Submersible Pumps

- Mechanical – Damage caused by pumping/mixing liquids in excess of 115 degrees F when not authorized by Flygt in writing, damage caused by dropping pump, damage caused to pump with leakage sensor resulting from pump more than 10 degrees off vertical and damage to pumps, parts, or other accessories caused by freight carriers.
- Electrical – Damage to pumps and motors when inappropriate or inadequate panels are used and have not prevented failure, damage to pumps when the failure is electrically related, and proof of motor protection cannot be supplied, motor burnout's that are caused by excessive high or low voltage, or unbalanced voltage conditions, damage caused by excessive starting frequency (starting more than 15 evenly spaced starts per hour) unless authorized by Flygt, damage caused by repeated attempted starts, after overload protection has tripped (without investigating cause), damage caused by ser not utilizing protective leakage and overheating devices and motor rewinding by an unauthorized rewind facility.
- Hydraulic – Damage caused by running a pump in reverse, damage caused by pumping in dotted portion of published curves, unless authorized by Flygt in writing and damage caused by pumping volatile liquids or liquids which are corrosive or hazardous, except where approved by Flygt.
- Other – Damage caused by pumping liquids with higher viscosity or higher specific gravity than Flygt's printed recommendations, unless authorized and approved by Flygt in writing, damage due to normal wear and tear in normal operation of the pump, damage to products derived from the use in applications not recommended by Flygt's printed instructions or sales literature, damage caused from the use of non-Flygt manufactured or supplied parts, damage caused by impellers not recommended in published curves, sales literature or technical manuals, product failures that are not reported within the required 30 days from the failure, pumps and parts damaged by freezing and lightning.

5.13.9 Dissolved Air Flotation System

Compressed air is used in air saturation tank. Air under pressure may present an explosive danger when removing components or initiating operation.

- Do not override or block off vents or pressure relief valves. Use isolation valves to close off circuits being removed.
- The air saturation tank should be vented and drained completely prior to inspection through the side flanges of the vessel. Air can be vented off in the return line above the vessel. The water can be drained at the bottom of the vessel through the valve.
- Use caution when opening valves. Open valves slowly to prevent loud noise or blown debris. When starting equipment, open valves slowly.
- Do not operate equipment with partial power to some components or missing phase.
- Do not operate equipment with clogged effluent, influent or float lines.
- Do not operate equipment with damaged, crushed or cut electrical conduits or cables.
- Do not run unattended if torque control device is not connected to DAF control panel
- The DAF unit is not configured for outdoor use and operation in sub-freezing temperatures.

5.14 Plant Safety Warnings

The following plant safety warnings are provided for each of the major component systems. These warnings are of a nature that serious damage to equipment or harm to employees could occur if not followed.

5.14.1 Equalization Tank and Wells

- Caution: Always assure that all valves are open to and from pumps. Running pumps dry or excessive head pressure can cause damage to equipment.
- Confined Space: The EQ tank is a confined space. Always use Confined Space entry procedures if entering tank.
- Warning: Fall protection is required if personnel will be doing work on tank.
- Warning: Always wear proper PPE while working around the EQ tank due to possible contamination.

5.14.2 Dissolved Air Flotation System:

- Caution: Always assure that all valves are open to and from pumps. Running pumps dry or excessive head pressure can cause damage to equipment.
- Warning: Rotating equipment, always assure that all guards are installed on pumping equipment.

- Warning: Automatic restarting or electrical shock can cause injury or death. Open and lock main disconnect and any other circuits before working on air system or servicing air compressors.
- Warning: Exercise Caution around Moving parts: Keep hands, clothing etc. always from moving parts. Always de-energize, lock and tag equipment before working or adjustments are made.
- Caution: Compressed air is used in the saturation tank. Always use extreme caution because it may present an explosion hazard. Always depressurize system if working on it or doing maintenance.
- Confined Space: The DAF tank is a confined space. Always use Confined Space entry procedures if entering tank.
- Warning: Always wear eye protection while working around equipment.
- Warning: Always wear proper PPE while working around the DAF unit due to possible contamination.

For additional safety instructions, refer to Westech's O&M manual under Volume III – Attachment 3.1.1.

5.14.3 Hydromation Deep Bed Filtration System

- Caution: Always assure that all valves are open to pumps. Running pumps dry can cause damage to equipment. Possible personnel injury can also occur due to heating of pump.
- Warning: Automatic restarting or electrical shock can cause injury or death. Open and lock main disconnect and any other circuits before working on or servicing equipment.
- Caution: Compressed air is used to operate automatic valves. Always use extreme caution because it may present an explosion hazard. Always depressurize system if working on it or doing maintenance.
- Warning: Caution should be used while working around equipment. Equipment runs automatically.
- Warning: Always wear eye protection while working around equipment.

5.14.4 Granular Activated Carbon Adsorbers

- Pressure Relief Warning: To avoid adsorber damage and endangerment of operation personnel, do not block the pressure relief device from venting to the atmosphere.
- May Reduce Oxygen Available for Breathing: Wet activated carbon in confined spaces may reduce oxygen below the level needed to support life. This potential lack of oxygen makes the use of an independent air supply necessary.
- May cause fire in contact with strong oxidizers: Contact between activated carbon and strong oxidizing agent such as liquid oxygen or concentrated ozone is not recommended. Also, reactive chemicals in contact with activated carbon may oxidize, decompose or polymerize to produce heat that could result in combustion.

- Other Potential Hazards-Process vapors or liquids: Activated carbon adsorption adsorbers, by virtue of their use, may contain irritating, toxic or explosive vapors.
- Ungrounded systems may accumulate static electricity: All systems should be grounded to avoid static electrical shock or ignition hazards.
- Confined Space: The GAC Adsorber is a confined space. Always use Confined Space entry procedures if entering the adsorber.

5.14.5 Digester and Dirty Backwash Tank Operation

- Warning: Assure that all Personnel Protective Equipment is worn while working on the Digester and dirty backwash equipment.
- Warning: While using Positive displacement Diaphragm pumps do not exceed maximum air inlet pressure. Assure that all hoses and components are capable of withstanding high pressures created by pump discharge. High pressure can cause serious personnel injury and property damage.
- Caution: Always depressurize system and pump before disconnecting or performing any maintenance on Diaphragm (filter press feed) pump.
- Warning: Always assure that blower valves are open prior to starting blower.
- Warning: Open and lock main disconnect and any other circuits before working on or performing maintenance on blower.

Warning*: Use extreme caution and wear all appropriate PPE while working with Chemicals such as lime or acids.*

5.14.6 Filter Press

- Caution: Do not operate equipment without eye protection.
- Caution: Do not operate unless safety guards or devices are in place and properly adjusted.
- Caution: Disconnect electrical power before servicing the press. Always lock and tag unit electrical system.
- Caution: Unit utilizes high pressure air and hydraulic fluid, always lock and tag all air and hydraulic system valves before servicing filter press.

5.14.7 Sump System:

- Caution: Always assure that all valves are open on the discharge side of pump to prevent excessive head pressure that can cause damage to pump and piping. Assure that pumps are completely submerged; running pump dry can cause damage to equipment.
- Warning: Automatic restarting or electrical shock can cause injury or death. Open and lock main disconnect and any other circuits before working on or servicing equipment.

5.14.8 Oil Processing

- Warning: Assure that all Personnel Protective Equipment is worn while working on the Oil processing equipment.
- Caution: Always assure that all valves are open to pumps. Running pumps dry can cause damage to equipment. Possible personnel injury can also occur due to heating of pump.
- Warning: Automatic restarting or electrical shock can cause injury or death. Open and lock main disconnect and any other circuits before working on or servicing equipment.
- Warning: While using Positive displacement Diaphragm pump do not exceed maximum air inlet pressure. Assure that all hoses and components are capable of withstanding high pressures created by pump discharge. High pressure can cause serious personnel injury and property damage.
- Caution: Always depressurize system and pump before disconnecting or performing any maintenance.
- Caution: All tanks are considered confined spaces. Always use Proper confined space entry procedures if entering.

5.14.9 Air System and Water System

- Danger: Air/oil under pressure will cause severe personal injury or death. Shut down compressor, relieve system of all pressure disconnect, tag and lockout power supply to the starter before removing valves, caps, plugs, fittings bolts and filters.
- Danger: Compressor, air/oil reservoir, separation chamber and all piping and tubing may be at high temperature during and after operation.
- Warning: Automatic restarting or electrical shock can cause injury or death. Open and lock main disconnect and any other circuits before working on the air or water systems or servicing air compressors or water pumps, piping or receiver and pressure tanks.
- Danger: Always drain water system of pressure before working on or servicing system.

TABLES

Note:
Most component IDs are listed in the List of Acronyms and Abbreviations.

Table 3-1: List of Process Sampling Ports
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

Flow stream	*Stream Description*	*Sampling Port ID*	*Reference Figure*
PLI	Equalization Tank Influent	SP-0	3-4
PLI	Equalization Tank Effluent	SP-1	3-4
DE	Filter feed Pump Effluent	SP-2	3-5
FI	HDBF Influent	SP-3	3-8
FE	HDBF Effluent	SP-4	3-8
	Carbon vessel 1 effluent	SP-5	3-9
	Carbon vessel 2 effluent	SP-6	3-9
	Carbon vessel 3 effluent	SP-7	3-9
	Carbon vessel 4 effluent	SP-8	3-9
	Carbon vessel 5 effluent	SP-9	3-9
PLE	Effluent Tank Influent	SP-10	3-9
PLE	Effluent Tank Effluent	SP-11	3-10
FRI	DAF Waste/Froth Tank Influent	SP-12	3-7
FRE	Decant Pump Effluent	SP-13	3-13
NAPL	Froth Tank NAPL Recovery	SP-14	3-13
BWE	After HDBF system	SP-15	3-8
BWE/FFE	After GAC system and prior to dirty backwash tank	SP-16	3-8
BWR	Dirty Backwash Tank effluent	SP-17	3-11
STW	Storm water Recycle Tank Effluent	SP-18	3-14

Notes

PLI – Plant influent
DE – DAF effluent
FI – Filter influent
FE – Filter effluent
PLE – Plant effluent
FRI – Froth influent
FRE – Froth effluent
NAPL – Non-aqueous phase liquids
BWE – Backwash effluent
BWE/FFE – Backwash effluent/forward flush effluent
BWR – Backwash recycle
STW – Storm water

Table 3-2: List of Process Flow Meters
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

Flow stream	*Stream Description*	*Flow meter ID*	*Reference Figure*
PLI	Plant Influent	FE/FIT - 1009	3-4
DI	DAF Influent	FE/FIT - 1110	3-4
PLE	Plant Effluent	FE/FIT – 1321	3-10
BWS	Backwash Source	FE/FIT - 1371	3-10
DR	Flow to DAF air saturation tank	FE/FIT - 1137	3-5

Notes

PLI – Plant influent
DI – DAF influent
PLE – Plant effluent
BWS – Backwash source
DR – DAF recycle

Table 3-3: List of Process Level Transmitters
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

Location	***Level Sensor ID***	***Reference Figure***
EQ Tank	LE/LIT – 1011	3-4
DAF Unit	LE/LIT – 1131	3-5
DAF Unit – Effluent Chamber	LE/LIT - 1211	3-5
Effluent Tank	LE/LIT – 1331	3-10
Froth Tank	LE/LIT - 1381	3-13
Digester Tank	LE/LIT - 1421	3-11
Dirty Backwash Tank	LE/LIT - 1441	3-11
Storm water Recycle Tank	LE/LIT - 1521	3-14
Plant Water Storage Tank	LT-1570	3-6

Table 3-4: PLC I/O List
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

							PROPOSED		
			FUNCTION		Volume VIII		PLC ADDRESS		
DEVICE NO.	DESCRIPTION	FUNCTION	TYPE	Figure #	DWG No.	I/O TYPE	RACK	SLOT	POINT
YS1002SUPER	Fire Alarm Control Panel - 50FACP1002	Supervisory	Status	Figure 3-7	L-1002	DI	0	1	0
YA1002ALARM	Fire Alarm Control Panel - 50FACP1002	Alarm	Alarm	Figure 3-7	L-1002	DI	0	1	1
FL1002TROUBLE	Fire Alarm Control Panel - 50FACP1002	Trouble	Alarm	Figure 3-7	L-1002	DI	0	1	2
ZS1021CLOSED	EQ Tank Discharge Valve	Closed	Status	Figure 3-4	L-1021	DI	0	1	3
ZS1021OPEN	EQ Tank Discharge Valve	Open	Status	Figure 3-4	L-1021	DI	0	1	4
ZS1031INUSE	DAF Emergancy Eyewash	In Use	Alarm	Figure 3-4	L-1031	DI	0	1	5
P1101ON	DAF Feed Pump 1	On	Status	Figure 3-4	L-1101	DI	0	1	6
P1101FAIL	DAF Feed Pump 1	Fail	Alarm	Figure 3-4	L-1101	DI	0	1	7
P1101REMOTE	DAF Feed Pump 1	Remote	Status	Figure 3-4	L-1101	DI	0	1	8
P1102ON	DAF Feed Pump 2	On	Status	Figure 3-4	L-1102	DI	0	1	9
P1102FAIL	DAF Feed Pump 2	Fail	Alarm	Figure 3-4	L-1102	DI	0	1	10
P1102REMOTE	DAF Feed Pump 2	Remote	Status	Figure 3-4	L-1102	DI	0	1	11
M1121AON	DAF Flocculator	On	Status	Figure 3-5	L-1121A	DI	0	1	12
M1121AFAIL	DAF Flocculator	Fail	Alarm	Figure 3-5	L-1121A	DI	0	1	13
M1121AREM	DAF Flocculator	Remote	Status	Figure 3-5	L-1121A	DI	0	1	14
M1121BON	DAF Auger	On	Status	Figure 3-5	L-1121A	DI	0	1	15
M1121BREM	DAF Auger	Remote	Status	Figure 3-5	L-1121A	DI	0	2	0
M1121CFAIL	DAF Skimmer	Fail	Alarm	Figure 3-5	L-1121A	DI	0	2	1
M1121CON	DAF Skimmer	On	Status	Figure 3-5	L-1121A	DI	0	2	2
M1121CREM	DAF Skimmer	Remote	Status	Figure 3-5	L-1121A	DI	0	2	3
M1135REM	DAF Recycle Pump	Remote	Status	Figure 3-5	L-1121A	DI	0	2	4
M1135ON	DAF Recycle Pump	On	Status	Figure 3-5	L-1121A	DI	0	2	5
ZS1235INUSE	Filter Press Emergancy Eyewash	Inuse	Alarm	Figure 3-7	L-1235	DI	0	2	6
ZS1237INUSE	Containment Area Emergancy Eyewash	Inuse	Alarm	Figure 3-13	L-1237	DI	0	2	7
P1241ON	Filter Feed Pump 1	On	Status	Figure 3-7	L-1241	DI	0	2	8
P1241FAIL	Filter Feed Pump 1	Fail	Alarm	Figure 3-7	L-1241	DI	0	2	9
P1241REM	Filter Feed Pump 1	Remote	Status	Figure 3-7	L-1241	DI	0	2	10
P1242ON	Filter Feed Pump 2	On	Status	Figure 3-7	L-1242	DI	0	2	11
P1242FAIL	Filter Feed Pump 2	Fail	Alarm	Figure 3-7	L-1242	DI	0	2	12
P1242REM	Filter Feed Pump 2	Remote	Status	Figure 3-7	L-1242	DI	0	2	13

Table 3-4: PLC I/O List
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

							PROPOSED		
			FUNCTION		Volume VIII		PLC ADDRESS		
DEVICE NO.	DESCRIPTION	FUNCTION	TYPE	Figure #	DWG No.	I/O TYPE	RACK	SLOT	POINT
YA1251ON	Froth Pump 1	On	Status	Figure 3-7	L-1251	DI	0	2	14
HS1251REM	Froth Pump 1	Remote	Status	Figure 3-7	L-1251	DI	0	2	15
YA1252ON	Froth Pump 2	On	Status	Figure 3-7	L-1252	DI	0	3	0
HS1252REM	Froth Pump 2	Remote	Status	Figure 3-7	L-1252	DI	0	3	1
M1260REM	Hydromation Deep Bed Filter Package System	Remote	Status	Figure 3-8	L-1260D	DI	0	3	2
M1260ON	Hydromation Deep Bed Filter Package System	On	Status	Figure 3-8	L-1260D	DI	0	3	3
ZS1261CLOSED	HDBF Process Inlet Control Valve	Closed	Status	Figure 3-8	L-1260A	DI	0	3	4
ZS1261OPEN	HDBF Process Inlet Control Valve	Open	Status	Figure 3-8	L-1260A	DI	0	3	5
ZS1262CLOSED	HDBF Process Discharge Control Valve	Closed	Status	Figure 3-8	L-1260A	DI	0	3	6
ZS1262OPEN	HDBF Process Discharge Control Valve	Open	Status	Figure 3-8	L-1260A	DI	0	3	7
ZS1263OPEN	HDBF Backwash Supply Control Valve	Open	Status	Figure 3-8	L-1260**B**	DI	0	3	8
ZS1263CLOSED	HDBF Backwash Supply Control Valve	Closed	Status	Figure 3-8	L-1260**B**	DI	0	3	9
ZS1264CLOSED	HDBF Backwash Discharge Control Valve	Closed	Status	Figure 3-8	L-1260**B**	DI	0	3	10
ZS1264OPEN	HDBF Backwash Discharge Control Valve	Open	Status	Figure 3-8	L-1260**B**	DI	0	3	11
ZS1265OPEN	HDBF Recirculation Control Valve	Open	Status	Figure 3-8	L-1260**C**	DI	0	3	12
ZS1265CLOSED	HDBF Recirculation Control Valve	Closed	Status	Figure 3-8	L-1260**C**	DI	0	3	13
ZS1266OPEN	HDBF Vent Control Valve	Open	Status	Figure 3-8	L-1260**C**	DI	0	3	14
ZS1266CLOSED	HDBF Vent Control Valve	Closed	Status	Figure 3-8	L-1260**C**	DI	0	3	15
ZS1267OPEN	HDBF Backflow Valve	Open	Status	FS20169e03	L-1260E	DI	0	4	0
ZS1267CLOSED	HDBF Backflow Valve	Closed	Status	FS20169e03	L-1260E	DI	0	4	1
351PB	HDBF Manual Backwash	Initiate	Control	FS20169e03	L-1260E	DI	0	4	2
217MON	HDBF Agitator Running	On	Status	FS20169e03	L-1260F	DI	0	4	3
217MO/LOK	HDBF Agitator Motor Over Load	Not Tripped	Alarm	FS20169e03	L-1260F	DI	0	4	4
207PMROK	HDBF Agitator Motor Phase Monitor	Not Tripped	Alarm	FS20169e03	L-1260F	DI	0	4	5
PSL1272PRES	HDBF Plant Air Pressure	Low	Alarm	FS20169e03	L-1260F	DI	0	4	6
215PB-2	HDBF Master Start / Reset	Initiate	Control	FS20169e03	L-1260F	DI	0	4	7
	SPARE				L-SPR DI	DI	0	4	8
	SPARE				L-SPR DI	DI	0	4	9
HS1351REM	Backwash Pump 1	Remote	Status	Figure 3-10	L-1351	DI	0	4	10
YA1351ON	Backwash Pump 1	On	Status	Figure 3-10	L-1351	DI	0	4	11

Table 3-4: PLC I/O List
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

							PROPOSED		
			FUNCTION		Volume VIII		PLC ADDRESS		
DEVICE NO.	**DESCRIPTION**	**FUNCTION**	**TYPE**	**Figure #**	**DWG No.**	**I/O TYPE**	**RACK**	**SLOT**	**POINT**
HS1352REM	Backwash Pump 2	Remote	Status	Figure 3-10	L-1352	DI	0	4	12
YA1352ON	Backwash Pump 2	On	Status	Figure 3-10	L-1352	DI	0	4	13
P1391REMOTE	Decant Pump 1	Remote	Status	Figure 3-13	L-1391	DI	0	4	14
P1391FAIL	Decant Pump 1	Fail	Alarm	Figure 3-13	L-1391	DI	0	4	15
P1391ON	Decant Pump 1	On	Status	Figure 3-13	L-1391	DI	0	5	0
P1392ON	Decant Pump 2	On	Status	Figure 3-13	L-1392	DI	0	5	1
P1392REMOTE	Decant Pump 2	Remote	Status	Figure 3-13	L-1392	DI	0	5	2
P1392FAIL	Decant Pump 2	Fail	Alarm	Figure 3-13	L-1392	DI	0	5	3
ZS1451OPENED	Dirty Backwash Tank Discharge Valve	Opened	Status	Figure 3-11	L-1451	DI	0	5	4
ZS1451CLOSED	Dirty Backwash Tank Discharge Valve	Closed	Status	Figure 3-11	L-1451	DI	0	5	5
HS1461REM	Backwash Recycle Pump	Remote	Status	Figure 3-11	L-1461	DI	0	5	6
YA1461ON	Backwash Recycle Pump	On	Status	Figure 3-11	L-1461	DI	0	5	7
LCP1500ON	Containment Sump	ON	Status	Figure 3-14	L-1500	DI	0	5	8
LSHH1511HIHI	Containment Sump HI HI Level	HIHI	Alarm	Figure 3-14	L-1500	DI	0	5	9
ZS1531OPENED	Stormwater Recycle Tank Discharge Valve	Opened	Status	Figure 3-14	L-1531	DI	0	5	10
ZS1531CLOSED	Stormwater Recycle Tank Discharge Valve	Closed	Status	Figure 3-14	L-1531	DI	0	5	11
HS1541REM	Stormwater Recycle Pump	Remote	Status	Figure 3-14	L-1541	DI	0	5	12
YA1541ON	Stormwater Recycle Pump	On	Status	Figure 3-14	L-1541	DI	0	5	13
HS1551REM	Aeration Blower	Remote	Status	Figure 3-12	L-1551	DI	0	5	14
M1551ON	Aeration Blower	On	Status	Figure 3-12	L-1551	DI	0	5	15
M1601ON	Polymer Mixer	On	Status	Figure 3-6	l-1601	DI	0	6	0
M1601AUTO	Polymer Mixer	Auto	Status	Figure 3-6	L-1601	DI	0	6	1
PSH1641HIGH	Polymer Feed Pump Discharge Pressure	High	Alarm	Figure 3-6	L-1641	DI	0	6	2
UPS1701ON BATT	Control System UPS on Battery	On Battery	Alarm	Figure 3-13	L-1701	DI	0	6	3
UPS1701FAIL	Control System UPS General Alarm	Fail	Alarm	Figure 3-13	L-1701	DI	0	6	4
HS1561REM	W2 Well PumpHOA Switch	Remote	Status	Figure 3-6	L-1561	DI	0	6	5
M1561ON	W2 Well Pump Status	On	Status	Figure 3-6	L-1561	DI	0	6	6
ZS1625OPEN	W2 Water Feed Solenoid Valve	Open	Status	Figure 3-6	L-1625	DI	0	6	7
FS1625FLOW	W2 Water Flow to Polymer System	Flow	Status	Figure 3-6	L-1625	DI	0	6	8
	SPARE				L-SPR DI	DI	0	6	9

Table 3-4: PLC I/O List
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

							PROPOSED		
			FUNCTION		**Volume VIII**		**PLC ADDRESS**		
DEVICE NO.	**DESCRIPTION**	**FUNCTION**	**TYPE**	**Figure #**	**DWG No.**	**I/O TYPE**	**RACK**	**SLOT**	**POINT**
	SPARE				L-SPR DI	DI	0	6	10
	SPARE				L-SPR DI	DI	0	6	11
	SPARE				L-SPR DI	DI	0	6	12
	SPARE				L-SPR DI	DI	0	6	13
	SPARE				L-SPR DI	DI	0	6	14
	SPARE				L-SPR DI	DI	0	6	15
	SPARE				L-SPR DI	DI	0	7	0
	SPARE				L-SPR DI	DI	0	7	1
	SPARE				L-SPR DI	DI	0	7	2
	SPARE				L-SPR DI	DI	0	7	3
	SPARE				L-SPR DI	DI	0	7	4
	SPARE				L-SPR DI	DI	0	7	5
	SPARE				L-SPR DI	DI	0	7	6
	SPARE				L-SPR DI	DI	0	7	7
	SPARE				L-SPR DI	DI	0	7	8
	SPARE				L-SPR DI	DI	0	7	9
	SPARE				L-SPR DI	DI	0	7	10
	SPARE				L-SPR DI	DI	0	7	11
	SPARE				L-SPR DI	DI	0	7	12
	SPARE				L-SPR DI	DI	0	7	13
	SPARE				L-SPR DI	DI	0	7	14
	SPARE				L-SPR DI	DI	0	7	15
JS1012STOP	**SPARE**	Stop	Hold	Figure 3-4	L-1012	DO	0	8	0
FV1021OPEN	EQ Tank Discharge Valve	Open	Hold	Figure 3-4	L-1021	DO	0	8	1
FV1021CLOSE	**(SPARE)**	Close	Hold	Figure 3-4	L-1021	DO	0	8	2
P1101RUN	DAF Feed Pump 1	Run	Hold	Figure 3-4	L-1101	DO	0	8	3
P1102RUN	DAF Feed Pump 2	Run	Hold	Figure 3-4	L-1102	DO	0	8	4
M1121BRUN	DAF Package System	Run	Hold	Figure 3-5	L-1121A	DO	0	8	5
M1135RUN	DAF Recycle Pump	Run	Hold	Figure 3-5	L-1121A	DO	0	8	6
P1241RUN	Filter Feed Pump 1	Run	Hold	Figure 3-7	L-1241	DO	0	8	7

Table 3-4: PLC I/O List
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

							PROPOSED		
			FUNCTION		Volume VIII		PLC ADDRESS		
DEVICE NO.	DESCRIPTION	FUNCTION	TYPE	Figure #	DWG No.	I/O TYPE	RACK	SLOT	POINT
P1242RUN	Filter Feed Pump 2	Run	Hold	Figure 3-7	L-1242	DO	0	8	8
HS1251RUN	Froth Pump 1	Run	Hold	Figure 3-7	L-1251	DO	0	8	9
HS1252RUN	Froth Pump 2	Run	Hold	Figure 3-7	L-1252	DO	0	8	10
M1260RUN	Hydromation Deep Bed Filter Package System	Run	Hold	Figure 3-8	L-1260A	DO	0	8	11
FV1261OPEN	HDBF Process Inlet Control Valve	Open	Hold	Figure 3-8	L-1260A	DO	0	8	12
FV1262OPEN	HDBF Process Discharge Control Valve	Open	Hold	Figure 3-8	L-1260A	DO	0	8	13
FV1263OPEN	HDBF Backwash Supply Control Valve	Open	Hold	Figure 3-8	L-1260B	DO	0	8	14
FV1264OPEN	HDBF Backwash Discharge Control Valve	Open	Hold	Figure 3-8	L-1260B	DO	0	8	15
FV1265OPEN	HDBF Recirculation Control Valve	Open	Hold	Figure 3-8	L-1260C	DO	0	9	0
FV1266OPEN	HDBF Vent Control Valve	Open	Hold	Figure 3-8	L-1260C	DO	0	9	1
FV1267OPEN	HDBF Backflow Valve	Open	Hold	FS20169e02	L-1260E	DO	0	9	2
263LT	HDBF Filter Fault Light	Status	Alarm	FS20169e02	L-1260F	DO	0	9	3
264LT	HDBF Filter Running Light	Status	Hold	FS20169e02	L-1260F	DO	0	9	4
265LT	HDBF Filtration Light	Status	Hold	FS20169e02	L-1260F	DO	0	9	5
266LT	HDBF Agitation Light	Status	Hold	FS20169e02	L-1260F	DO	0	9	6
267LT	HDBF Backwash Light	Status	Hold	FS20169e02	L-1260F	DO	0	9	7
268LT	HDBF Delay Cycle Light	Status	Hold	FS20169e02	L-1260F	DO	0	9	8
269LT	HDBF Recirculation Light	Status	Hold	FS20169e02	L-1260F	DO	0	9	9
270LT	HDBF Agitator Phase Monitor Tripped Light	Status	Alarm	FS20169e02	L-1260F	DO	0	9	10
HS1351RUN	Backwash Pump 1	Run	Hold	Figure 3-10	L-1351	DO	0	9	11
HS1352RUN	Backwash Pump 2	Run	Hold	Figure 3-10	L-1352	DO	0	9	12
P1391RUN	Decant Pump 1	Run	Hold	Figure 3-13	L-1391	DO	0	9	13
P1392RUN	Decant Pump 2	Run	Hold	Figure 3-13	L-1392	DO	0	9	14
FV1451OPEN	Dirty Backwash Tank Discharge Valve	Open	Hold	Figure 3-11	L-1451	DO	0	9	15
FV1451CLOSE	**(SPARE)**	Close	Hold	Figure 3-11	L-1451	DO	0	10	0
HS1461RUN	Backwash Recycle Pump	Run	Hold	Figure 3-11	L-1461	DO	0	10	1
FV1531OPEN	Stormwater Recycle Tank Discharge Valve	Open	Hold	Figure 3-14	L-1531	DO	0	10	2
FV1531CLOSE	**(SPARE)**	Close	Hold	Figure 3-14	L-1531	DO	0	10	3
HS1541RUN	Stormwater Recycle Pump	Run	Hold	Figure 3-14	L-1541	DO	0	10	4
M1551RUN	Aeration Blower	Run	Hold	Figure 3-12	L-1551	DO	0	10	5

Table 3-4: PLC I/O List
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

							PROPOSED		
			FUNCTION		Volume VIII		PLC ADDRESS		
DEVICE NO.	**DESCRIPTION**	**FUNCTION**	**TYPE**	**Figure #**	**DWG No.**	**I/O TYPE**	**RACK**	**SLOT**	**POINT**
P1640RUN	Polymer Feed Pump	Run	Hold	Figure 3-6	L-1640	DO	0	10	6
P1561RUN	W2 Well Pump	Run	Hold	Figure 3-6	L-1561	DO	0	10	7
Autodialer_TS1_1	Autodialer Alarm #1 UPS on Battery	Alarm			L-SPR DO	DO	0	10	8
Autodialer_TS1_2	Autodialer Alarm #2 General Plant Alarm	Alarm			L-SPR DO	DO	0	10	9
	SPARE				L-SPR DO	DO	0	10	10
	SPARE				L-SPR DO	DO	0	10	11
	SPARE				L-SPR DO	DO	0	10	12
	SPARE				L-SPR DO	DO	0	10	13
	SPARE				L-SPR DO	DO	0	10	14
	SPARE				L-SPR DO	DO	0	10	15
FIT1009FLOW	Plant Influent Flow	Flow		Figure 3-4	L-1009	AI	0	16	0
LIT1011LEVEL	Equalization Tank Level	Level		Figure 3-4	L-1011	AI	0	16	1
FIT1110FLOW	DAF Feed Flow	Flow		Figure 3-4	L-1110	AI	0	16	2
LIT1131LEVEL	DAF Effluent Chamber Level	Level		Figure 3-5	L-1211	AI	0	16	3
FIT1137FLOW	DAF Recycle Flow	Flow		Figure 3-5	L-1137	AI	0	16	4
LIT1211LEVEL	DAF Influent Chamber Level	Level		Figure 3-5	L-1211	AI	0	16	5
AIT1245TURB	DAF Effluent Turbidity	Turb		Figure 3-7	L-1245	AI	0	16	6
DPIT1281PRESS DIF	HDBF Differential Pressure	Press Diff		Figure 3-8	L-1260D	AI	0	16	7
PT1282PRESS	HDBF Discharge Pressure	Pressuer		Figure 3-8	L-1282	AI	0	17	0
PT1310PRESS	GAC 1 Filter Influent Bypass Inlet Pressure	Pressuer		Figure 3-9	L-1310	AI	0	17	1
PT1311Press	GAC 1 Discharge Pressure	Pressuer		Figure 3-9	L-1311	AI	0	17	2
PT1312Press	GAC 2 Discharge Pressure	Pressuer		Figure 3-9	L-1312	AI	0	17	3
PT1313Press	GAC 3 Discharge Pressure	Pressuer		Figure 3-9	L-1313	AI	0	17	4
PT1314Press	GAC 4 Discharge Pressure	Pressuer		Figure 3-9	L-1314	AI	0	17	5
PT1315Press	GAC 5 Discharge Pressure	Pressuer		Figure 3-9	L-1315	AI	0	17	6
FIT1321FLOW	Plant Effluent Tank Inlet Flow	Flow		Figure 3-10	L-1321	AI	0	17	7
LIT1331LEVEL	Effluent Tank	Level		Figure 3-10	L-1331	AI	0	18	0
FIT1371FLOW	Backwash Flow	Flow		Figure 3-10	L-1371	AI	0	18	1
LIT1381LEVEL	Froth Tank	Level		Figure 3-13	L-1381	AI	0	18	2

Table 3-4: PLC I/O List
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

							PROPOSED		
			FUNCTION		**Volume VIII**		**PLC ADDRESS**		
DEVICE NO.	**DESCRIPTION**	**FUNCTION**	**TYPE**	**Figure #**	**DWG No.**	**I/O TYPE**	**RACK**	**SLOT**	**POINT**
LIT1421LEVEL	Digester Tank	Level		Figure 3-11	L-1421	AI	0	18	3
LIT1441LEVEL	Dirty Backwash Tank	Level		Figure 3-11	L-1441	AI	0	18	4
PIT1466PRESS	Plant Process Air Pressure	Pressure		Figure 3-12	L-1466	AI	0	18	5
LIT1521LEVEL	Stormwater Recycle Tank	Level		Figure 3-14	L-1521	AI	0	18	6
PIT1555PRESS	Aeration **Blower Discharge Pressure**	Pressure		Figure 3-12	L1555	AI	0	18	7
PIT1591PRESS	Plant Water Pressure	Pressure		Figure 3-6	L-1591	AI	0	19	0
PIT1650PRESS	Air Compressor Discharge Pressure	Pressure		Figure 3-6	L-1650	AI	0	19	1
LT1570LEVEL	Plant Warer Storage Tank Level (Existing)	Level		Figure 3-6	L-1570	AI	0	19	2
	SPARE				L-SPR AI	AI	0	19	3
	SPARE				L-SPR AI	AI	0	19	4
	SPARE				L-SPR AI	AI	0	19	5
	SPARE				L-SPR AI	AI	0	19	6
	SPARE				L-SPR AI	AI	0	19	7
P1101SPEED	DAF Feed Pump 1	Speed		Figure 3-4	L-1101	AO	0	20	0
P1102SPEED	DAF Feed Pump 2	Speed		Figure 3-4	L-1102	AO	0	20	1
M1121CSPEED	DAF Skimmer	Speed		Figure 3-5	L-1121B	AO	0	20	2
M1121ASPEED	DAF Flocculator	Speed		Figure 3-5	L-1121B	AO	0	20	3
	SPARE			Figure 3-5	L-1132	AO	0	20	4
P1241SPEED	Filter Feed Pump 1	Speed		Figure 3-7	L-1241	AO	0	20	5
P1242SPEED	Filter Feed Pump 2	Speed		Figure 3-7	L-1242	AO	0	20	6
P1391SPEED	Decant Pump 1	Speed		Figure 3-13	L-1391	AO	0	20	7
P1392SPEED	Decant Pump 2	Speed		Figure 3-13	L-1392	AO	0	21	0
P1640SPEED	Polymer Feed Pump	Speed		Figure 3-6	L-1640	AO	0	21	1
	SPARE				L-SPR AO	AO	0	21	2
	SPARE				L-SPR AO	AO	0	21	3
	SPARE				L-SPR AO	AO	0	21	4
	SPARE				L-SPR AO	AO	0	21	5
	SPARE				L-SPR AO	AO	0	21	6
	SPARE				L-SPR AO	AO	0	21	7

Table 3-5 – List of Alarms and Troubleshooting
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

	Location	Type	Possible Cause	Possible Remedy
1	Fire alarm control panel	Alarm	1. Fire 2.Faulty fire/smoke detector 3.Malfuctioning system	1. Follow Emergency action plan. 2. Isolate Zone and replace sensor 3. a) See Manufacturers Service Manual b) Contact Response center so that they are aware of a malfunction. **Refer to sequence of matrix operations – Table 3-5 for Fire alarm operations**
2	Fire alarm control panel	Trouble	1.Faulty fire/smoke detector 2.Malfuctioning system	1. Isolate Zone and replace sensor 2.a)See Manufacturers Service Manual b) Contact Response center so that they are aware of a malfunction.
3	DAF Emergency Eye Wash	In Use	1.Eyewash Inadvertently turned on 2.Leaking valve or piping 3.In-operative Flow switch	1. Check status of eye was and turn off 2.Turn off water supply and repair leak 3. Calibrate, Repair/replace Pressure switch
4	Plant Influent Flow	Low	1. Set points are incorrect at HMI. 2. Well pumps inoperative or shut down 3. Incorrect valving. 4. Check for obstruction in influent piping. 5. Inoperative flow meter.	1. Make sure that set points in HMI are correct 2. Assure that well proper pumps are operating and pumping 3. Assure that proper valves are Opened or Closed. 4. Clear obstructions. 5. Calibrate, repair or replace flow meter. See flow meter Operations Manual.
5	Plant Influent Flow	High	1. Set points are incorrect in at HMI 2. Excessive flow from extraction wells 3. Inoperative flow meter.	1. Make sure that set pints in HMI are correct for flow. 2. Assure that proper Extraction well pumps are operating. 3. Calibrate, repair or replace flow meter. See flow meter operations Manual.
6	DAF Feed pump flow	Low	1. EQ tank level low 2. EQ tank Level set point incorrect. 3. DAF feed pump valves not open 4. DAF feed pump VFD in "LOCAL" control 5. Inoperative Flow meter 6. Inoperative DAF Feed pump	1. Check EQ tank level and make sure that there is sufficient volume in tank. 2. Assure that set points in HMI are correct and is set in 'AUTO" mode 3. Assure that all valves are in the correct position. 4. Make sure VFD is in "remote" control. 5. Calibrate, repair or replace flow meter. See flow meter

Table 3-5 – List of Alarms and Troubleshooting
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

	Location	Type	Possible Cause	Possible Remedy
				operations Manual. 6. See DAF feed pump manual for pump troubleshooting.
7	DAF Feed pump flow	High	1. EQ tank level set point incorrect 2. DAF feed pump VFD in "LOCAL" control 3. Incorrect high speed setting or pump in manual mode	1. Assure that set points in HMI are correct. 2. Make sure VFD is in "remote" control. 3. For #3 cause, ensure both 1 and 2 remedies are followed
8	DAF Feed Pump 1	Fail	Check VFD for fault condition	Determine fault displayed on VFD and refer to VFD Operations manual for further troubleshooting.
9	DAF Feed Pump 2	Fail	Check VFD for fault condition	Determine fault displayed on VFD and refer to VFD Operations manual for further troubleshooting.
10	DAF Package System - Auger	Fail	1. Overload tripped 2. Jam or obstruction 3. Faulty Auger Drive Motor	1. Reset Overload 2. Remove obstruction 3. Replace Drive Motor 4. See Manufacturers Manual
11	DAF Froth Chamber	Low	Froth Level	Assure that froth pumps are running at proper speed and flow rate and level indicator is removed, checked and calibrated
12	DAF Froth Chamber	High	1. Froth Level 2. Obstructed Suction/Discharge piping.	1. a) assure that froth pumps are on b) assure that froth pumps are running at proper speed and flow rate and level indicator is removed, checked and calibrated 2. Clear obstructions from piping.
13	DAF Package System - Skimmer	Fail	1. Obstructed Skimmer 2. Skimmer Over torque 3. Motor Overload condition 4. Faulty Motor Drive 5. Broken/Misaligned Chain drive	1. Clear obstruction 2. Check torque adjustment/reset 3. Reset Overload 4. Repair/Replace Drive 5. Realign/replace Chain

Table 3-5 – List of Alarms and Troubleshooting
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

	Location	Type	Possible Cause	Possible Remedy
14	Filter Press Emergency Eye Wash	In Use	1.Eyewash turned On 2.Leaking valve or piping 3. Non-operative Flow switch	1. Check status of eye was 2.Turn off, repair leak 3. Calibrate, Repair/replace Pressure switch
15	Containment Area Emergency Eye Wash	In Use	1.Eyewash turned On 2.Leaking valve or piping 3. Faulty flow switch	1. Check status of eye was 2.Turn off, repair leak 3. Calibrate, Repair/replace Flow switch
16	Filter feed pump 1	Fail	Check VFD for fault condition	Determine fault displayed on VFD and refer to VFD Operations manual for further troubleshooting
17	Filter feed pump 2	Fail	Check VFD for fault condition	Determine fault displayed on VFD and refer to VFD Operations manual for further troubleshooting
18	HDBF Agitator Motor Overload	Fail	1. See manufactures manual	1. See manufactures Manual.
19	HDBF Agitator Motor Phase Monitor	Fail	1. Loss of power or partial loss of power. 2. Faulty Phase Monitor 3. HDBF system troubles	1. a) Check system supply power b) Check all system circuit breaker san fuses. 2. Calibrate, Repair or Replace phase monitor. 3. See Manufactures manual.
20	HDBF Differential Pressure High	High	1. Backwash time set too long 2. Excessive solids 3. Faulty pressure sensors	1. Manually backwash unit, reset time or DP 2. Check DAF for proper operation and effluent turbidity. 3. Calibrate, repair, or replace pressure switch 4. Refer to Manufacturers manual.
21	HDBF Filter Fault Light	Status	See Manufacturers Manual	See Manufacturers Manual
22	HDBF Agitator Phase Monitor Tripped Light	Status	1. Loss of phase 2. Under voltage 3. Uneven Phases 4. Over voltage	1. Check equipment line power 2. Calibrate, repair or Replace Phase monitor
23	HDBF Plant Air Pressure	Low	1. Low plant air supply pressure 2. HDBF regulator	1. Trouble shoot plant air system 2. a) Regulator set to too low of pressure. b) Faulty regulator
24	Decant Pump 1	Fail		

Table 3-5 – List of Alarms and Troubleshooting
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

	Location	Type	Possible Cause	Possible Remedy
			Check VFD for fault condition	Determine fault displayed on VFD and refer to VFD Operations manual for further troubleshooting.
25	Decant Pump 2	Fail	Check VFD for fault condition	Determine fault displayed on VFD and refer to VFD Operations manual for further troubleshooting.
26	Containment Sump HI HI Level	HIHI	1. Faulty level sensor 2. Storm water tank level high 3. Improper valving 4. Pump failure	1. Visually check sump level 2. Pump down Storm water tank or redirect flow to dirty backwash tank 3. Assure that all proper valves are open. 4. a) Pump not in "AUTO" position b). Seal failure c). Pump over temperature. d).Pump supply power
27	Polymer feed pump discharge pressure	High	1. Obstructed Polymer feed line 2. Faulty pressure switch 3. Inoperative Polymer feed pump	1. Clear polymer feed line 2. Calibrate, Replace pressure switch 3. Calibrate, Repair/replace polymer pump.
28	Control System UPS	On Battery	1. Power lose	1. Check plant supply power
29	Control System UPS	Fail	1. Inoperative UPS	2. See Manufacturers Manual
30	EQ Tank Hi level	High	1. DAF feed pumps 2. DAF controls and VFD control. 3. Set points are in-correct at HMI. 4. Faulty level detector	1. See DAF feed pump trouble shooting 2. Assure that feed pumps are in auto position on VFD and HMI 3. Verify level set point at HMI 4. a) Visually check EQ tank for proper level. b) Calibrate, Repair /Replace level detector or electrical circuitry
31	EQ Tank High High level	HH	1. DAF feed pumps 2. DAF controls and VFD control. 3. Set points are in-correct at HMI. 4. Faulty level detector	1. See DAF feed pump trouble shooting 2. Assure that feed pumps are in auto position on VFD and HMI 3. Verify level set point at HMI 4. a) Visually check EQ tank for proper level.

Table 3-5 – List of Alarms and Troubleshooting
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

	Location	Type	Possible Cause	Possible Remedy
				b) Repair /Replace level detector or electrical circuitry
32	EQ Tank Level Low	Low	1. DAF controls and VFD controls 2. Set points are in-correct at HMI. 3. Faulty Level Detector	1. Assure that DAF pumps are in auto position on VFD and HMI 2. Verify level set point at HMI 3. a) Visually check EQ tank for proper level. b) Calibrate, Repair /Replace level detector or electrical circuitry
33	EQ Tank Level Low low	Low	1. DAF controls and VFD controls 2. Set points are in-correct at HMI. 3. Faulty Level Detector	1. Assure that DAF pumps are in auto position on VFD and HMI 2. Verify level set point at HMI 3. a) Visually check EQ tank for proper level. b) Calibrate, Repair /Replace level detector or electrical circuitry
34	DAF effluent chamber Hi Level	High	1. Filter Feed pump controls and VFD control. 2. Set points are in-correct at HMI. 3. Filter feed pumps operation 4. Faulty level detector	1. Assure that filter feed pumps are in auto position at the DAF tank PID controller 2. Verify level set point at HMI 3. See filter feed pump trouble shooting under Volume II – Griswold pumps 4. a) Visually check DAF tank for proper level. b) Calibrate, Repair /Replace level detector or electrical circuitry
35	DAF effluent chamber High-High level	HH	1. Filter Feed pump controls and VFD control. 2. Set points are in-correct at HMI. 3. Filter feed pumps operation 4. Faulty level detector	1. Assure that filter feed pumps are in auto position at the DAF tank PID controller 2. Verify level set point at HMI 3. See filter feed pump trouble shooting under Volume II – Griswold pumps 4. a) Visually check DAF tank for proper level. b) Calibrate, Repair /Replace level detector or electrical circuitry
36	Effluent Tank Inlet flow	Low	1. Set points are in-correct at HMI. 2. Proper Valving 3. Blocked or restricted flow.	1. Make sure that set points in HMI are correct 2. Assure that all valves are in the proper positions 3. a) Check flow and pressers at HDBF filters. b) Check flows and pressures at GAC units.

Table 3-5 – List of Alarms and Troubleshooting
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

	Location	Type	Possible Cause	Possible Remedy
37	Effluent Tank Inlet flow	High	1. Set points are in-correct at HMI. 2. Proper Valving	1. Make sure that set points in HMI are correct 2. Assure that all valves are in the proper positions
38	Effluent tank Hi Level	High	1. Effluent Valve Closed 2. Effluent pipeline is obstructed 3. DAF Level set points incorrect. 4. Faulty level detector in DAF tank.	1. Assure that effluent valves are open 2. Remove obstruction from discharge line. 3. Check DAF level set point in HMI for correct setting. 4. Calibrate, repair or replace level detector.
39	Effluent tank High-High level	HH	1. Effluent Valve Closed 2. Effluent pipeline is obstructed 3. DAF Level set points incorrect. 4. Faulty level detector in DAF tank.	1. Assure that effluent valves are open 2. Remove obstruction from discharge line. 3. Check DAF level set point in HMI for correct setting. 4. Calibrate, repair or replace level detector.
40	Effluent Tank Lo	LO	Faulty Level Detector in Effluent tank	1.a. Verify level in effluent tank. b. Calibrate, repair or replace level detector
41	Effluent Tank Lo Lo	LO-LO	Faulty Level Detector in Effluent tank	1.a. Verify level in effluent tank. b. Calibrate, repair or replace level detector
42	Froth tank Hi Level	High	1. Incorrect level set point 2. Faulty level sensor in Froth tank. 3. Decant pumps not working	1. Assure that level set point is correct in HMI. 2. Calibrate, Repair/Replace level detector 3. a). Assure pump VFD is on and in remote b). Check for Decant pump fault on VFD and refer to VFD operating instructions.
43	Froth Tank High-High level	HH	1. Incorrect level set point 2. Faulty level sensor in Froth tank. 3. Decant pumps not working	1. Assure that level set point is correct in HMI. 2. Calibrate, Repair/Replace level detector 3. a). Assure pump VFD is on and in remote b). Check for Decant pump fault on VFD and refer to VFD operating instructions.

Table 3-5 – List of Alarms and Troubleshooting
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

	Location	Type	Possible Cause	Possible Remedy
44	Froth tank Level LO	LO	1. DAF controls and VFD control. 2. Set points are in-correct at HMI. 3. Faulty level detector	1. Assure that feed pumps are in auto position on VFD and HMI 2. Verify level set point at HMI 3. a). Visually check EQ tank for proper level. b). Calibrate, Repair /Replace level detector or electrical circuitry
45	Froth tank Level LO LO	LO-LO	1. DAF controls and VFD control. 2. Set points are in-correct at HMI. 3. Faulty level detector	1. Assure that feed pumps are in auto position on VFD and HMI 2. Verify level set point at HMI 3. a). Visually check EQ tank for proper level. b). Calibrate, Repair /Replace level detector or electrical circuitry
46	Digester Tank Hi Level	High	1. Level high 2. Inaccurate reading 3. Faulty level detector	1. Manually pump out digester decant/solids 2. Manually check level of tank 3. Calibrate, repair or replace level detector
47	Digester Tank High-High level	HH	1. Level high 2. Inaccurate reading 3. Faulty level detector	1. Manually pump out digester decant/solids 2. Visually check level in Digester tank. 3. Calibrate, repair or replace level indicator.
48	Dirty Backwash Tank Hi Level	High	1. Level High 2. Inaccurate reading 3. Level Indicator	1. Suspend backwash operations and manually pump out digester decant/solids 2. Visually check level in Backwash tank 3. Calibrate, repair or replace level indicator.
49	Dirty Backwash Tank High-High level	HH	1. Level High 2. Inaccurate reading 3. Level Indicator	1. Manually pump out digester decant/solids 2. Visually check level in Backwash tank 3. Calibrate, repair or replace level indicator.
50	Dirty backwash Tank LO	LO	1. Faulty level detector. 2. Assure that all valves are closed	1. a). Visually check EQ tank for proper level. b). Calibrate Repair /Replace level detector or electrical circuitry 2. Check and make sure that valves TS-01, TS-02 and TS/SS-01 are closed and not leaking.

Table 3-5 – List of Alarms and Troubleshooting
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

	Location	Type	Possible Cause	Possible Remedy
51	Digester Tank LO	LO	1. Faulty level detector. 2. Assure that all valves are closed	1. a). Visually check EQ tank for proper level. b). Repair /Replace level detector or electrical circuitry 2. Check and make sure that valves DS-01 and DS-02 are closed and there is no leakage.
52	Storm water Recycle Hi Level	High	1. Level High 2. Inaccurate reading 3. Level indicator	1. Pump out storm water tank 2. Visually check level in Stromwater tank. 3. Calibrate, repair or replace level indicator.
53	Storm water Recycle high-High level	HH	1. Level High 2. Inaccurate reading 3. Level indicator	1. Pump out storm water tank 2. Visually check level in Stromwater tank. 3. Calibrate, repair or replace level indicator.
54	Storm water Recycle Tank Lo	LO	1. Faulty level detector. 2. Assure that all valves are closed	1. a). Visually check EQ tank for proper level. b). Calibrate, Repair /Replace level detector or electrical circuitry 2. Check and make sure that valves STW-09 and field drains are closed and there is no leakage.
55	Plant water Storage Level Low	Low	1. Open valve or piping 2. Level sensor inoperative 3. Well pump inoperative 4 Inaccurate reading	1. Close valve or repair piping. 2. Check level in tank 3. Assure well pump is running 4. Check well pump controls of tripped overload
56	Plant Water Level Storage Level Low-Low	LL	1. Open valve or piping 2. Level sensor inoperative 3. Well pump inoperative 4 Inaccurate reading	1. Close valve or repair piping. 2. Check level in tank 3. Assure well pump is running 4. Check well pump controls of tripped overload
57	Plant water level High	High	1. Incorrect set point in HMI 2. Level Indicator	1. Check set points in HMI 2. Calibrate, repair or replace level indicator.
58	Plant water level High-High	HH	1. Incorrect set point in HMI 2. Level Indicator	1. Check set points in HMI 2. Calibrate, repair or replace level indicator.
59	Air Compressor discharge pressure Low	Low	1. Compressor shutdown 2. Faulty regulator 3. Inoperative Pressure switch 4. Leak in air system	1. Assure compressor is running and producing air 2. Readjust/replace air pressure regulator 3. Calibrate, repair or Replace pressure switch 4. Repair leaky system

Table 3-5 – List of Alarms and Troubleshooting
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

	Location	Type	Possible Cause	Possible Remedy
60	Plant Process Air Pressure Low	Low	1. Compressor shutdown 2. Faulty regulator 3. Inoperative Pressure switch 4. Leak in air system	1. Assure compressor is running and producing air 2. Readjust/replace air pressure regulator 3. Calibrate, repair or Replace pressure switch 4. Repair leaky system
61	Plant Water Pressure Low	Low	1. Inoperative pressure pump 2. Faulty pressure switch 3. Tripped overload relay	1. Repair/Replace pressure pump 2. Calibrate, Repair/Replace pressure switch 3. Reset overload protective device
62	Aeration Blower High Pressure	High	1. Valves not open 2. Check level in digester tank	1. a) Make sure that all blower discharge valves are open 2. Pump down digester tank.
63	FIT-1009 LO (Total well flow)	LO	1. Extraction well flow low 2. Obstructed piping from extraction wells 3. Faulty or inaccurate flow meter	1. Adjust extraction well(s) flow rate 2. Check and clear extraction well influent lines. 3. Troubleshoot, calibrate, repair or replace flow meter.
64	FIT-1009 HI (Total well flow)	HI	1. Extraction well flow 2. Faulty or inaccurate flow meter	1. Adjust extraction well(s) flow rate 2. Troubleshoot, calibrate, repair or replace flow meter.
65	FIT-1110 LO (DAF feed flow meter)	LO	1. DAF feed pump VFD control in manual mode. 2. DAF feed pump coupling 3. DI-01 and DAF feed pump valves closed 4. Obstructed piping in filter feed lines. 5. Faulty level detector in EQ tank. 6. Faulty or inaccurate flow meter	1. Assure that VFD is in remote control AUTO position 2. Replace coupling 3. Assure that all valves are open in system 4. Clear obstruction 5. a). Visually check EQ tank for proper level. b). Repair /Replace level detector or electrical circuitry 6. Troubleshoot, calibrate, repair or replace flow meter.
66	FIT 1110 HI (DAF feed flow Meter)	HI	1. Filter feed pump VFD control in manual mode 2. Faulty level detector in EQ tank. 3. Faulty or inaccurate flow meter	1. Assure that VFD is in remote control AUTO position 2.. a). Visually check EQ tank for proper level. b). Repair /Replace level detector or electrical circuitry 3. Troubleshoot, Calibrate, repair or replace flow meter.
67	FIT 1321 LO (Plant Effluent flow meter)	LO	1. Filter feed pump VFD control in manual mode. 2. Filter feed pump coupling 3. Valve PLE-09 closed or partially open 4. Obstructed piping in filter feed lines. 5. Faulty level detector in effluent tank. 6. Faulty or inaccurate flow meter	1. Assure that VFD is in remote control AUTO position 2. Replace coupling 3. Assure that valve PLE-09 is open in system 4. Clear obstruction 5. a). Visually check EQ tank for proper level. b). Repair /Replace level detector or electrical circuitry 6. Troubleshoot, Calibrate, repair or replace flow meter.

Table 3-5 – List of Alarms and Troubleshooting
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

	Location	Type	Possible Cause	Possible Remedy
68	FIT 1321 HI (Plant Effluent flow meter)	HI	1. Filter feed pump VFD control in manual mode. 2. Faulty level detector in effluent tank. 3. Faulty or inaccurate flow meter	1. Assure that VFD is in remote control AUTO position 2. a). Visually check EQ tank for proper level. b). Repair /Replace level detector or electrical circuitry 3. Troubleshoot, calibrate, repair or replace flow meter.
69	FIT 1371 LO (Backwash Flow Meter)	LO	1. Backwash pumps valves closed 2. Obstructed piping in filter feed lines. 3. DAF feed pump coupling 4. Faulty or inaccurate flow meter	1. Assure that all valves are open in system 2. Clear obstruction 3. Replace coupling 4. Troubleshoot, repair or replace flow meter.
70	FIT 1371 HI (Backwash Flow Meter)	HI	Valve Throttled incorrectly	1. Throttle valve to correct flow

***Always refer to Manufacturers Manual for further information and trouble shooting procedures.**

Table 3-6: Operator Set Points
11/17/2008
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

Equipment	Transmitter	Set Point	Setting		Units
Plant Influent Flow	FIT1009	HIHI	150.0		GPM
		HI	150.0		
		LO	0.0		
		LOLO	0.0		
EQ Tank Level	LIT1011	HIHI	23.0		Feet
		HI	22.0		
		LO	5.5		
		LOLO	4.5		
DAF Feed Flow	FIT1110	HIHI	150.0		GPM
		HI	150.0		
		LO	0.0		
		LOLO	0.0		
Media Filter Differential Pressure	DPIT1281	HIHI	30.0		PSIG
		HI	20.0		
		LO	0.0		
		LOLO	0.0		
Media Filter Discharge Pressure	DPIT1282	HIHI	30.0		PSIG
		HI	20.0		
		LO	0.0		
		LOLO	0.0		
Effluent Tank Level	LIT1331	HIHI	22.0		Feet
		HI	21.0		
		LO	4.0		
		LOLO	2.0		
Plant Effluent Flow	FIT1321	HIHI	150.0		GPM
		HI	150.0		
		LO	0.0		
		LOLO	0.0		
Backwash Flow	FIT1371	HIHI	700.0		GPM
		HI	700.0		
		LO	0.0		
		LOLO	0.0		
Froth Tank Level	LIT1381	HIHI	5.0		Feet
		HI	4.0		
		LO	2.0		
		LOLO	1.0		

Table 3-6: Operator Set Points
11/17/2008
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

Equipment	Transmitter	Set Point	Setting		Units
Aeration Blower Discharge Pressure	PIT1555	HIHI	5.0		PSIG
		HI	5.0		
		LO	0.0		
		LOLO	0.0		
Digester Tank Level	LIT1421	HIHI	13.0		Feet
		HI	12.0		
		LO	2.0		
		LOLO	1.0		
Dirty Backwash Tank Level	LIT1441	HIHI	12.5		Feet
		HI	11.5		
		LO	2.5		
		LOLO	1.5		
Stormwater/Recycle Tank Level	LIT1521	HIHI	16.5		Feet
		HI	15.5		
		LO	2.0		
		LOLO	1.0		
Air Compressor Discharge Pressure	PT1650	HIHI	150.0		PSIG
		HI	150.0		
		LO	90.0		
		LOLO	0.0		
Plant Process Air Pressure	PT1466	HIHI	150.0		PSIG
		HI	150.0		
		LO	90.0		
		LOLO	0.0		
Plant Water Storage Tank Level	LIT1570	HIHI	8.5		Feet
		HI	7.5		
		LO	2.5		
		LOLO	1.5		
Plant Water Pressure	PIT1591	HIHI	100.0		PSIG
		HI	100.0		
		LO	45.0		
		LOLO	0.0		

Table 4-1: Normal Operations – EQ Tanks, DAF and DAF Effluent Systems
(Figures 3-4, 3-5, 3-6 and 3-7)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments/Location
PLI-01	Plug	Open	Isolation valve to EQ tank
STW-13	Plug	Open	Recycle water from stormwater recycle pump
STW-V03	Ball	Closed	Storm water recycle line vent
NAPL-01	Plug	Closed	LNAPL draw off
NAPL-02	Plug	Closed	DNAPL draw off
BWR/FI/RCY-01	Plug	Open	Filter feed pump recycle
PLE/RCY-01	Plug	Closed	Plant effluent recycle
FRE-07	Plug	Open	Froth Tank decant
PLI-D01	Ball	Closed	Influent line drain
STW-D05	Ball	Closed	Storm water recycle line drain
DI-01	Pneumatic plug valve (FV-1021)	Open	From equalization tank to DAF feed pumps
SP-1	Sample Port	Closed	Sample port prior to DAF feed
DI-02	Plug	Open	3 inch DI line associated with DAF feed pump
DI-05	Plug	Open	Spare DAF Feed Pump valve
DI-03	Swing Check	Check	
DI-04	Plug	Open	3 inch DI line associated with DAF feed pump
DI-06	Swing Check	Check	Spare DAF Feed Pump valve
DI-07	Plug	Open	Spare DAF Feed Pump valve
DI-08	Plug	Open	3 inch DI line after DAF feed pump
DI-09	Plug	Open	3 inch DI line after DAF feed pump
DI-10	Plug	Open	3 inch DI line prior to DAF unit
FRI-01	Diaphragm	Open	1 inch froth line FRI from DAF unit
FRI-02	Diaphragm	Open	1 inch froth line FRI from DAF unit
DAF-D01	Diaphragm	Closed	DAF unit drain

Table 4-1: Normal Operations – EQ Tanks, DAF and DAF Effluent Systems (Figures 3-4, 3-5, 3-6 and 3-7) (Continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments/Location
DAF-D02	Diaphragm	Closed	DAF unit drain
DE-01	Plug	Open	3 inch DE line after DAF unit
SP-2	Sample Port	Closed	DAF effluent sample
DR-03	Diaphragm	Open	2 inch recycle line from air saturation tank to DAF unit
DR-04	Gate Regulated Side Pressure Control	Open	Recycle line from recycle pump to DAF unit
DR-05	Ball	Open	Recycle line from recycle pump to DAF unit
AHP-09	Ball	Open	High pressure air from air receiver
AHP-10	Gate	Open	High pressure air from air receiver
AHP-11	Needle	Open	High pressure air from air receiver
AHP-12	Ball	Open	High pressure air from air receiver
AHP-13	Ball	Open	High pressure air from air receiver
AHP-14	Ball	Open	High pressure air from air receiver
DR-01	Diaphragm	Open	Recycle line from DAF prior to recycle pump
DR-D01	Diaphragm	Closed	Recycle line drain from DAF prior to recycle pump
DR-02	Diaphragm	Open	Recycle line to air saturation tank
DR-V01	Ball	Closed	Air saturation tank vent
DR-D02	Butterfly	Closed	Air saturation tank drain
FRI-03	Plug	Open	Froth Pump #1
FRI-04	Pressure	Open	Froth Pump #1
FRI-05	Check	Check	Froth Pump #1
FRI-06	Plug	Open	Froth Pump #1
FRI-07	Plug	Open	Froth Pump #2
FRI-08	Pressure	Open	Froth Pump #2
FRI-09	Check	Check	Froth Pump #2
FRI-10	Plug	Open	Froth Pump #2
DE-02	Plug	Open	Filter feed pump #1
DE-03	Check	Check	Filter feed pump #1

Table 4-1: Normal Operations – EQ Tanks, DAF and DAF Effluent Systems (Figures 3-4, 3-5, 3-6 and 3-7) (Continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments/Location
DE-04	Plug	Open	Filter feed pump #1
DE-05	Plug	Open	Filter feed pump #2
DE-06	Check	Check	Filter feed pump #2
DE-07	Plug	Open	Filter feed pump #2
DE-08	Plug	Open	DAF effluent
FI/SA-01	Plug	Open	Prior to turbidimeter
FI/SA-02	Pressure	Open	Prior to turbidimeter
FI-01	Plug	See comments	Closed during recirculation and Open during HDBF operation
FI/RCY-01	Plug	See comments	Open during recirculation and Closed during HDBF operation

Table 4-2: Normal Operations - Hydromation Bed Filtration System
(Figure 3-8)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments/Location
PCV-1271	Regulated gate	Open	Instrument air supply
V-116	Ball	Open	Instrument air supply
AV-1266	Ball	Closed	Vent line
PRV-100	Pressure relief	Closed	Vent line
V-110	Ball	Closed	Media drain
V-107	Ball	Closed	Filter backwash effluent vent
V-108	Ball – Sample Port	Closed	Backwash discharge
AV-1264	Ball	Closed	Backwash discharge effluent
V-115	Plug	Closed	Filter backwash effluent
V-106 (SP-3)	Ball – Sample port	Closed	Filter influent
V-103	Ball	Closed	Isolation valve
V-102	Ball	Closed	Filter inlet pressure
V-104	Ball	Closed	Isolation valve
V-109	Ball	Closed	Filter drain
V-105 (SP-4)	Ball – Sample port	Closed	Filter discharge sampling
AV-1267	Ball	Closed	Isolation Valve (backwash)
AV-1263	Ball	Closed	Backwash supply
V-114	Plug	Closed	Backwash supply
AV-1261	Ball	Open	Filter influent from filter feed pumps
V-113	Plug	Open	Filter influent from filter feed pumps
AV-1262	Ball	Open	Filter effluent from filter
V-112	Plug	Open	Filter effluent from filter
AV-1265	Ball	Closed	Recirculation forward flush effluent
V-111	Ball	Closed	Forward flush effluent
SP-15	Sample Ports	Closed	HDBF Backwash effluent

Table 4-3: Backwash Operation - Hydromation Bed Filtration System
(Figures 3-8 and 3-10)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

Backwash Operation Cycle takes approximately 12 minutes and is initiated based upon differential pressure across the filter system measured at DPIT-1281 (Pressure difference between P-100 and P-101). The forward flush recirculation is done immediately after the backwash operation and takes approximately 2 minutes

VALVE#	TYPE	POSITION	Comments/Location
PCV-1271	Regulated gate	Open	Instrument air supply
V-116	Ball	Open	Instrument air supply
AV-1266	Ball	Closed	Vent line
PRV-100	Pressure relief	Closed	Vent line
V-110	Ball	Closed	Media drain
V-107	Ball	Closed	Filter backwash effluent line
V-108	Ball – Sample Port	Closed	Backwash discharge
AV-1264	Ball	Open	Backwash discharge effluent
V-115	Plug	Open	Filter backwash effluent
V-106 (SP-3)	Ball – Sample port	Closed	Filter influent
V-103	Ball	Closed	Isolation valve
V-102	Ball	Open	Filter inlet pressure
V-104	Ball	Closed	Isolation valve
V-109	Ball	Closed	Filter drain
V-105 (SP-4)	Ball – Sample port	Closed	Filter discharge sampling
AV-1267	Ball	Open	Isolation Valve (backwash)
AV-1263	Ball	Open	Backwash supply
V-114	Plug	Open	Backwash supply
AV-1261	Ball	Closed	Filter influent from filter feed pumps
V-113	Plug	Closed	Filter influent from filter feed pumps
AV-1262	Ball	Closed	Filter effluent from filter
V-112	Plug	Closed	Filter effluent from filter
AV-1265	Ball	Closed	Recirculation forward flush effluent
V-111	Ball	Closed	Forward flush effluent
SP-15	Sample Port	Closed	Backwash effluent

Tables 4-4-a: Normal Operations - GAC System (Figure 3-9)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

Carbon Vessels in Series – GAC-1, GAC-2 and GAC-3 operation combination
Carbon Vessels – GAC-4 and GAC-5 in stand-by mode

VALVE#	TYPE	POSITION	Comments/Location
FI/BYP-02	Plug	Closed	Bypasses filter system
FE-02	Plug	Closed	Common header for influent from filters
FE-04	Plug	Closed	Common header for influent from filters
FE-06	Plug	Closed	Common header for influent from filters
FE-07	Plug	Closed	Common header for influent from filters
FI/RCY/BYP - 01	Plug	Closed	
PLE-03	Plug	Closed	Common top effluent header
PLE-06	Plug	Closed	Common top effluent header
PLE-07	Plug	Open	Common effluent
PLE-08	Plug	Closed	Common effluent
PLE-09	Plug	Open	Effluent from GAC system
SP-10	Sample Port	Closed	Plant effluent after GACs
BWE/FFS-02	Plug	Closed	GAC-1
GAC 1-I01	Plug	Closed	From GAC-5
FE-01	Plug	Open	GAC-1 influent
SP-5	Sample Port	Closed	GAC-1 effluent
BWS/FFE-02	Plug	Closed	GAC-1
GAC1-E01	Plug	Open	GAC-1 effluent

Tables 4-4-a: Normal Operations - GAC System (Figure 3-9) (continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments/Location
PLE-01	Plug	Closed	GAC-1 to common top effluent header
GAC1-V01	Plug	Closed	Relief valve – GAC-1
CAV-01	Plug	Closed	Air supply
GAC1-D01	Plug	Closed	Water Drain – GAC-1
CF-01	Plug	Closed	Carbon Inlet – GAC-1
CD-01	Plug	Closed	Carbon Outlet – GAC-1
BWE/FFS-03	Plug	Closed	GAC-2
GAC 2-I01	Plug	Closed	From GAC-5
FE-03	Plug	Open	GAC-2 influent
SP-6	Sample Port	Closed	GAC-2 effluent
BWS/FFE-03	Plug	Closed	GAC-2
GAC 2-E02	Plug	Closed	GAC-2
PLE-02	Plug	Closed	Influent to GAC-2 from GAC-1
PLE-04	Plug	Closed	Effluent from GAC-2 to top common header
GAC2-V01	Plug	Closed	Relief valve – GAC-2
CAV-02	Plug	Closed	Air supply
GAC2-D01	Plug	Closed	Water Drain – GAC-2
CF-02	Plug	Closed	Carbon Inlet – GAC-2
CD-02	Plug	Closed	Carbon Outlet – GAC-2
BWE/FFS-04	Plug	Closed	GAC-3
FE-05	Plug	Open	GAC-3 influent

Tables 4-4-a: Normal Operations - GAC System
(Figure 3-9) (continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments/Location
SP-7	Sample Port	Closed	GAC-3 effluent
BWS/FFE-04	Plug	Closed	GAC-3
GAC3-E01	Plug	Closed	GAC-3 effluent
PLE-05	Plug	Closed	Effluent from GAC-3 to top common header
GAC3-V01	Plug	Closed	Relief valve – GAC-3
CAV-03	Plug	Closed	Air supply
GAC3-D01	Plug	Closed	Water Drain – GAC-3
CF-03	Plug	Closed	Carbon Inlet – GAC-3
CD-03	Plug	Closed	Carbon Outlet – GAC-3
BWE/FFS-05	Plug	Closed	GAC-4
GAC 4-I01	Plug	Closed	GAC-4 influent
SP-8	Sample Port	Closed	GAC-4 effluent
BWS/FFE-05	Plug	Closed	GAC-4
GAC4-E01	Plug	Closed	GAC-4 effluent
GAC4-V01	Plug	Closed	Relief valve – GAC-4
CAV-04	Plug	Closed	Air supply
GAC4-D01	Plug	Closed	Water Drain – GAC-4
CF-04	Plug	Closed	Carbon Inlet – GAC-4
CD-04	Plug	Closed	Carbon Outlet – GAC-4
BWE/FFS-06	Plug	Closed	GAC-5
GAC 5-I01	Plug	Closed	GAC-5 influent
SP-9	Sample Port	Closed	GAC-5 effluent

Tables 4-4-a: Normal Operations - GAC System
(Figure 3-9) (continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments/Location
BWS/FFE-06	Plug	Closed	GAC-5
GAC5-E01	Plug	Closed	GAC-5 effluent
GAC5-E02	Plug	Closed	GAC-5 effluent
GAC5-V01	Plug	Closed	Relief valve – GAC-5
CAV-05	Plug	Closed	Air supply
GAC5-D01	Plug	Closed	Water Drain – GAC-5
CF-05	Plug	Closed	Carbon Inlet – GAC-5
CD-05	Plug	Closed	Carbon Outlet – GAC-5

Table 4-4-b: Normal Operations - GAC System (Figure 3-9)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

Carbon Vessels in Series – GAC-2, GAC-3 and GAC-4 operation combination
Carbon Vessels – GAC-1 and GAC-5 in stand-by mode

VALVE#	TYPE	POSITION	Comments/Location
FI/BYP-02	Plug	Closed	Bypasses filter system
FE-02	Plug	Open	Common header for influent from filters
FE-04	Plug	Closed	Common header for influent from filters
FE-06	Plug	Closed	Common header for influent from filters
FE-07	Plug	Closed	Common header for influent from filters
FI/RCY/BYP - 01	Plug	Closed	
PLE-03	Plug	Closed	Common top effluent header
PLE-06	Plug	Closed	Common top effluent header
PLE-07	Plug	Closed	Common effluent
PLE-08	Plug	Open	Common effluent
PLE-09	Plug	Open	Effluent from GAC system
SP-10	Sample Port	Closed	
BWE/FFS-02	Plug	Closed	GAC-1
GAC 1-I01	Plug	Closed	To GAC-1 from GAC-5
FE-01	Plug	Closed	GAC-1
SP-5	Sample Port	Closed	GAC-1
BWS/FFE-02	Plug	Closed	GAC-1
GAC1-E01	Plug	Closed	GAC-1
PLE-01	Plug	Closed	GAC-1 to common top effluent header

Table 4-4-b: Normal Operations - GAC System
(Figure 3-9) (continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments/Location
GAC1-V01	Plug	Closed	Relief valve – GAC-1
CAV-01	Plug	Closed	Air supply
GAC1-D01	Plug	Closed	Water Drain – GAC-1
CF-01	Plug	Closed	Carbon Inlet – GAC-1
CD-01	Plug	Closed	Carbon Outlet – GAC-1
BWE/FFS-03	Plug	Closed	GAC-2
GAC 2-I01	Plug	Closed	To GAC-2 from GAC-5
FE-03	Plug	Open	GAC-2
SP-6	Sample Port	Closed	GAC-2
BWS/FFE-03	Plug	Closed	GAC-2
GAC2-E02	Plug	Open	GAC-2
PLE-02	Plug	Closed	Influent to GAC-2 from GAC-1
PLE-04	Plug	Closed	Effluent from GAC-2 to top common header
GAC2-V01	Plug	Closed	Relief valve – GAC-2
CAV-02	Plug	Closed	Air supply
GAC2-D01	Plug	Closed	Water Drain – GAC-2
CF-02	Plug	Closed	Carbon Inlet – GAC-2
CD-02	Plug	Closed	Carbon Outlet – GAC-2
BWE/FFS-04	Plug	Closed	GAC-3
FE-05	Plug	Open	GAC-3
SP-7	Sample Port	Closed	GAC-3

Table 4-4-b: Normal Operations - GAC System
(Figure 3-9) (continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments/Location
BWS/FFE-04	Plug	Closed	GAC-3
GAC3-E01	Plug	Open	GAC-3
PLE-05	Plug	Closed	Effluent from GAC-3 to top common header
GAC3-V01	Plug	Closed	Relief valve – GAC-3
CAV-03	Plug	Closed	Air supply
GAC3-D01	Plug	Closed	Water Drain – GAC-3
CF-03	Plug	Closed	Carbon Inlet – GAC-3
CD-03	Plug	Closed	Carbon Outlet – GAC-3
BWE/FFS-05	Plug	Closed	GAC-4
GAC 4-I01	Plug	Open	GAC-4
SP-8	Sample Port	Closed	GAC-4
BWS/FFE-05	Plug	Closed	GAC-4
GAC4-E01	Plug	Closed	GAC-4
GAC4-V01	Plug	Closed	Relief valve – GAC-4
CAV-04	Plug	Closed	Air supply
GAC4-D01	Plug	Closed	Water Drain – GAC-4
CF-04	Plug	Closed	Carbon Inlet – GAC-4
CD-04	Plug	Closed	Carbon Outlet – GAC-4
BWE/FFS-06	Plug	Closed	GAC-5
GAC 5-I01	Plug	Closed	GAC-5
SP-9	Sample Port	Closed	GAC-5
BWS/FFE-06	Plug	Closed	GAC-5

Table 4-4-b: Normal Operations - GAC System (Figure 3-9) (continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments/Location
GAC5-E01	Plug	Closed	GAC-5
GAC5-E02	Plug	Closed	GAC-5
GAC5-V01	Plug	Closed	Relief valve – GAC-5
CAV-05	Plug	Closed	Air supply
GAC5-D01	Plug	Closed	Water Drain – GAC-5
CF-05	Plug	Closed	Carbon Inlet – GAC-5
CD-05	Plug	Closed	Carbon Outlet – GAC-5

Table 4-4-c: Normal Operations - GAC System (Figure 3-9)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

Carbon Vessels in Series – GAC-3, GAC-4 and GAC-5 operation combination
Carbon Vessels – GAC-1 and GAC-2 in stand-by mode

VALVE#	TYPE	POSITION	Comments/Location
FI/BYP-02	Plug	Closed	Bypasses filter system
FE-02	Plug	Open	Common header for influent from filters
FE-04	Plug	Open	Common header for influent from filters
FE-06	Plug	Closed	Common header for influent from filters
FE-07	Plug	Closed	Common header for influent from filters
FI/RCY/BYP - 01	Plug	Closed	
PLE-03	Plug	Closed	Common top effluent header
PLE-06	Plug	Closed	Common top effluent header
PLE-07	Plug	Closed	Common effluent
PLE-08	Plug	Closed	Common effluent
PLE-09	Plug	Open	Effluent from GAC system
SP-10	Sample Port	Closed	
BWE/FFS-02	Plug	Closed	GAC-1
GAC 1-I01	Plug	Closed	To GAC-1 from GAC-5
FE-01	Plug	Closed	GAC-1
SP-5	Sample Port	Closed	GAC-1
BWS/FFE-02	Plug	Closed	GAC-1
GAC1-E01	Plug	Closed	GAC-1
PLE-01	Plug	Closed	GAC-1 to common top effluent header

Table 4-4-c: Normal Operations - GAC System
(Figure 3-9) (continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments/Location
GAC1-V01	Plug	Closed	Relief valve – GAC-1
CAV-01	Plug	Closed	Air supply
GAC1-D01	Plug	Closed	Water Drain – GAC-1
CF-01	Plug	Closed	Carbon Inlet – GAC-1
CD-01	Plug	Closed	Carbon Outlet – GAC-1
BWE/FFS-03	Plug	Closed	GAC-2
GAC 2-I01	Plug	Closed	GAC-2
FE-03	Plug	Closed	GAC-2
SP-6	Sample Port	Closed	GAC-2
BWS/FFE-03	Plug	Closed	GAC-2
GAC2-E02	Plug	Closed	GAC-2
PLE-02	Plug	Closed	Influent to GAC-2 from GAC-1
PLE-04	Plug	Closed	Effluent from GAC-2 to top common header
GAC2-V01	Plug	Closed	Relief valve – GAC-2
CAV-02	Plug	Closed	Air supply
GAC2-D01	Plug	Closed	Water Drain – GAC-2
CF-02	Plug	Closed	Carbon Inlet – GAC-2
CD-02	Plug	Closed	Carbon Outlet – GAC-2
BWE/FFS-04	Plug	Closed	GAC-3
FE-05	Plug	Open	GAC-3
SP-7	Sample Port	Closed	GAC-3

Table 4-4-c: Normal Operations - GAC System
(Figure 3-9) (continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments/Location
BWS/FFE-04	Plug	Closed	GAC-3
GAC3-E01	Plug	Open	GAC-3
PLE-05	Plug	Closed	Effluent from GAC-3 to top common header
GAC3-V01	Plug	Closed	Relief valve – GAC-3
CAV-03	Plug	Closed	Air supply
GAC3-D01	Plug	Closed	Water Drain – GAC-3
CF-03	Plug	Closed	Carbon Inlet – GAC-3
CD-03	Plug	Closed	Carbon Outlet – GAC-3
BWE/FFS-05	Plug	Closed	GAC-4
GAC 4-I01	Plug	Open	GAC-4
SP-8	Sample Port	Closed	GAC-4
BWS/FFE-05	Plug	Closed	GAC-4
GAC4-E01	Plug	Open	GAC-4
GAC4-V01	Plug	Closed	Relief valve – GAC-4
CAV-04	Plug	Closed	Air supply
GAC4-D01	Plug	Closed	Water Drain – GAC-4
CF-04	Plug	Closed	Carbon Inlet – GAC-4
CD-04	Plug	Closed	Carbon Outlet – GAC-4
BWE/FFS-06	Plug	Closed	GAC-5
GAC 5-I01	Plug	Open	GAC-5
SP-9	Sample Port	Closed	GAC-5
BWS/FFE-06	Plug	Closed	GAC-5

Table 4-4-c: Normal Operations - GAC System
(Figure 3-9) (continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments/Location
GAC5-E01	Plug	Open	GAC-5
GAC5-E02	Plug	Closed	GAC-5
GAC5-V01	Plug	Closed	Relief valve – GAC-5
CAV-05	Plug	Closed	Air supply
GAC5-D01	Plug	Closed	Water Drain – GAC-5
CF-05	Plug	Closed	Carbon Inlet – GAC-5
CD-05	Plug	Closed	Carbon Outlet – GAC-5

Table 4-4-d: Normal Operations - GAC System (Figure 9)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

Carbon Vessels in Series – GAC-4, GAC-5 and GAC-1 operation combination
Carbon Vessels – GAC-2 and GAC-3 in stand-by mode

VALVE#	TYPE	POSITION	Comments/Location
FI/BYP-02	Plug	Closed	Bypasses filter system
FE-02	Plug	Open	Common header for influent from filters
FE-04	Plug	Open	Common header for influent from filters
FE-06	Plug	Open	Common header for influent from filters
FE-07	Plug	Closed	Common header for influent from filters
FI/RCY/BYP - 01	Plug	Closed	
PLE-03	Plug	Open	Common top effluent header
PLE-06	Plug	Open	Common top effluent header
PLE-07	Plug	Closed	Common effluent
PLE-08	Plug	Closed	Common effluent
PLE-09	Plug	Open	Effluent from GAC system
SP-10	Sample Port	Closed	
BWE/FFS-02	Plug	Closed	GAC-1
GAC 1-I01	Plug	Open	To GAC-1 from GAC-5
FE-01	Plug	Closed	GAC-1
SP-5	Sample Port	Closed	GAC-1
BWS/FFE-02	Plug	Closed	GAC-1
GAC1-E01	Plug	Closed	GAC-1
PLE-01	Plug	Open	GAC-1 to common top effluent header

Table 4-4-d: Normal Operations - GAC System (Figure 9) (continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments/Location
PLE-01	Plug	Open	GAC-1 to common top effluent header
GAC1-V01	Plug	Closed	Relief valve – GAC-1
CAV-01	Plug	Closed	Air supply
GAC1-D01	Plug	Closed	Water Drain – GAC-1
CF-01	Plug	Closed	Carbon Inlet – GAC-1
CD-01	Plug	Closed	Carbon Outlet – GAC-1
BWE/FFS-03	Plug	Closed	GAC-2
GAC 2-I01	Plug	Closed	To GAC-2 from GAC-5
FE-03	Plug	Closed	GAC-2
SP-6	Sample Port	Closed	GAC-2
BWS/FFE-03	Plug	Closed	GAC-2
GAC2-E02	Plug	Closed	GAC-2
PLE-02	Plug	Closed	Influent to GAC-2 from GAC-1
PLE-04	Plug	Closed	Effluent from GAC-2 to top common header
GAC2-V01	Plug	Closed	Relief valve – GAC-2
CAV-02	Plug	Closed	Air supply
GAC2-D01	Plug	Closed	Water Drain – GAC-2
CF-02	Plug	Closed	Carbon Inlet – GAC-2
CD-02	Plug	Closed	Carbon Outlet – GAC-2
BWE/FFS-04	Plug	Closed	GAC-3
FE-05	Plug	Closed	GAC-3
SP-7	Sample Port	Closed	GAC-3

Table 4-4-d: Normal Operations - GAC System (Figure 9) (continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments/Location
BWS/FFE-04	Plug	Closed	GAC-3
GAC3-E01	Plug	Closed	GAC-3
PLE-05	Plug	Closed	Effluent from GAC-3 to top common header
GAC3-V01	Plug	Closed	Relief valve – GAC-3
CAV-03	Plug	Closed	Air supply
GAC3-D01	Plug	Closed	Water Drain – GAC-3
CF-03	Plug	Closed	Carbon Inlet – GAC-3
CD-03	Plug	Closed	Carbon Outlet – GAC-3
BWE/FFS-05	Plug	Closed	GAC-4
GAC 4-I01	Plug	Open	GAC-4
SP-8	Sample Port	Closed	GAC-4
BWS/FFE-05	Plug	Closed	GAC-4
GAC4-E01	Plug	Open	GAC-4
GAC4-V01	Plug	Closed	Relief valve – GAC-4
CAV-04	Plug	Closed	Air supply
GAC4-D01	Plug	Closed	Water Drain – GAC-4
CF-04	Plug	Closed	Carbon Inlet – GAC-4
CD-04	Plug	Closed	Carbon Outlet – GAC-4
BWE/FFS-06	Plug	Closed	GAC-5
GAC 5-I01	Plug	Open	GAC-5
SP-9	Sample Port	Closed	GAC-5
BWS/FFE-06	Plug	Closed	GAC-5

Table 4-4-d: Normal Operations - GAC System (Figure 9) (continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments/Location
GAC5-E01	Plug	Closed	GAC-5
GAC5-E02	Plug	Open	GAC-5
GAC5-V01	Plug	Closed	Relief valve – GAC-5
CAV-05	Plug	Closed	Air supply
GAC5-D01	Plug	Closed	Water Drain – GAC-5
CF-05	Plug	Closed	Carbon Inlet – GAC-5
CD-05	Plug	Closed	Carbon Outlet – GAC-5

Table 4-4-e: Normal Operations - GAC System (Figure 9) (continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

Carbon Vessels in Series – GAC-5, GAC-1 and GAC-2 operation combination
Carbon Vessels – GAC-3 and GAC-4 in stand-by mode

VALVE#	TYPE	POSITION	Comments/Location
FI/BYP-02	Plug	Closed	Bypasses filter system
FE-02	Plug	Open	Common header for influent from filters
FE-04	Plug	Open	Common header for influent from filters
FE-06	Plug	Open	Common header for influent from filters
FE-07	Plug	Open	Common header for influent from filters
FI/RCY/BYP - 01	Plug	Closed	
PLE-03	Plug	Closed	Common top effluent header
PLE-06	Plug	Open	Common top effluent header
PLE-07	Plug	Closed	Common effluent
PLE-08	Plug	Closed	Common effluent
PLE-09	Plug	Open	Effluent from GAC system
SP-10	Sample Port	Closed	
BWE/FFS-02	Plug	Closed	GAC-1
GAC 1-I01	Plug	Open	To GAC-1 from GAC-5
FE-01	Plug	Closed	GAC-1
SP-5	Sample Port	Closed	GAC-1
BWS/FFE-02	Plug	Closed	GAC-1
GAC1-E01	Plug	Open	GAC-1
PLE-01	Plug	Closed	GAC-1 to common top effluent header

Table 4-4-e: Normal Operations - GAC System (Figure 9) (continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments/Location
GAC1-V01	Plug	Closed	Relief valve – GAC-1
CAV-01	Plug	Closed	Air supply
GAC1-D01	Plug	Closed	Water Drain – GAC-1
CF-01	Plug	Closed	Carbon Inlet – GAC-1
CD-01	Plug	Closed	Carbon Outlet – GAC-1
BWE/FFS-03	Plug	Closed	GAC-2
GAC 2-I01	Plug	Closed	To GAC-2 from GAC-5
FE-03	Plug	Open	GAC-2
SP-6	Sample Port	Closed	GAC-2
BWS/FFE-03	Plug	Closed	GAC-2
GAC2-E02	Plug	Closed	GAC-2
PLE-02	Plug	Closed	Influent to GAC-2 from GAC-1
PLE-04	Plug	Open	Effluent from GAC-2 to top common header
GAC2-V01	Plug	Closed	Relief valve – GAC-2
CAV-02	Plug	Closed	Air supply
GAC2-D01	Plug	Closed	Water Drain – GAC-2
CF-02	Plug	Closed	Carbon Inlet – GAC-2
CD-02	Plug	Closed	Carbon Outlet – GAC-2
BWE/FFS-04	Plug	Closed	GAC-3
FE-05	Plug	Closed	GAC-3
SP-7	Sample Port	Closed	GAC-3
BWS/FFE-04	Plug	Closed	GAC-3

Table 4-4-e: Normal Operations - GAC System (Figure 9) (continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments/Location
GAC3-E01	Plug	Closed	GAC-3
PLE-05	Plug	Closed	Effluent from GAC-3 to top common header
GAC3-V01	Plug	Closed	Relief valve – GAC-3
CAV-03	Plug	Closed	Air supply
GAC3-D01	Plug	Closed	Water Drain – GAC-3
CF-03	Plug	Closed	Carbon Inlet – GAC-3
CD-03	Plug	Closed	Carbon Outlet – GAC-3
BWE/FFS-05	Plug	Closed	GAC-4
GAC 4-I01	Plug	Closed	GAC-4
SP-8	Sample Port	Closed	GAC-4
BWS/FFE-05	Plug	Closed	GAC-4
GAC4-E01	Plug	Closed	GAC-4
GAC4-V01	Plug	Closed	Relief valve – GAC-4
CAV-04	Plug	Closed	Air supply
GAC4-D01	Plug	Closed	Water Drain – GAC-4
CF-04	Plug	Closed	Carbon Inlet – GAC-4
CD-04	Plug	Closed	Carbon Outlet – GAC-4
BWE/FFS-06	Plug	Closed	GAC-5
GAC 5-I01	Plug	Open	GAC-5
SP-9	Sample Port	Closed	GAC-5
BWS/FFE-06	Plug	Closed	GAC-5
GAC5-E01	Plug	Closed	GAC-5

Table 4-4-e: Normal Operations - GAC System (Figure 9) (continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments/Location
GAC5-E02	Plug	Open	GAC-5
GAC5-V01	Plug	Closed	Relief valve – GAC-5
CAV-05	Plug	Closed	Air supply
GAC5-D01	Plug	Closed	Water Drain – GAC-5
CF-05	Plug	Closed	Carbon Inlet – GAC-5
CD-05	Plug	Closed	Carbon Outlet – GAC-5

Table 4-5-a: Backwash Operations - GAC-1 System (Figures 3-8, 3-9 and 3-10)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments/Location
FI/BYP-02	Plug	Closed	
FE-02	Plug	Closed	
FE-04	Plug	Closed	
FE-06	Plug	Closed	
FE-07	Plug	Closed	
FI/RCY/BYP - 01	Plug	Closed	
PLE-03	Plug	Closed	
PLE-06	Plug	Closed	
PLE-07	Plug	Closed	
PLE-08	Plug	Closed	
SP-10	Sample Port	Closed	
BWE/FFS-01		Open	
BWS/FFE-01		Closed	
SP-16	Sample Port	Closed	Backwash effluent from carbon units
BWS-01	Plug	Open	Valve after effluent tank
BWS-02	Plug	Open	1st Backwash Pump
BWS-V02	Ball	Closed	
BWS-03	Swing Check	Check	1st Backwash Pump
BWS-V03	Ball	Closed	

Table 4-5-a: Backwash Operations - GAC-1 System
(Figures 3-8, 3-9 and 3-10) (Continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments/Location
BWS-04	Plug	Open	1st Backwash Pump
BWS-05	Plug	Open	2nd Backwash Pump
BWS-06	Swing Check	Check	2nd Backwash Pump
BWS-07	Plug	Open	2nd Backwash Pump
BWE/FFS-02	Plug	Open	All valves for GAC-1
GAC 1-I01	Plug	Closed	
FE-01	Plug	Closed	
SP-5	Sample Port	Closed	
BWS/FFE-02	Plug	Open	
GAC1-E01	Plug	Closed	
PLE-01	Plug	Closed	
GAC1-V01	Plug	Closed	Relief valve – GAC-1
CAV-01	Plug	Closed	Air supply
GAC1-D01	Plug	Closed	Water Drain – GAC-1
CF-01	Plug	Closed	Carbon Inlet – GAC-1
CD-01	Plug	Closed	Carbon Outlet – GAC-1
BWE/FFS-03	Plug	Closed	All valves for GAC-2
GAC 2-I01	Plug	Closed	
FE-03	Plug	Closed	
SP-6	Sample	Closed	

Table 4-5-a: Backwash Operations - GAC-1 System
(Figures 3-8, 3-9 and 3-10) (Continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments/Location
BWS/FFE-03	Plug	Closed	
GAC2-E02	Plug	Closed	
PLE-02	Plug	Closed	
PLE-04	Plug	Closed	
GAC2-V01	Plug	Closed	Relief valve – GAC-2
CAV-02	Plug	Closed	Air supply
GAC2-D01	Plug	Closed	Water Drain – GAC-2
CF-02	Plug	Closed	Carbon Inlet – GAC-2
CD-02	Plug	Closed	Carbon Outlet – GAC-2
BWE/FFS-04	Plug	Closed	All valves for GAC-3
FE-05	Plug1	Closed	
SP-7	Sample	Closed	
BWS/FFE-04	Plug	Closed	
GAC3-E01	Plug	Closed	
PLE-05	Plug	Closed	
GAC3-V01	Plug	Closed	Relief valve – GAC-3
CAV-03	Plug	Closed	Air supply
GAC3-D01	Plug	Closed	Water Drain – GAC-3
CF-03	Plug	Closed	Carbon Inlet – GAC-3
CD-03	Plug	Closed	Carbon Outlet – GAC-3
BWE/FFS-05	Plug	Closed	All valves for GAC-4

Table 4-5-a: Backwash Operations - GAC-1 System
(Figures 3-8, 3-9 and 3-10) (Continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments/Location
GAC 4-I01	Plug	Closed	
SP-8	Sample	Closed	
BWS/FFE-05	Plug	Closed	
GAC4-E01	Plug	Closed	
GAC4-V01	Plug	Closed	Relief valve – GAC-4
CAV-04	Plug	Closed	Air supply
GAC4-D01	Plug	Closed	Water Drain – GAC-4
CF-04	Plug	Closed	Carbon Inlet – GAC-4
CD-04	Plug	Closed	Carbon Outlet – GAC-4
BWE/FFS-06	Plug	Closed	All valves for GAC-5
GAC 5-I01	Plug	Closed	
SP-9	Sample	Closed	
BWS/FFE-06	Plug	Closed	
GAC5-E01	Plug	Closed	
GAC5-E02	Plug	Closed	
GAC5-V01	Plug	Closed	Relief valve – GAC-5
CAV-05	Plug	Closed	Air supply
GAC5-D01	Plug	Closed	Water Drain – GAC-5
CF-05	Plug	Closed	Carbon Inlet – GAC-5
CD-05	Plug	Closed	Carbon Outlet – GAC-5

Table 4-5-b: Backwash Operations - GAC-2 System
(Figures 3-8, 3-9 and 3-10)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments
FI/BYP-02	Plug	Closed	
FE-02	Plug	Closed	
FE-04	Plug	Closed	
FE-06	Plug	Closed	
FE-07	Plug	Closed	
FI/RCY/BYP - 01	Plug	Closed	
PLE-03	Plug	Closed	
PLE-06	Plug	Closed	
PLE-07	Plug	Closed	
PLE-08	Plug	Closed	
SP-10	Sample Port	Closed	
BWE/FFS-01		Open	
BWS/FFE-01		Closed	
SP-16	Sample Port	Closed	Backwash effluent from carbon units
BWS-01	Plug	Open	Valve after effluent tank
BWS-02	Plug	Open	1st Backwash Pump
BWS-V02	Ball	Closed	
BWS-03	Swing Check	Check	1st Backwash Pump
BWS-V03	Ball	Closed	
BWS-04	Plug	Open	1st Backwash Pump

Table 4-5-b: Backwash Operations - GAC-2 System
(Figures 3-8, 3-9 and 3-10) (Continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments
BWS-05	Plug	Open	2^{nd} Backwash Pump
BWS-06	Swing Check	Check	2^{nd} Backwash Pump
BWS-07	Plug	Open	2^{nd} Backwash Pump
BWE/FFS-02	Plug	Closed	All valves for GAC-1
GAC 1-I01	Plug	Closed	
FE-01	Plug	Closed	
SP-5	Sample Port	Closed	
BWS/FFE-02	Plug	Closed	
GAC1-E01	Plug	Closed	
PLE-01	Plug	Closed	
GAC1-V01	Plug	Closed	Relief valve – GAC-1
CAV-01	Plug	Closed	Air supply
GAC1-D01	Plug	Closed	Water Drain – GAC-1
CF-01	Plug	Closed	Carbon Inlet – GAC-1
CD-01	Plug	Closed	Carbon Outlet – GAC-1
BWE/FFS-03	Plug	Open	All valves for GAC-2
GAC 2-I01	Plug	Closed	
FE-03	Plug	Closed	
SP-6	Sample	Closed	
BWS/FFE-03	Plug	Open	

Table 4-5-b: Backwash Operations - GAC-2 System
(Figures 3-8, 3-9 and 3-10) (Continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments
GAC2-E02	Plug	Closed	
PLE-02	Plug	Closed	
PLE-04	Plug	Closed	
GAC2-V01	Plug	Closed	Relief valve – GAC-2
CAV-02	Plug	Closed	Air supply
GAC2-D01	Plug	Closed	Water Drain – GAC-2
CF-02	Plug	Closed	Carbon Inlet – GAC-2
CD-02	Plug	Closed	Carbon Outlet – GAC-2
BWE/FFS-04	Plug	Closed	All valves for GAC-3
FE-05	Plug1	Closed	
SP-7	Sample	Closed	
BWS/FFE-04	Plug	Closed	
GAC3-E01	Plug	Closed	
PLE-05	Plug	Closed	
GAC3-V01	Plug	Closed	Relief valve – GAC-3
CAV-03	Plug	Closed	Air supply
GAC3-D01	Plug	Closed	Water Drain – GAC-3
CF-03	Plug	Closed	Carbon Inlet – GAC-3
CD-03	Plug	Closed	Carbon Outlet – GAC-3
BWE/FFS-05	Plug	Closed	All valves for GAC-4

Table 4-5-b: Backwash Operations - GAC-2 System
(Figures 3-8, 3-9 and 3-10) (Continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments
GAC 4-I01	Plug	Closed	
SP-8	Sample	Closed	
BWS/FFE-05	Plug	Closed	
GAC4-E01	Plug	Closed	
GAC4-V01	Plug	Closed	Relief valve – GAC-4
CAV-04	Plug	Closed	Air supply
GAC4-D01	Plug	Closed	Water Drain – GAC-4
CF-04	Plug	Closed	Carbon Inlet – GAC-4
CD-04	Plug	Closed	Carbon Outlet – GAC-4
BWE/FFS-06	Plug	Closed	All valves for GAC-5
GAC 5-I01	Plug	Closed	
SP-9	Sample	Closed	
BWS/FFE-06	Plug	Closed	
GAC5-E01	Plug	Closed	
GAC5-E02	Plug	Closed	
GAC5-V01	Plug	Closed	Relief valve – GAC-5
CAV-05	Plug	Closed	Air supply
GAC5-D01	Plug	Closed	Water Drain – GAC-5
CF-05	Plug	Closed	Carbon Inlet – GAC-5
CD-05	Plug	Closed	Carbon Outlet – GAC-5

Table 4-5-c: Backwash Operations - GAC-3 System
(Figures 3-8, 3-9 and 3-10)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments
FI/BYP-02	Plug	Closed	
FE-02	Plug	Closed	
FE-04	Plug	Closed	
FE-06	Plug	Closed	
FE-07	Plug	Closed	
FI/RCY/BYP - 01	Plug	Closed	
PLE-03	Plug	Closed	
PLE-06	Plug	Closed	
PLE-07	Plug	Closed	
PLE-08	Plug	Closed	
SP-10	Sample Port	Closed	
BWE/FFS-01		Open	
BWS/FFE-01		Closed	
SP-16	Sample Port	Closed	Backwash effluent from carbon units
BWS-01	Plug	Open	Valve after effluent tank
BWS-02	Plug	Open	1st Backwash Pump
BWS-V02	Ball	Closed	
BWS-03	Swing Check	Check	1st Backwash Pump
BWS-V03	Ball	Closed	
BWS-04	Plug	Open	1st Backwash Pump

Table 4-5-c: Backwash Operations - GAC-3 System
(Figures 3-8, 3-9 and 3-10) (Continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments
BWS-05	Plug	Open	2nd Backwash Pump
BWS-06	Swing Check	Check	2nd Backwash Pump
BWS-07	Plug	Open	2nd Backwash Pump
BWE/FFS-02	Plug	Closed	All valves for GAC-1
GAC 1-I01	Plug	Closed	
FE-01	Plug	Closed	
SP-5	Sample Port	Closed	
BWS/FFE-02	Plug	Closed	
GAC1-E01	Plug	Closed	
PLE-01	Plug	Closed	
GAC1-V01	Plug	Closed	Relief valve – GAC-1
CAV-01	Plug	Closed	Air supply
GAC1-D01	Plug	Closed	Water Drain – GAC-1
CF-01	Plug	Closed	Carbon Inlet – GAC-1
CD-01	Plug	Closed	Carbon Outlet – GAC-1
BWE/FFS-03	Plug	Closed	All valves for GAC-2
GAC 2-I01	Plug	Closed	
FE-03	Plug	Closed	
SP-6	Sample	Closed	
BWS/FFE-03	Plug	Closed	

Table 4-5-c: Backwash Operations - GAC-3 System
(Figures 3-8, 3-9 and 3-10) (Continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments
GAC2-E02	Plug	Closed	
PLE-02	Plug	Closed	
PLE-04	Plug	Closed	
GAC2-V01	Plug	Closed	Relief valve – GAC-2
CAV-02	Plug	Closed	Air supply
GAC2-D01	Plug	Closed	Water Drain – GAC-2
CF-02	Plug	Closed	Carbon Inlet – GAC-2
CD-02	Plug	Closed	Carbon Outlet – GAC-2
BWE/FFS-04	Plug	Open	All valves for GAC-3
FE-05	Plug1	Closed	
SP-7	Sample	Closed	
BWS/FFE-04	Plug	Open	
GAC3-E01	Plug	Closed	
PLE-05	Plug	Closed	
GAC3-V01	Plug	Closed	Relief valve – GAC-3
CAV-03	Plug	Closed	Air supply
GAC3-D01	Plug	Closed	Water Drain – GAC-3
CF-03	Plug	Closed	Carbon Inlet – GAC-3
CD-03	Plug	Closed	Carbon Outlet – GAC-3
BWE/FFS-05	Plug	Closed	All valves for GAC-4

Table 4-5-c: Backwash Operations - GAC-3 System
(Figures 3-8, 3-9 and 3-10) (Continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments
GAC 4-I01	Plug	Closed	
SP-8	Sample	Closed	
BWS/FFE-05	Plug	Closed	
GAC4-E01	Plug	Closed	
GAC4-V01	Plug	Closed	Relief valve – GAC-4
CAV-04	Plug	Closed	Air supply
GAC4-D01	Plug	Closed	Water Drain – GAC-4
CF-04	Plug	Closed	Carbon Inlet – GAC-4
CD-04	Plug	Closed	Carbon Outlet – GAC-4
BWE/FFS-06	Plug	Closed	All valves for GAC-5
GAC 5-I01	Plug	Closed	
SP-9	Sample	Closed	
BWS/FFE-06	Plug	Closed	
GAC5-E01	Plug	Closed	
GAC5-E02	Plug	Closed	
GAC5-V01	Plug	Closed	Relief valve – GAC-5
CAV-05	Plug	Closed	Air supply
GAC5-D01	Plug	Closed	Water Drain – GAC-5
CF-05	Plug	Closed	Carbon Inlet – GAC-5
CD-05	Plug	Closed	Carbon Outlet – GAC-5

Table 4-5-d: Backwash Operations - GAC-4 System
(Figures 3-8, 3-9 and 3-10)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments
FI/BYP-02	Plug	Closed	
FE-02	Plug	Closed	
FE-04	Plug	Closed	
FE-06	Plug	Closed	
FE-07	Plug	Closed	
FI/RCY/BYP - 01	Plug	Closed	
PLE-03	Plug	Closed	
PLE-06	Plug	Closed	
PLE-07	Plug	Closed	
PLE-08	Plug	Closed	
SP-10	Sample Port	Closed	
BWE/FFS-01		Open	
BWS/FFE-01		Closed	
SP-16	Sample Port	Closed	Backwash effluent from carbon units
BWS-01	Plug	Open	Valve after effluent tank
BWS-02	Plug	Open	1st Backwash Pump
BWS-V02	Ball	Closed	
BWS-03	Swing Check	Check	1st Backwash Pump
BWS-V03	Ball	Closed	
BWS-04	Plug	Open	1st Backwash Pump

Table 4-5-d: Backwash Operations - GAC-4 System
(Figures 3-8, 3-9 and 3-10) (Continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments
BWS-05	Plug	Open	2nd Backwash Pump
BWS-06	Swing Check	Check	2nd Backwash Pump
BWS-07	Plug	Open	2nd Backwash Pump
BWE/FFS-02	Plug	Closed	All valves for GAC-1
GAC 1-I01	Plug	Closed	
FE-01	Plug	Closed	
SP-5	Sample Port	Closed	
BWS/FFE-02	Plug	Closed	
GAC1-E01	Plug	Closed	
PLE-01	Plug	Closed	
GAC1-V01	Plug	Closed	Relief valve – GAC-1
CAV-01	Plug	Closed	Air supply
GAC1-D01	Plug	Closed	Water Drain – GAC-1
CF-01	Plug	Closed	Carbon Inlet – GAC-1
CD-01	Plug	Closed	Carbon Outlet – GAC-1
BWE/FFS-03	Plug	Closed	All valves for GAC-2
GAC 2-I01	Plug	Closed	
FE-03	Plug	Closed	
SP-6	Sample	Closed	
BWS/FFE-03	Plug	Closed	

Table 4-5-d: Backwash Operations - GAC-4 System
(Figures 3-8, 3-9 and 3-10) (Continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments
GAC2-E02	Plug	Closed	
PLE-02	Plug	Closed	
PLE-04	Plug	Closed	
GAC2-V01	Plug	Closed	Relief valve – GAC-2
CAV-02	Plug	Closed	Air supply
GAC2-D01	Plug	Closed	Water Drain – GAC-2
CF-02	Plug	Closed	Carbon Inlet – GAC-2
CD-02	Plug	Closed	Carbon Outlet – GAC-2
BWE/FFS-04	Plug	Closed	All valves for GAC-3
FE-05	Plug1	Closed	
SP-7	Sample	Closed	
BWS/FFE-04	Plug	Closed	
GAC3-E01	Plug	Closed	
PLE-05	Plug	Closed	
GAC3-V01	Plug	Closed	Relief valve – GAC-3
CAV-03	Plug	Closed	Air supply
GAC3-D01	Plug	Closed	Water Drain – GAC-3
CF-03	Plug	Closed	Carbon Inlet – GAC-3
CD-03	Plug	Closed	Carbon Outlet – GAC-3
BWE/FFS-05	Plug	Open	All valves for GAC-4

Table 4-5-d: Backwash Operations - GAC-4 System
(Figures 3-8, 3-9 and 3-10) (Continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments
GAC 4-I01	Plug	Closed	
SP-8	Sample	Closed	
BWS/FFE-05	Plug	Open	
GAC4-E01	Plug	Closed	
GAC4-V01	Plug	Closed	Relief valve – GAC-4
CAV-04	Plug	Closed	Air supply
GAC4-D01	Plug	Closed	Water Drain – GAC-4
CF-04	Plug	Closed	Carbon Inlet – GAC-4
CD-04	Plug	Closed	Carbon Outlet – GAC-4
BWE/FFS-06	Plug	Closed	All valves for GAC-5
GAC 5-I01	Plug	Closed	
SP-9	Sample	Closed	
BWS/FFE-06	Plug	Closed	
GAC5-E01	Plug	Closed	
GAC5-E02	Plug	Closed	
GAC5-V01	Plug	Closed	Relief valve – GAC-5
CAV-05	Plug	Closed	Air supply
GAC5-D01	Plug	Closed	Water Drain – GAC-5
CF-05	Plug	Closed	Carbon Inlet – GAC-5
CD-05	Plug	Closed	Carbon Outlet – GAC-5

Table 4-5-e: Backwash Operations - GAC-5 System
(Figures 3-8, 3-9 and 3-10)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments
FI/BYP-02	Plug	Closed	
FE-02	Plug	Closed	
FE-04	Plug	Closed	
FE-06	Plug	Closed	
FE-07	Plug	Closed	
FI/RCY/BYP - 01	Plug	Closed	
PLE-03	Plug	Closed	
PLE-06	Plug	Closed	
PLE-07	Plug	Closed	
PLE-08	Plug	Closed	
SP-10	Sample Port	Closed	
BWE/FFS-01		Open	
BWS/FFE-01		Closed	
SP-16	Sample Port	Closed	Backwash effluent from carbon units
BWS-01	Plug	Open	Valve after effluent tank
BWS-02	Plug	Open	1st Backwash Pump
BWS-V02	Ball	Closed	
BWS-03	Swing Check	Check	1st Backwash Pump
BWS-V03	Ball	Closed	
BWS-04	Plug	Open	1st Backwash Pump
BWS-05	Plug	Open	2nd Backwash Pump

Table 4-5-e: Backwash Operations - GAC-5 System (Figures 3-8, 3-9 and 3-10) (Continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments
BWS-06	Swing Check	Check	2nd Backwash Pump
BWS-07	Plug	Open	2nd Backwash Pump
BWE/FFS-02	Plug	Closed	All valves for GAC-1
GAC 1-I01	Plug	Closed	
FE-01	Plug	Closed	
SP-5	Sample Port	Closed	
BWS/FFE-02	Plug	Closed	
GAC1-E01	Plug	Closed	
PLE-01	Plug	Closed	
GAC1-V01	Plug	Closed	Relief valve – GAC-1
CAV-01	Plug	Closed	Air supply
GAC1-D01	Plug	Closed	Water Drain – GAC-1
CF-01	Plug	Closed	Carbon Inlet – GAC-1
CD-01	Plug	Closed	Carbon Outlet – GAC-1
BWE/FFS-03	Plug	Closed	All valves for GAC-2
GAC 2-I01	Plug	Closed	
FE-03	Plug	Closed	
SP-6	Sample	Closed	
BWS/FFE-03	Plug	Closed	

Table 4-5-e: Backwash Operations - GAC-5 System
(Figures 3-8, 3-9 and 3-10) (Continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments
GAC2-E02	Plug	Closed	
PLE-02	Plug	Closed	
PLE-04	Plug	Closed	
GAC2-V01	Plug	Closed	Relief valve – GAC-2
CAV-02	Plug	Closed	Air supply
GAC2-D01	Plug	Closed	Water Drain – GAC-2
CF-02	Plug	Closed	Carbon Inlet – GAC-2
CD-02	Plug	Closed	Carbon Outlet – GAC-2
BWE/FFS-04	Plug	Closed	All valves for GAC-3
FE-05	Plug1	Closed	
SP-7	Sample	Closed	
BWS/FFE-04	Plug	Closed	
GAC3-E01	Plug	Closed	
PLE-05	Plug	Closed	
GAC3-V01	Plug	Closed	Relief valve – GAC-3
CAV-03	Plug	Closed	Air supply
GAC3-D01	Plug	Closed	Water Drain – GAC-3
CF-03	Plug	Closed	Carbon Inlet – GAC-3
CD-03	Plug	Closed	Carbon Outlet – GAC-3
BWE/FFS-05	Plug	Closed	All valves for GAC-4

Table 4-5-e: Backwash Operations - GAC-5 System (Figures 3-8, 3-9 and 3-10) (Continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments
GAC 4-I01	Plug	Closed	
SP-8	Sample	Closed	
BWS/FFE-05	Plug	Closed	
GAC4-E01	Plug	Closed	
GAC4-V01	Plug	Closed	Relief valve – GAC-4
CAV-04	Plug	Closed	Air supply
GAC4-D01	Plug	Closed	Water Drain – GAC-4
CF-04	Plug	Closed	Carbon Inlet – GAC-4
CD-04	Plug	Closed	Carbon Outlet – GAC-4
BWE/FFS-06	Plug	Open	All valves for GAC-5
GAC 5-I01	Plug	Closed	
SP-9	Sample	Closed	
BWS/FFE-06	Plug	Open	
GAC5-E01	Plug	Closed	
GAC5-E02	Plug	Closed	
GAC5-V01	Plug	Closed	Relief valve – GAC-5
CAV-05	Plug	Closed	Air supply
GAC5-D01	Plug	Closed	Water Drain – GAC-5
CF-05	Plug	Closed	Carbon Inlet – GAC-5
CD-05	Plug	Closed	Carbon Outlet – GAC-5

Table 4-6: Normal Operations - Plant Effluent (Figure 3-10)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments/Location
PLE-D01	Ball	Closed	3 inch PLE drain to containment sump
PLE-10	Plug	Closed	PLE Effluent line from effluent tank before SP-11
SP-11	Sample Port	Closed	Plant effluent after effluent tank
PLE-11	Plug	Open	PLE Effluent line from effluent line after SP-11
PLE-12	Plug	Open	24 hour Composite sampler line after SP-11 from main effluent line

Table 4-7: Side Stream Operations - Digester and Dirty Backwash Tanks
(Figure 3-11 and 3-12)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE/POSITION	Comments/Location
OF/DC-08	Plug/Closed	Digester Tank Overflow
BWE/FFE-D01	Ball/Closed	6 inch dirty backwash line from carbon tanks and media filter to dirty backwash tank
ALP-01	Swing Check	Air line from rotary blower
ALP 02	Butterfly/Open	Air line from rotary blower
ALP-03	Ball/Open	Air line to digester tank from blower
ALP-05	Ball/Open	Air line to digester tank from blower
ALP-04	Ball Check	Air line to digester tank from blower
ALP-07	Ball/Open	Air line to digester tank from blower
ALP-06	Ball Check	Air line to digester tank from blower
DS-01	Plug/Open	2 inch Solids line from digester tank
DS-02	Plug/Open	2 inch Solids line from digester tank
DS-03	Plug/Open	2 inch Solids line from digester tank
DS-04	Plug/Closed	2 inch Solids line from digester tank
AHP-17	Ball/Open	Air line for digester skim pump
DS-05	Plug/Open	Digester Tank Solids feed line to filter press feed tank 1
DS-06	Plug/Closed	Digester Tank Solids feed line to filter press feed tank 2
SS-01	Plug/Open	Filter press feed tank 1 solids removal line prior to filter press feed pump
SS-02	Plug/Closed	Filter press feed tank 2 solids removal line prior to filter press feed pump
BWR-V01	Ball/Closed	Vent for decanted line from dirty backwash tank
BWR-01	Plug/Open	Decant line from dirty backwash tank
TS-02	Plug/Open	2inch Solids line from dirty backwash tank feeding digester tank
TS-01	Plug/Open	2inch Solids line from dirty backwash tank feeding digester tank
TS/SS-01	Plug/Open	Solids line from digester tank prior filter press feed pump

Table 4-7: Side Stream Operations - Digester and Dirty Backwash Tanks (Figure 3-11 and 3-12) (Continued)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE/POSITION	Comments/Location
AHP-16	Ball/Open	Air line for operation of filter press digester feed pump
SS-03	Plug/Open	Solids line pumped by filter press feed pump to filter press
BWR-02	Pneumatic Plug Valve (FV-1451)/Open	3inch Decant line at dirty backwash tank leading to equalization or storm water recycle tank
BWR-D01	Ball/Closed	Drain on 3 inch decant line from dirty backwash tank
BWR-V02	Ball/Closed	Vent on 3 inch decant line from dirty backwash tank
BWR-03	Plug/Open	3inch Decant line from dirty backwash tank prior to backwash recycle pump to equalization or storm water recycle tank
BWR-04	Swing Check	Backwash recycle pump valve
BWR-05	Plug/Open	Backwash recycle pump valve
SP-17	Sample Port/ Closed	Dirty Backwash Tank effluent
BWR-06	Plug/Open	3inch Decant line from dirty backwash tank/backwash recycle pump leading to equalization tank
BWR-07	Plug	3inch Decant line from dirty backwash tank/backwash recycle pump leading to storm water recycle tank
AI-02	Ball (Open/Close)	See steps
SS-04	Open	Influent to filter press
AHP-07	Ball (Open)	Air from air receiver
AHP-08	Ball (Open)	Air from air receiver
F-01	Plug/Open	Filtrate from press
F-D01	Ball/Closed	Filtrate Drain
F-02	Plug/Open	Filtrate outlet from filtrate tank

Table 4-8: Side Stream Operations – Oil Processing System (Figures 3-4 and 3-13)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments/Location
NAPL-01	Plug	Open	EQ Tank LNAPL
NAPL-02	Plug	Open	EQ Tank DNAPL
NAPL-03	Plug	Open	NAPL transfer valve
NAPL-04	Plug	Open	
NAPL-05	Plug	Open	2 inch product line from equalization skim sump to froth tank
NAPL-06	Plug	Closed	2 inch product line from equalization skim sump to froth tank
NAPL-07	Plug	Closed	1 inch product line from froth to product tank
NAPL-08	Plug	Closed	1 inch product line from froth to product tank
NAPL-09	Plug	Closed	1 inch product line from froth to product tank
FRE-00	Plug	Open	1 inch Froth effluent FRE after froth tank to equalization tank
NAPL-10	Plug	Closed	Product from froth line to product tank prior to oil pump
AHP-18	Ball	Closed	Air line for oil pump
FRE-01	Plug	Open	Froth Pump 1 valve
FRE-02	Swing Check	Check	Froth Pump 1 valve
FRE-03	Plug	Open	Froth Pump 1 valve
FRE-04	Plug	Open	Froth Pump 2 valve
FRE-05	Swing Check	Check	Froth Pump 2 valve
FRE-06	Plug	Open	Froth Pump 2 valve
SP-13	Sample	Closed	Decant from froth tank
NAPL-11	Plug	Closed	Product from froth line to product tank after oil pump
SP-14	Sample	Closed	Product Tank influent
NAPL-12	Plug	Closed	Product from froth line to product tank after oil pump and SP-14

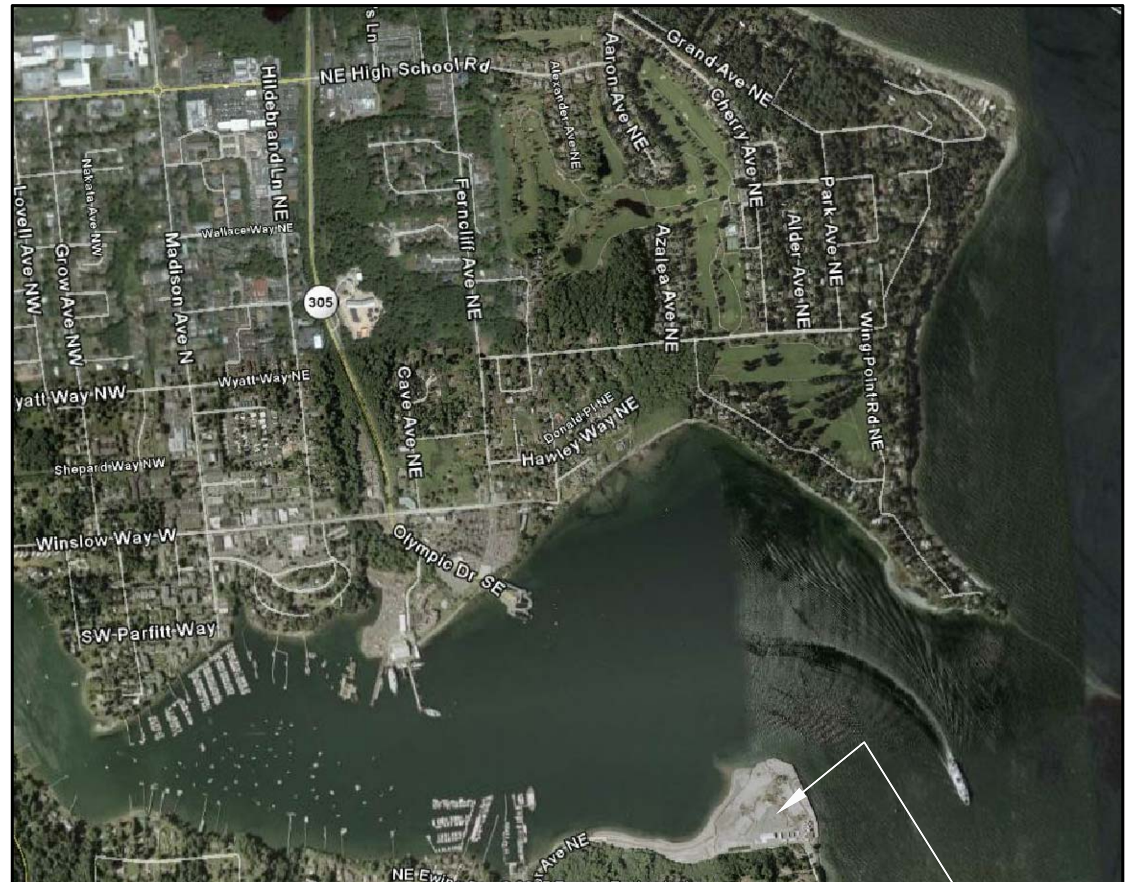
Table 4-9: Side Stream Operations - Storm water and Containment Sump (Figure 3-14)
Wyckoff/Eagle Harbor Groundwater Treatment Plant
Bainbridge Island, Washington

VALVE#	TYPE	POSITION	Comments/Location
STW-02	Plug	Open	Decon water from decon pad
STW-01	Plug	Open	Decon water from decon pad next to old plant
STW-D01	Ball	Closed	3 inch storm water drain
STW-03	Swing Check	Check	Sump pump -1
STW-04	Plug	Open	Sump pump - 1 valve
STW-D02	Ball	Closed	Sump pump - 1 valve drain
STW-D03	Ball	Closed	Sump pump - 2 valve drain
STW-05	Swing Check	Check	Sump pump -2
STW-06	Plug	Open	Sump pump -2 valve
STW-07	Plug	Open	3 inch storm water line to storm water recycle tank
STW-08	Plug	Closed	3 inch storm water line to dirty backwash tank
STW-09	Pneumatic Plug valve (FV-1531)	Open	3 inch storm water line from storm water recycle tank to equalization tank
SP-18	Sample Port	Closed	Storm and containment water from storm water recycle tank
STW-D04	Ball	Closed	3inch drain from 3 inch storm water recycle tank line
STW-V01	Ball	Closed	Vent from 3 inch storm water recycle tank line
STW-10	Plug	Open	Storm water recycle pump valve
STW-11	Swing Check	Check	Storm water recycle pump
STW-12	Plug	Open	Storm water recycle pump valve
STW-V02	Ball	Closed	Vent on 3 inch storm water line after Storm water recycle pump
STW-13	Plug	Open	Line to EQ tank

FIGURES

PROJECT SITE

VICINTY MAP



LOCATION MAP

PROJECT LOCATION

LOCATION MAP

PROJECT LOCATION

PROJECT LOCATION

LOCATION MAP

FILENAMEPATH

ECC
1746 COLE BOULEVARD, SUITE 350
LAKEWOOD, CO 80401
(303) 298-7607

DRAWN BY: J. BITTER	**FIGURE 1-1, SITE LOCATION MAP**
APPROVED BY: R. WALSTON	WYCKOFF/EAGLE HARBOR SUPERFUND SITE REPLACEMENT GROUNDWATER TREATMENT PLANT BAINBRIDGE ISLAND, WASHINGTON
DATE: 4/5/2007	PROJECT CODE: 5403.EC1 — CONTRACT CODE: W912DQ-04-D-0017
SIZE: B	SCALE: NTS — FILENAME: FIG 1-1.DWG — SHEET: 1 OF 1 — REV: -

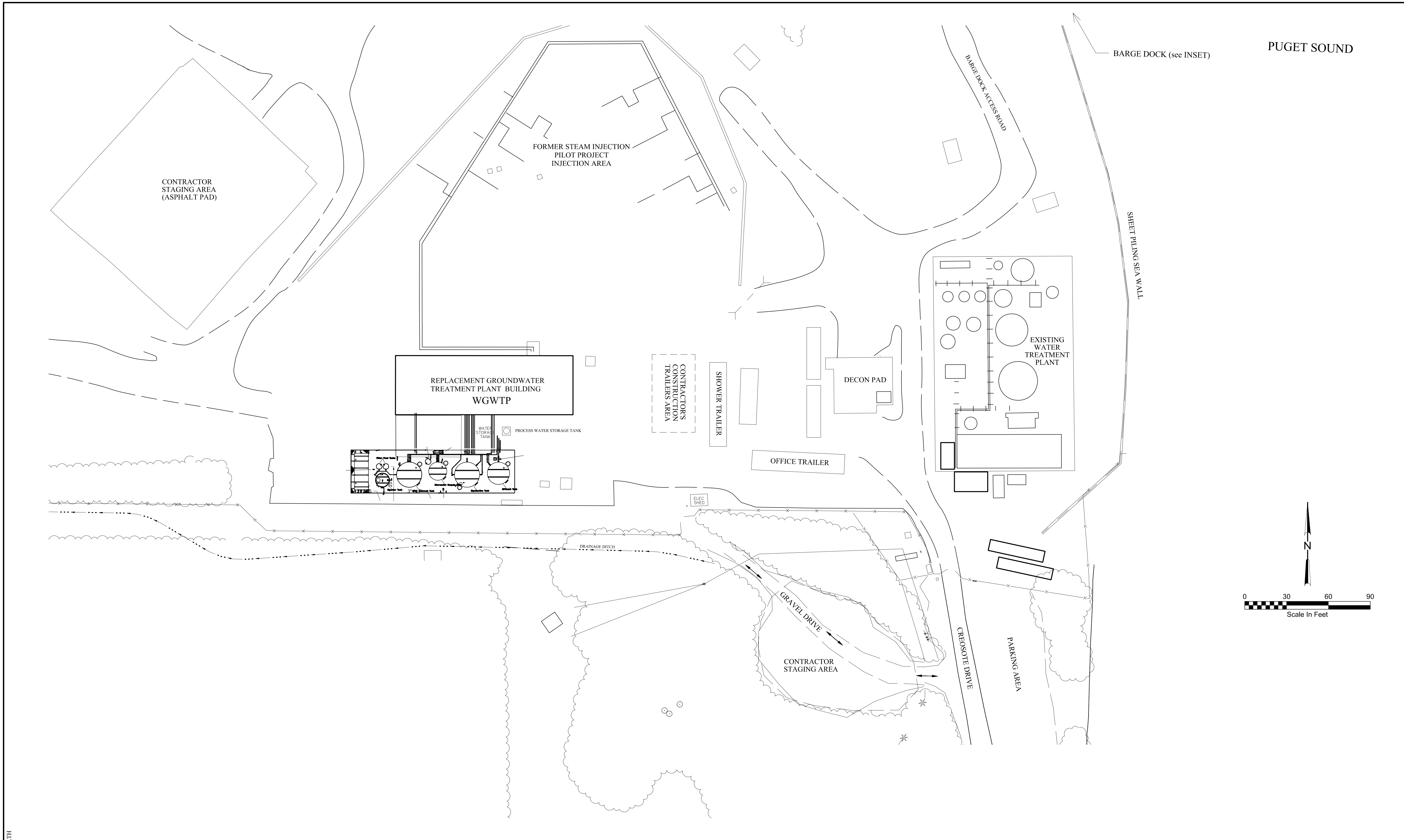
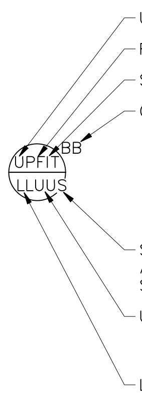


Figure 1-2 - Site Layout
Operation and Maintenance Manual

INSTRUMENT IDENTIFICATION

EXAMPLE SYMBOLS



- UNIT PROCESS NUMBER
- FIRST LETTER(S)
- SUCCEEDING LETTER(S)
- CLARIFYING ABBREVIATIONS
- SET LETTER (USED WHEN THERE ARE MULTIPLE DEVICES WITH THE SAME UNIT NUMBER)
- UNIT NUMBER
- LOOP NUMBER

INSTRUMENT IDENTIFICATION LETTERS TABLE

LETTER	FIRST–LETTER		SUCCEEDING–LETTERS		
	PROCESS OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS (+)		ALARM		
B	BURNER, COMBUSTION		USER'S CHOICE***	USER'S CHOICE***	USER'S CHOICE***
C	USER'S CHOICE***			CONTROL	
D	DENSITY (S.G)	DIFFERENTIAL			
E	VOLTAGE		PRIMARY ELEMENT, SENSOR		
F	FLOW RATE	RATIO (FRACTION)			
G	USER'S CHOICE***		GLASS, GAUGE VIEWING DEVICE	GATE	
H	HAND (MANUAL)				HIGH
!	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME, TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT (PILOT)		LOW
M	MOTION	MOMENTARY			MIDDLE, INTERMEDIATE
N	TORQUE		USER'S CHOICE***	USER'S CHOICE***	USER'S CHOICE***
O	USER'S CHOICE***		ORIFICE, RESTRICTION		
P	PRESSURE, VACUUM		POINT (TEST) CONNECTION		
Q	QUANTITY	INTEGRATE, TOTALIZE			
R	RADIATION		RECORD OR PRINT		
S	SPEED, FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION, MECHANICAL ANALYSIS			VALVE, DAMPER, LOUVER	
W	WEIGHT, FORCE		WELL		
X	UNCLASSIFIED (+)	X AXIS	UNCLASSIFIED (+)	UNCLASSIFIED (+)	UNCLASSIFIED (+)
Y	EVENT, STATE OR PRESENCE	Y AXIS		RELAY, COMPUTE, CONVERT	
Z	POSITION	Z AXIS		DRIVE, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

TABLE BASED ON THE INSTRUMENTATION, SYSTEMS, AND AUTOMATION SOCIETY (ISA) STANDARD.

*+*WHEN USED, EXPLANATION IS SHOWN ADJACENT TO INSTRUMENT SYMBOL. SEE ABBREVIATIONS AND LETTER SYMBOLS.

*** WHEN USED, DEFINE THE MEANING HERE FOR THE PROJECT

DIGITAL SYSTEM INTERFACES

▲ ANALOG INPUT
▼ ANALOG OUTPUT
Δ_x DISCRETE INPUT
∇_x DISCRETE OUTPUT

WHERE X=
A = ALARM
H = MAINTAINED
M = MOMENTARY
S = STATUS

GENERAL INSTRUMENT OR FUNCTIONAL SYMBOLS

- FIELD MOUNTED INSTRUMENT
- REAR–OF–PANEL MOUNTED INSTRUMENT (OPERATOR INACCESSIBLE)
- PANEL MOUNTED INSTRUMENT
- MOTOR CONTROL CENTER MOUNTED INSTRUMENT
- COMPUTER FUNCTION
- PLC FUNCTION

SPECIAL CASES

YL OO — ON AND OFF EVENT LIGHTS

HS OO — ON–OFF HAND SWITCH. MAINTAINED CONTACT SWITCH (CONTROLLED DEVICE WILL RESTART ON RETURN OF POWER AFTER POWER FAILURE).

HS SS — STOP–START HAND SWITCH MOMENTARY CONTACT SWITCHES (CONTROLLED DEVICE WILL NOT RESTART ON RETURN OF POWER AFTER POWER FAILURE).

TRANSDUCERS

A ANALOG
D DIGITAL
E VOLTAGE
F FREQUENCY
H HYDRAULIC
I CURRENT
P PNEUMATIC
PF PULSE FREQUENCY
PD PULSE DURATION
R RESISTANCE

EXAMPLE:

FY I/P — CURRENT TO PNEUMATIC TRANSDUCER (BACK OF PANEL, IN A FLOW LOOP)

ACCESSORY DEVICES

EXAMPLE: TRANSMITTER AS AN ACCESSORY TO A FLOW ELEMENT

FT
T

A = ALARM
C = CONTROLLER
I = INDICATOR
R = RECORDER
S = SWITCH
T = TRANSMITTER
X = UNCLASSIFIED

LINE LEGEND

- PROCESS (CLOSED CONDUIT, DASHED LINE INDICATES ALTERNATE FLOW STREAM)
- PROCESS (OPEN CHANNEL)
- ANALOG SIGNAL (4 TO 20 mAdc, ETC.)
- DISCRETE SIGNAL (ON/OFF, ETC.)
- PNEUMATIC SIGNAL
- FILLED SYSTEM SIGNAL
- HYDRAULIC SYSTEM SIGNAL
- DATA LINK
- EXISTING EQUIPMENT
- FLEXIBLE HOSE
- BUILDING OR FACILITY BOUNDARY
- PACKAGE SYSTEM EQUIPMENT

PARALLELING LINES

(2) 3(2)

(A) (B)

(A) TOTAL OF 2 SIGNALS
(B) 3 TYPICAL SETS OF 2 SIGNALS EACH. TOTAL OF 6 SIGNALS.

CONNECTING LINES

NON–CONNECTING LINES

INTERFACE SYMBOLS

S WA — WA D

= PROCESS INTERFACE
= SIGNAL INTERFACE
W = SOURCE UNIT PROCESS NO. (1 OR 2 DIGITS)
A = INTERFACE NO. (2 DIGITS)
D = DESTINATION DRAWING NO.
S = SOURCE DRAWING NO.

N — PROCESS OR SIGNAL LINE CONTINUATION N=1,2,3,ETC — N

INTERFACE TO OR FROM PROCESS EXTERNAL TO PROJECT

SELF CONTAINED VALVE & EQUIPMENT TAG NUMBERS

W–D–X–Y

W = UNIT PROCESS NUMBER
D: ARV = AIR RELEASE VALVE
AVRV = AIR AND VACUUM RELEASE VALVE
E = EJECTOR
G = GATE
M = MECHANICAL EQUIPMENT
P = PUMP
T = TANK

X = LOOP NUMBER
Y = UNIT NUMBER

ABBREVIATIONS & LETTER SYMBOLS

AC	ALTERNATING CURRENT
AM	AUTO–MANUAL
CAM	COMPUTER–AUTO–MANUAL
CCS	CENTRAL CONTROL SYSTEM
CL_2 etc.	CHLORINE (TYPICAL: USE STANDARD CHEMICAL ELEMENT ABBREVIATION)
CM	COMPUTER–MANUAL
COD	CHEMICAL OXYGEN DEMAND
CP–X	CONTROL PANEL NO. X
DC	DIRECT CURRENT
DCS	DISTRIBUTED CONTROL SYSTEM
DCU	DISTRIBUTED CONTROL UNIT
DO	DISSOLVED OXYGEN
FCL_2	FREE CHLORINE RESIDUAL
FOS	FAST–OFF–SLOW
FOSA	FAST–OFF–SLOW–AUTO
FOSR	FAST–OFF–SLOW–REMOTE
FP–W–X	FIELD PANEL NO. WX (W = UNIT PROCESS NUMBER X = PANEL NUMBER)
FR	FORWARD–REVERSE
HOA	HAND–OFF–AUTO
HOR	HAND–OFF–REMOTE
!SR	INTRINSICALLY SAFE RELAY
LEL	LOWER EXPLOSIVE LIMIT
LOS	LOCKOUT STOP
LR	LOCAL–REMOTE
MA	MANUAL–AUTO
MC	MODULATE–CLOSE
MCC–X	MOTOR CONTROL CENTER NO. X
MSC	MANUFACTURER SUPPLIED CABLE
OC	OPEN–CLOSE (D)
OCR	OPEN–CLOSE–REMOTE
OCA	OPEN–CLOSE–AUTO
OO	ON–OFF
OOA	ON–OFF–AUTO
OOR	ON–OFF–REMOTE
ORP	OXIDATION REDUCTION POTENTIAL
OSC	OPEN–STOP–CLOSE
pH	HYDROGEN ION CONCENTRATION
PLC	PROGRAMMABLE LOGIC CONTROLLER
RM–X	REMOTE MULTIPLEXING MODULE NO. X
RTU–X	REMOTE TELEMETRY UNIT NO. X
SF	SLOWER–FASTER
SS	START–STOP
SSC	SUPERVISORY SET POINT CONTROL
TCL_2	TOTAL CHLORINE RESIDUAL
TOC	TOTAL ORGANIC CARBON
TOD	TOTAL OXYGEN DEMAND
TURB	TURBIDITY
VHC	VOLATILE HYDROCARBONS
VIB	VIBRATION
Δ	DIFFERENCE
Σ	SUM
X	MULTIPLY
$\div$	DIVIDE
f(x)	CHARACTERIZED
X^n	RAISE TO THE Nth POWER
$\sqrt{\ }$	SQUARE ROOT
AVG	AVERAGE
1:1	REPEAT OR BOOST
*	SELECT HIGHEST SIGNAL
*	SELECT LOWEST SIGNAL
*	BIAS
%	GAIN OR ATTENUATE

GENERAL NOTES

1. COMPONENTS AND PANELS SHOWN WITH A SINGLE ASTERISK (*) ARE TO BE PROVIDED AS PART OF A PACKAGE SYSTEM.
2. COMPONENTS AND PANELS SHOWN WITH A DOUBLE ASTERISK (**) ARE TO BE PROVIDED UNDER DIVISION 16, ELECTRICAL.
3. THIS IS A STANDARD LEGEND. THEREFORE, NOT ALL OF THIS INFORMATION MAY BE USED ON THIS PROJECT.

INSTRUMENTATION AND CONTROL LEGEND
SHEET 1

VALVE SYMBOLS

- GATE
- KNIFE GATE
- BUTTERFLY
- GLOBE
- BALL
- VENTED BALL
- PLUG
- SEAT PORT ECCENTRIC PLUG
- DIAPHRAGM
- PINCH
- NEEDLE
- SWING CHECK
- BALL CHECK
- PRESSURE RELIEF
- AIR AND/OR VACUUM RELEASE
- REGULATED SIDE PRESSURE CONTROL
- MULTI-PORT VALVES (BALL VALVE SHOWN. FOR OTHER VALVE TYPES, APPROPRIATE VALVE SYMBOL SHOWN.) ARROWS INDICATE FLOW PATTERN. SEAT PORTS ARE IMPLIED BY INDICATED FLOW PATTERN.
- TELESCOPE
- SAMPLE
- MUD

GATE SYMBOLS

- SLUICE
- BUTTERFLY
- FLAP
- FABRICATED SLIDE
- SHEAR

ACTUATOR SYMBOLS

- XX PNEUMATIC DIAPHRAM SPRING-OPPOSED, SINGLE OR DOUBLE ACTING
- XX PNEUMATIC CYLINDER SINGLE OR DOUBLE ACTING ACTUATED BY ONE INPUT
- MANUAL
- XX ELECTRIC MOTOR
- XX ELECTROHYDRAULIC
- XX SOLENOID
- XX HYDRAULIC

NOTE:
ON LOSS OF PRIMARY POWER (PNEUMATIC, ELECTRICAL OR HYDRAULIC)
XX: FO =FAIL OPEN
FC =FAIL CLOSED
FLP=FAIL TO LAST POSITION

PRIMARY ELEMENT SYMBOLS

- PARSHALL FLUME
- WEIR
- ORFICE PLATE
- FLOW TUBE
- PITOT-STATIC
- VORTEX METER
- FI ROTAMETER
- ULTRASONIC FLOWMETER
- ELECTROMAGNETIC FLOWMETER
- PROPELLER OR TURBINE METER
- DE DENSITY METER
- XX GENERIC
- LE LEVEL (ULTRASONIC)
- LEVEL (BUBBLER TUBE)
- LS LEVEL (FLOAT)

MISCELLANEOUS SYMBOLS

- LE SIGHT GLASS
- DIAPHRAGM SEAL
- BLIND FLANGE
- THREADED PLUG
- AIR GAP
- V VENT TO ATMOSPHERE
- AERATOR
- PLUG
- RECEPTACLE
- A SELF CONTAINED AIR SUPPLY
- SD COMPOSITE SAMPLER (DIPPER TYPE)
- SS COMPOSITE SAMPLER (SUCTION TYPE)
- RADIO ANTENNA
- A ON-TD X-SEC B "ON" TIME DELAY B "ON" X-SEC. AFTER A "ON". INSTANT "OFF".
- A OFF-TD X-SEC B "OFF" TIME DELAY B "OFF" X-SEC. AFTER A "OFF". INSTANT "ON".
- I OR I INTERLOCK. SEE CONTROL DIAGRAMS
- A B S R C MEMORY ELEMENT S= SET , R= RESET
- X PURGE SET X: W = WATER A = AIR SEE
- XX AIR SET XX= SUPPLY PRESSURE IN PSIG.
- FILTER/ REGULATOR/ GAUGE SET
- FLEXIBLE CONNECTOR
- PULSATION DAMPENER
- FILTER
- 120V 120 VOLT, 60 HZ POWER
- 480V 480 VOLT, 60 HZ POWER
- ANNULAR DIAPHRAGM SEAL
- RUPTURE DISK (PRESSURE)
- RUPTURE DISK (VACUUM)
- PIG INSERT POINT
- OR PIG CATCH POINT
- MIXER
- M ELECTRIC MOTOR
- PRESSURE GAUGE
- X TONE TRANSMITTER NO. X
- X TONE RECEIVER NO. X
- VOICE COMMUNICATION POINT
- TV TV MONITOR
- A B AND C LOGIC ELEMENT: IF A AND NOT B THEN C
- A B OR C LOGIC ELEMENT: IF A OR B THEN C
- S R ON/OFF RELAY. INPUT IS CONNECTED TO OUTPUT WHEN SWITCHING SIGNAL IS PRESENT.
- S R SWITCHING SIGNAL SWITCHING RELAY. INPUT WITH DOT IS CONNECTED TO OUTPUT WHEN SWITCHING SIGNAL IS PRESENT. OTHER INPUT IS CONNECTED TO OUTPUT WHEN SWITCHING SIGNAL IS NOT PRESENT.
- F FLUSHING CONNECTION
- FEMALE HOSE ADAPTOR / MALE HOSE ADAPTOR
- S SEAL WATER SET
- SIGHT GLASS
- FFLCPLLLX C PANEL CONTINUED ON SAME OR OTHER DRAWING; PANEL OUTLINE; PANEL NAME; CONTROL PANEL DATABASE SYMBOL

PUMP AND COMPRESSOR SYMBOLS

NOTE: XX: AS ADJUSTABLE SPEED
CS-1 CONSTANT SPEED (SINGLE SPEED)
CS-2 CONSTANT SPEED (TWO SPEED)

- XX CENTRIFUGAL PUMP (DRY PIT)
- XX CENTRIFUGAL WET PIT PUMP OR TURBINE PUMP
- XX CHEMICAL FEED PUMP
- XX DIAPHRAGM PUMP
- XX GEAR PUMP OR BLOWER (POSITIVE DISPLACEMENT)
- XX PISTON PUMP
- XX SUBMERSIBLE SUMP PUMP
- XX PROGRESSIVE CAVITY PUMP
- XX COMPRESSOR (CENTRIFUGAL)
- XX COMPRESSOR (PISTON)
- XX BLOWER OR FAN (CENTRIFUGAL)
- EJECTOR

LINE SIZE AND MATERIAL IDENTIFICATION

(FOR REFERENCE ONLY. SEE SITE AND MECHANICAL DRAWINGS)

PIPING CHANGE DATABASE SYMBOL — 18CLDI — PIPE DIAMETER IN INCHES — PIPE MATERIAL ABBREVIATION

CISP	CAST IRON SOIL PIPE
CLDI	CEMENT LINED DUCTILE IRON
CLSTL	CEMENT LINED STEEL
CU	COPPER
FRP	FIBERGLASS REINFORCED PLASTIC
PVC	POLYVINYL CHLORIDE
SST	STAINLESS STEEL
STL	STEEL

FLOW STREAM IDENTIFICATION

AHP	AIR,HIGH PRESSURE PROCESS
AI	AIR, INSTRUMENT
ALP	AIR, LOW PRESSURE PROCESS
BDS	BLENDED DIGESTED SLUDGE
BFE	BIO-FILTER EFFLUENT
BFI	BIO-FILTER INFLUENT
BFR	BIO-FILTER RECYCLE
BWE	BACKWASH EFFLUENT
BWR	BACKWASH RECYCLE
BWS	BACKWASH SUPPLY
BYP	BYPASS
C	CARBON SLURRY
CHS	CHEMICAL SLUDGE
CL	CHLORINE LIQUID
CO	CONDENSATE DRAIN
CS	CHLORINE SOLUTION
CWR	COOLING WATER RETURN
CWS	COOLING WATER SUPPLY
D	DRAIN (SANITARY)
DAS	DIGESTED ACTIVATED SLUDGE
DC	DECANT
DE	DAF EFFLUENT
DG	DIGESTER GAS
DI	DAF INFLUENT
DL	DRY LIME
DR	DAF RECYCLE
DS	DIGESTED SLUDGE
DSS	DEWATERED STABILIZED SLUDGE
DW	DISTILLED WATER
F	FILTRATE
FD	FREEZE DRAIN
FE	FILTER EFFLUENT
FFE	FORWARD FLUSH EFFLUENT
FFS	FORWARD FLUSH SUPPLY
FI	FILTER INFLUENT
FOR	FUEL OIL RETURN
FRE	FROTH EFFLUENT
FRI	FROTH INFLUENT
FTW	FILTER TO WASTE
GR	GRIT SLURRY
HCL	HYDROCHLORIC ACID
HPR	HIGH PRESSURE RETURN (CONDENSATE)
HPS	HIGH PRESSURE STEAM
HS	HEAVY SOLIDS
HWR	HEATING WATER RETURN
HWS	HEATING WATER SUPPLY
LD	DRY LIME
LPO	LIQUID POLYMER
LPR	LOW PRESSURE RETURN (CONDENSATE)
LPS	LOW PRESSURE STEAM
LS	LIME SLURRY
LSD	LIME SLUDGE
ML	MIXED LIQUOR
MPR	MEDIUM PRESSURE RETURN (CONDENSATE)
MPS	MEDUIM PRESSURE STEAM
NA	SODIUM HYDROXIDE
NAPL	NONAQUEOUS PHASE LIQUID
OF	OVERFLOW
PD	PLANT DRAIN
PDS	PRIMARY DIGESTED SLUDGE
PE	PRIMARY EFFLUENT
PI	PRIMARY INFLUENT
PLE	PLANT EFFLUENT
PLI	PLANT INFLUENT
PO	POLYMER SOLUTION
PS	PRESSURE SEWER
PSD	PRIMARY SLUDGE
PSM	PRIMARY SCUM
RAS	RETURN ACTIVATED SLUDGE
RCS	RECARBONATION SLUDGE
RCY	RECYCLE
RHW	RECIRCULATED HOT WATER
RSD	RECIRCULATED SLUDGE
SA	SAMPLE
SE	SECONDARY EFFLUENT
SH	HEATED SLUDGE
SHC	SODIUM HYPOCHLORITE
SS	STABILIZED SOLIDS
SSD	SECONDARY DIGESTED SLUDGE
SSM	SECONDARY SCUM
STS	SANITARY SEWER
STW	STORM WATER
SW	SURFACE WASH
TAS	THICKENED ACTIVATED SLUDGE
TB	TREATED BRINE
TBS	THICKENER BOTTOM SLUDGE
TDS	THICKENED DIGESTED SLUDGE
TPS	THICKENED PRIMARY SLUDGE
TS	THICKENED SOLIDS
TUF	THICKENER UNDERFLOW
UD	UNDERDRAIN
V	VENT
VAC	VACUUM
WAS	WASTE ACTIVATED SLUDGE
W1	NO. 1 (POTABLE) WATER
W2	NO. 2 (NONPOTABLE) WATER
W3	NO. 3 WATER
W4	NO. 4 WATER

INSTRUMENTATION AND CONTROL LEGEND
SHEET 2

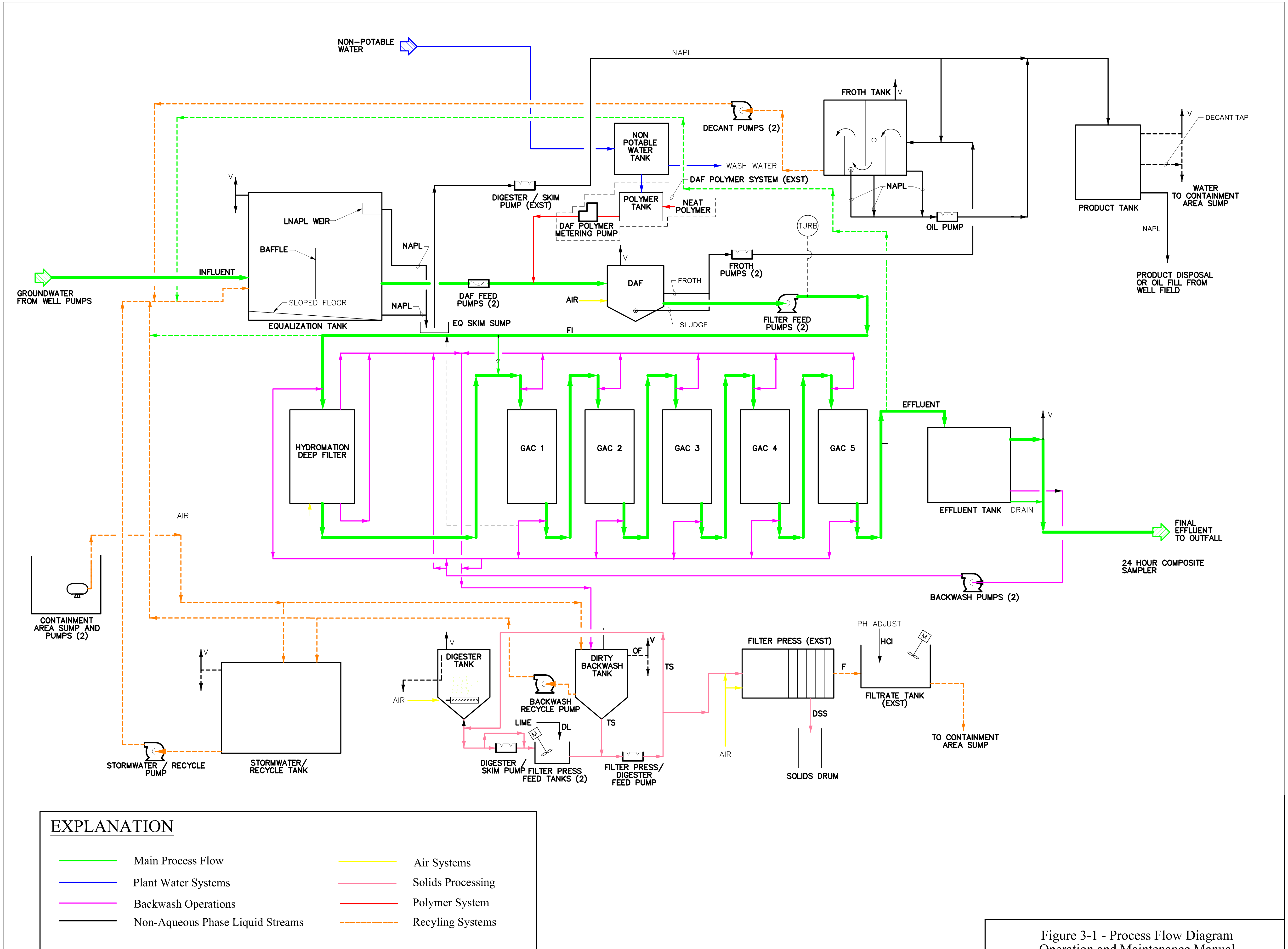
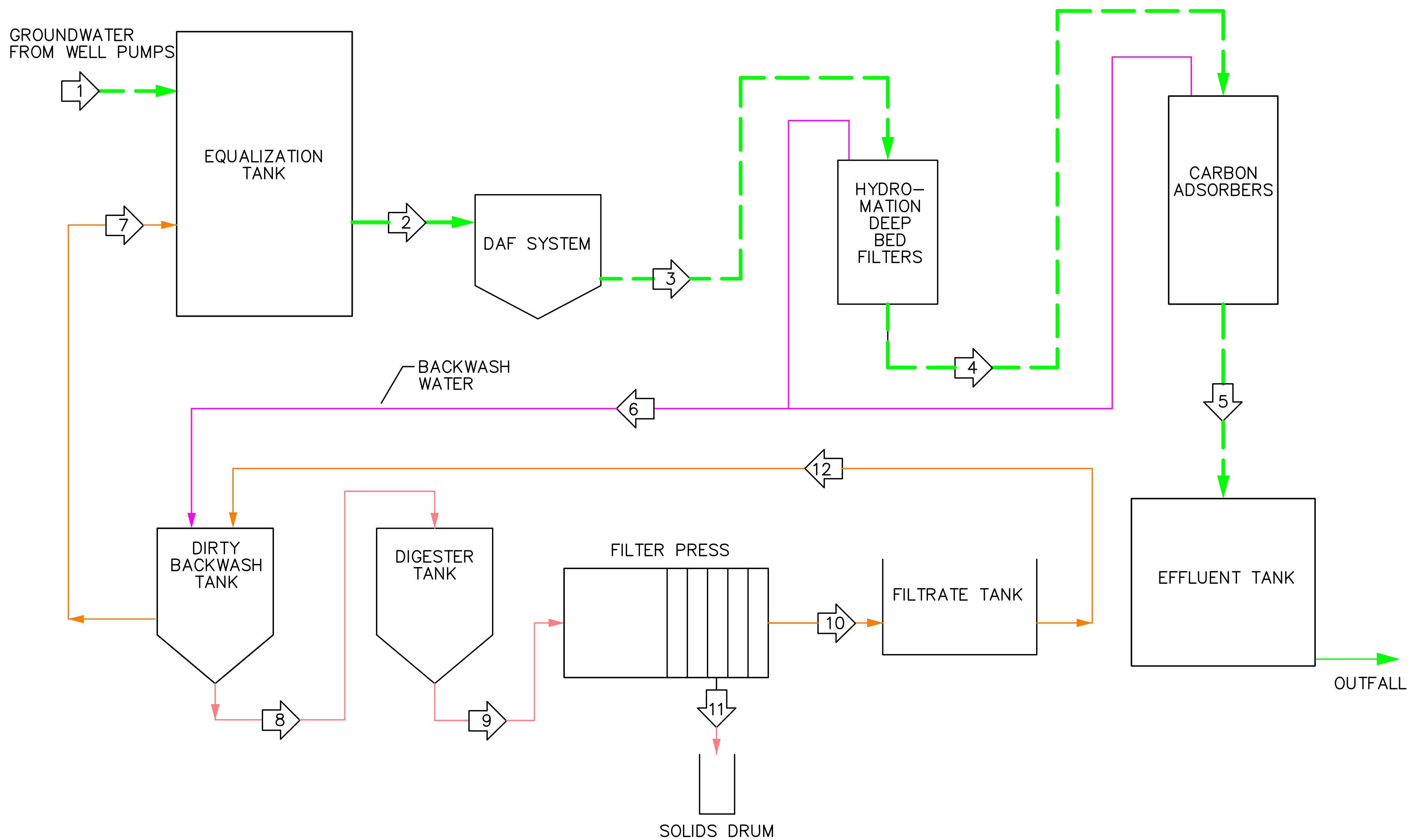


Figure 3-1 - Process Flow Diagram
Operation and Maintenance Manual



EXPLANATION:

MAIN PROCESS STREAMS
RECYCLE/BACKWASH/SOLIDS STREAMS
1 MASS BALANCE STREAM NUMBER

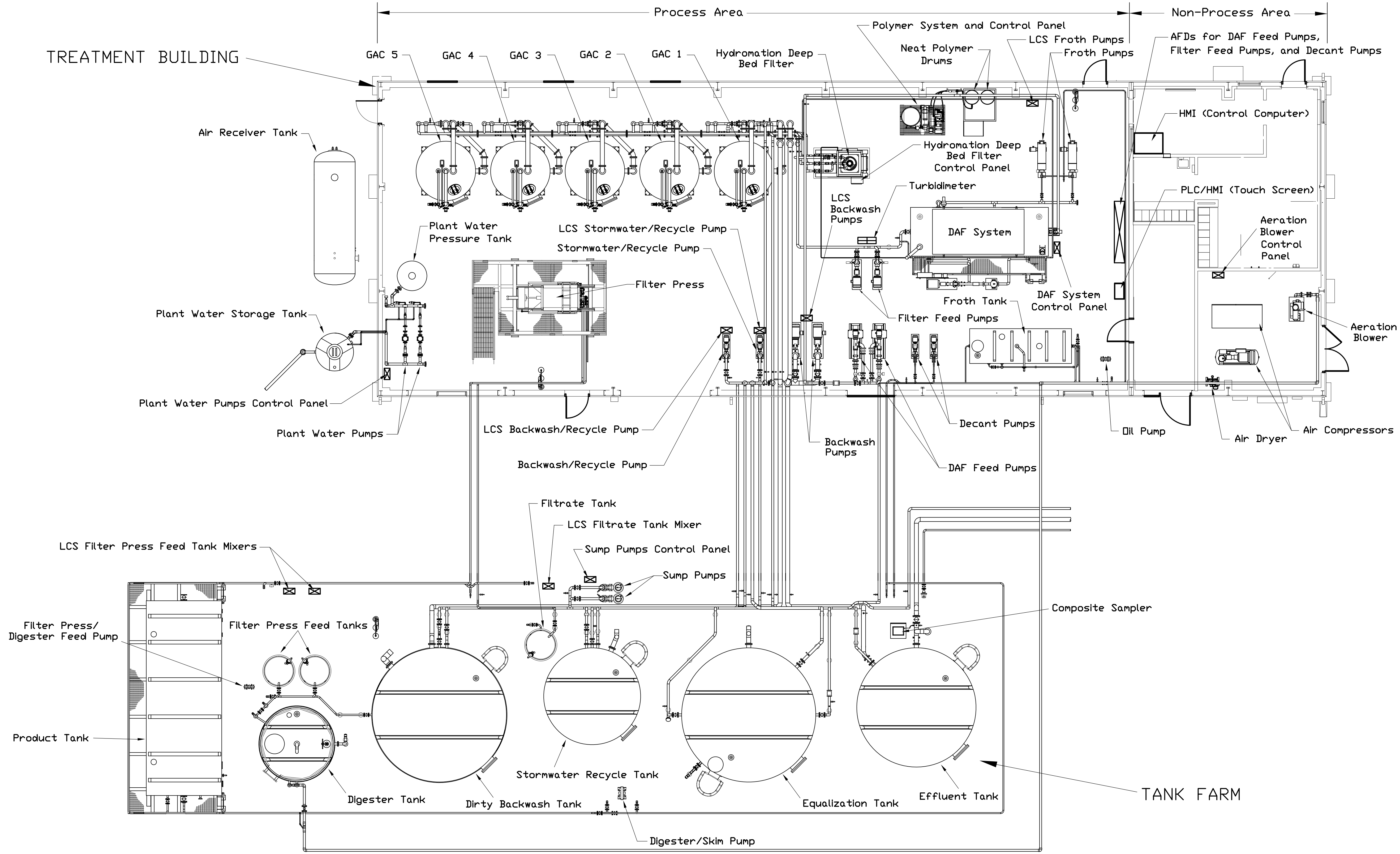
Stream 1 - Groundwater Influent
Stream 2 - EQ Tank Effluent/DAF Influent
Stream 3 - DAF Effluent/MF Influent
Stream 4 - MF Effluent/Carbon Influent
Stream 5 - Carbon Effluent/Outfall
Stream 6 - Dirty Backwash Tank Influent
Stream 7 - Dirty Backwash Tank Supernatant
Stream 8 - Dirty Backwash Underflow/Digester Influent
Stream 9 - Digester Effluent/Filter Press Influent
Stream 10 - Filter Press Effluent/Filtrate Tank Influent
Stream 11 - Filter Press Cake Effluent
Stream 12 - Filtrate Tank Effluent

LEGEND

Main Process Flow
Backwash Operations
Recyling Systems
Solids Processing

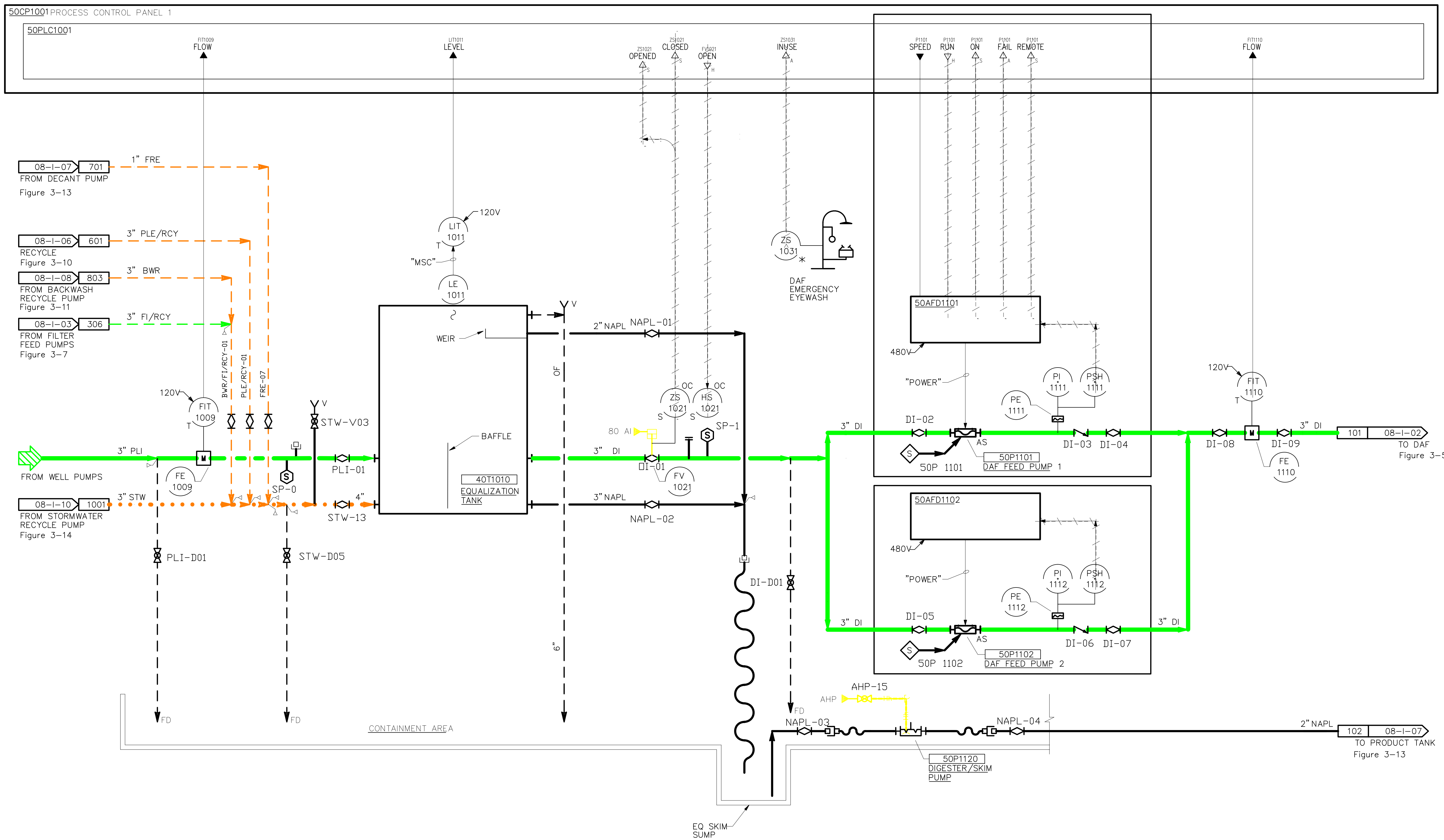
STREAM NUMBER		1	2	3	4	1	2	3	4	9	10	11	12
DESCRIPTION		Groundwater Influent	EQ Tank Effluent/ DAF Influent	DAF Effluent/ MF Influent	MF Effluent/ Carbon Influent	Groundwater Influent	EQ Tank Effluent/ DAF Influent	DAF Effluent/ MF Influent	MF Effluent/ Carbon Influent	Digester Effluent/ Filter Press Influent	Filter Press Effluent/ Filtrate Tank Influent	Filter Press Cake Effluent	Filtrate Tank Effluent
FLOWRATE													
Overall	(gpm)	63	75	70	70	63	75	70	70	-	-	-	-
	(gpd)	-	-	-	-	-	-	-	-	12	11	1.7	11
O&G	(lb/day)	14	18	9	5.7	14	18	9	5.7	N/A	N/A	N/A	N/A
TSS	(lb/day)	23	25	12	5.8	23	25	12	5.8	4.2	0.04	4.2	0.04
PCP	(lb/day)	0.4	0.4	0.3	0.3	0.4	0.4	0.3	0.3	N/A	N/A	N/A	N/A
PAH	(lb/day)	15	16	7.5	5.0	15	16	7.5	5.0	N/A	N/A	N/A	N/A
CONCENTRATION													
O&G	(mg/L)	19	20	10	7	19	20	10	7	N/A	N/A	N/A	N/A
TSS	(mg/L)	30	28	14	7	30	28	14	7	41240	479	294118	479
PCP	(μg/L)	480	435	405	360	480	435	405	360	N/A	N/A	N/A	N/A
PAH	(μg/L)	19800	17955	8977	6015	19800	17955	8977	6015	N/A	N/A	N/A	N/A

Figure 3-2 - Simplified Process Flow Diagram
Operation and Maintenance Manual



AFD - Adjustable Frequency Drive
DAF - Dissolved Air Flotation
GAC - Granular Activated Carbon
LCS - Local Control Station

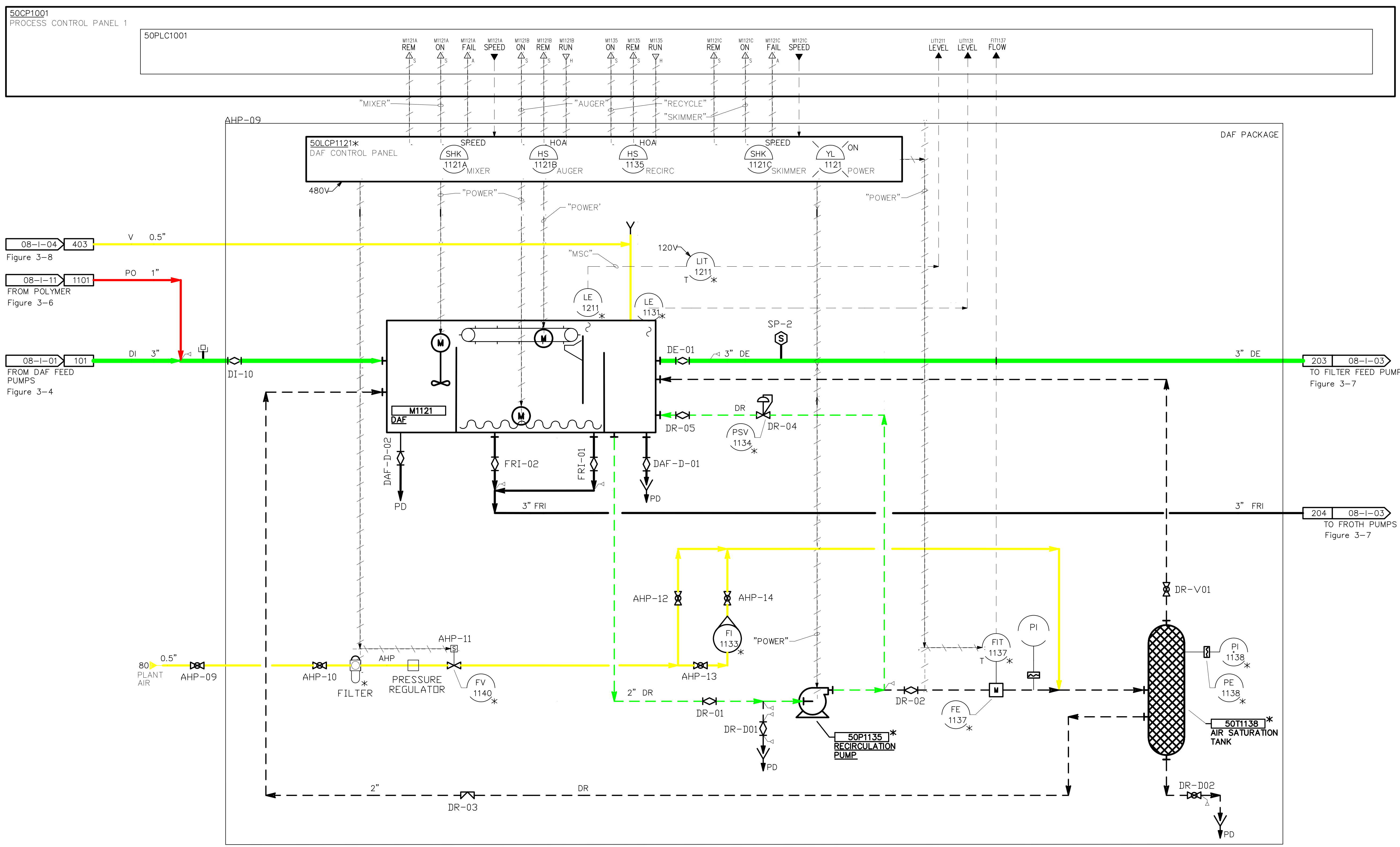
Figure 3-3 - Treatment System Layout
Operation and Maintenance Manual



EXPLANATION

Main Process Flow	Air Systems
Plant Water Systems	Solids Processing
Backwash Operations	Polymer System
Non-Aqueous Phase Liquid Streams	Recyling Systems

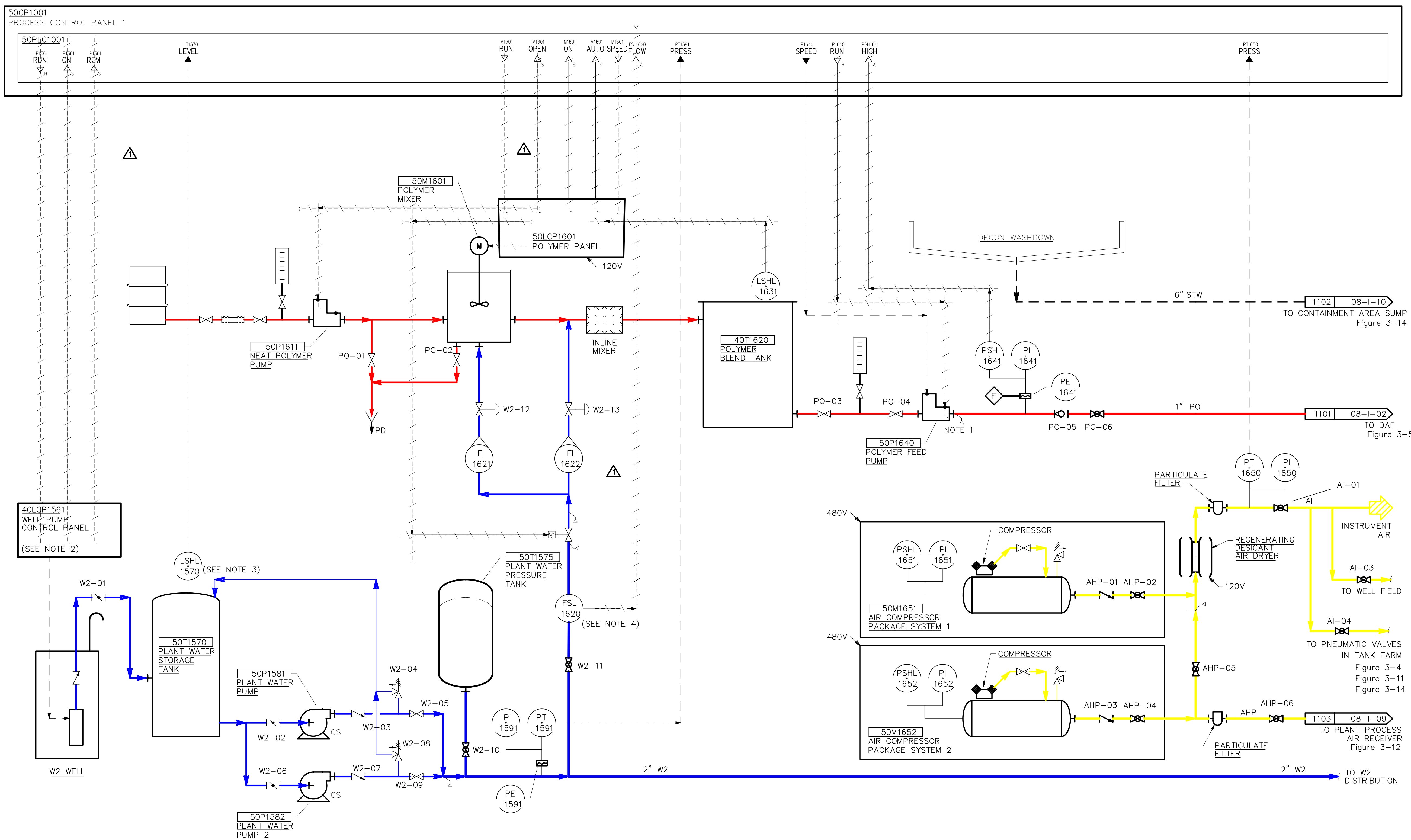
Figure 3-4 Equalization Tank and Skim Sump
Operation and Maintenance Manual



EXPLANATION

Main Process Flow	Air Systems
Plant Water Systems	Solids Processing
Backwash Operations	Polymer System
Non-Aqueous Phase Liquid Streams	Recyling Systems

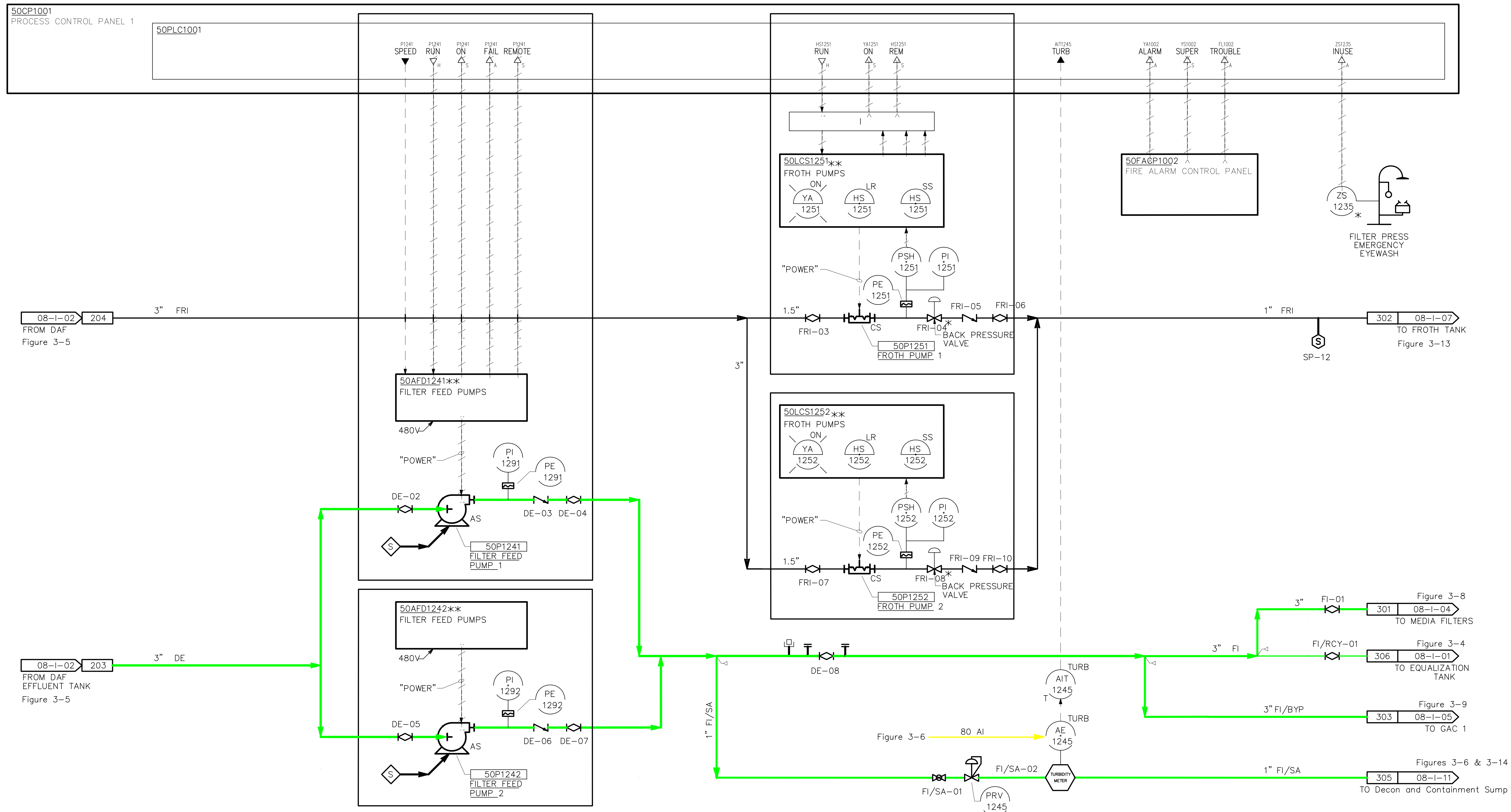
Figure 3-5 - Dissolved Air Flotation System
Operation and Maintenance Manual



EXPLANATION

- Main Process Flow
- Plant Water Systems
- Backwash Operations
- Non-Aqueous Phase Liquid Streams
- Air Systems
- Solids Processing
- Polymer System
- Recyling Systems

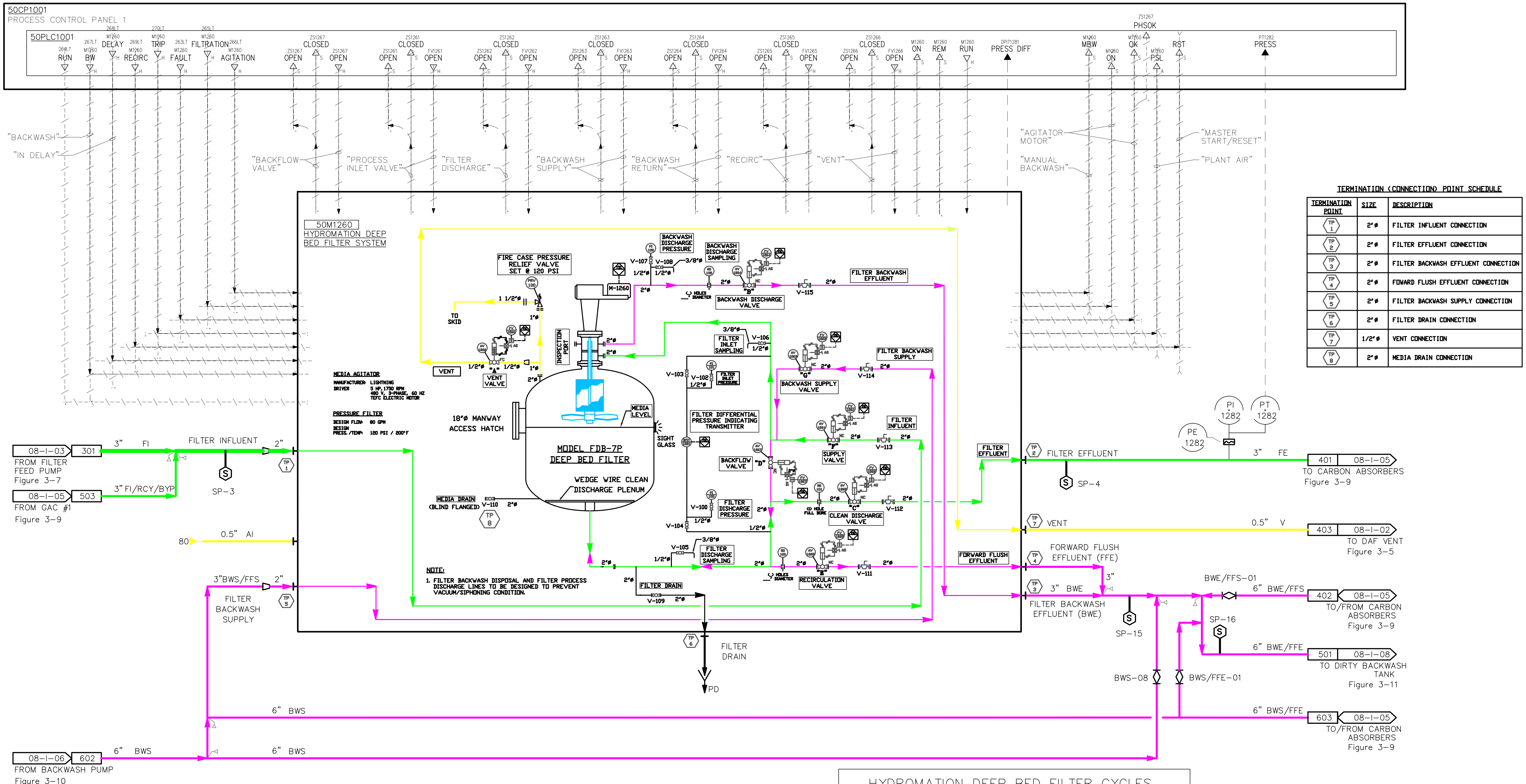
Figure 3-6 - DAF Polymer, Plant Water and Air Systems
Operation and Maintenance Manual



EXPLANATION

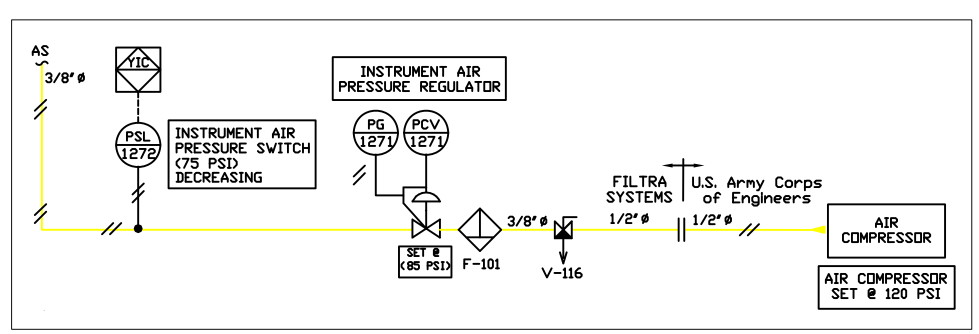
Main Process Flow	Air Systems
Plant Water Systems	Solids Processing
Backwash Operations	Polymer System
Non-Aqueous Phase Liquid Streams	Recyling Systems

Figure 3-7 - DAF Effluent System
Operation and Maintenance Manual



TERMINATION (CONNECTION) POINT SCHEDULE

TERMINATION POINT	SIZE	DESCRIPTION
TP 1	2"ø	FILTER INFLUENT CONNECTION
TP 2	2"ø	FILTER EFFLUENT CONNECTION
TP 3	2"ø	FILTER BACKWASH EFFLUENT CONNECTION
TP 4	2"ø	FOWARD FLUSH EFFLUENT CONNECTION
TP 5	2"ø	FILTER BACKWASH SUPPLY CONNECTION
TP 6	2"ø	FILTER DRAIN CONNECTION
TP 7	1/2"ø	VENT CONNECTION
TP 8	2"ø	MEDIA DRAIN CONNECTION



HYDROMATION DEEP BED FILTER CYCLES

NO.	CYCLE	VENT A	BACKWASH DISCHARGE B	CLEAN DISCHARGE C	BACKFLOW D	RECIRCULATION E	FILTER SUPPLY F	BACKWASH SUPPLY G	FILTER SUPPLY PUMP	BACKWASH SUPPLY PUMP	MIXER	TIME	FLOW GPM
1	FILTRATION	I		O			O		O			12 HRS	80
2	FILTRATION VENT	O		O			O		O			5 MIN	80
3	DELAY ONE							O		O		30 SEC	0
4	AGITATION							O		O	O	1.0 MIN	0
5	BACKWASH		O		O			O		O	O	4.3 MIN	80
6	DELAY TWO							O		O	O	15 SEC	0
7	DELAY THREE								O			30 SEC	0
8	RECIRCULATION					O	O		O			3 MIN	80

O INDICATES VALVE IS OPEN; ALL OTHER VALVES ARE CLOSED
I INDICATES VALVE CYCLES ON & OFF

EXPLANATION

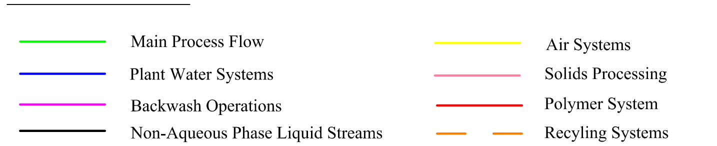
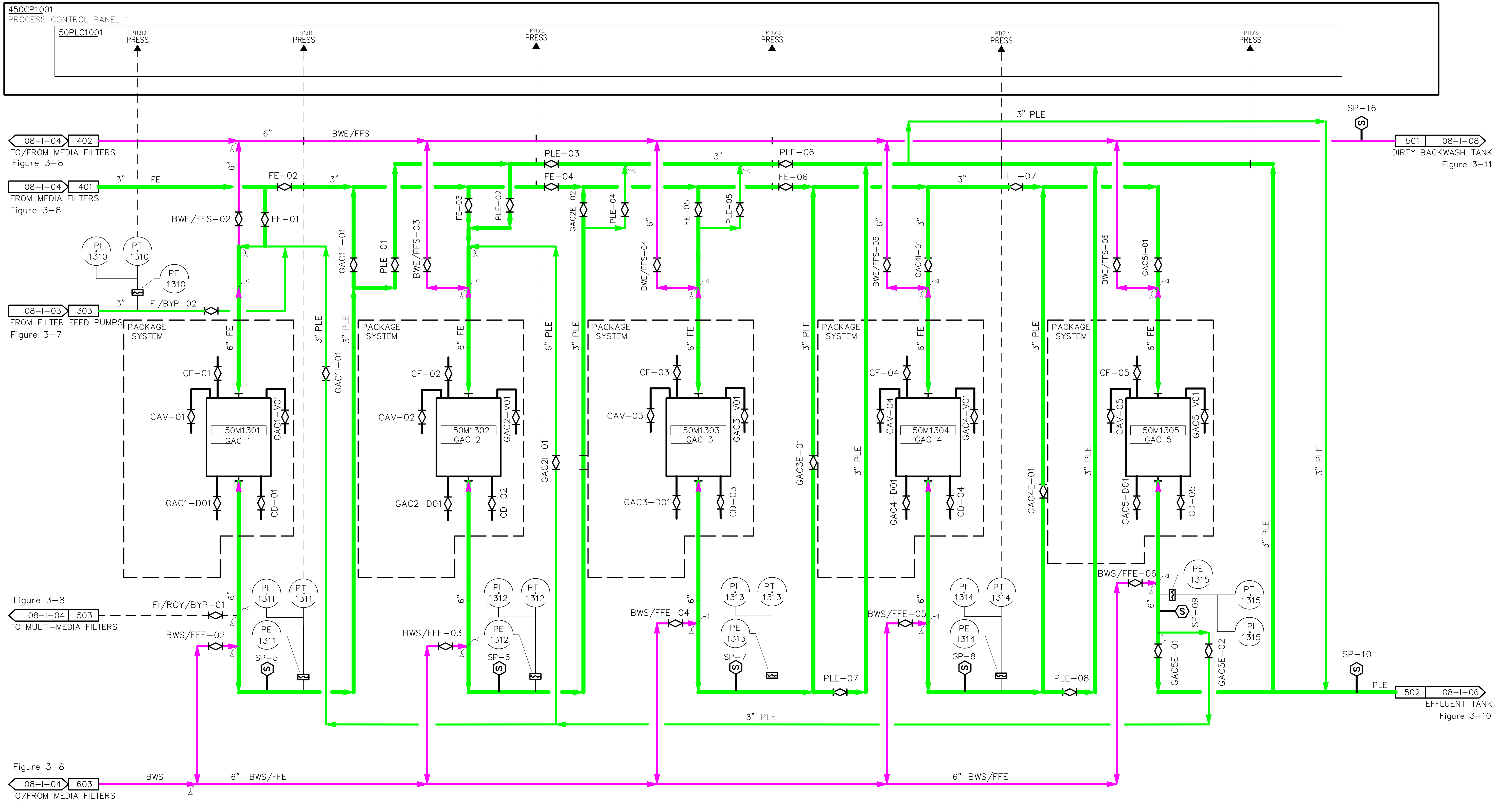


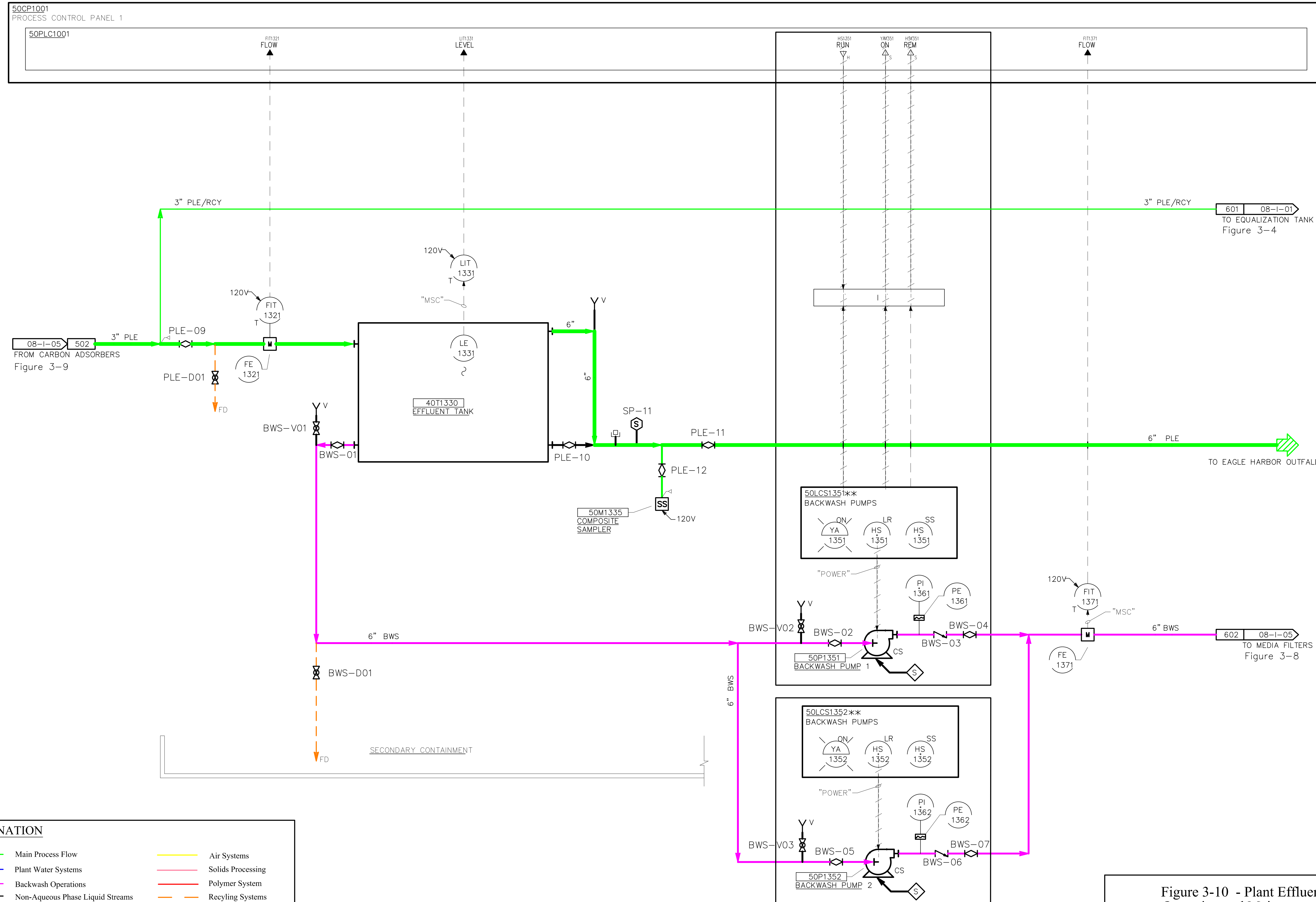
Figure 3-8 - Hydromation Filtration System Operation and Maintenance Manual



EXPLANATION

- Main Process Flow
- Plant Water Systems
- Backwash Operations
- Non-Aqueous Phase Liquid Streams
- Air Systems
- Solids Processing
- Polymer System
- Recyling Systems

Figure 3-9 Granular Activated Carbon System
Operation and Maintenance Manual



EXPLANATION

Main Process Flow	Air Systems
Plant Water Systems	Solids Processing
Backwash Operations	Polymer System
Non-Aqueous Phase Liquid Streams	Recyling Systems

Figure 3-10 - Plant Effluent System
Operation and Maintenance Manual

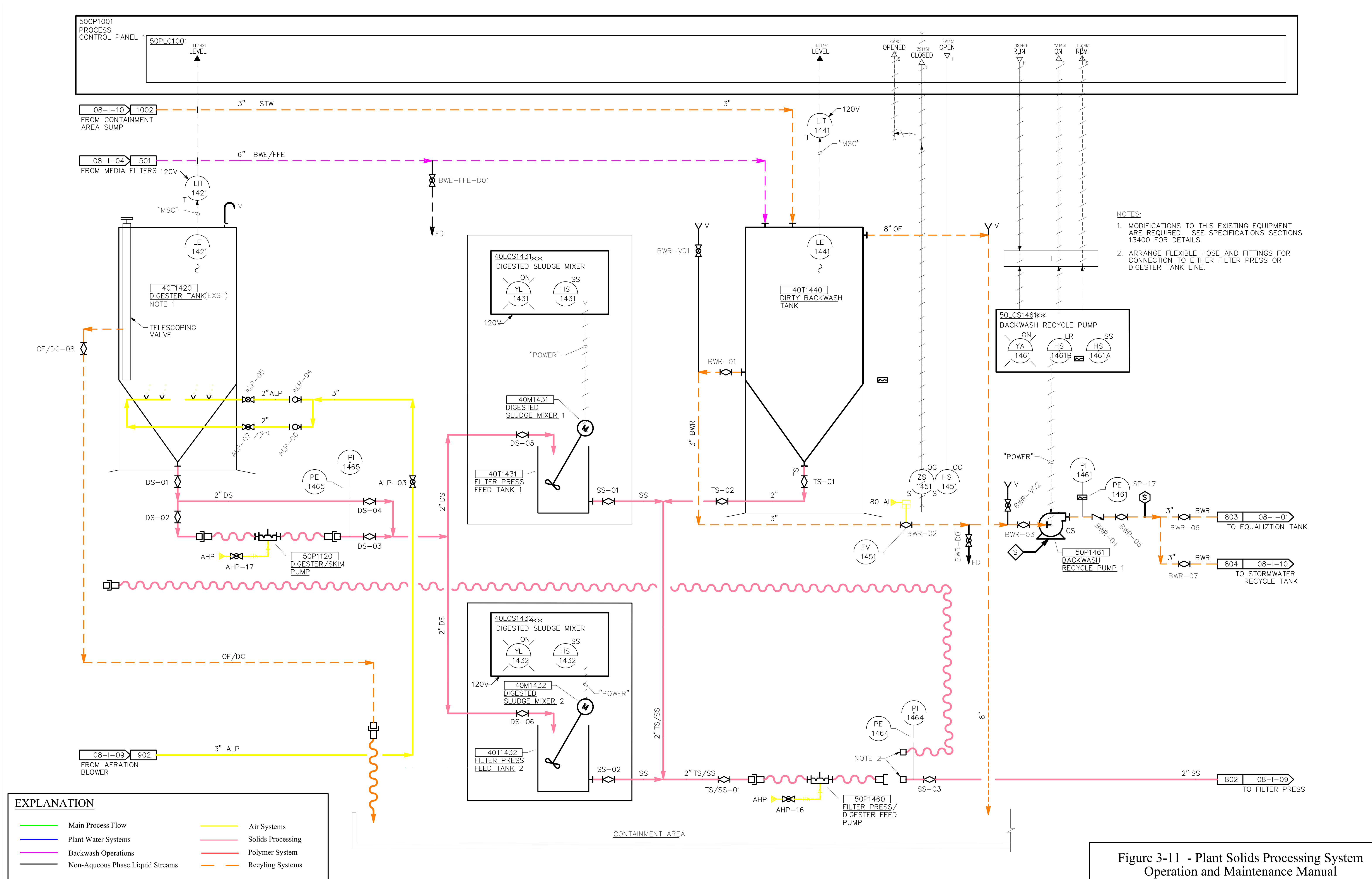
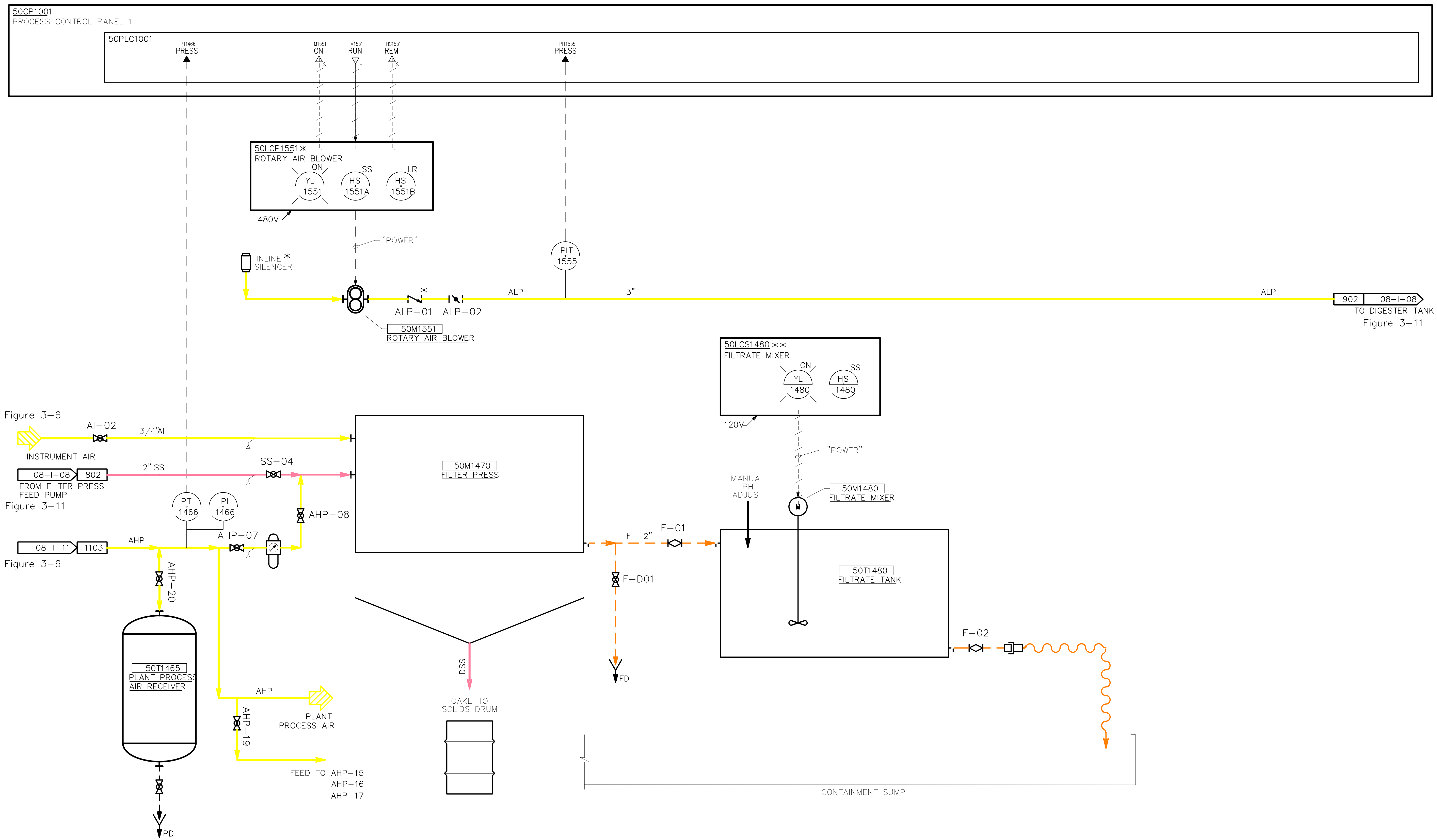


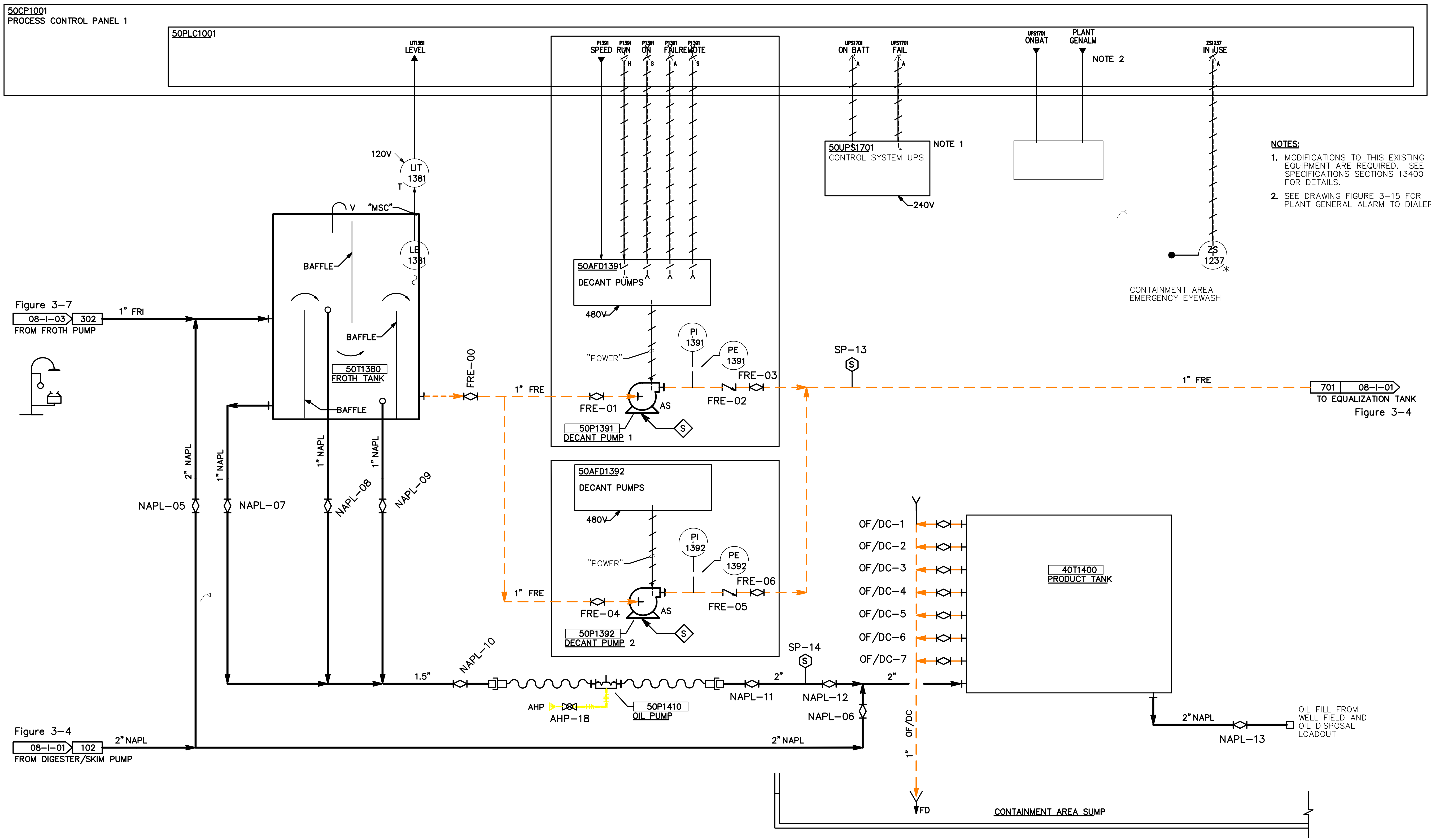
Figure 3-11 - Plant Solids Processing System
Operation and Maintenance Manual



EXPLANATION

Main Process Flow	Air Systems
Plant Water Systems	Solids Processing
Backwash Operations	Polymer System
Non-Aqueous Phase Liquid Streams	Recyling Systems

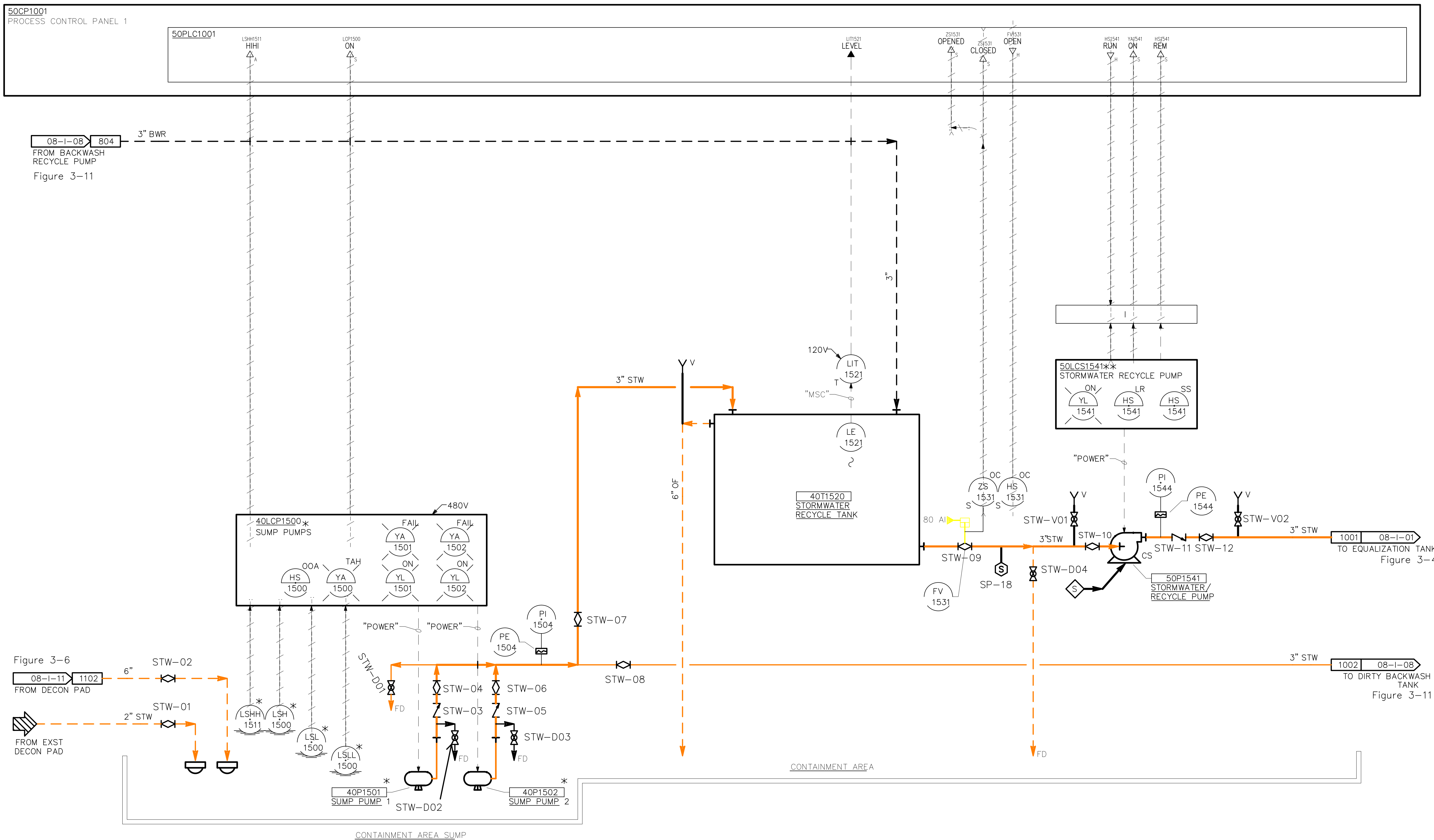
Figure 3-12 - Plant Filter Press System
Operation and Maintenance Manual



EXPLANATION

Main Process Flow	Air Systems
Plant Water Systems	Solids Processing
Backwash Operations	Polymer System
Non-Aqueous Phase Liquid Streams	Recyling Systems

Figure 3-13 - Plant Oil Processing System
Operation and Maintenance Manual



EXPLANATION

Main Process Flow	Air Systems
Plant Water Systems	Solids Processing
Backwash Operations	Polymer System
Non-Aqueous Phase Liquid Streams	Recyling Systems

Figure 3-14 - Stormwater and Containment Area Sump
Operation and Maintenance Manual

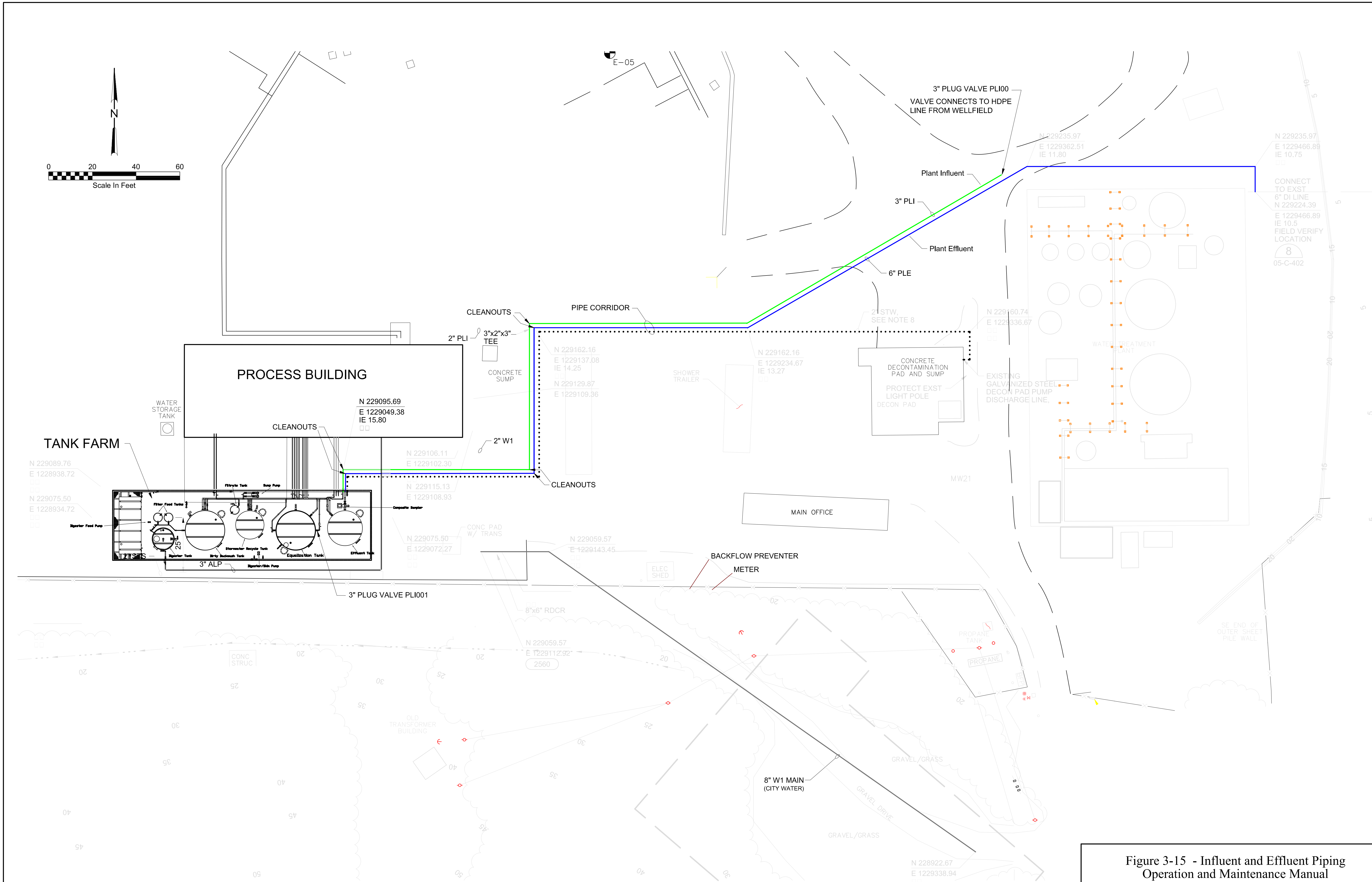


Figure 3-15 - Influent and Effluent Piping
Operation and Maintenance Manual

APPENDIX A

State of Washington
National Pollution Discharge Elimination System (NPDES) Requirements

Summary of Current Effluent Limitations and Monitoring Requirements (a)

CHEMICAL MONITORING

Effluent Characteristic	Discharge Limitation: Daily Maximum (ug/L)	Discharge Limitation: Monthly Average (ug/L)	Monitoring Requirements: Measurement Frequency	Sample Type	Reported Value(s)
Total of 16 Polynuclear Aromatic Hydrocarbons (PAHs)	20	--	Once per week	24-hour composite (c)	Maximum daily
Individual PAHs (b)					
Naphthalene	4	--	Once per week	24-hour composite	Maximum daily
Acenaphthylene	4	--	Once per week	24-hour composite	Maximum daily
Acenaphthene	4	--	Once per week	24-hour composite	Maximum daily
Fluorene	2	--	Once per week	24-hour composite	Maximum daily
Phenanthrene	2	--	Once per week	24-hour composite	Maximum daily
Anthracene	2	--	Once per week	24-hour composite	Maximum daily
Fluoranthene	2	--	Once per week	24-hour composite	Maximum daily
Pyrene	2	--	Once per week	24-hour composite	Maximum daily
Benzo(a)anthracene	2	--	Once per week	24-hour composite	Maximum daily
Chrysene	2	--	Once per week	24-hour composite	Maximum daily
Benzo(b)fluoranthene	2	--	Once per week	24-hour composite	Maximum daily
Benzo(k)fluoranthene	2	--	Once per week	24-hour composite	Maximum daily
Benzo(a)pyrene	2	--	Once per week	24-hour composite	Maximum daily
Dibenzo(a,h)anthracene	2	--	Once per week	24-hour composite	Maximum daily
Benzo(g,h,i)perylene	2	--	Once per week	24-hour composite	Maximum daily
Indeno(1,2,3-cd)pyrene	2	--	Once per week	24-hour composite	Maximum daily
Pentachlorophenol (d)	6	--	Once per week	24-hour composite	Maximum daily
Discharge Flow (gpm) (e)	NA	--	Continuous	Recording	Maximum daily
Total Suspended Solids [TSS] (mg/L)	NA	--	Once per week	24-hour composite	Maximum daily
Total Dissolved Solids [TDS] (mg/L)	NA	--	Once per week	Grab	Maximum daily
Temperature [degrees C]	NA	--	Once per week	Grab	Maximum daily
Dissolved Oxygen [DO] (mg/L)	NA	--	Once per week	Grab	Maximum daily
pH	6.0 - 9.0	--	Once per week	Grab	Maximum daily
Metals (f)					
Zinc	95	47	Once per week	24-hour composite	Maximum daily
Lead	140	70	Once per week	24-hour composite	Maximum daily
Mercury	2.1	1	Once per week	24-hour composite	Maximum daily
Nickel	75	37	Once per week	24-hour composite	Maximum daily
Cadmium	43	21	Once per week	24-hour composite	Maximum daily
Chromium (Total)	1100	548	Once per week	24-hour composite	Maximum daily

BIOMONITORING (g)

Organism	Type of Toxicity Test	Monitoring Requirements: Measurement Frequency	Sample Type	Reported Value(s)
Inland Silversides (Menidia beryllina)	Acute survival test	Quarterly	24-hour composite	LC50
Purple sea urchin or sand dollar (h)	Chronic test	Quarterly	24-hour composite	IC25
Pacific oyster or mussel larvae (h)	Chronic test	Quarterly	24-hour composite	NOEC, LOEC, EC50/LC50

Notes:

(a) Modified from EPA's Administrative Order for Necessary Interim Response Actions No. 1091-06-03-106 dated June 17, 1991.

(b) Each of the 16 priority pollutants PAHs are quantified separately using EPA Method 8310 from Test Methods for Evaluating Solid Waste, Third Edition, SW-846. The 16 individual PAHs are summed to arrive at the total PAH value.

(c) A 24 hour composite sample is collected using an automatic sampler.

(d) Pentachlorophenol is quantified using EPA Method 8040 from Test Methods for Evaluating Solid Waste, Third Edition, SW-846.

(e) Flow is measured by a continuous flow meter.

(f) Metals are quantified using EPA Contract Laboratory Program (CLP) analytical methods and QA/QC, however full documentation is not required. Documentation only includes calibration, blank, accuracy, and precision results.

(g) Specific requirements for analytical methods, QA/QC, and reporting are provided in the attached fact sheet.

(h) These organisms may be used interchangeably if required.

Reference: Interim ROD
Wyckoff Groundwater Operable Unit
Wyckoff/Eagle Harbor Superfund Site
September 30, 1994

Current Biomonitoring Requirements

I. Acute Toxicity Test Requirements:

1. For each test period (see also Paragraph I.8 below), acute survival toxicity tests are required for Inland Silversides (*Menidia beryllina*).

2. The test protocol is adapted from C.I. Weber, et al, *Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms*. EPA/600/4-90/027, 1991.

3. All quality assurance criteria used are in accordance with *Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms*, EPA/600/4-90/027. Test results which are not valid (e.g.. control mortality exceeds acceptable level) will not be accepted and must be repeated.

4. The test is performed with a series of dilutions (100, 50, 25, 12.5, and 6.25 percent effluent) plus a control (0 percent effluent) to determine (1) the LC_{50}, and (2) any statistically significant differences between the results for the control and each effluent concentration tested.

5. If the test demonstrates the presence of acute toxicity, EPA will undertake the following actions as needed to determine the source of toxicity:

   (a) Chemical analyses.

   (b) Evaluation of treatment processes and chemicals used.

   (c) Physical inspection of facility for proper operation of treatment units, spills, etc.

   (d) Examination of records.

   (e) Interviews with plant personnel to determine if toxicant releases occurred through spills, unusual operating conditions, etc.

   If any toxicity remains after conducting the above steps, additional monitoring or treatment may be required.

6. A written report of the toxicity test results and any related source investigation are prepared for EPA within 60 days after the initial sampling. The report of the toxicity test results and chemical analyses shall be prepared in accordance with the Reporting Sections in the documents specified above in Section I-3.

7. Chemical testing for the parameters for which effluent limitations exist shall be performed on a split of each sample collected for bioassay testing. To the extent that the timing of sample collection coincides with that of the sampling required for the effluent limitations, analysis of the split sample will fulfill the requirements of that monitoring as well.

8. Testing shall be conducted every three months (4 times per year), until EPA modifies this requirement in writing. Additional toxicity testing is also required at any time that spills or other unusual events result in different or substantially increased discharge of pollutants.

II. Chronic Toxicity Test Requirements:

1. For each test period (see also Paragraph II.11 below), chronic toxicity tests are required for the following organisms:

   (a) *Stronglyocentrotus purpuratus* (purple sea urchin), or *Dendraster excentricus* (sand dollar).

   (b) *Mytilus edulis* (mussel) or *Crassostrea gigas* (Pacific oyster) larvae.

   The purple sea urchin and sand dollar, and the mussel and Pacific oyster may be used interchangeably if necessary.

2. In each year, the bioassay tests shall be conducted four times with each organism during the organism's natural spawning period. To the extent that these seasons overlap, testing shall be conducted on splits of the same effluent samples. Any tests which fail the criteria for control mortality as specified in the respective protocols shall be repeated on a freshly collected sample

3. Testing is conducted on 24-hour composite samples of effluent. Each composite sample collected shall be large enough to provide enough effluent to conduct toxicity tests, as well as chemical tests required in Part II.10. below.

4. The chronic toxicity tests are performed as follows:

(a) For the purple sea urchin/sand dollar, tests are performed on a series of dilutions, plus a control (0 percent effluent). The IC_{25} value (the incipient concentration of effluent causing a 25 percent reduction in biological measurement, e.g., fertilization, is calculated. EPA has indicated that the IC_{25} is the approximate analogue to the no observable effect concentration (NOEC) of the effluent in the control water. The NOEC is that concentration of effluent for which survival, reproduction, or growth of the test organisms is not significantly different (at the 95% confidence level) from that of the control organisms (see *Technical Support Document for Water Quality-based Toxics Control,* EPA/505/2-90-001, March 1991).

(b) For the mussel or Pacific oyster larvae, tests are performed on a series of dilutions, plus a control (0 percent effluent). The NOEC, LOEC (lowest observable effect concentration), and the EC50/LC50 (effective concentration [EC] at which 50 percent of the population shows sublethal effects such as reduction in growth and lethal concentration [LC] at which 50 percent of the population dies, respectively), are calculated.

5. The chronic bioassays are conducted in accordance with the following protocols:

(a) For purple sea urchin/sand dollar: *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms*, EPA/600/4-87/028 and The Environmental Monitoring and Support Laboratory, Cincinnati, OH, 1988.

(b) For mussel/Pacific oyster larvae: *Standard Guide for Conducting Static Acute Toxicity Tests Starting with Embryos of Saltwater Bivalve Molluscs,* ASTM E 724-89.

6. All quality assurance criteria used shall be in accordance with *Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms*, EPA/600/4-85-013, *Quality Assurance Guidelines for Biological Testing*, EPA/600/4-78-043, and for oyster/mussel larvae test, *Standard Guide for Conducting Static Acute Toxicity Tests Starting with Embryos of Saltwater Bivalve Molluscs,* ASTM E 724-89. The control water shall be high quality natural seawater. No exceptions will be made for artificial sea salts or concentrated brine unless Wyckoff submits data to EPA which demonstrates that the lab has reliably conducted the specified test with one of these media.

7. The results of the bioassay tests are provided to EPA within 45 days after completion of each test in accordance with the Reporting Section in *Short Term Methods for Estimating Chronic Toxicity Effluents and Receiving Water to Marine and Estuarine Organisms*, EPA/600/4-87/028, May 1988, and include any other information required by the protocols.

8. EPA and Ecology will evaluate the results to determine whether they indicate the occurrence of chronic toxicity outside the mixing zone. If it appears that this may be occurring, a toxicity evaluation and reduction plan will be prepared within 90 days. The evaluation portion of the plan may include additional toxicity testing if needed to follow up on initial results or gather information for a possible toxicity limit in the future.

9. If the sea urchin/sand dollar or mussel/oyster larvae tests prove inadequate for evaluating Wyckoff's effluent, EPA may substitute alternative tests which will provide the required toxicity information.

10. Chemical testing for the parameters for which effluent limitations exist shall be performed on a split of each sample collected for bioassay testing. To the extent that the timing of sample collection coincides with that of the sampling required for the effluent limitations, analysis of split sample will fulfill the requirements of that monitoring as well.

11. After one year, EPA may reduce the monitoring requirements to once per year, using the more sensitive species. All modifications will be approved by EPA in writing.

Modifications to the Current Effluent Limitations
Wyckoff Thermal Remediation
Pilot Study Treatment System[1]

The following modifications will be made to the Chemical and/or Biomonitoring requirements:

1. Remove metals (zinc, lead, mercury, nickel, cadmium, and chromium) as a monitoring requirement. Metals was not used during wood-preserving operations at the Wyckoff/Eagle Harbor site. Additionally, years of sampling never detected metals in the treatment plant effluent.

2. Temperature will be monitored. Ecology believes an effluent temperature discharge of 20°C (68°F) to 25°C (77°F) would not cause a water quality violation in receiving waters of Puget Sound. A mixing zone has been established at the point of discharge. Grab samples for temperature monitoring will be taken once per week.

3. Dissolved oxygen (DO) and turbidity will also be monitored by grab samples once per week. The daily maximum discharge limitations are:

DO:	Shall exceed 6 mg/L (the receiving waters of Puget Sound off Wyckoff are considered to be Class A Marine Water)
Turbidity:	If background is $<$ 50 ntu, discharge cannot exceed background plus 5 ntu If background is $>$ 50 ntu, discharge cannot exceed a 10% increase

4. The following Measurement Frequency will be employed during the first three months of pilot study operation:

   - Daily effluent sampling for weeks 0 to 2
   - Twice a week for week 2 to month 3
   - Biomonitoring at month 3

   Based on the results of the sampling data, the Measurement Frequency will be adjusted as appropriate after month 3. Any sampling adjustments made shall be no less than once per week for effluent chemical monitoring and quarterly for biomonitoring, for the remainder of the pilot study.

The above modifications will be employed during the thermal pilot study. Effluent Limitations will be developed/adjusted for the full-scale treatment system based on the results of the pilot study, as appropriate.

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[1] Per agreement by the EPA Project Manager, Hanh Gold, and the Ecology Project Managers, Guy Barrett and Marian Abbett on February 2, 2000, and during subsequent communications on February 8 and 10, 2000.

APPENDIX B

Major Process Equipment Warranty

11240 - Metering pumps

A.1.1

No mention of hours of service are stated in any literature of Milton Roy's for diaphragm life. 12,000 hours is equal to 500 days, which is less than their standard warranty of thirty six months.

METERING PUMP PRODUCTS THIRTY-SIX MONTH

LIMITED WARRANTY

The Flow Control Division of the Milton Roy Company warrants its metering pump products against defects in workmanship or materials for three years under normal use form the date of shipment from our warehouse or the warehouse of our agent. All metering pump components are warranted for three years, except that warranties on equipment and accessories furnished with the pump but manufactured by others are limited to the warranties offered by the manufacturers of their respective products. This warranty is not extended to electronic or Pneumatic control devices supplied with a Milton Roy metering pump. These items are covered by the warranties offered by the manufacturer or the Milton Roy Warranty for Electronic Controls and Actuators.

All obligations and liabilities under this warranty are limited to refunding, repairing or replacing (at our option), f.o.b. our plant, such allegedly defective units as are returned to our plant, carrier charges prepaid. Repairs or replacements are made subject to factory inspection of returned items.

This warranty does not extend to damage by corrosion or erosion. The materials of construction offered are recommendations subject in all cases to verification and acceptance by the customer. These recommendations, based on previous Company experience and best available information, do not constitute guarantees against wear or chemical action.

Expressly excluded from this warranty are defects caused by misuse, abuse, or improper application, employment, or operation of the unit. Expendable items and damage resulting from unauthorized repair are not covered by this warranty. No liability for consequential damages or reinstallation labor is accepted. Milton Roy Company will not assume responsibility for contingent liability for alleged failure of its products.

This warranty is in lieu of all other warranties expressed or implied.

ITT FLYGT WARRANTY

GENERAL:
For the period defined, ITT FLYGT offers a commercial warranty to the original End Purchaser against defects in workmanship and/or material. Warranty covers parts and labor at a rate outlined in **ADDENDUM – A.** ITT FLYGT products will be covered when applied in compliance with the requirements of the ITT FLYGT Catalog and the ITT FLYGT Technical Manual specifications and used for mixing and/or pumping of Qualified Liquids.

CONDITIONS:
ITT FLYGT will pay the cost of replacement parts and labor, provided that the product, with cable attached, is returned prepaid to an Authorized ITT FLYGT Service Facility for repairs. Coverage for replacement of parts and labor will be provided at the rate as shown in **ADDENDUM - A** for the period indicated. Coverage will begin from date of shipment or date of a valid Start-up. In cases where the Start-up date is used as the beginning of the warranty, a Start-up Report completed by an approved service technician from an ITT FLYGT Authorized Service Facility and must be received by the ITT FLYGT Area Service Manager within thirty (30) days of the initial onset of the unit placed into service or the beginning of the warranty coverage will default to the product ship date. Start-up must occur within one (1) year from date of shipment from ITT FLYGT or warranty will automatically default to ship date as start of warranty. (See **STORAGE** section) Warranty coverage will be calculated from the determined start date to the date that the defective product and/or warranty claim is received by an ITT FLYGT Authorized Service Facility. (See **TIME** section)

A copy of Electrical System Schematics of the control used (including Control's Bill of Material) and, if requested, a copy of the Start-up Report may be required to support any Warranty Claims submitted for approval. ITT FLYGT retains the exclusive right to replace, repair or grant credit for product submitted under this warranty. In the event that the product is replaced, warranty on the replacement product will be equal to the balance remaining on the original product or ninety (90) days, which ever is greater.

This Warranty shall not apply to any Product or Part of Product which has been subjected to misuse, accident, negligence, used in a manner contrary to ITT FLYGT's printed instructions or damaged due to a defective power supply, improper electrical protection, faulty installation or repair, an act of God, an act of war or by an act of terrorism.

This warranty is exclusive of costs for standard and/or scheduled maintenance performed and for parts that, by virtue of their operation, require replacement through normal wear (aka: Wear Parts).

Wear Parts being described as Cutters, Cutting Plates, Impellers, Agitators, Diffusers, Wear Rings (Stationary or Rotating), Volutes (when used in an abrasive environment), oil, grease and/or any items deemed as necessary to perform normal maintenance on ITT FLYGT equipment will not be included in this warranty unless a defect in material or workmanship can be determined by ITT FLYGT.

STORAGE:
Should a delay occur between ship date and the date of start-up, maintenance as outlined in ITT FLYGT's *Care & Maintenance Manual* must be performed by the "CONTRACTOR" and/or "OWNER" during any such period of storage. Documentation providing proof and outlining what maintenance was performed must be provided to ITT FLYGT or its representative within thirty (30) days of said maintenance, or the ITT FLYGT warranty may be considered void.

TIME:
Unless otherwise specified by ITT FLYGT US Corporate Headquarters, the beginning of this warranty will be determined by one of the following: time from date of original ship date from a ITT Flygt Authorized Facility or time from date of start-up and shall be determined by the date in which either event took place, to the date that the defective product (or Warranty Claim) is received by ITT FLYGT, or its authorized service facility. Note: Date of Start-up must include an ITT FLYGT Start-up Report submitted to ITT FLYGT by a qualified representative of an ITT FLYGT Authorized Service Facility within thirty (30) days of actual start-up in order to qualify.

ITT FLYGT WARRANTY

IMPORTANT: FOR WARRANTY PURPOSES, MONITORING DEVICES PURCHASED WITH UNITS FOR PROTECTION MUST BE CONNECTED AND UTILIZED. FAILURE TO DO SO WILL RENDER THIS WARRANTY NULL AND VOID.

ITT FLYGT NEITHER ASSUMES, NOR AUTHORIZES ANY PERSON OR COMPANY TO ASSUME FOR ITT FLYGT, ANY OTHER OBLIGATION IN CONNECTION WITH THE SALE OF ITS EQUIPMENT. ANY ENLARGEMENT OR MODIFICATION OF THIS WARRANTY BY A DISTRIBUTOR, OR OTHER SELLING AGENT SHALL BECOME HIS EXCLUSIVE RESPONSIBILITY.

THE WARRANTIES MADE HEREIN BY ITT FLYGT ARE IN LIEU OF ANY AND ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED AND THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY EXPRESSLY DISCLAIMED. ITT FLYGT ASSUMES NO LIABILITY FOR LOSS OF USE OR FOR ANY DIRECT, INDIRECT OR CONSEQUENTIAL DAMAGES OF ANY KIND IN RESPECT TO THE USE OR OPERATION OF ITT FLYGT PRODUCTS, OR ANY EQUIPMENT OR ACCESSORIES IN CONNECTION THEREWITH.

ITT FLYGT WILL NOT BE HELD RESPONSIBLE FOR TRAVEL EXPENSES, RENTED EQUIPMENT, OUTSIDE CONTRACTOR'S FEES, EXPENSES PERFORMED BY AN UNAUTHORIZED REPAIR SHOP, UNAUTHORIZED ALTERATIONS, OR FOR PUMPS USED WITHOUT ITT FLYGT SUPPLIED CABLE OR CONTROLS UNLESS IT CAN BE PROVEN SUCH ANCILLARY EQUIPMENT IS SUITABLE FOR THE PURPOSE AND EQUAL TO ITT FLYGT CABLES OR CONTROLS THAT WOULD ORIGINALLY BE SUPPLIED WITH THE TYPE OF EQUIPMENT IN USE. REIMBURSEMENT COSTS FOR CRANES AND/OR ANY SPECIAL EQUIPMENT USED IN CONJUNCTION FOR THE REMOVAL OR REINSTALLATION OF ANY ITT FLYGT EQUIPMENT WILL NOT COVERED UNDER THIS WARRANTY.

WITHOUT THE EXPRESSED PERMISSION IN WRITING FROM THE FLYGT-US HEADQUARTERS, PRODUCT EXPORTED OUTSIDE U.S. BORDERS WILL RENDER THIS WARRANTY NULL AND VOID.

It is agreed by the owner of the product that Periodic Maintenance (PM) will be performed as prescribed in accordance with ITT FLYGT's *Operations & Maintenance Manual* during the period of the warranty as outlined in **ADDENDUM – A.** Not maintaining and/or performing a maintenance regiment, as outlined in the *Operating & Maintenance Manual*, may be considered reason render this warranty null and void.

A written record, hereby known as "the log", will be associated with each unit serial number and must be maintained by the organization having product maintenance responsibility. The log must record each PM activity during the life of the warranty. Other information in the log shall include, but is not limited to, any repairs that were performed on the unit, or verification that a Flygt authorized Service Contract is in force during the life of the warranty and is available for review and/or auditing. Failure to maintain a maintenance record log may render this warrant null and void. Such logs must be made available for auditing by ITT FLYGT.

Customers and/or service personnel claiming to be unaware or unable to acknowledge the existence of the contents of this warranty does not constitute alteration of the conditions as outlined in this document. Owners of Flygt products have certain rights under this warranty and may have other rights dictated by the laws within the state in which this product is purchased.

ITT FLYGT WARRANTY

ADDENDUM - A

PRODUCT	PRODUCT SERIES AND CONFIGURATION	Months 1-12	Months 13-18	Months 19-36	Months 37-39	Months 40-60
Axial Flow/ Mixed Flow/ Centrifugal Pumps & Mixers	3000 Series: CP, NP, DP, CT, NT, CZ, LL, 7000 Series, PL, 4000 Series, SR, PP	100%		50%		25%
Permanent Controls	Permanent	100%				
Abrasion/Corrosion Resistant/ Chopper/ Grinder Pumps	3000 Series: MP, MF, MH, FS, FP, HP, HS, 5000 Series: HP, HS	100%				
Dewatering Pumps	2000 Series: BS, 3000 Series: CS, NS, DS	100%				
Hydroejectors/ Aerators	HE, JA	100%				
Accessories	Permanent/Portable	100%				
Portable Controls	Portable	100%				
Small Pumps	C/D 3045 ~ 3057, SX.	100%				
Parts - *		100%				

* - Parts used in a repair that fail are warranted for the failed part only – no labor.

ITT

Engineered for life

A.1.3 Horizontal Centrifugal Pumps - 11312

11312 1.03 B 3
11312 1.03 B 4
11312 1.03 B 8

Congratulations!
You are the owner of a Griswold Model 811 ANSI B73.1 Process Pump. The finest ANSI pump made. The utmost care has been taken in the manufacture of this pump, and as a result our warranty for this product is:

WARRANTY

Seller warrants equipment (and its component parts) of its own manufacture against defects in materials and workmanship under normal use and service for three (3) years after the date of shipment. Seller does not warrant accessories or components that are not manufactured by Seller. However to the extent possible Seller agrees to assign to Buyer its right under the original manufacturer's warranty, without recourse to Seller. Buyer must give Seller notice in writing of any alleged defect covered by this warranty (together with all identifying details, including the serial number, the type of equipment, and the date of purchase) within thirty (30) days of the discovery of such defect during the warranty period. No claim made more than 30 days after the expiration of the warranty period shall be valid.

Guarantees of performance and warranties are based on the use of the original equipment manufactured (OEM) replacement parts. Griswold Pump Company assumes no responsibility or liability if alterations, non-authorized design modifications and/or non-OEM replacement parts are incorporated.

If requested by the Seller, any equipment (or its component parts) must be promptly returned to Seller prior to any attempted repair, or sent to an authorized service station designated by Seller, and Buyer shall prepay all shipping expenses. Seller shall not be liable for any loss or damage to goods in transit, nor will any warranty claim be valid unless the returned goods are received intact and undamaged as a result of shipment. Repaired or replaced material returned to customer will be shipped F. O. B., Seller's factory. Seller will not give Buyer credit for parts or equipment returned to Seller, and will not accept delivery of any such parts or equipment, unless Buyer has obtained Seller's approval in writing.

The warranty extends to repaired or replaced parts of Seller's manufacture for ninety (90) days or for the remainder of the original warranty period applicable to the equipment or parts being repaired or replaced. This warranty applies to the repaired or replaced part and is not extended to the product or any other component of the product being repaired.

Repair parts of its own manufacture sold after the original warranty period are warranted for a period of one (1) year from shipment against defects in materials and workmanship under normal use and service. This warranty applies to the replacement part only and is not extended to the product or any component of the product being repaired.

Seller may substitute new equipment or improved part(s) of any equipment judged defective without further liability. All repairs or services performed by Seller, which are not covered by this warranty, will be charged in accordance with Seller's standard prices then in effect.

THIS WARRANTY IS THE SOLE WARRANTY OF SELLER AND SELLER HEREBY EXPRESSLY DISCLAIMS AND BUYER WAIVES ALL OTHER WARRANTIES EXPRESSED, IMPLIED IN LAW OR IMPLIED IN FACT, INCLUDING ANY WARRANTIES OR MERCHANT ABILITY OR FITNESS OF A PARTICULAR PURPOSE. Seller's sole obligation under this warranty shall be, at its option, to repair or replace any equipment (or its components parts) which has a defect covered by this warranty, or to refund the purchase price of such equipment or part under the terms of this warranty, Seller shall not be liable for (a) consequential, collateral, special or liquidated losses or damage; (b) equipment conditions caused by normal wear and tear, abnormal conditions of use, accident, neglect, or misuse of said equipment; (c) the expense of, and loss or damage caused by, repairs or alterations made by anyone other than the Seller; (d) damage caused by abrasive materials, chemicals, scale deposits, corrosion, lightning, improper voltage, mishandling, or other similar conditions; (e) any loss, damage, or expense relating to or resulting from installation, removal or reinstallation of equipment; (f) any labor costs or charges incurred in repairing or replacing defective equipment parts, including the cost of reinstalling parts that are repaired or replaced by Seller; (g) any expense of shipment of equipment or repaired or replacement parts; or (h) any other loss, damage or expense of any nature.

***CONDITION OF WARRANTY WORK:** If Buyer is in default (including, but not limited to, the failure of Buyer to maintain a current account with Seller) under the Order or any other agreement between Buyer and Seller, Buyer's rights under the warranty shall be suspended and the original warranty period will not be extended.*

***PERFORMANCE:** Equipment performance is not warranted or guaranteed unless separately agreed to by Seller in accordance with its guarantee policy. Performance curves and other information submitted to Buyer are approximate and no warranty or guarantee shall be deemed to arise as a result of such submittal. All testing shall be done in accordance with Seller's standard policy.*

***LIABILITY LIMITATIONS:** Under no circumstances shall the Seller have the liability under the Order or otherwise for liquidated damages or for collateral, consequential or special damages or for loss of profits, or for actual losses of production or progress of construction, regardless of the cause of such damage or losses. In any event, Seller's aggregate total liability under the Order or otherwise shall not exceed the contract price. Buyer agrees to indemnify and hold harmless Seller from all claims by third party in excess of these limitations.*

***COMPLIANCE WITH LAW:** Since the compliance with the various Federal, State, and Local laws and regulations concerning occupational health and safety and pollution are affected by the use, installation and operation of the equipment and other matters over which Seller has no control. Seller assumes no responsibility for compliance with those laws and regulations, whether by way of indemnity, warranty, or otherwise.*

A.1.4 DAF feed pumps – 11315

NETZSCH Progressing Cavity NEMO® PUMPS

LIMITED WARRANTY

The Company will repair or replace, at its option, defects or deficiencies in material or workmanship developing within one year from start-up or 18 months from date of delivery. Written notice of such defects and/or deficiencies must be received and substantiated by the Company within the Warranty period.

Correction of such defects by repair or replacement, F.O.B. factory, shall constitute fulfillment of the guarantee. The return of all parts submitted under this guarantee must be authorized by the Company and transportation prepaid by the shipper. The Company has no liability for any repairs made outside the Company's factory, unless with prior written consent.

The guarantee will not be applicable unless the apparatus has been properly cared for and operated under normal conditions nor will the Company be responsible for damage resulting from improper storage or handling prior to placing the apparatus in service.

The Guarantee of the Company on purchased items, assemblies or accessories which are installed as a separable unit shall not extend beyond the guarantee made by the manufacturer of the component.

THE WARRANTY DOES NOT EXTEND TO, AND NETZSCH INCORPORATED SHALL HAVE NO LIABILITY FOR, ANY INCIDENTAL, SPECIAL, OR CONSEQUENTIAL LOSS, COST, EXPENSE, LIABILITY OR DAMAGE, WHETHER DIRECT OR INDIRECT, IN CONNECTION WITH OR ARISING OUT OF THE SUPPLY OF THIS EQUIPMENT. OUR LIABILITY ARISING OUT OF THE SUPPLY OF THIS EQUIPMENT OR ITS USE SHALL NOT IN ANY CASE EXCEED THE COST OF CORRECTING DEFECTS IN THE EQUIPMENT OF ITS INSTALLATION AS STATED ABOVE AND, UPON THE EXPIRATION OF THE PERIOD STATED ABOVE, ALL SUCH LIABILITIES SHALL TERMINATE.

Except for the express warranty above set forth the Company makes no warranty, express or implied, and makes no warranty of fitness for a particular use.

A.1.5

Air diaphragm pumps - 11318

WARRANTY

Each and every product manufactured by Wilden Pump and Engineering, LLC is built to meet the highest standards of quality. Every pump is functionally tested to insure integrity of operation.

Wilden Pump and Engineering, LLC warrants that pumps, accessories and parts manufactured or supplied by it to be free from defects in material and workmanship for a period of five (5) years from date of installation or six (6) years from date of manufacture, whichever comes first. Failure due to normal wear, misapplication, or abuse is, of course, excluded from this warranty.

Since the use of Wilden pumps and parts is beyond our control, we cannot guarantee the suitability of any pump or part for a particular application and Wilden Pump and Engineering, LLC shall not be liable for any consequential damage or expense arising from the use or misuse of its products on any application. Responsibility is limited solely to replacement or repair of defective Wilden pumps and parts.

All decisions as to the cause of failure are the sole determination of Wilden Pump and Engineering, LLC.

Prior approval must be obtained from Wilden for return of any items for warranty consideration and must be accompanied by the appropriate MSDS for the product(s) involved. A Return Goods Tag, obtained from an authorized Wilden distributor, must be included with the items which must be shipped freight prepaid.

The foregoing warranty is exclusive and in lieu of all other warranties expressed or implied (whether written or oral) including all implied warranties of merchantability and fitness for any particular purpose. No distributor or other person is authorized to assume any liability or obligation for Wilden Pump and Engineering, LLC other than expressly provided herein.

PLEASE PRINT OR TYPE AND FAX TO WILDEN

PUMP INFORMATION

Item # ____________________ Serial # ____________________

Company Where Purchased ____________________

YOUR INFORMATION

Company Name ____________________

Industry ____________________

Name ____________________ Title ____________________

Street Address ____________________

City ____________ State ______ Postal Code ______ Country ______

Telephone ____________ Fax ____________ E-mail ____________ Web Address ____________

Number of pumps in facility? ____________ Number of Wilden pumps? ____________

Types of pumps in facility (check all that apply): ☐ Diaphragm ☐ Centrifugal ☐ Gear ☐ Submersible ☐ Lobe

☐ Other ____________________

Media being pumped? ____________________

How did you hear of Wilden Pump? ☐ Trade Journal ☐ Trade Show ☐ Internet/E-mail ☐ Distributor

☐ Other ____________________

ONCE COMPLETE, FAX TO (909) 783-3440

NOTE: WARRANTY VOID IF PAGE IS NOT FAXED TO WILDEN

WILDEN PUMP & ENGINEERING, LLC

A.2
A.2.1, 2.2 and 2.3 DAF system - 11500

WESTECH

WARRANTY

WesTech equipment is backed by WesTech's reputation as a quality manufacturer, and by many years of experience in design of reliable equipment.

Equipment manufactured and sold by WesTech Engineering, Inc., once paid for in full, is backed by the following warranty:

For the benefit of the original user, WesTech warrants all new equipment manufactured by WesTech Engineering, Inc. to be free from defects in material and workmanship; and will replace or repair, F.O.B. at its factories or other location designated by it, any part or parts returned to it which WesTech's examination shall show to have failed under normal use and service by the original user within one (1) year following initial start-up, or eighteen (18) months from shipment to the purchaser, whichever occurs first. Such repair or replacement shall be free of charge for all items except for those items, such as resin, filter media and the like that are consumable and normally replaced during maintenance with respect to which repair or replacement shall be subject to pro-rata charge based upon WesTech's estimate of the percentage of normal service life realized from the part. WesTech's obligation under this warranty is conditioned upon its receiving prompt notice of claimed defects, which shall in no event be later than thirty (30) days following expiration of the warranty period; and is limited to repair or replacement as aforesaid.

THIS WARRANTY IS EXPRESSLY MADE BY WESTECH AND ACCEPTED BY PURCHASER IN LIEU OF ALL OTHER WARRANTIES, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE, WHETHER WRITTEN, ORAL, EXPRESS, IMPLIED, OR STATUTORY. WESTECH NEITHER ASSUMES NOR AUTHORIZES ANY OTHER PERSON TO ASSUME FOR IT ANY OTHER LIABILITY WITH RESPECT TO ITS EQUIPMENT. WESTECH SHALL NOT BE LIABLE FOR NORMAL WEAR AND TEAR, NOR FOR ANY CONTINGENT, INCIDENTAL, OR CONSEQUENTIAL DAMAGE OR EXPENSE DUE TO PARTIAL OR COMPLETE INOPERABILITY OF ITS EQUIPMENT FOR ANY REASON WHATSOEVER.

This warranty shall not apply to equipment or parts thereof which have been altered or repaired outside of a WesTech factory, or damaged by improper installation, application, or maintenance, or subjected to misuse, abuse, neglect, accident, or incomplete adherence to all manufacturer's requirements, including, but not limited to, Operations & Maintenance Manual guidelines & procedures.

This warranty applies only to equipment made or sold by WesTech Engineering, Inc.

WesTech Engineering, Inc. makes no warranty with respect to parts, accessories, or components manufactured by others. The warranty which applies to such items is that offered by their respective manufacturers.

A.3

11203 Carbon Tanks

TIGG Corporation
Standard Warranty Statement

TIGG Corporation warrants that the carbon adsorption equipment sold hereunder shall be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. The warranty does not apply to problems associated with normal wear and tear, improper maintenance, negligence, misuse, or the failure to operate the system properly. For those items provided by, but not directly manufactured by TIGG, the manufacturer's warranty shall apply provided warranty coverage exceeds that which is provided by TIGG. All other warranties, either express or implied, are hereby disclaimed including but not limited to the warranty of merchantability and fitness for a particular purpose. There are no warranties made with regard to the equipment sold hereunder other than those contained in this paragraph.

This warranty is limited to the replacement and/or repair by TIGG Corporation of any part, parts or material which in TIGG's determination are defective and does not extend to any other types of damage or loss in consequence of such defects. This warranty does not cover any charges by the Buyer for replacement of parts, adjustments or repairs, or any other work unless such charges shall be assumed or authorized in advance in writing by TIGG Corporation.

1 Willow Ave
Oakdale, PA 15071
(724) 703-3020 phone
(724) 703-3026 facsimile
www.tigg.com
information@tigg.com

A.5.2

16260

General Terms and Conditions of Sale

8. Warranties and Remedies.

(a) Equipment and Services Warranty. ABB warrants that Equipment (excluding Software, which is warranted as specified in paragraph (d) below) shall be delivered free of defects in material and workmanship and that Services shall be free of defects in workmanship. The Warranty Remedy Period for Equipment (excluding Software, Spare Parts and Refurbished or Repaired Parts) shall end twelve (12) months after installation or eighteen (18) months after date of shipment, whichever first occurs. The Warranty Remedy Period for new spare parts shall end twelve (12) months after date of shipment. The Warranty Remedy Period for refurbished or repaired parts shall end ninety (90) days after date of shipment. The Warranty Remedy Period for Services shall end ninety (90) days after the date of completion of Services.

(b) Equipment and Services Remedy. If a nonconformity to the foregoing warranty is discovered in the Equipment or Services during the applicable Warranty Remedy Period, as specified above, under normal and proper use and provided the Equipment has been properly stored, installed, operated and maintained and written notice of such nonconformity is provided to ABB promptly after such discovery and within the applicable Warranty Remedy Period, ABB shall, at its option, either (i) repair or replace the nonconforming portion of the Equipment or re-perform the nonconforming Services or (ii) refund the portion of the price applicable to the nonconforming portion of Equipment or Services. If any portion of the Equipment or Services so repaired, replaced or re-performed fails to conform to the foregoing warranty, and written notice of such nonconformity is provided to ABB promptly after discovery and within the original Warranty Remedy Period applicable to such Equipment or Services or 30 days from completion of such repair, replacement or re-performance, whichever is later, ABB will repair or replace such nonconforming Equipment or re-perform the nonconforming Services. The original Warranty Remedy Period shall not otherwise be extended.

(c) Exceptions. ABB shall not be responsible for providing working access to the nonconforming Equipment, including disassembly and re-assembly of non-ABB supplied equipment, or for providing transportation to or from any repair facility, all of which shall be at Purchaser's risk and expense. ABB shall have no obligation hereunder with respect to any Equipment which (i) has been improperly repaired or altered; (ii) has been subjected to misuse, negligence or accident; (iii) has been used in a manner contrary to ABB's instructions; (iv) is comprised of materials provided by or a design specified by Purchaser; or (v) has failed as a result of ordinary wear and tear. Equipment supplied by ABB but manufactured by others is warranted only to the extent of the manufacturer's warranty, and only the remedies, if any, provided by the manufacturer will be allowed.

(d) Software Warranty and Remedies. ABB warrants that, except as specified below, the Software will, when properly installed, execute in accordance with ABB's published specification. If a nonconformity to the foregoing warranty is discovered during the period ending one (1) year after the date of shipment and written notice of such nonconformity is provided to ABB promptly after such discovery and within that period, including a description of the nonconformity and complete information about the manner of its discovery, ABB shall correct the nonconformity by, at its option, either (i) modifying or making available to the Purchaser instructions for modifying the Software; or (ii) making available at ABB's facility necessary corrected or replacement programs. ABB shall have no obligation with respect to any nonconformities resulting from (i) unauthorized modification of the Software or (ii) Purchaser-supplied software or interfacing. ABB does not warrant that the functions contained in the software will operate in combinations which may be selected for use by the Purchaser, or that the software products are free from errors in the nature of what is commonly categorized by the computer industry as "bugs".

(e) THE FOREGOING WARRANTIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES OF QUALITY AND PERFORMANCE, WHETHER WRITTEN, ORAL OR IMPLIED, AND ALL OTHER WARRANTIES INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USAGE OF TRADE ARE HEREBY DISCLAIMED. THE REMEDIES STATED HEREIN CONSTITUTE PURCHASER'S EXCLUSIVE REMEDIES AND ABB'S ENTIRE LIABILITY FOR ANY BREACH OF WARRANTY.

9. Patent Indemnity.

(a) ABB shall defend at its own expense any action brought against Purchaser alleging that the Equipment or the use of the Equipment to practice any process for which such Equipment is specified by ABB (a "Process") directly infringes any claim of a patent of the United States of America and to pay all damages and costs finally awarded in any such action, provided that Purchaser has given ABB prompt written notice of such action, all necessary assistance in the defense thereof and the right to control all aspects of the defense thereof including the right to settle or otherwise terminate such action in behalf of Purchaser.

(b) ABB shall have no obligation hereunder and this provision shall not apply to: (i) any other equipment or processes, including Equipment or Processes which have been modified or combined with other equipment or process not supplied by ABB; (ii) any Equipment or Process supplied according to a design, other than an ABB design, required by Purchaser; (iii) any products manufactured by the Equipment or Process; (iv) any patent issued after the date hereof; or (v) any action settled or otherwise terminated without the prior written consent of ABB.

(c) If, in any such action, the Equipment is held to constitute an infringement, or the practice of any Process using the Equipment is finally enjoined, ABB shall, at its option and its own expense, procure for Purchaser the right to continue using said Equipment; or modify or replace it with non-infringing equipment or, with Purchaser's assistance, modify the Process so that it becomes non-infringing; or remove it and refund the portion of the price allocable to the infringing Equipment. THE FOREGOING PARAGRAPHS STATE THE ENTIRE LIABILITY OF ABB AND EQUIPMENT MANUFACTURER FOR ANY PATENT INFRINGEMENT.

(d) To the extent that said Equipment or any part thereof is modified by Purchaser, or combined by Purchaser with equipment or processes not furnished hereunder (except to the extent that ABB is a contributory infringer) or said Equipment or any part thereof is used by Purchaser to perform a process not furnished hereunder by ABB or to produce an article, and by reason of said modification, combination, performance or production, an action is brought against ABB, Purchaser shall defend and indemnify ABB in the same manner and to the same extent that ABB would be obligated to indemnify Purchaser under this "Patent Indemnity" provision.

10. Limitation of Liability.

(a) In no event shall ABB, its suppliers or subcontractors be liable for special, indirect, incidental or consequential damages, whether in contract, warranty, tort, negligence, strict liability or otherwise, including, but not limited to, loss of profits or revenue, loss of use of the Equipment or any associated equipment, cost of capital, cost of substitute equipment, facilities or services, downtime costs, delays, and claims of customers of the Purchaser or other third parties for any damages. ABB's liability for any claim whether in contract, warranty, tort, negligence, strict liability, or otherwise for any loss or damage arising out of, connected with, or resulting from this Agreement or the performance or breach thereof, or from the design, manufacture, sale, delivery, resale, repair, replacement, installation, technical direction of installation, inspection, operation or use of any equipment covered by or furnished under this Agreement, or from any services rendered in connection therewith, shall in no case (except as provided in the section entitled "Patent Indemnity") exceed one-half (1/2) of the purchase price allocable to the equipment or part thereof or Services which gives rise to the claim.

(b) All causes of action against ABB arising out of or relating to this Agreement or the performance or breach hereof shall expire unless brought within one year of the time of accrual thereof.

(c) In no event, regardless of cause, shall ABB be liable for penalties or penalty clauses of any description or for indemnification of Purchaser or others for costs, damages, or expenses arising out of or related to the Equipment and/Services.

A · 6 · 1 11235 - Mixers 11235 1.05.A

Neptune CHEMICAL PUMP CO., INC.

Metering Pumps
& Chemical
Feed Systems

P.O. Box 247 Lansdale, PA 19446-0247
215-699-8700
FAX: 215-699-0370
Toll Free FAX: 1-800-255-4017

NEPTUNE CHEMICAL PUMP COMPANY WARRANTY

If the equipment is installed properly, Neptune Chemical Pump Company warrants to the purchaser of this product for a period of twelve months from the date of first use or twenty four months from shipment, whichever occurs first. This product shall be free of defects in material and/or workmanship, as follows:

1. **Neptune Chemical Pump Company will replace, at no charge, any part that fails due to a defect in material and/or workmanship during the warranty period. F.O.B. our factory, Lansdale, Pennsylvania. To obtain warranty service, you must forward the defective parts to the factory for examination, freight pre-paid.**

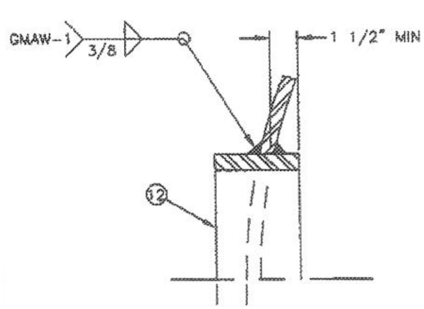
2. **This warranty period does not cover any product or product part which has been subject to accident, misuse, abuse or negligence. Neptune Chemical Pump Company shall only be liable under this warranty if the product is used in the manner intended by the manufacturer as specified in the written instructions furnished with this product.**

Any express warranty not provided in this warranty document, and any remedy for breach of contract that, but for this provision, might arise by implication or operation of law, is hereby excluded and disclaimed. Under no circumstances shall Neptune Chemical Pump Company be liable to purchaser or any other person for any change for labor, repairs, or parts, performed or furnished by others, nor for any incidental consequential damages, whether arising out of breach of warranty, express or implied, a breach of contract or otherwise. Except to the extent prohibited by applicable law, any implied warranty of merchantability and fitness for a particular purpose are expressly limited in duration to the duration of this limited warranty.

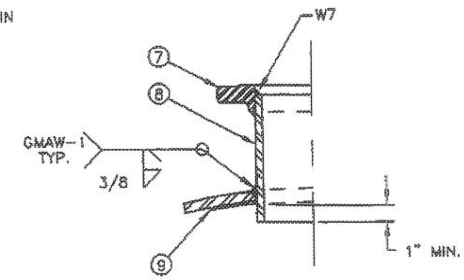
Some states do not allow the exclusion or limitation of incidental or consequential damages, or allow limitation on how long any implied warranty lasts, so the above limitations may not apply to you. This warranty gives you specific legal rights, and you may have other rights, which may vary, from state to state.

11371 1.03.A.1.b
(2.02.A.1-8)

NO.	QTY	DESCRIPTION	SPEC	SUB-DWG.
1	1	.375 NOM. X 120" X 206 3/8" SHELL	SA-516-70	
2	1	.375 NOM. X 59 1/4" X 206 3/8" SHELL	SA-516-70	
3	2	.375 NOM. 66" O.D. 2:1 ELLIP. HEAD 2" S.F.	SA-516-70	
4	1	3"-NPT 3000# HALF COUPLING	SA-105	
5	1	1/4"-NPT 1500# RADIAL FLANGE	SA-181-70	
6	1	1"-NPT 1500# RADIAL FLANGE	SA-181-70	
7	2	6" 150# ANSI RF. SO. FLANGE	SA-105	
8	2	6" S/XXH PIPE X 7 3/4" LONG	SA-106-B	
9	2	.134 X 8 5/8" O.D. X 6 5/8" I.D. BACKING RING	C1008	
10	1	2"-NPT 1500# FLAT FLANGE	SA-181-70	
11	2	3/4"-NPT 1500# RADIAL FLANGE	SA-181-70	
12	1	12" X 16" X 1 1/4" X 6" 300# MANWAY	SA-106-C	
13	2	3/8" X 19" X 66" SADDLE BRACKET	SA-36/C1008	
14	4	3/8" X 6" X 13 13/16" GUSSET	SA-36/C1008	
15	2	3/4" X 5" X 12" STANDARD LIFT LUG		A84388
16	1	ASME DATA PLATE	304L S.S.	



MANWAY DETAIL



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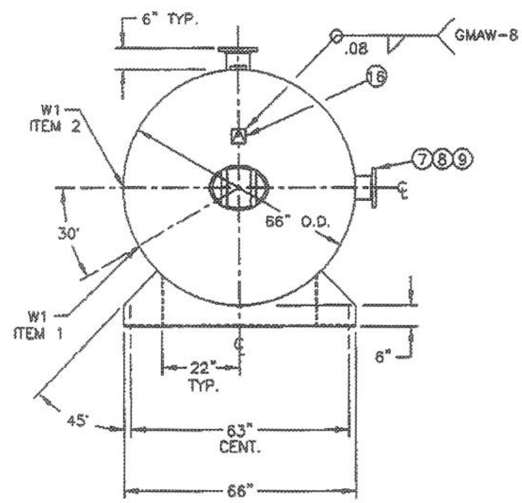

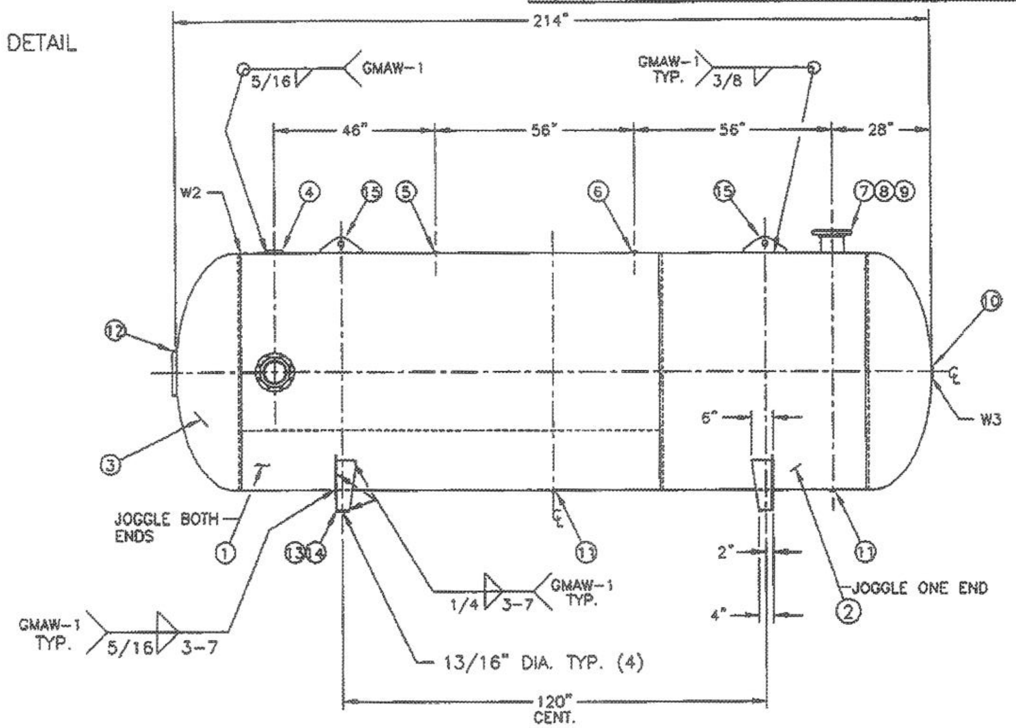

Page 5

A.6.2

NOTES:
FLANGE BOLT HOLES TO STRADDLE VESSEL CENTERLINE.
BLAST EXTERIOR TO SSPC SP-6.
PRIME EXTERIOR WITH DEVOE 233H EPOXY.
PAINT EXTERIOR WITH DEVOE 389 URETHANE WHITE.
SEAL WELD DATA PLATE.

SPECIFICATIONS

O.D. 66" LGTH. 214"
WT. 7000#
S.A. 326.5 SQ.FT.
GAL. 3000 CU.FT. 401
CODE: ASME SEC. VIII DIV. I, LATEST EDITION & ADDENDA
STD. TOLERANCES: M-2461 (UNLESS OTHERWISE NOTED)

HEAD: .333 MAT'L. SA-516-70
SHELL: .334 MAT'L. SA-516-70
MAWP 165 PSI @ 400°F
TEST 215 PSI
EXMT UG20(f)

CRN:
RT-2 MDMT: -20°F @ 165 PSI
X-RAY: FULL/SPOT W
CORR ALW .0625 SH .0625 HD
WELD DETAILS: M-1932

SYM	DATE	BY	REVISION	APP	REV

CODE 2004/2006 APPROVED JR
RELEASED FOR PRODUCTION
Q.C. ______ DATE ______
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN: INCHES

MANCHESTER TANK

66" X 214"
HORZ. AIR REC.

FILE LOCATION: Q:\3000
DRAWN BY: JR DATE: 06-21-07
APPR. BY: JR DATE: 06-21-07
SCALE: NONE
DRWG. NO. 307326

MANCHESTER TANK
SINCE 1946

WARRANTY

Manchester Tank & Equipment Co., corporate office at: 1000 Corporate Centre Drive, Franklin, TN 37067

That all tanks, cylinders and equipment manufactured by it to be free from defects in material and workmanship under normal use and service when installed and used in accordance with all applicable state and local laws and regulations.

Defects in material or workmanship shall be corrected, at the option of Manchester, by repair, replacement or refund. In the event a repair is not commercially practicable or cannot be timely made, the item will be replaced, or with the consent of the consumer, a refund may be made.

This warranty does not cover damage resulting from abuse, misuse, negligence or accident; nor from problems resulting from failure to comply with all applicable state and local laws and regulations or problems caused, in whole or in part, by alteration or modification to the product.

This warranty does not cover stress cracks (3000 series) caused by use of compressors which do not meet ASME UG-22 Stress Calculations.

This warranty does not cover transportation to and from service locations, loss of time, inconvenience, commercial loss, loss of use, incidental charges or other consequential damages.

All such repairs will be made at authorized service centers. The names and locations of service centers can be obtained from the dealer from whom the item was purchased.

This warranty shall be for the term of three years on D.O.T. products and one year on A.S.M.E. products from the date of the sale by the dealer to the consumer. Upon demand by Manchester or the service center, the consumer shall produce the original sales contract or receipt to identify the date of purchase.

Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

LP-gas regulators are not manufactured by Manchester. Therefore, they are covered by a separate manufacture's warranty.

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Warranty

All items that we manufacture are warranted, when paid for and properly installed, operated and maintained, to be free from defects in material and workmanship and to conform to the specification, if any, listed on the other side of this form. If no specifications are listed, the items are warranted to conform to our currently published specifications. The warranty period is one year from the date of installation by the first user of the goods, or eighteen (18) months from the date of shipment to the first user, whichever occurs first. No warranty is given for products or components (such as electric or pneumatic mechanisms) manufactured by companies not affiliated by ownership with Seller, or for goods which have been subject to misuse, improper installation, corrosion, or which have been modified or repaired by unauthorized persons. We must receive written notice of defect within the warranty period. Our liability is limited to servicing or adjusting any item returned to the factory for that purpose, including replacing any defective parts therein. Customer must pay packing, crating and transportation costs to and from the factory. At Customer's request, we will make reasonable efforts to provide warranty service at the Customer's premises, provide that Customer pays our then current rates for field service and the associated travel and living expenses. If a fault has been caused by improper installation, maintenance or use, or by abnormal conditions of operation, repairs will be billed at normal rates. If any fault develops, the following steps should be taken:

1. Notify us by giving the item model number, serial number and details of the difficulty. On receipt of this information, you will be given service data or shipping instructions.
2. On receipt of shipping instructions, forward the item prepaid. If the item or the fault is not covered by warranty, an estimate of charges will be furnished before work begins.

WE DISCLAIM STATUTORY AND IMPLIED WARRANTIES, SUCH AS WARRANTIES OF MERCHANTABLITY AND FITNESS FOR PURPOSE. WE ALSO DISCLAIM ALL WARRANTIES REGARDING ANY ANCILLARY SERVICES RENDERED.

USA/Canada Latin America/Caribbean Europe, Middle East, Africa Asia Pacific

Tyco International

Copyright © 2008 Tyco Flow Control. All rights reserved

A.6.3

Rotary blower – 11374
11374 1.03.B & D

DRESSER
Roots

GENERAL TERMS OF SALE

1. GENERAL
   A. Seller's prices are based on these sales terms, and (i) this document together with any additional writings signed by Seller shall represent the final, complete and exclusive statement of the agreement between the parties and may not be modified, supplemented, explained or waived by parol evidence, Buyer's purchase order, a course of dealing, Seller's performance or delivery, or in any other way except in writing signed by an authorized representative of Seller, and (ii) these terms are intended to cover all activity of Seller and Buyer hereunder, including sales and use of products, parts and work and all related matters (references to products include parts and references to work include construction, installation and start-up). Any reference by Seller to Buyer's specification and similar requirements are only to describe the products and work covered herby and no warranties or other terms therein shall have any force or effect. Catalogs, circulars and similar pamphlets of the Seller are issued for general information purposes only and shall not be deemed to modify the provisions hereof.
   B. IF THIS AGREEMENT DIFFERS IN ANY WAY FROM BUYER'S ORDER OR IF THIS AGREEMENT IS CONSTRUED AS AN ACCEPTANCE OR CONFIRMATION ACTING AS AN ACCEPTANCE, THEN SELLER'S ACCEPTANCE IS EXPRESSLY MADE CONDITIONAL ON BUYER'S ASSENT TO ANY TERMS OR CONDITIONS CONTAINED HEREIN THAT ARE DIFFERENT FROM OR ADDITIONAL TO THOSE CONTAINED IN BUYER'S WRITING. FURTHER, THIS AGREEMENT SHALL BE DEEMED NOTICE OF OBJECTION TO SUCH TERMS AND CONDITIONS OF BUYER. IF THIS AGREEMENT IS CONSTRUED AS THE OFFER, ACCEPTANCE OF SAME IS EXPRESSLY LIMITED TO THE TERMS AND CONDITIONS CONTAINED HEREIN. IN ANY EVENT, BUYER'S ACCEPTANCE OF THE ORDERED PRODUCTS OR SERVICES SHALL CONSTITUTE AND MANIFEST BUYER'S ASSENT TO SELLER'S TERMS AND CONDITIONS.
   C. The agreement formed hereby and the language herein shall be subject to the laws in effect on the date hereof of the State of Texas without regard to the conflict of laws rules of Texas.

2. TAXES
   Any sales, use or other similar type taxes imposed on this sale or on this transaction are not included in the price. Such taxes shall be billed separately to the Buyer. Seller will accept a valid exemption certificate from the Buyer if applicable; however, if an exemption certificate previously accepted is not recognized by the governmental taxing authority involved, and the Seller is required to pay the tax covered by such exemption certificate, Buyer agrees to promptly reimburse Seller for the Taxes paid.

3. CONTRACT PERFORMANCE, INSPECTION AND ACCEPTANCE
   A. Unless Seller specifically assumes installation, construction or start-up responsibility, all products shall be finally inspected and accepted within thirty (30) days after receipt at point of delivery. Products not covered by the foregoing and all work shall be finally inspected and accepted within thirty (30) days after completion of the applicable work by Seller. All claims whatsoever by Buyer (including claims for storage) excepting only those provided for under the WARRANTY and PATENTS Clauses hereof must be asserted in writing by Buyer within said thirty (30) day period or they are waived. If this contract involves partial performance, all such claims must be asserted within said thirty (30) day period for each partial performance. There shall be no revocation of acceptance. Rejection may be only for defects substantially impairing the value of products or work and Buyer's remedy for lesser defects shall be those provided for under the WARRANTY Clause.
   B. Shipping dates are approximate and are based upon prompt receipt of all necessary information. Seller shall not be responsible for nonperformance or delays in performance occasioned by any causes beyond Seller's reasonable control, including, but not limited to, labor difficulties, delays of vendors or carriers, fires, governmental actions and material shortages. Any such delay shall affect a corresponding extension of Seller's performance dates which are, in any event, understood to be approximate. In no event shall Buyer be entitled to damages including but not limited to incidental or consequential damages for late performance.

4. RISK OF LOSS & TITLE
   Full risk of loss and title (including transportation delays and losses) shall pass to the Buyer upon delivery of products to the agreed to point of delivery per latest INCO terms or if Seller consents to a delay in shipment beyond the contract date at the request of the Buyer, upon notification by the Seller that the products are manufactured. All shipments, unless otherwise specified, shall be FCA manufacturer's plant per latest INCO terms.

5. WARRANTY
   A. Seller warrants that its products and parts when shipped will be free from defects in materials and workmanship and its services (including installation, construction and start-up) will be performed in a workmanship. All claims for defective products or parts or services under this warranty must be made in writing immediately upon discovery and, in any event, within one (1) year from start-up or eighteen (18) months from shipment of the applicable item, or the date services are provided whichever occurs first. Defective items must be held for Seller's inspection and returned to the original agreed to point of delivery per latest INCO terms upon request. THE FOREGOING IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES WHATSOEVER, EXPRESS, IMPLIED AND STATUTORY, INCLUDING WITHOUT LIMITATION, THE IMPLIED WARRRANTIES OF MERCHANTBLITY AND FITNESS.
   B. Upon Buyer's submission of a claim as provided above and its substantiation, Seller shall at its option either (i) repair or replace its product, part or work at the original agreed to point of delivery per latest INCO terms, or (ii) refund an equitable portion of the purchase price.
   C. The warranty specified herein shall apply to this contract, but it is specifically understood that products sold hereunder are not warranted for operation with erosive or corrosive fluids or those which may tend to buildup within the product quoted. No product or part shall be deemed to be defective by reason of failure to resist erosive or corrosive action of any fluid and Buyer shall have no claim whatsoever against Seller therefore nor for problems resulting from buildup of material within the unit.
   D. The foregoing is Seller's only obligation and Buyer's exclusive remedy for breach of warranty, and except for remedies permitted under THE CONTRACT PERFORMANCE, INSPECTION AND ACCEPTANCE and the PATENTS Clause hereof, the foregoing is Buyer's exclusive remedy hereunder by way of breach of contract, tort or otherwise. In no event shall Buyer be entitled to incidental or consequential damages. Any action for breach of this agreement must commence within two (2) years after the cause of action has accrued.

6. PATENTS
   Seller agrees to assume the defense of any suit for infringement of any United States patents brought against Buyer to the extent such suit charges infringement of an apparatus or product claim by Seller's product in and of itself, provided (i) said product is built entirely to Seller's design, (ii) Buyer notifies Seller in writing of the filing of such suit within ten (10) days after the service of process thereof, and (iii) Seller is given complete control of the defense of such suit, including the right to defend, settle and make changes in the product for the purpose of avoiding infringement. Seller assumes no responsibility for charges of infringement of any process or method claims, unless infringement of such claims result from following specific instructions furnished by Seller.

7. TERMS OF PAYMENT
   A. Unless other terms are specified, all payments shall be in U.S. dollars. If delivery is delayed by Buyer, date of readiness for delivery shall be deemed date of delivery for payment purposes. If manufacture is delayed by Buyer, a payment shall be due based upon purchase price and percentage of completion. Balance shall be payable in accordance with terms stated herein.
   B. For contracts totaling less than $100,000 U.S. dollars, all payment shall become due thirty (30) days after shipment.
   C. For contracts totaling $100,000 U.S. dollars and greater, special progress payments, as offered by Seller, shall apply. In cases where special terms are not proposed, final payment shall become due thirty (30) days after shipment.
      (1) In the event any equipment is ready for shipment prior to the scheduled date, any payment not due in accordance with the above terms shall immediately become due and payable upon notification by Seller to buyer that the equipment is ready for shipment.
      (2) If shipments are delayed by Buyer for any cause whatsoever or are delayed by Seller for any cause whatsoever beyond Seller's control, payments shall become due and payable from the date of notification by Seller and the equipment is ready for shipment.
   D. Seller may, at its option, upon Buyer's default in payment hereunder, charge Buyer with any cost incurred by seller incidental to its collection efforts including without limitation, reasonable attorney's fees and court costs.
   E. A service fee equal to 2% percent per month shall be charged on all amounts not received by the specified due date in order to recover costs and damages incurred as a result of the delay in payment.

8. LIMITATION OF LIABILITY
   A. THE LIABILITY OF SELLER UNDER THIS AGREEMENT OR WITH RESPECT TO ANY PRODUCTS SUPPLIED OR SERVICES PERFORMED PURSUANT TO THIS AGREEMENT, WHETHER IN CONTRACT, IN TORT, IN STRICT LIABILITY OR OTHERWISE, SHALL NOT EXCEED THE PURCHASE PRICE PAID BY BUYER WITH RESPECT THERETO.
   B. IN NO EVENT WILL SELLER BE LIABLE IN CONTRACT, IN TORT, IN STRICT LIABILITY OR OTHERWISE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING, BUT NOT LIMITED TO, LOSS OF ANTICIPATED PROFITS OR REVENUES, LOSS OF USE, NON-OPERATION OR INCREASED EXPENSE OF OPERATION OF EQUIPMENT, COST OF CAPITAL.

9. US EXPORT CONTROL COMPLIANCE
   Buyer shall comply with all applicable export control and trade embargo laws, rules and regulations, including but not limited to the U. S. Export Administration Regulations, and shall not resell, export, re-export, distribute, transfer or dispose of the ROOTS™ products, directly or indirectly, without first obtaining all necessary written consents, permits and authorizations and completing such formalities as may be required by any such laws, rules and regulations. Failure by Buyer to comply with such laws, rules and regulations shall constitute a material breach of this Agreement. ROOTS' assumes no responsibility or liability for Buyer's failure to obtain required authorizations. Buyer agrees to impose this same compliance requirement in its contracts with third parties pertaining to the ROOTS™ products. These commodities, technology or software shall be exported from the United States in accordance with the Export Administration Regulations. Diversion contrary to U.S. law is prohibited.

DRESSER
Roots

*WARRANTY POLICY: REPAIR OR REPLACEMENT PROCEDURE

1. The Authorized Distributor of Dresser ROOTS is contacted by customer with a warranty claim for a:
   - URAI® & URAI-J® Series 2½-inch through 7-inch gear diameter. Including the Dual Splash Lube (DSL) units.
   - RAM™ & RAM –J™ Series 4 ½ through 6-inch gear diameter.

   Note: Units not explicitly listed (i.e. mechanical seal gas units including URAI-G®, water sealed units, steam blowers, DVJ series units, ROOTSFLO™ & special material units etc...) are specifically excluded from this amended policy and will conform to the General Terms of Sale GTS-5001.

2. Distributor must obtain S/N and call Dresser ROOTS Service Manager, Small Rotary Products, to ensure that the Warranty Policy applies and the unit is within the warranty period.

3. Distributor receives the failed unit for inspection and disposition by ROOTS' Service Manager, Small Rotary Products. Any freight charges incurred between the Distributor's facility and the Customer's plant are Customer's responsibility. Customer pays all Distributor charges related to removal and installation of the unit repaired or replaced under this warranty.

4. Distributor completes warranty inspection report and forwards with failed unit nameplate to Dresser ROOTS Service Manager, Small Rotary Products for processing.

   NOTE: If the Distributor does not have necessary repair parts or replacement unit in stock, the Distributor should immediately advise ROOTS' Service Manager, Small Rotary Products.

5. The required repair parts or a replacement unit will then be sent to the Distributor FREIGHT PREPAID. Unless Dresser ROOTS factory requests return for further inspection or analysis, the failed parts or unit should be scrapped at Distributor's facility.

6. Items A through F of **WARRANTY POLICY AND PROCEDURE WP-5020**, with the exception of Item E, apply as if set out herein in their entirety. Only Item E, "PROCEDURE," of WP-5020 is being expanded for simplicity.

I have read and understand the Warranty Repair or Replacement Procedure.

________________________ ________________

Signature . Date

STOCKHAM TERMS AND CONDITIONS

1. **DEFINITIONS:** The following definitions apply:
   a. "Crane Energy" means Crane Energy Flow Solutions and includes STOCKHAM.
   b. "Buyer" means the person, firm, or corporation to whom Crane Energy has offered to sell goods or from whom Crane Energy has received an order to purchase goods.
   c. "Material" means the goods the Buyer is to purchase from Crane Energy.
   d. "Order" means the Buyer's purchase order and all attachments, exhibits, and other documents referenced herein.
2. **APPROVAL AND ACCEPTANCE OF ORDERS:** All Orders, including any changes thereto, shall be subject to approval and acceptance by Crane Energy.
3. **PRICES:** Prices published or announced by Crane Energy are subject to change without notice. Prices, at the discretion of Crane Energy, may be subject to a surcharge due to the volatility of raw materials and invoiced as part of the price of the material or as a separate charge.
4. **TAXES:** In addition to the stated prices and any other charges due, Buyer shall reimburse Crane Energy for all sales, use, excise, purchase transaction, or any other taxes that Crane Energy must at any time either pay or collect in connection with Material sold by Crane Energy to the Buyer.
5. **TERMS OF PAYMENT:** Crane Energy will determine extension of credit and terms of payment at its sole discretion. Standard Payments shall be due thirty (30) days from the invoice date. Payment must be made in U.S. dollars and by means acceptable to Crane Energy. Overdue payments shall bear interest at the lesser of 1.5% per month or the maximum permitted by law. Buyer WAIVES ANY RIGHT OF SET-OFF AND SHALL MAKE NO DEDUCTIONS FROM PAYMENTS DUE TO CRANE ENERGY OR FOR ANY DAMAGES OF ANY TYPE CLAIMED BY BUYER AGAINST CRANE ENERGY. Pending approval of credit, delivery may be delayed without liability to Crane Energy. If, in Crane Energy's judgment, Buyer's financial responsibility is or becomes impaired or unsatisfactory or if Buyer has failed or fails to perform under any contract, CNVA shall have the right to demand and Buyer shall provide advance payment or security to Crane Energy and Crane Energy may withhold shipment until receipt thereof. Material is subject to shipment in whole or in part, at the option of Crane Energy, and each shipment is subject to immediate invoicing. Crane Energy may, at it discretion, suspend shipment or terminate the Order if any such invoice is not paid according to terms of payment.
6. **SECURITY INTEREST:** Buyer hereby grants to Crane Energy a purchase money security interest in each item of Material. This interest will be satisfied by payment in full to Crane Energy, or, if expressly consented to by Crane Energy in writing, by the Buyer's return of the Material to Crane Energy. Buyer hereby authorizes and empowers Crane Energy to execute on behalf of Buyer and to file with the appropriate governmental authorities any and all financing statements and other documents necessary to perfect Crane Energy's security interest in the Material, for this purpose only, hereby appoints Crane Energy and its representatives and designees as attorney-in-fact, agents and authorized signatories of Buyer with respect to such financing statements and other documents.
7. **MINIMUM ORDER CHARGE:** Orders for valves will be subject to a net minimum invoice charge of $100.
8. **DELIVERY AND SHIPMENT OF MATERIAL:** Delivery of Material to a common carrier shall constitute delivery thereof to Buyer, and risk of loss shall pass to Buyer at such time. Buyer shall pay all shipping and handling charges. Any claims for damage to or loss of Material in transit shall be filed by Buyer directly with, and shall be the sole responsibility of, the carrier. Shipping schedules are estimates. Crane Energy will use every reasonable means at its disposal to make delivery within the time specified. Shipping schedules are computed from time of Order entry. IN NO EVENT SHALL CRANE ENERGY BE LIABLE FOR DAMAGES OF ANY KIND, LIQUIDATED OR UNLIQUIDATED, INCLUDING CONSEQUENTIAL DAMAGES OR DAMAGES FOR LOSS OF USE OR LOST PROFITS, OR DUE TO FAILURE TO MAKE TIMELY DELIVERY OR MEET SHIPPING SCHEDULES.
9. **CORRECTIONS:** Crane Energy reserves the right to correct clerical and arithmetic or stenographic errors or omissions in Orders, invoices, quotations, price schedules, acknowledgements, or other documents.
10. **DEFAULT BY BUYER:** Upon failure or refusal of Buyer to accept conforming Material, or upon any other default by Buyer, Crane Energy shall be entitled to exercise all remedies of a secured party under the Uniform Commercial Code with respect to the Material as well as any other remedies to which Crane Energy may be entitled by law or in equity, including specific performance, and Crane Energy shall be entitled to recover all costs incurred by it in connection therewith, including reasonable attorney's fees.
11. **CLAIMS:** All claims for shortages or other nonconformity in filling Orders shall be made in writing within ten (10) calendar days after Buyer's receipt of Material.
12. **RETURN OF MATERIAL AND TERMINATION OF ORDERS:**
   a. Except as provided in Section 13 below, Buyer shall not be entitled to return any Material without first obtaining written consent from Crane Energy.
   b. Buyer shall not be entitled to terminate the Order or any part thereof. If Buyer seeks to terminate all or any part of an Order prior to delivery, Buyer shall make such request to Crane Energy in writing at once. No Order or part thereof shall be subject to cancellation or termination by Buyer without prior written consent, which may be given, withheld, or conditioned upon payment of a cancellation charge Crane Energy's sole discretion.
   c. Material which has been specifically manufactured or modified for Buyer shall not be returnable.
   d. For Crane Energy to consider Buyer's request to return Material, such Material must be:
      (1) of Crane Energy's manufacture,
      (2) in clean, new, saleable condition,
      (3) shipped from Crane Energy's factory or a Crane Energy service center within twelve (12) calendar months preceding the request to return, and the request will not cause inventory to exceed maximum allowable level,
      (4) personally inspected by a Crane Energy Sales Representative prior to its return.
   e. If a return is allowed, Crane Energy will credit Buyer's account the invoiced price, less 35% handling cost, and less any freight paid by Crane Energy.
13. **WARRANTY:** Crane Energy warrants that the Material manufactured by it is free from defects in materials and workmanship under normal use and service and that it will function in accordance with Crane Energy's published specifications, if any, for a period of one year after shipment. This warranty is made to the initial Buyer who buys the Material for commercial or industrial purposes only and does not extend to any other person or entity. No warranty whatever is made with respect to Material purchased by Buyer for personal, family, or household use. OUR SOLE AND EXCLUSIVE LIABILITY AND BUYER'S SOLE AND EXCLUSIVE REMEDY UNDER THIS WARRANTY OR ANY WARRANTY IMPLIED BY LAW, AND FOR ANY CAUSE WHATSOEVER, REGARDLESS OF THE FORM OF ACTION, WHETHER IN CONTRACT OR IN TORT, INCLUDING STRICT LIABILITY, AND NEGLIGENCE, SHALL BE LIMITED TO:
   (1) the repair of the defective Material,
   (2) replacement of any part or the whole of the Material proven to be defective, or
   (3) refund of the purchase price of the defective Material.

STOCKHAM TERMS AND CONDITIONS

The choice of such remedy shall be determined by Crane Energy at its sole discretion. Buyer must notify Crane Energy within ten (10) calendar days of discovery of any claimed defect. If instructed by Crane Energy to do so, Buyer must return the Material claimed to be defective to our factory at Buyer's cost for inspection. If Crane Energy elects remedies (1) or (2) above, the repaired or replaced Material will be made available to Buyer F.O.B. factory. If Crane Energy elects remedies (2) or (3) above, we will be entitled to keep the defective Material or parts thereof. Buyer shall not be required to deliver defective Material or a defective part to Crane Energy if the Material or part was destroyed as a result of its defect or of any defect in any part covered in this warranty, and Crane Energy is reasonably satisfied that the Material or part was defective at the time of sale. If both of these conditions are met, Crane Energy shall replace such Material or part or refund the purchase price in the same manner provided herein as if Buyer had delivered it to Crane Energy's factory. Except for the warranty of title, the warranty in this section is made in lieu of all other warranties, express or implied, including, without limitation, the warranties of MERCHANTABILITY and FITNESS FOR ANY PARTICULAR PURPOSE, AND NO OTHER WARRANTY IS MADE OR AUTHORIZED TO BE MADE. Crane Energy also does not warrant that the use or operation of Material will be uninterrupted or trouble free or will meet Buyer's requirements. IN NO EVENT SHALL Crane Energy BE LIABLE OR RESPONSIBLE FOR DAMAGES FOR PERSONAL INJURY, DAMAGES FOR HARM TO PROPERTY, OR FOR CONSEQUENTIAL, INCIDENTAL, PUNITIVE, OR EXEMPLARY DAMAGES INCLUDING, WITHOUT LIMITATION, DAMAGES FOR LOSS OF USE, LOST PROFITS, INTERRUPTION OF BUSINESS, OTHER ECONOMIC LOSS, OR ANY OTHER DAMAGES WHATSOEVER IN CONNECTION WITH THE WARRANTY SET FORTH ABOVE OR IMPLIED BY LAW, OR IN CONNECTION WITH ANY OTHER LIABILITY, REGARDLESS OF THE FORM OF ACTION, WHETHER IN CONTRACT OR IN TORT, INCLUDING, BUT NOT LIMITED TO, STRICT LIABILITY AND NEGLIGENCE. THE WARRANTY AND REMEDY SET FORTH ABOVEARE THE SOLE WARRANTY AND EXCLUSIVE REMEDY AVAILABLE TO BUYER OR ANY OTHER PERSON OR ENTITY. The sole purpose of the stipulated sole and exclusive remedy shall be to provide Buyer with the free repair or replacement of defective Material in the manner provided herein. This exclusive remedy shall not be deemed to have failed of its essential purpose so long as Crane Energy is willing and able to repair or replace defective Material in the prescribed manner. No warranty applies to any Material which has been modified or changed in design or function after leaving Crane Energy's factory or which has been misused, neglected, mishandled, improperly installed, improperly serviced, improperly maintained, operated beyond its design capabilities, or used for other than its intended purposes. Buyer assumes all risk that the Material will not be suitable for Buyer's particular purpose. Buyer shall consult knowledgeable advisors and use its own skill and judgment to select suitable goods, including, but not limited to, size, capacity, and proper type and material of construction for such goods.

14. **ILLUSTRATIONS:** Catalog illustrations are representations of a certain size of each product line but do not necessarily represent all sizes in all details. Crane Energy reserves the right to institute changes in materials, designs, and specifications without notice in keeping with our policy of continuous product improvement.
15. **EFFECT OF TERMS AND CONDITIONS:** The terms and conditions herein contained shall apply to any Order or direction received from Buyer, and any provision or direction from Buyer purporting to modify or change said terms and conditions in any way is objected to and shall not be binding upon Crane Energy. Crane Energy's terms and conditions will be in effect regardless of any provisions to the contrary contained in Buyer's Order or request for shipment.
16. **ACTS OF GOD, STRIKES, EMBARGOES**: The time for Crane Energy to perform shall be extended proportionately as its ability to perform is materially affected by causes beyond its reasonable control, including, but not limited to, any Act of God, or by labor disputes, whether authorized by the applicable bargaining unit or not, by embargoes, trade restrictions, governmental directives, war, riots or insurrections, fire, flood, delays in transportation or failure by suppliers to deliver equipment or supplies.
17. **WAIVER**: Waiver by Crane Energy of any breach of these provisions shall not be construed as a waiver of any other breach.
18. **ASSIGNMENT**: None of Buyer's rights under any Order shall be assigned or otherwise transferred by Buyer to any other person, whether by the operation or law or otherwise, without Crane Energy's prior written approval.
19. **WEIGHTS:** Weights in catalogs, price schedules, quotations, and acknowledgements of all Orders are approximate and in no sense guaranteed. They represent the average weight of products as made from patterns in use at the time weights were compiled.
20. **SPECIAL CONDITIONS:** Any additional cost incurred in packaging or in making any special tests of inspection requested by Buyer in addition to those regularly supplied by Crane Energy will be charged to Buyer. Such tests and inspections will be made only at the factory before the date of shipment.
21. **STATUTE OF LIMITATIONS:** Crane Energy and Buyer expressly agree that any action for Crane Energy's breach of these provisions or any contract of sale with Buyer must be commenced within one (1) year of the date of the alleged breach.
22. **APPLICABLE LAW / FORUM:** Buyer's Order shall be governed by the domestic state laws of the State of Delaware, U.S.A. Crane Energy and Buyer agree that any appropriate state or federal court located in Delaware, U.S.A. shall have exclusive jurisdiction over any case or controversy arising under or in connection with Buyer's Order and shall be a proper forum in which to adjudicate such case or controversy.
23. **TECHNICAL INFORMATION:** Buyer shall hold in confidence any and all technical information proprietary to Crane Energy, including, but not limited to, designs, specifications, and any know-how which is disclosed directly or indirectly, intentionally or unintentionally, to Buyer.
24. **COMPLIANCE WITH LAW**: Buyer shall comply with all laws and other requirements having force of law applicable at any time which affect in any manner Buyer's Order or Buyer's performance there under. Buyer shall notify Crane Energy at once of any governmental action, prohibition, or limitation which affects in any manner Buyer's Order. By placing its Order with Crane Energy, Buyer represents and warrants that it is neither subject to any U.S. embargo or trade prohibition or limitation, nor subject to any embargo or trade prohibition or limitation in which the U.S. participates. Buyer agrees that it will not resell or distribute Material to any individual or entity prohibited from receiving Crane Energy goods or from dealing with Crane Energy under U.S. law or under any embargo or trade prohibition or limitation in which the U.S. participates. Buyer shall indemnify and hold Crane Energy harmless from and against any and all claims, demands, losses, costs, or liability incurred by Crane Energy as a result of Buyer's breach of this provision. Crane Energy reserves the right to cancel Buyer's Order, suspend, or terminate Crane Energy's performance, or take any other action it deems necessary as a result of Buyer's breach of this provision.
25. **SEVERABILITY**: If any provision herein shall be held invalid, illegal, or unenforceable, the validity, legality, and enforceability of the remaining provisions shall not in any way be affected or impaired thereby.
26. **ATTORNEY'S FEES:** Crane Energy shall be entitled to recover its reasonable attorneys' fees incurred in connection with collection of all or a portion of the purchase price and/or reasonable additional charges from Buyer.
27. **ENTIRETY OF AGREEMENT:** These terms and conditions, together with Crane Energy's quote, Buyer's Order, and any specifications, requisitions, drawings, and other related documents attached to Buyer's Order or referred to therein (subject to paragraph 15 above), shall constitute the entire agreement between Crane Energy and Buyer. Any change, amendment, or modification of any of these terms and conditions must be made in writing and signed by Crane Energy.

Conbraco Industries Statement of Warranty & Limitation of Liability

Conbraco Industries Inc. warrants, to its initial purchaser only, that its products which are delivered to this initial purchaser will be of the kind described in the order or price list and will be free of defects in workmanship or material for a period of two years from the date of delivery to you, our initial purchaser.

Should any failure to conform to this warranty appear within two years after the date of the initial delivery to our initial purchaser, Conbraco will, upon written notification thereof and substantiation that the goods have been stored, installed, maintained and operated in accordance with Conbraco's recommendations and standard industry practice, correct such defects by suitable repair or replacements at Conbraco's own expense.

THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OTHER WARRANTY OF QUALITY, WHETHER EXPRESSED OR IMPLIED, EXCEPT THE WARRANTY OF TITLE AND AGAINST PATENT INFRINGEMENT. Correction of non-conformities in the manner and for the period of time provided above, shall constitute fulfillment of all liabilities of Conbraco to our initial purchaser, with respect to the goods, whether based on contract, negligence, strict tort or otherwise. It is the intention of Conbraco Industries, Inc. that no warranty of any kind, whether, express or implied, shall pass through our initial purchaser to any other person or corporation.

LIMITATION OF LIABILITY: Conbraco Industries, Inc. SHALL NOT UNDER ANY CIRCUMSTANCES BE LIABLE FOR SPECIAL OR CONSEQUENTIAL DAMAGES SUCH AS, BUT NOT LIMITED TO, DAMAGES OR LOSS OF OTHER PROPERTY OR EQUIPMENT, LOSS OF PROFITS OR REVENUE, COST OF CAPITAL, COST OF PURCHASED OR REPLACEMENTS GOODS, OR CLAIMS OF CUSTOMERS OF OUR INITIAL PURCHASER, AND ALL OTHERS, SET FORTH HEREIN ARE EXCLUSIVE, AND THE LIABILITY OF CONBRACO WITH RESPECT TO SAME SHALL NOT, EXCEPT AS EXPRESSLY PROVIDED HEREIN, EXCEED THE PRICE OF THE GOODS UPON WHICH SUCH LIABILITY IS BASED.

NIBCO
AHEAD OF THE FLOW

NIBCO INC.
WORLD HEADQUARTERS

1516 MIDDLEBURY STREET
ELKHART, IN 46516-4740
USA

TECHNICAL SERVICES
PHONE: 888.446.4226
FAX: 888.336.4226

Warranty Information

NIBCO LIMITED WARRANTY

Applicable to NIBCO INC. Plumbing Fittings and Valves

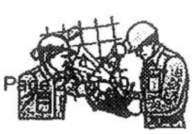
NIBCO INC. warrants each NIBCO plumbing plastic fitting (including plumbing valves) to be free from defects in materials and workmanship under normal use and service for a period of five (5) years from the date of purchase.

In the event any defect occurs which the owner believes is covered by this Warranty, the owner should immediately contact NIBCO INC., Technical Services, either in writing or by telephone call, (888) 446-4226 or (219) 523-3480. The owner will be instructed to return said fitting or valve, at the owner's expense to NIBCO INC. or an authorized NIBCO INC. representative for inspection. In the event said inspection discloses to the satisfaction of NIBCO INC., that said fitting or valve is defective, a replacement shall be mailed free of charge to the owner, and NIBCO INC. shall further pay the installing contractor the sum of ten ($10.00) dollars to apply on the cost of installation of said replacement valve.

NIBCO CLASSIC VALVES ONLY

For the Classic Line Only: NIBCO INC. warrants that al Classic plumbing valves shall be free from defect for as long as the original owner owns this product. In addition to the 5-year $10.00 limited warranty outlined above, if a defect in a Classic Valve occurs after the end of the 5-year period, NIBCO INC. will replace the valve in issue in the event an inspection by NIBCO INC. or an authorized representative of NIBCO INC. discloses to NIBCO INC.'s satisfaction that said valve is defective. However, the sole warranty for any Classic Valve product failure occurring after the 5-year $10.00 limited warranty period is product replacement of like grade, quality and function.

TO THE EXTENT PERMITTED BY LAW, THIS WARRANTY SPECIFICALLY EXCLUDES INCIDENTAL AND CONSEQUENTIAL DAMAGES OF EVERY TYPE AND DESCRIPTION RESULTING FROM ANY CLAIMED DEFECT IN MATERIAL OR WORKMANSHIP, INCLUDING BUT NOT LIMITED TO, PERSONAL INJURIES AND PROPERTY DAMAGES. Some states do not allow the exclusion or limitations of incidental or consequential damages, so these limitations may not apply to you. **TO THE EXTENT PERMITTED BY LAW, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE LIMITED IN DURATION.**



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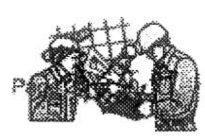
NIBCO INC.
WORLD HEADQUARTERS

1516 MIDDLEBURY STREET
ELKHART, IN 46516-4740
USA

TECHNICAL SERVICES
PHONE: 888.446.4226
FAX: 888.336.4226

This Warranty gives you specific legal rights, and you may also have other rights which vary from state to state.



RYAN HERCO PRODUCTS STANDARD TERMS & CONDITIONS OF SALE

1. ACCEPTANCE. Unless otherwise stated in a writing signed by Seller's duly authorized agent all quotations covering Seller's products are made and all contracts or orders for said products are accepted and all shipments are made on the condition that the Standard Terms and Conditions of Sale set forth herein shall be applicable. Any term in Buyer's purchase order or acceptance in addition to or not identical with these Terms and Conditions of Sale is objected to and these Terms and Conditions of Sale shall not be varied, qualified, modified, amended or interpreted by any prior course of dealing between the parties or by any usage or trade or in any manner other than by subsequent writing signed by Seller's duly authorized agent. All orders or contracts must be approved and accepted by a duly authorized agent of Seller. These Terms and Conditions of Sale shall be applicable whether or not they are attached to or enclosed with the products to be sold hereunder.

2. PRICES. Prices are subject to change without notice, and Seller's price in effect at the time of shipment will apply.

3. CANCELLATION. An order once placed with and accepted by Seller can be cancelled only with Seller's consent and upon payment to Seller of reasonable cancellation charges which shall take into account expenses already incurred, commitments made, and Seller's anticipated profit.

4. TAXES. The amount of any present or future sales, revenue, excise or other tax applicable to the products covered by this order, or the manufacture or sale thereof, shall be added to the purchase price and shall be paid by the Buyer or, in lieu thereof, Buyer shall provide Seller with an appropriate tax exemption certificate.

5. DELIVERY. Shipping dates are approximate and are based upon prompt receipt from Buyer of all necessary information. In no event will Seller be liable for damages of any kind arising out of delay or non-delivery, due to causes beyond its reasonable control including, but not limited to, acts of God, acts of civil or military authority, war, riots, fire, explosion, flood, strike, lockout, injunction, accident, breakage of machinery or apparatus, or inability to obtain fuel, power, raw materials, labor, containers or transportation facilities. In the event of any such delay, the date of delivery shall, at the request of Seller, be deferred for a period equal to the time lost by reason of the delay.

6. PAYMENT.(a) Unless otherwise specified on the invoice, all accounts are due and payable thirty (30) days from the date of invoice. Accounts extending beyond the terms will be subject to a service charge of 1-1/2% per month (18% per annum) or such greater amount as may be authorized by law and specified in the invoice. Discounts for prompt payment do not apply to labor and shipping charges, and no discounts other than those noted on the invoice are authorized. Shipments, deliveries and performance of work shall at all times be subject to the approval of Seller's credit department, and the Seller may at any time decline to make any shipments or deliveries or perform any work, except upon receipt of payment or upon terms and conditions of security satisfactory to such department. All lien rights are reserved until full payment of the invoice has been made.

(b) If, in Seller's judgment, the financial condition of the Buyer at any time does not justify continuation of production or shipment on the terms of payment originally specified, the Seller may require full or partial payments in advance and in the event of the bankruptcy or insolvency to the Buyer or in the event any proceeding is brought by or against Buyer under the bankruptcy or insolvency laws, the Seller shall be entitled to cancel any order then outstanding and shall receive reimbursement for its cancellation charges.

(c) Should Seller initiate any legal action or proceeding to collect on any unpaid invoice or to enforce any of the terms hereof, Seller shall be entitled to recover from Buyer all costs and expenses incurred in connection therewith, including court costs and reasonable attorney's fees.

7. CLAIMS AND RETURNS. (a) Claims for shipping damages shall be made against the carrier on all products shipped F.O.B. shipping point. On products shipped F.O.B. destination, Buyer shall notify Seller of shipping damages within ten (10) days from date of receipt and afford Seller a reasonable opportunity to inspect the products. No products shall be returned without Seller's consent.

(b) Claims for shortage or inaccurate filling of orders shall be submitted to Seller within ten (10) days after Buyer's receipt, accompanied by a copy of the invoice or shipper on which the products were purchased. Buyer will then receive from Seller a Returned Goods (RG) authorization number. Products returned without the RG authorization number will be refused. If Seller in good faith determines that any error was not Seller's, a minimum 15% restocking charge will be made to Buyer on any products returned for credit or exchange.

MESSAGE TO OUR CUSTOMERS

At Ryan Herco, we are committed to being a valuable partner in the growth of your company. We continually upgrade our operations and develop our employees to meet your changing requirements. Knowledgeable people who provide prompt, courteous, error-free service are the cornerstone of our company.

RyanHerco FLUID FLOW SOLUTIONS

(c) Claims or notices asserting a defective product must be given to Seller immediately upon discovery of such defect, but in any event no more than one year after date of shipment by Seller, and must include a copy of the invoice or shipper on which the products were purchased, evidence that such products were inspected within ten (10) days after Buyer's receipt, and the details of the defect(s) claimed, and afford the Seller a reasonable opportunity to inspect the products.

LIMITATION ON DAMAGES. In no event shall any liability of Seller exceed the purchase price of the product and Seller shall not be liable for incidental, special or consequential damages with respect to the sale or use of the product, including without limitation, labor charges, lost profits, expenses of repair, other costs incident to replacement, or transportation costs incurred in shipping products to or from Seller's plant.

INFORMATION. Seller does not, by any advice or information it may provide regarding the use of any product by Buyer, make any warranty beyond the description on the face hereof including of merchantability or fitness for a particular purpose or assume any liability for such advice or information given, orally or in print, or for the results obtained by Buyer. Buyer assumes all risk and liability which may result from the use of any products, whether singly or in combination with other products. No suggestion for product use shall be construed as a recommendation for use in infringement on any existing patent.

(d) Seller is under no obligation to take back material for credit or exchange when the reason for the return was anything other than the Seller's error. At Seller's sole discretion, should a return of this nature be authorized, the items returned must be of current manufacture, in its original packaging with all original manuals and/or documentation, and be in resalable condition. A minimum 15% restocking charge will apply as well as any additional charges necessary to restore items to a resalable condition.

8. LIMITED WARRANTY ON PRODUCTS MANUFACTURED BY SELLER. The Seller warrants to the original purchaser that products of its own manufacture to be delivered hereunder will be free from defects in materials or workmanship under normal use and service for a period of one year from date of shipment. Seller's obligations under this Warranty are limited to replacing or repairing or giving credit for, at its option and at any of its plants, any of said products which shall, within one year after shipment, be returned to Seller's plant of origin, transportation charges prepaid, and which are, after products examination, disclosed to the Seller's satisfaction to be thus defective. This Warranty does not apply to defects caused by shipping damages, or to any products manufactured by Seller which have been subject to improper installation, misuse, neglect, accident, ordinary wear and tear, or Buyer's attempts to use any product beyond its mechanical, thermal or electrical capacity. The aforementioned provisions do not extend the original Warranty period of any product that has either been repaired or replaced by Seller.

THIS LIMITED WARRANTY OF SELLER, SUBJECT TO THE LIMITATION ON DAMAGES, IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, STATUTORY, OR IMPLIED BEYOND THE DESCRIPTION ON THE FACE HEREOF, INCLUDING THE WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND OF ALL OTHER LIABILITIES OR OBLIGATIONS ON THE SELLER'S PART, AND SELLER NEITHER ASSUMES NOR AUTHORIZES ANY OTHER PERSON TO ASSUME FOR IT ANY OTHER LIABILITIES IN CONNECTION WITH THE SALE OF THE SAID PRODUCTS. THIS LIMITED WARRANTY MAY NOT BE VERBALLY CHANGED OR MODIFIED BY ANY REPRESENTATIVE OF SELLER.

9. DISCLAIMER OF SELLER'S WARRANTY ON PRODUCTS MANUFACTURED BY OTHERS. Products not manufactured by Seller are covered, if at all, by the original manufacturer's warranty, copies of which are available on Buyer's request. Seller makes no warranty or representation whatsoever, expressed or implied, beyond the description on the face hereof including the warranty of merchantability and fitness for a particular purpose, with respect to products not manufactured by Seller.

10. APPLICABLE LAW. The validity, performance and construction of these terms and all sales there under shall be governed by the laws of the state in which Buyer's order is accepted by Seller.

CHECK FOR DAMAGE & VERIFY CONTENTS UPON RECEIPT

ANY OBVIOUS DAMAGE TO THE CARTON OR PACKAGES SHOULD BE IMMEDIATELY BROUGHT TO THE ATTENTION OF THE CARRIER DELIVERING THE SHIPMENT TO YOU AND NOTED ON THE DELIVERY RECEIPT. IF CONCEALED DAMAGE IS DISCOVERED WHEN MERCHANDISE IN UNPACKED, SAVE THE PACKAGES AND NOTIFY THE CARRIER FOR INSPECTION. YOUR CLAIM FOR DAMAGED MATERIALS SHOULD BE FILED AT ONCE WITH THE TRANSPORTATION COMPANY. AS THE RESPONSIBILITY OF RYAN HERCO PRODUCTS CEASES UPON DELIVERY TO THE CARRIER AT THE SHIPPING POINT. SHOULD YOU NEED ASSISTANCE WITH THE CLAIM, WE WILL BE GLAD TO HELP.

CLAIMS FOR SHORTAGES OR INACCURATE FILLING OF ORDERS MUST BE MADE TO RYAN HERCO PRODUCTS WITHIN TEN DAYS AFTER RECEIPT OF GOODS. THERE IS A MINIMUM OF 15% RESTOCKING CHARGE ON ANY UNUSED ITEMS RETURNED FOR CREDIT OR EXCHANGE WHEN RYAN HERCO PRODUCTS CORPORATION IS NOT IN ERROR.

RETURNED GOODS WILL BE ACCEPTED ONLY WITH PRIOR APPROVAL.

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IMPORTANT NOTES ABOUT YOUR WARRANTY AND SAFETY

Replacement Parts

The use of parts and components other than those supplied by **Flowserve Corporation** could severely restrict the operation and performance of this valve. Unauthorized modifications or substitution of components can lead to valve **failure** due to corrosion and/or **premature failure** of the substituted parts.

Selection, Installation, Operation and Maintenance

Flowserve Corporation has established industry leadership in the design and manufacture of its products. When properly selected, each product is designed to perform its intended function safely during its useful service life. However, it is necessary that Flowserve's customers be fully aware of their responsibilities when using these products.

Each Flowserve product may be used in numerous applications under a wide variety of industrial service conditions. Although Flowserve can, and often does, provide general guidelines, it is obviously not possible to provide application specific data and warnings for all conceivable applications. The purchaser/end user must therefore assume the ultimate responsibility for the proper selection, installation, operation and maintenance of the products. Read the appropriate IOM before installing, operating or repairing any valve. The purchaser/end user should train its employees and/or contractors in the safe use of the Flowserve products in connection with the purchaser's manufacturing processes.

Flowserve will continue to provide its customers with the best possible products and service available. We do not recommend substituting surplus or remanufactured valves over new Flowserve valves or those repaired in an authorized service center. Should you have any questions about these provisions or about Flowserve's products in general, please contact your local Flowserve representative, who will be happy to help.

SECTION I

Installation Instructions

1. The protective flange covers provided on each valve should remain in place during any storage or handling operations.
2. Gaskets are not required for the T-Line valve since the valve liner itself forms a gasket on both flange faces. Gaskets may be used, however, for protection of the liner where frequent disassembly of the associated piping may be required. Gaskets are recommended when the valve is to be installed between smooth face (ground or rigid plastic) or glass lined pipe flanges.
3. Care should be used to protect the valve liner and coated plug (where appropriate) from damage during handling.
4. When installing the valve between flanges, care should be exercised to note that the valve liner not be allowed to catch on the pipe I.D. and fold over. This will cause severe liner damage and result in flange leakage.
5. When tightening the flange bolts, normal wrench torque may be used without fear of damage to the valve or liner.
6. Do not run sharp instruments between the valve body and the liner, the liner and the pipe, or between the plug and the liner. This practice will result in severe liner and/or plug damage.
7. Valves as shipped are adjusted and pneumatically tested to hold (T-41) 1/2"-8" 150 PSI/(T-43) 1"-6" 300 PSI.
8. Plug adjustment at installation should not be required and is not recommended. Increased operating torque will result.
9. It is imperative that top cap fasteners be re-torqued prior to installation. (See Table I, page 6.)

SPECIAL NOTE: Consult the piping specifications for proper flange torque and installation procedures. Over-torquing may damage the gasket surface. When mating dissimilar materials, use the lower torque value.

Valves may require adjustment to remain drop tight when operating at the lower end of the temperature range or on extreme temperature cycles.

⚠ WARNING

To avoid personal injury and prevent damage to equipment, do not operate or repair this valve without observing the following procedures outlined in this manual.

V462 Valve Cock Handle
1 yr. warranty thru Holmes

TERMS AND CONDITIONS OF SALE

1. United Brass Works, Inc.. agrees to sell products pursuant to its standard terms and conditions, unless it agrees to other terms in writing signed by both parties. The printed provisions on the reverse of any customer Purchase Order or on any other form supplied unilaterally by any customer shall be deemed rejected by United Brass Works, Inc. and shall be void and of no effect.

2. Where shown, valves will be shipped in multiples of packaged quantities. Order quantities will be changed to coincide with multiples of packaged quantities.

3. All prices are listed net, FOB, Randleman, North Carolina with freight allowed in Bronze and/or Iron Valves of 750 lbs. or more to all points in the U.S. (excluding Alaska and Hawaii) and to the nearest port of embarkation for foreign shipments (including Alaska and Hawaii), on all orders and back orders United Brass' responsibility terminates upon receipt of a bill of lading by the carrier.

4. Minimum merchandise invoice amount shall be $25.00 per order. All orders received for merchandise that totals to less than $25.00 shall be invoiced at the minimum charge.

5. Prices are subject to change without notice and orders will be invoiced at price in effect at time of shipment.

6. Terms are thirty days net, provided credit is approved. Where no credit information is available, shipments will be made COD or sight draft Charge accounts are extended to businesses, institutions, and organizations only, not to individuals. To qualify for open account privileges, an account must be rated satisfactory in Dun & Bradstreet or supply names of three commercial vendors who have extended credit. Allow four weeks to establish account when references other than a satisfactory Dun & Bradstreet rating are furnished.

7. No material shall be accepted for credit or replacement without prior return authorization being obtained and an RMA number being issued for the material. All materials must be returned prepaid.

8. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state. During the first ninety (90) days after date of delivery of this product to the original purchaser. United Brass Works, Inc., will remedy any defect or malfunction found therein. However, the original purchaser shall be responsible for all labor costs. United Brass Works, Inc., extends this limited 90-Day Warranty to the original purchaser of this product only, and not to any subsequent transferees.

   This warranty does not apply to conditions resulting from improper installation, inadequate maintenance, misuse, abuse, accident or alteration. This is the only warranty applicable to products manufactured by United Brass Works, Inc., and the Company neither assumes nor authorizes anyone to assume for it any other obligation or liability in connection with such products.

   ANY IMPLIED WARRANTIES OR MERCHANT-ABILITY OR FITNESS FOR A PARTICULAR PURPOSE SHALL BE LIMITED INDURATION TO THE PERIOD OF THE ABOVE 90-DAY WARRANTY. SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

   UNITED BRASS WORKS, INC., SHALL NOT BE LIABLE FOR COMMERCIAL CONSEQUENTIAL DAMAGES SUCH AS PROPERTY DAMAGES AND INCIDENTAL EXPENSES RESULTING FROM BREACH OF THIS WARRANTY. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

9. All United Brass merchandise may be returned for credit if unused and in new condition after receipt of prior authorization within 60 days of purchase. Merchandise will not be accepted for return beyond 60 days after purchase. (This does not apply to defective merchandise.) A 15% restocking charge will be levied unless United Brass Works was in error. **Please call for Return Material Authorization number before returning merchandise.**

10. There will be a 15% surcharge on all merchandise drop shipped unless the invoice amount exceeds $50.00.

11. All claims for short shipments must be made within 10 days of receipt of material. Claims made after 10 days of receipt will not be honored.

12. United Brass Works, Inc., reserves the right to ship orders by means we deem most expedient and least expensive unless your order contains specific instructions and provided these instructions do not entail additional expense for the company.

13. All cancellations must be in writing and any expense incurred processing your order prior to the cancellation shall be invoiced to you.

14. All telephone and telegraph orders must be confirmed in writing.

15. All orders taken by salesmen are subject to approval by home office.

16. United Brass Works, Inc., reserves the right to make partial shipment if such is necessary, unless order has specific instruction to the contrary.

17. All delivery dates are approximate and United Brass Works, Inc., is not responsible for failure to meet dates specified.

HAMMOND VALVE

Terms and Conditions of Acceptance

CANCELLATIONS: Orders accepted by Seller cannot be countermanded, cancelled, changed, or deliveries deferred except with the Seller's consent and upon terms that will indemnify Seller against loss.

CLAIMS: Seller will not be liable for any delay in its performance hereof, or for any damages suffered by Buyer, by reason of such delay, if caused by or arising from, directly or indirect, fires, floods, substantial damages to its plant, accidents, riots, acts of God, war, governmental interference or embargoes, strikes, labor difficulties, shortage of labor, fuel, power, materials, or supplies, transportation delays or any other cause or causes (whether or not similar in nature to any of those herein before specify Ed) beyond its control. OUR RESPONSIBILITY CEASES AFTER DELIVERY TO CARRIER. IF SHIPMENT ARRIVES IN DAMAGED CONDITION, SECURE PROPER NOTATION ON FREIGHT BILL AND FILE CLAIM AGAINST CARRIER. DO NOT RETURN GOODS WITHOUT OUR CONSENT.

CREDITS: Buyer agrees to make prompt payment of invoiced amount due in accordance with the terms of the contract. Seller reserves the right or option to modify, change or withdraw credit terms at any time without notice and to request guarantees, security or any payment in advance or extension of credit. On all past due accounts the legal rate of interest will be added and charged from net due date. Outstanding delinquent balances on all accounts shall, in addition to the above mentioned monthly interest charge, also include all costs of collection so incurred by Seller at any level of enforcement.

DESIGN: Hammond Valve, reserves the right to change design, specification, or materials without notice, due to a research and development program of continuous product improvement and reserves all rights to label products covered hereunder with appropriate directions or warnings as may be required in its opinion.

LIMITED WARRANTY: (for consumer, personal, family or household): Seller warrants the product to be free from defects in workmanship and material, and Seller will, without charge, repair the returned product which, upon inspection at Seller's premises, is found to have a defect, provided written notice thereof is given to Seller by buyer and the product is returned within 12 months after date of purchase. Notices and returns are to be made to Hammond Valve. Buyer's remedy for breach of this warranty is limited to such repair, but Seller will replace the returned product with an identical or conforming product where repair is unfeasible. This warranty does not cover deterioration by erosion or cutting or severing of resilient components or any cause of failure other than defective material or workmanship. Damage and/or labor charges incurred by Buyer incidental to repair or replacement are not included herein and are specifically negated. This warranty shall also not apply where the product after purchase has been damaged by accident, careless handling or improper application, installation or use. Buyer assumes sole responsibility for the use or misuse of the product after purchase. Seller shall not be liable for incidental or consequential damage of any kind. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THAT THE LIMITATION ON EXCLUSION MAY NOT APPLY TO YOU. This warranty is extended only to the original retail purchaser of the product and his lawful successors utilizing same for personal, family, or household purposes for the balance of the warranty period. Any implied warranties construed to be applicable under State law are limited to both the time and terms of this express Limited Warranty. Where State laws may vary, return, repair or replacement of product shall be in accordance therewith as appropriate.

ORDER AND QUOTATIONS: All orders and quotations are subject to approval and acceptance by Hammond Valve. Seller's published prices are subject to change without notice, AND WILL

BE INVOICED AT THOSE PRICES IN EFFECT AT TIME OF SHIPMENT. Prices include Seller's standard commercial packaging unless stated otherwise. Seller reserves the right to correct clerical or stenographic errors on all documents.
PATENTS: No sale of goods covered by this order shall grant to Buyer or anyone else, any license or right of any kind under any patent owned or controlled by Seller or under any patent which Seller has a license. Buyer agrees to indemnify Seller against, and save Seller, harmless from, any and all claims, liabilities, losses, or damages, sustained or incurred by Seller for, or by reason of any alleged patent infringement arising from the manufacture or sale of any product furnished Buyer which is not part of Seller's standard line offered by it to the trade generally in the usual course of Seller's business and to defend at Buyer's own expense any actions which may be brought against Seller, for or by reason of, such alleged infringement.
REPAIRS: All repairs are made on F.O.B. factory basis and transportation charges on materials returned for repairs to be prepaid. Where State laws may vary, return, repair or replacement shall be in accordance therewith as appropriate.
RETURNED GOODS:
SELLER'S WRITTEN AUTHORIZATION MUST BE OBTAINED before goods are returned for credit or exchange. (Full Cartons Only). Returns must be made 180 days from date of the original shipment.
Goods returned to accommodate purchases will be credited at invoice price or prevailing price at time of return whichever is lower. A minimum charge for inspection and handling of 25%, plus freight both ways and expense incurred in restoring goods to saleable conditions will be assessed on returns which are approved.
Credit allowed on returned goods will be a material credit to be applied on future orders Obsolete goods, or goods made on special order, and modifications of regular goods are not returnable.
TAXES: Prices on the merchandise described herein are exclusive of all city, state and federal taxes including without limitation, Federal, State or municipal taxes on manufacturing, sales, receipts, gross income, occupation, use and similar taxes and exercises. Such tax or taxes not included in Seller's prices by express notation thereof will be added to the invoice as a separate charge and paid by Buyer.
TERMS: Multi-Turn and Quarter-Turn Valves: 30 days net.
Parts-minimum order $100.00 net minimum value.
Complete valves-Minimum order $200.00 net minimum value.
Full freight Allowed order is $5,000 net.
NOTE: 5% SURCHARGE WILL BE APPLIED AGAINST ORDERS FOR BROKEN CARTON QUANTITIES.
Prepaid Freight or cartage charges, which are added to the invoice, are not subject to cash discount.
FREIGHT: Freight allowed orders will be shipped via the carrier of our choice. If requested to ship other than our choice, any additional freight charges incurred must be borne by customer. Freight is not allowed on UPS, Parcel Post or air shipments.
WARRANTY: (NON-CONSUMER): Seller warrants the merchandise to be free from defects in workmanship and material and Seller will without charge repair any returned merchandise which upon inspection at Seller's factory is found to have such a defect, provided written notice thereof is given to Seller by Buyer and the merchandise is returned within 12 months after date of delivery hereunder. Buyer's remedy for breach of this warranty is limited to such repair, but Seller at its option may replace the returned merchandise with conforming goods. Damage and/or labor charges incurred by Buyer incidental to repair or replacement are not included herein and are specifically negated. This warranty shall not apply where the merchandise after delivery has been damaged by accident, careless handling, or improper application, installation or use. Buyer assumes sole responsibility for all consequences of the use or misuse of the merchandise by Buyer, its employees or agents, and Seller shall not be liable under any circumstances for incidental or consequential damages of any kind except as above set forth. SELLER MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PAR-TICULAR PURPOSE nor is there any other warranty, express or implied.
(NOTE: In the event that the merchandise covered by this Customer Acknowledgement is intended for consumer, personal, family, or household use. then the terms of the LIMITED

warranty (as outlined in No.5) shall apply thereto in place of the foregoing.)

Effective with publication hereof it is the announced and declared policy of Hammond Valve, New Berlin, Wisconsin, a Wisconsin corporation, that it will determine with whom it shall do business and that this unilateral declaration is applicable and effective to any party regardless of nature, size or identity and regardless of any past or prior customer relationship.

Errors and Shortages: No claims for shortages, receipt of incorrect product, or clerical errors or otherwise, will be allowed unless reported in writing no later than thirty (30) days after Buyer's receipt of product. Issuance of credit is dependent upon the Company's approval.

Rev 02/19/2007

PENN-TROY MANUFACTURING, INC. (570)-297-2125 *FAX* (570)-297-4136
an equal opportunity/affirmative action employer e-mail penntroy@epix.net
P O BOX 187 650 RAILROAD ST., TROY, PA 16947

WARRANTY POLICY

PENN-TROY warrants for one year from date of shipment PENN-TROY's manufactured products to the extent that PENN-TROY will replace those having defects in material or workmanship when used for the purpose and in the manner which PENN-TROY recommends. If PENN-TROY examination shall disclose to its satisfaction that the products are defective, and an adjustment is required, the amount of such adjustment shall not exceed the net sales price of the defective products or workmanship or damage resulting from the same. PENN-TROY warrants the products which it sells of other manufacturers to the extent of the warranties of their respective makers. Where engineering design or fabrication work is supplied, buyer's acceptance of PENN-TROY's design or delivery of work shall relieve PENN-TROY of all further obligation, other than as expressed in PENN-TROY's product warranty.
THIS IS PENN-TROY'S SOLE WARRANTY. PENN-TROY MAKES NO OTHER WARRANTY OF ANY KIND,EXPRESSED OR IMPLIED: AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE WHICH EXCEED PENN-TROY'S AFORESTATED OBLIGATION ARE HEREBY DISCLAIMED BY PENN-TROY AND EXCLUDED FROM THIS WARRANTY. PENN-TROY neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of its engineering design or products. This warranty shall not apply to any products or parts of products which **a:** have been repaired or altered outside of PENN-TROY's factory without prior written authorization from PENN-TROY; or **b:** have been subjected to misuse, negligence or accidents; or **c:** have been used in a manner contrary to PENN-TROY's instructions or recommendations. PENN-TROY shall not be responsible for design errors due to inaccurate or incomplete information supplied by buyer or its representatives.

PENN-TROY will not be liable for any loss, damage, cost of repairs, incidental or consequential damages of any kind, whether based upon warranty (except for the obligation accepted by PENN-TROY under WARRANTY above) contract or negligence, arising in connection with design, manufacture, sale, use or repair of the products or of the engineering designs supplied to buyer.

WATTS®

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Keyword or Part # Search

Water Safety & Flow Control | Backflow Prevention | Water Quality Products | Drainage Products | Brass & Tubular | Control Valves | Potable PEX Plumbing | Quick-Connect Solutions | Marine Products | OEM Division

Warranty Information

Important details regarding your Watts product(s).

Limited Warranty:

Watts Regulator Company warrants each product to be free from defects in material and workmanship under normal usage for a period of one year from the date of original shipment. In the event of such defects within the warranty period, the Company will, at its option, replace or recondition the product without charge. This shall constitute the sole and exclusive remedy for breach of warranty, and the Company shall not be responsible for any incidental, special or consequential damages, including without limitation, lost profits or the cost of repairing or replacing other property which is damaged if this product does not work properly, other costs resulting from labor charges, delays, vandalism, negligence, fouling caused by foreign material, damage from adverse water conditions, chemical, or any other circumstances over which the Company has no control. This warranty shall be invalidated by any abuse, misuse, misapplication or improper installation of the product. THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Any implied warranties that are imposed by law are limited in duration to one year.

Some States do not allow limitations on how long an implied warranty lasts, and some States do not allow the exclusion or limitation of incidental or consequential damages. Therefore the above limitations may not apply to you. This Limited Warranty gives you specific legal rights, and you may have other rights that vary from State to State. You should consult applicable state laws to determine your rights.

Service Policy:

For inoperative products beyond the warranty period, we assume no liability for replacement of valves due to service conditions beyond our control.

Returned Goods:

No material shall be returned without authorization. When credit is issued it will be at the price charged, or prevailing price if lower, less handling charges based on costs of reconditioning, boxing, etc. Products which are obsolete or made to special order are not returnable.

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WATTS® WATER TECHNOLOGIES

Canadian Customers
Careers / Investors / Terms of Use / Privacy Policy
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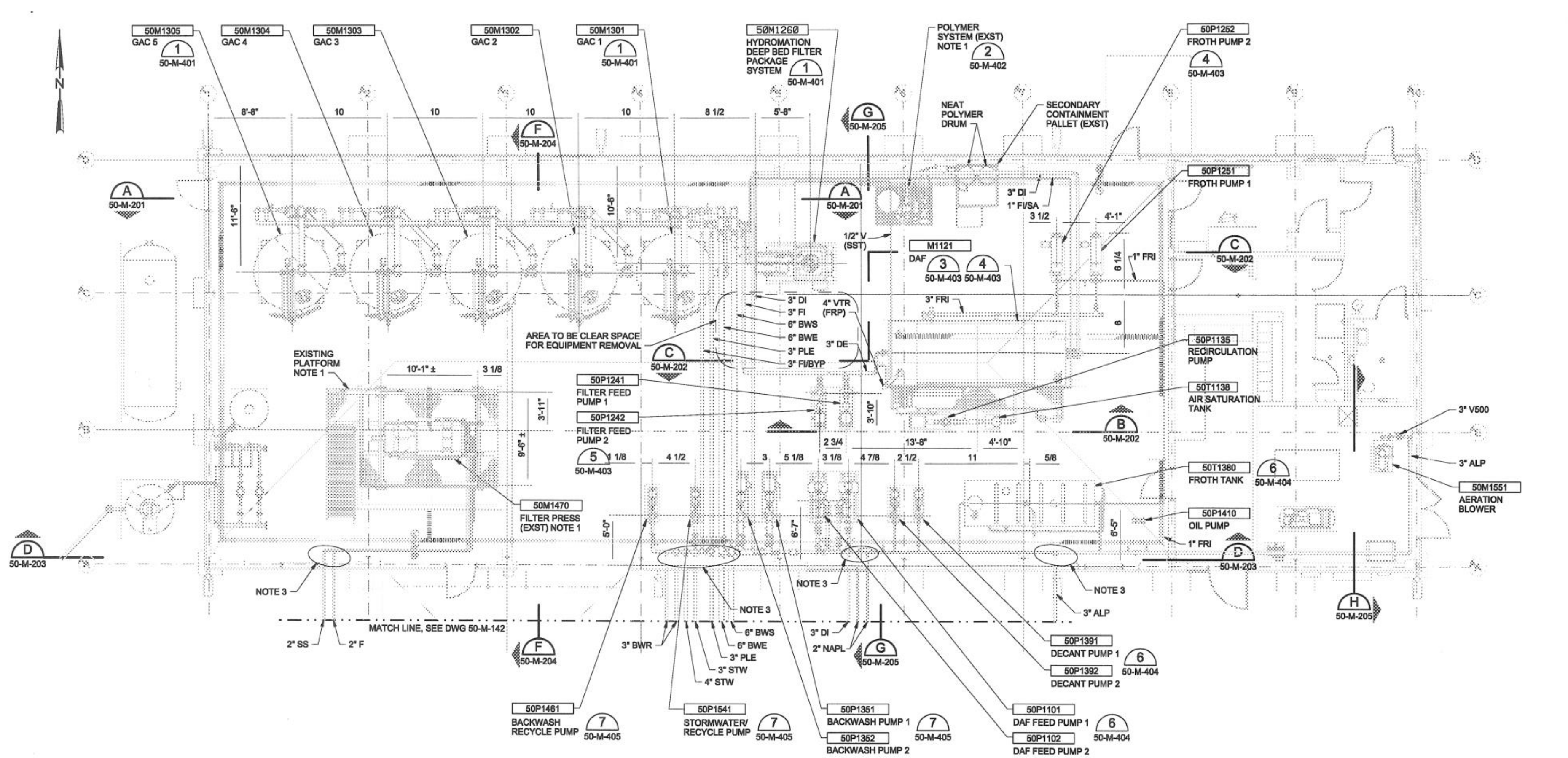
APPENDIX C
As-Built Drawings



NOTES:

1. SEE DWG 05-C-100 AND SPECIFICATION 01645 FOR EXISTING EQUIPMENT RELOCATION INFORMATION.
2. SEE DWG 50-DME-141 FOR EXISTING EQUIPMENT LOCATION.
3. CONCRETE ENCASE PIPING UNDER STRUCTURE TO OUTSIDE EDGE OF FOOTING PER (3316).

   BED ALL BURIED PIPE FROM OUTSIDE EDGE OF PIPE ENCASEMENT TO 5 FEET OUTSIDE OF STRUCTURE ON ONE LAYER OF 50MM POLYETHYLENE FOAM (DOW ETHAFOAM HS45). EXTEND FOAM A MINIMUM OF 2-INCH OUTSIDE OF PIPE DIAMETER.

TREATMENT BUILDING PLAN

3/16"=1'-0"

DSGN	NO.	DATE	REVISION	BY	APVD
DR					
CHK					
APVD					

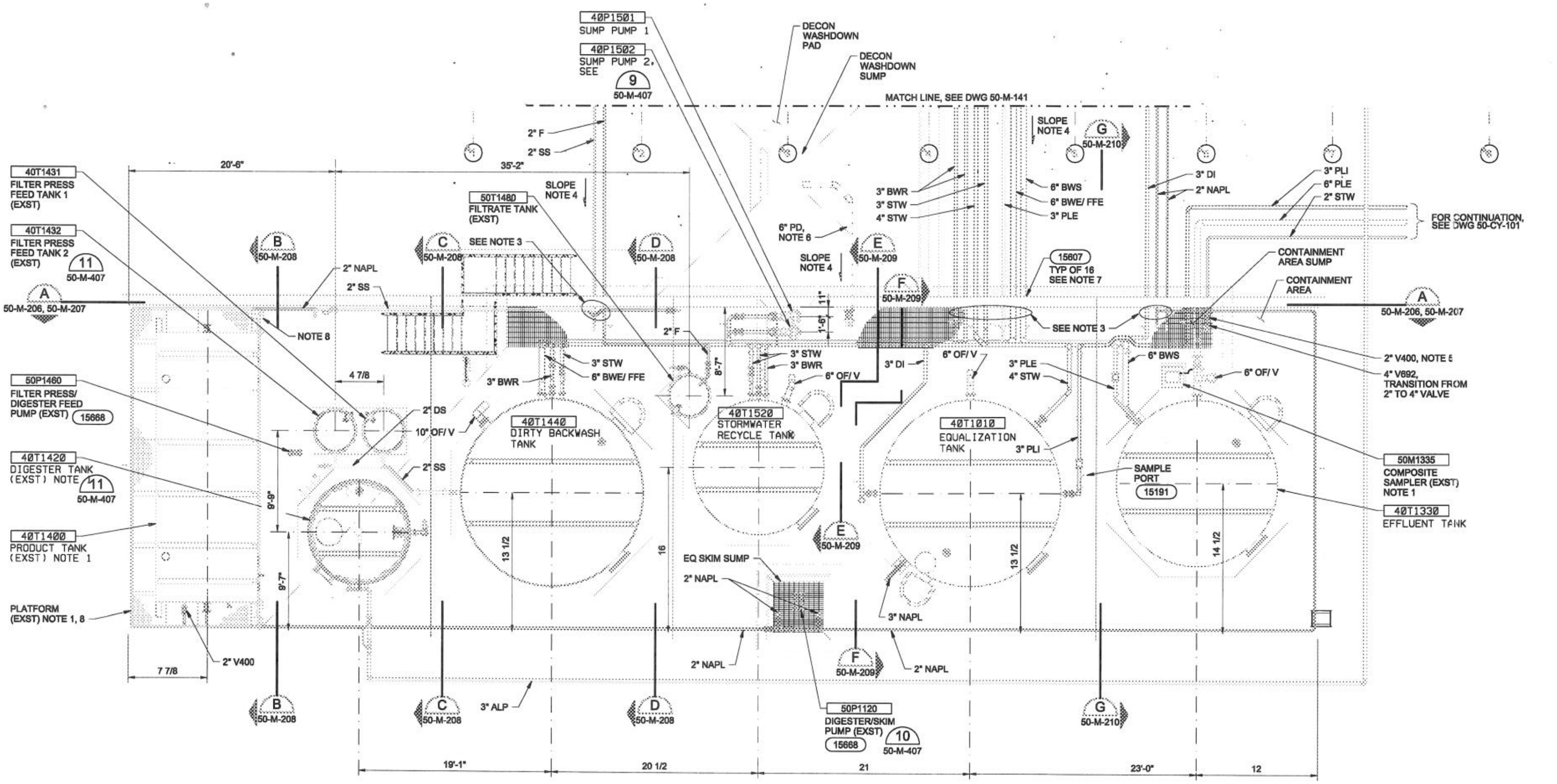
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

CH2MHILL

TREATMENT FACILITY
MECHANICAL
TREATMENT BUILDING PLAN

SHEET	48
DWG	50-M-141
DATE	
PROJ	

FILENAME: $FILENAME PLOT DATE: $PLOTDATE PLOT TIME: $PLOTTIME



TANK FARM PLAN

3/16"=1'-0"

NOTES:

1. SEE DWG 05-C-100 AND SPECIFICATION 01645 FOR EXISTING EQUIPMENT RELOCATION INFORMATION.
2. FOR ISOMETRIC DETAIL OF THIS TANK FARM, SEE 8 50-M-406.
3. PROVIDE DOUBLE WALL LEAK DETECTION CONNECTION IN CONTAINMENT SUMP PER DETAIL 15510. TRANSITION TO SINGLE WALL PIPE AFTER LEAK DETECTION CONNECTION WITH DUAL WALL TO SINGLE WALL TRANSITION FITTING.
4. SLOPE ALL PIPING 1/8" PER FOOT TO THE TANK FARM SUMP.
5. PROVIDE VALVE WITH EXTENSION STEM, STEM GUIDE AND OPERATING NUT, LOCATED 2-INCH BELOW GRATING. REMOVE GRATING GRID AS REQUIRED TO ACCESS OPERATING NUT.
6. CONCRETE ENCASE PIPING PER 3316.
7. BED ALL BURIED PIPE FROM OUTSIDE WALL OF STRUCTURE TO 5 FEET OUTSIDE OF STRUCTURE ON ONE LAYER OF 50MM POLYETHYLENE FOAM (DOW ETHAFOAM HS45). EXTEND FOAM A MINIMUM OF 2-INCH OUTSIDE OF PIPE DIAMETER.
8. FOR DETAILS OF EXISTING PLATFORM AND LADDERS, SEE SELWAY CORP DRAWINGS 9651 -1 THRU - 3. REMOVE TWO GALV STL LADDERS NEAR CORNERS OF PLATFORM AND REINSTALL AT NE AND SE CORNERS OF RELOCATED PLATFORM AS INDICATED. PROVIDE ADDITIONAL GALV STL POSTS AS REQ'D TO SUPPORT LADDER SIDE RAILS. CUT AND PATCH EXISTING RAILING AT NEW LADDER LOCATIONS. PROVIDE NEW GALV STL RAILING AT EXISTING LADDER LOCATIONS.
9. INSTALL BIRD SCREEN ON ALL VENT AND EXHAUST OPENINGS.

DSGN	GT HICKMAN					
DR	ER BROWN					
CHK	MW DAVIS	1	1/04/08	1 1/2" NAPL Lines Changed to 2" NAPL Lines	ROW	
APVD	KT SCHEFFLER	NO.	DATE	REVISION	BY	APVD

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

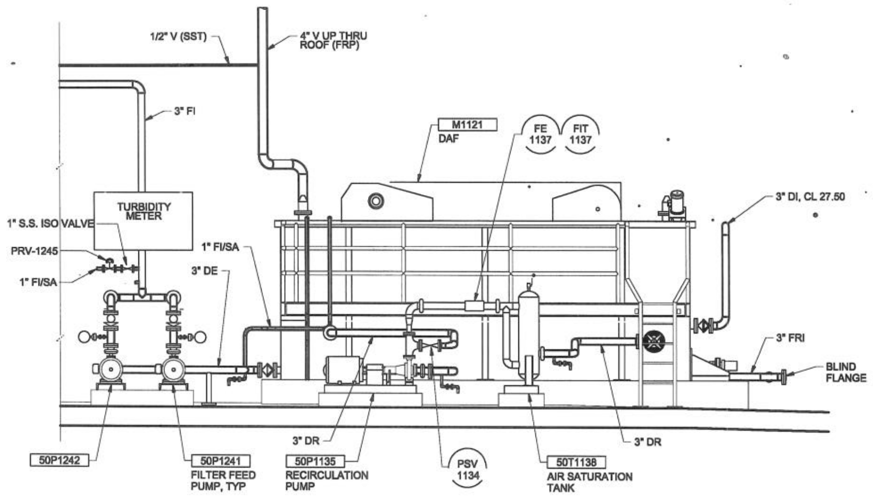
CH2MHILL

US ENVIRONMENTAL PROTECTION AGENCY
WYCKOFF GROUNDWATER TREATMENT PLANT
BAINBRIDGE ISLAND, WA

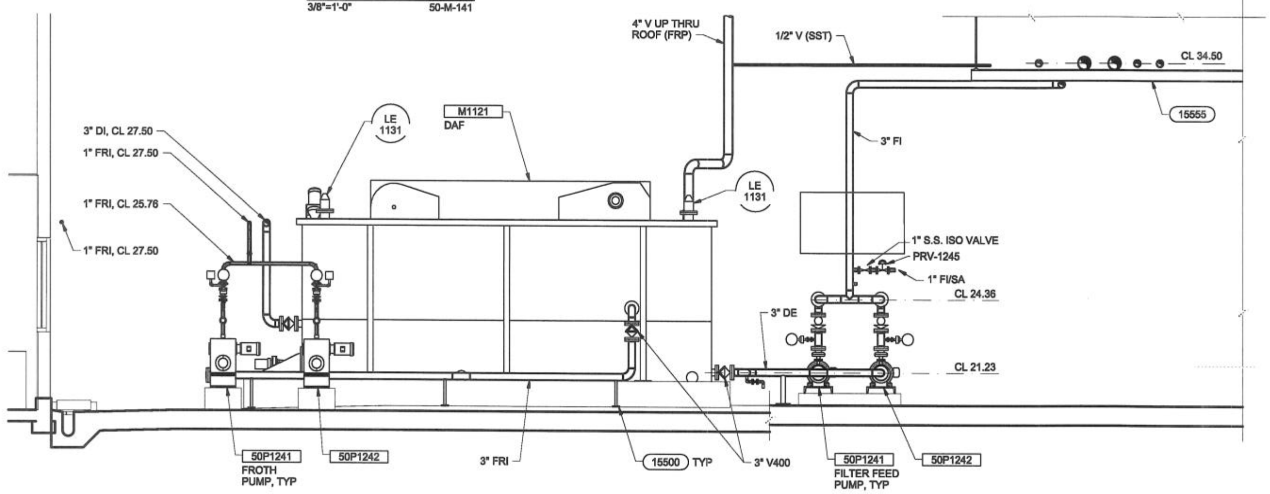
TREATMENT FACILITY
MECHANICAL
TANK FARM PLAN

SHEET	49
DWG	50-M-142
DATE	JANUARY 4 2006
PROJ	316783.FD.B

FILENAME: PLOT DATE: PLOT TIME:



SECTION B
3/8"=1'-0" 50-M-141

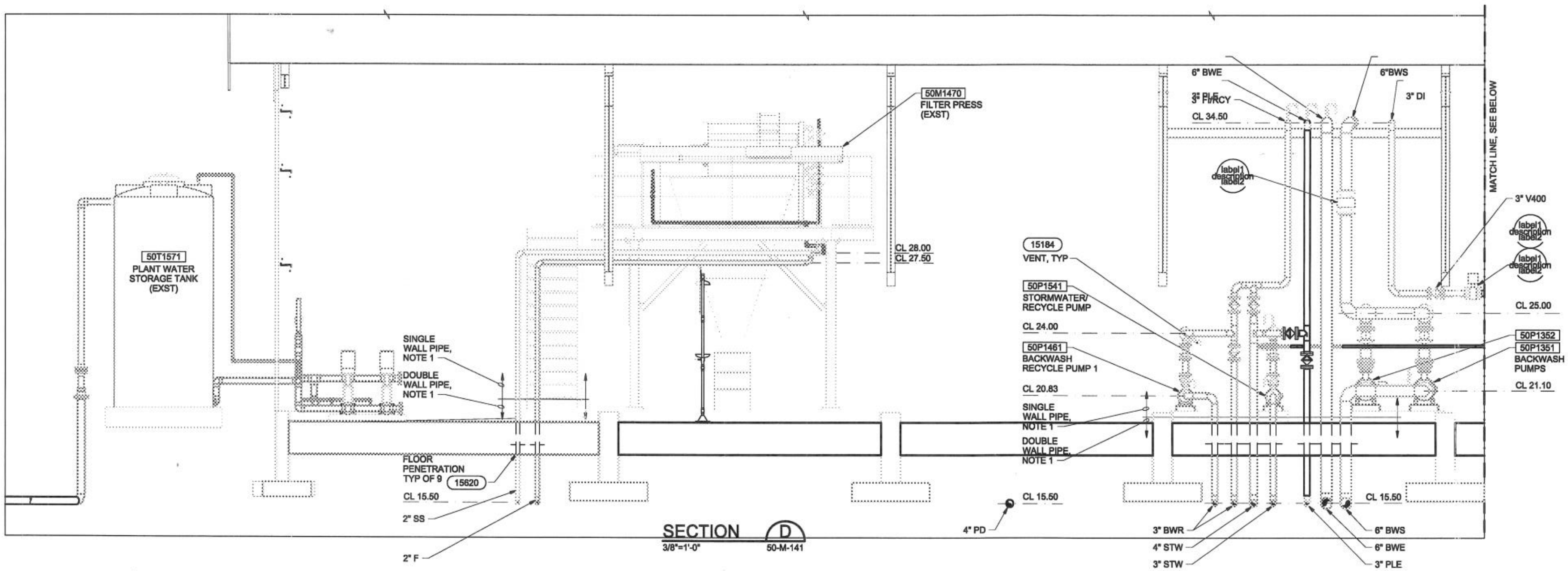


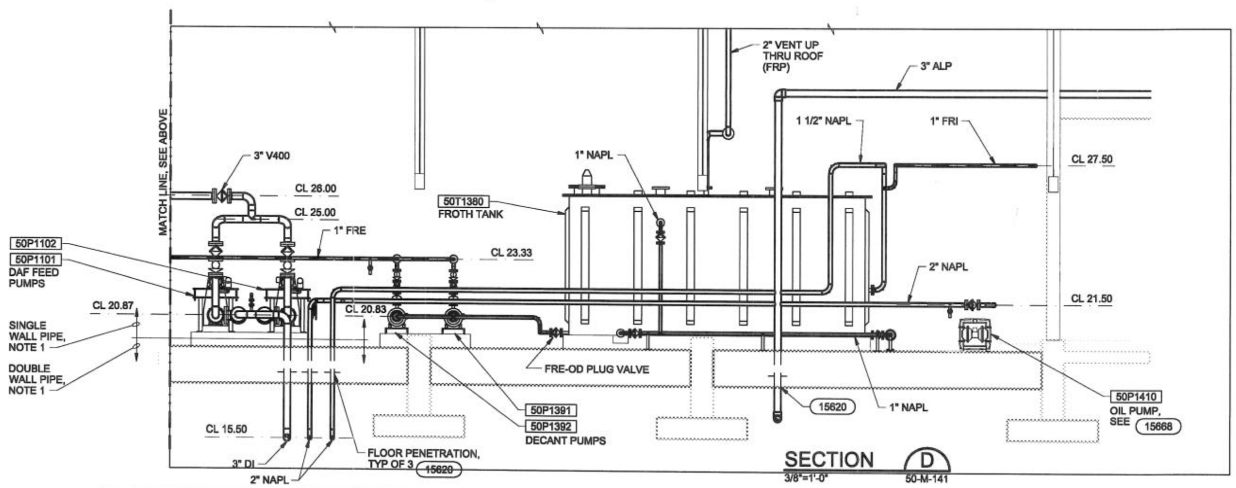
SECTION C
3/8"=1'-0" 50-M-141

DSGN						
DR						
CHK						
APVD		1	1/04/08	ROW		
		NO.	DATE		BY	APVD

TREATMENT FACILITY
MECHANICAL SECTIONS

SHEET	51
DWG	50-M-202
DATE	
PROJ	





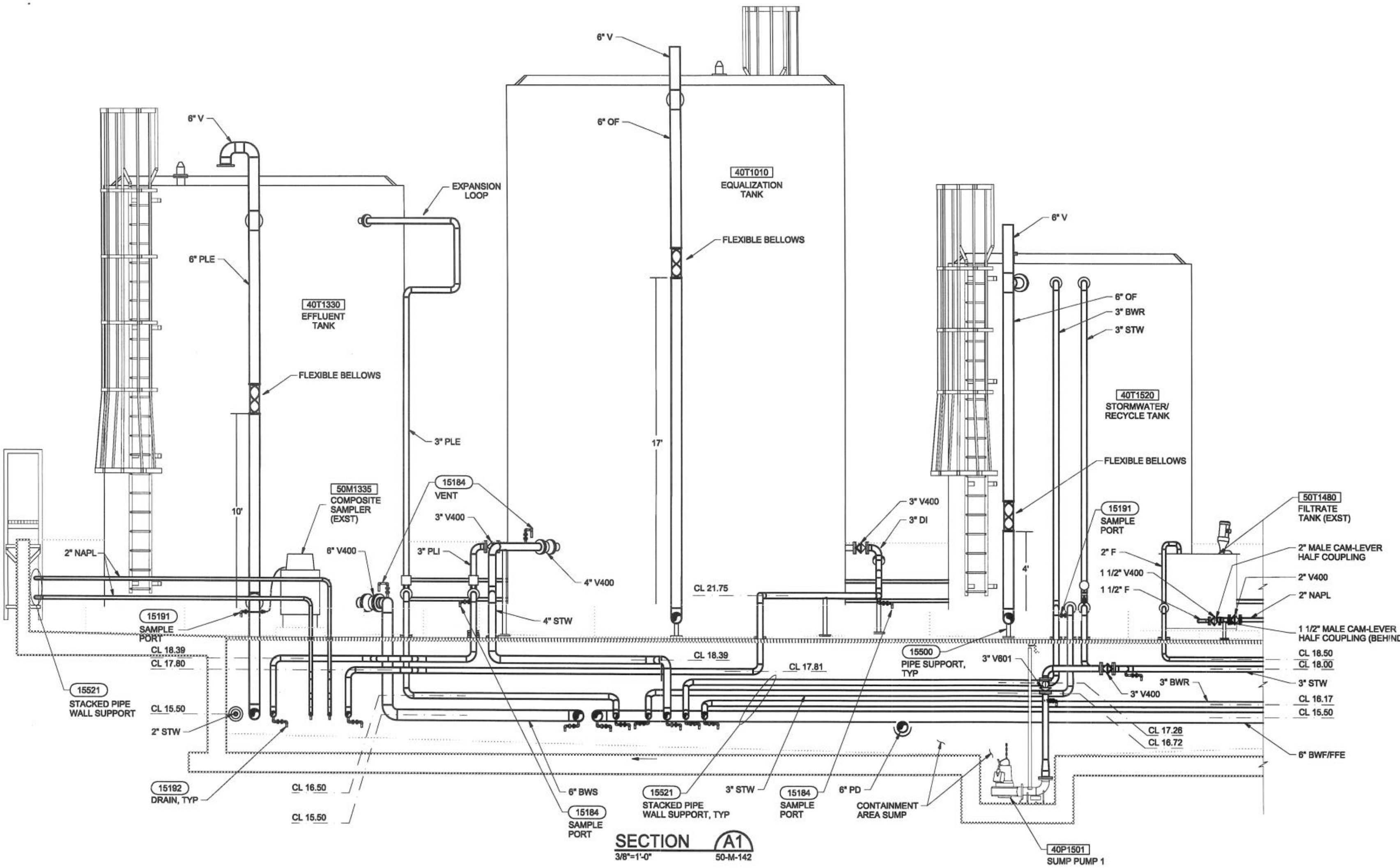
NOTES:

1. FOR TRANSITION FROM DOUBLE WALL TO SINGLE WALL PIPE USE TRANSITION FITTING.

DSGN							
DR							
CHK							
APVD		1	1/04/08	1 1/2 " NAPL Lines Changed to 2" NAPL Lines. Added FRE-OD Plug Valve Between Decant Pumps and Froth Tank.	ROW		
		NO.	DATE		BY	APVD	

TREATMENT FACILITY
MECHANICAL
SECTIONS

SHEET	52
DWG	50-M-203
DATE	
PROJ	

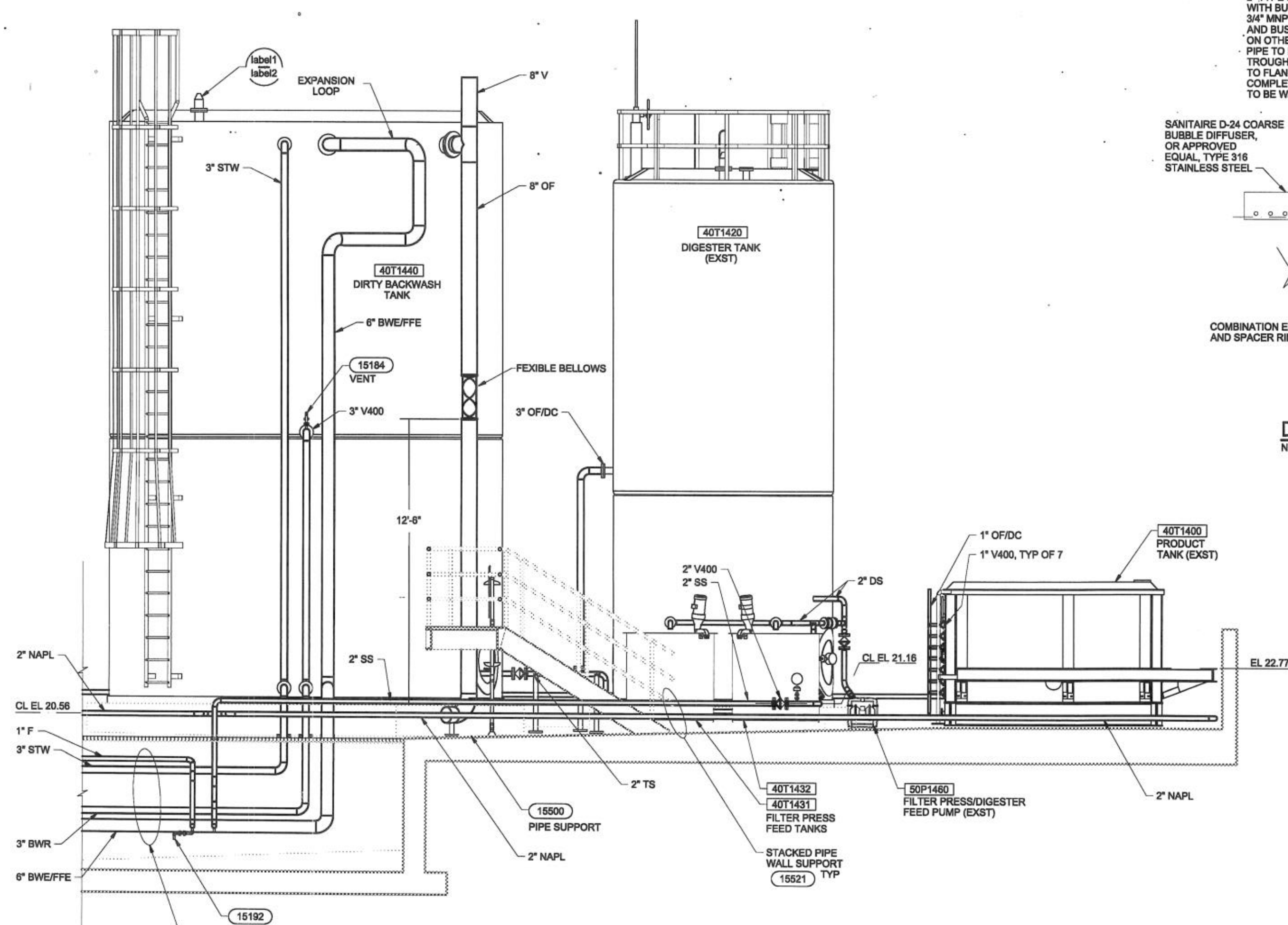


SECTION A1
3/8"=1'-0" 50-M-142

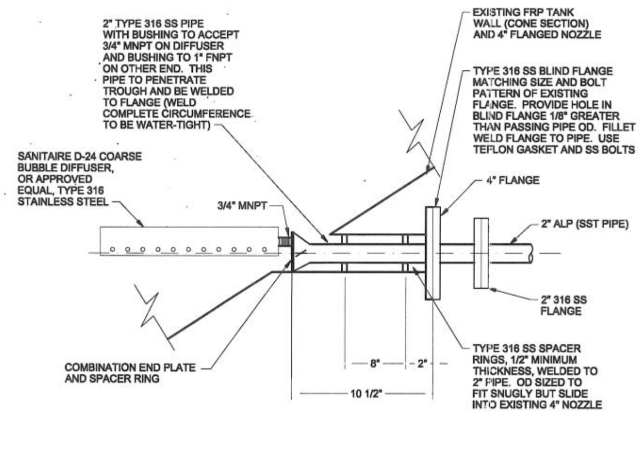
DSGN					
DR					
CHK					
APVD		1	1/04/08	1 1/2 " NAPL Line Changed to 2" NAPL Line. Inserted Flexible Bellows on 6-Inch Standpipes (3 Total). Added Expansion Loop on 3" PLE Line to Effluent Tank.	ROW	
		NO.	DATE		BY	APVD

TREATMENT FACILITY
MECHANICAL SECTIONS

SHEET	55
DWG	50-M-206
DATE	
PROJ	



SECTION A2
3/8"=1'-0" 50-M-142



DIGESTER TANK AERATOR DETAIL 1
NTS 50-M-208

DSGN		NO.	DATE	REVISION	BY	APVD
DR						
CHK						
APVD						

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

CH2MHILL

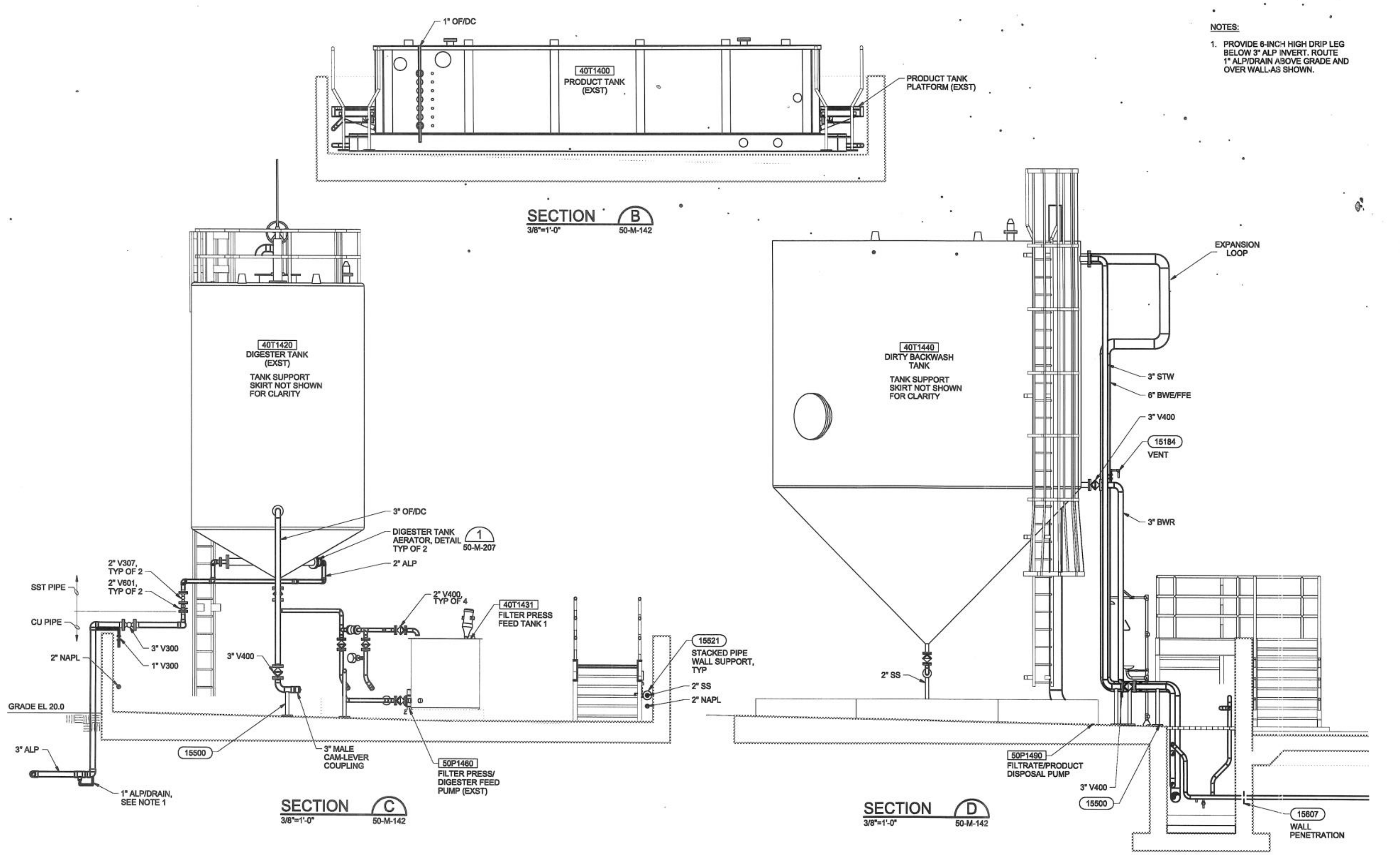
TREATMENT FACILITY
MECHANICAL
SECTION AND DETAIL

SHEET	56
DWG	50-M-207
DATE	
PROJ	

FILENAME: $FILENAME PLOT DATE: $PLOTDATE PLOT TIME: $PLOTTIME

NOTES:

1. PROVIDE 6-INCH HIGH DRIP LEG BELOW 3" ALP INVERT. ROUTE 1" ALP/DRAIN ABOVE GRADE AND OVER WALL-AS SHOWN.

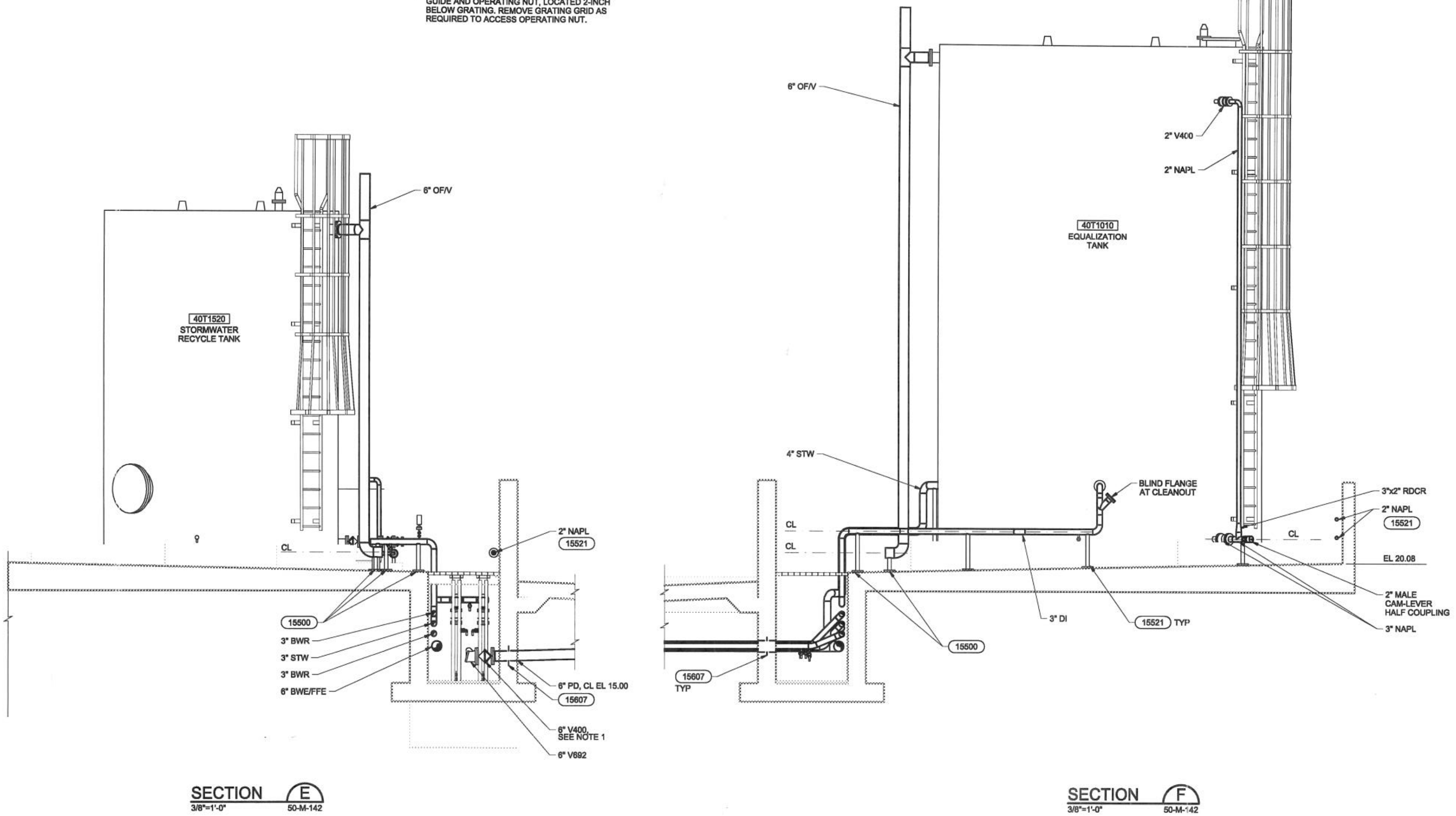


DSGN					VERIFY SCALE	CH2MHILL		TREATMENT FACILITY	SHEET	57
DR					BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"			MECHANICAL SECTIONS	DWG	50-M-208
CHK	1	1/04/09	Added Expansion Loop on 6-Inch BWE/FFE Line from Dirty Backwash Tank	ROW	IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.				DATE	
APVD	NO.	DATE	REVISION	BY APVD					PROJ	

FILENAME: $FILENAME PLOT DATE: $PLOTDATE PLOT TIME: $PLOTTIME

NOTES:

1. PROVIDE VALVE WITH EXTENSION STEM, STEM GUIDE AND OPERATING NUT, LOCATED 2-INCH BELOW GRATING. REMOVE GRATING GRID AS REQUIRED TO ACCESS OPERATING NUT.



DSGN				
DR				
CHK	1	1/04/09	Changed 1 1/2" NAPL Line to 2" NAPL Line.	ROW
APVD	NO.	DATE	REVISION	BY / APVD

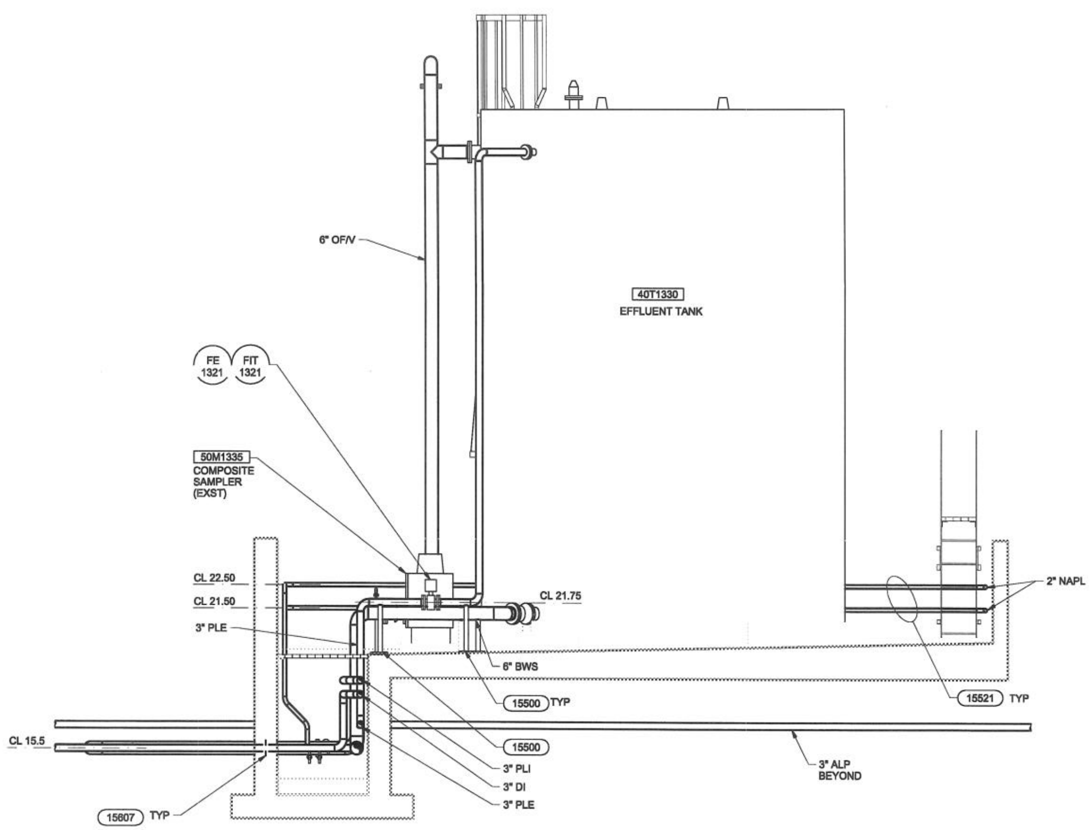
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

CH2MHILL

TREATMENT FACILITY
MECHANICAL SECTIONS

SHEET	58
DWG	50-M-209
DATE	
PROJ	

FILENAME: $FILENAME PLOT DATE: $PLOTDATE PLOT TIME: $PLOTTIME



SECTION G
3/8"=1'-0" 50-M-142

DSGN		NO.	DATE	REVISION	BY	APVD
DR		1	1/04/09	Changed 1 1/2" NAPL Line to 2" NAPL Line	ROW	
CHK						
APVD						

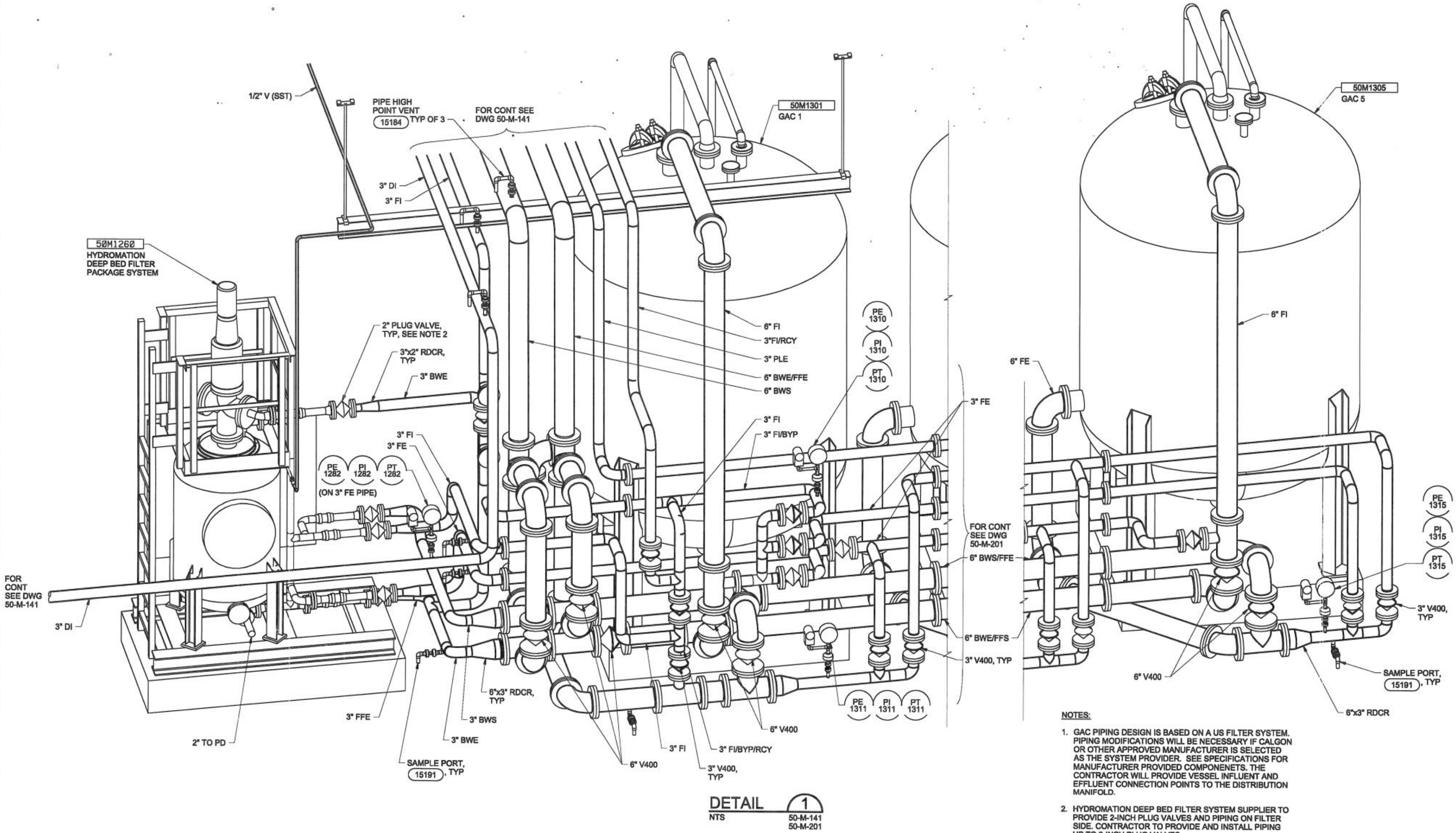
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

CH2MHILL

TREATMENT FACILITY
MECHANICAL
SECTIONS

SHEET	59
DWG	50-M-210
DATE	
PROJ	

FILENAME: $FILENAME PLOT DATE: $PLOTDATE PLOT TIME: $PLOTTIME



DETAIL 1
NTS
50-M-141
50-M-201

NOTES:

1. GAC PIPING DESIGN IS BASED ON A US FILTER SYSTEM. PIPING MODIFICATIONS WILL BE NECESSARY IF CALGON OR OTHER APPROVED MANUFACTURER IS SELECTED AS THE SYSTEM PROVIDER. SEE SPECIFICATIONS FOR MANUFACTURER PROVIDED COMPONENETS. THE CONTRACTOR WILL PROVIDE VESSEL INFLUENT AND EFFLUENT CONNECTION POINTS TO THE DISTRIBUTION MANIFOLD.
2. HYDROMATION DEEP BED FILTER SYSTEM SUPPLIER TO PROVIDE 2-INCH PLUG VALVES AND PIPING ON FILTER SIDE. CONTRACTOR TO PROVIDE AND INSTALL PIPING UP TO 2-INCH PLUG VALVES.

NO.	DATE	REVISION	BY	APVD
1	1/05/09	Removed 1" FI/SA Line	ROW	

DSGN
DR
CHK
APVD

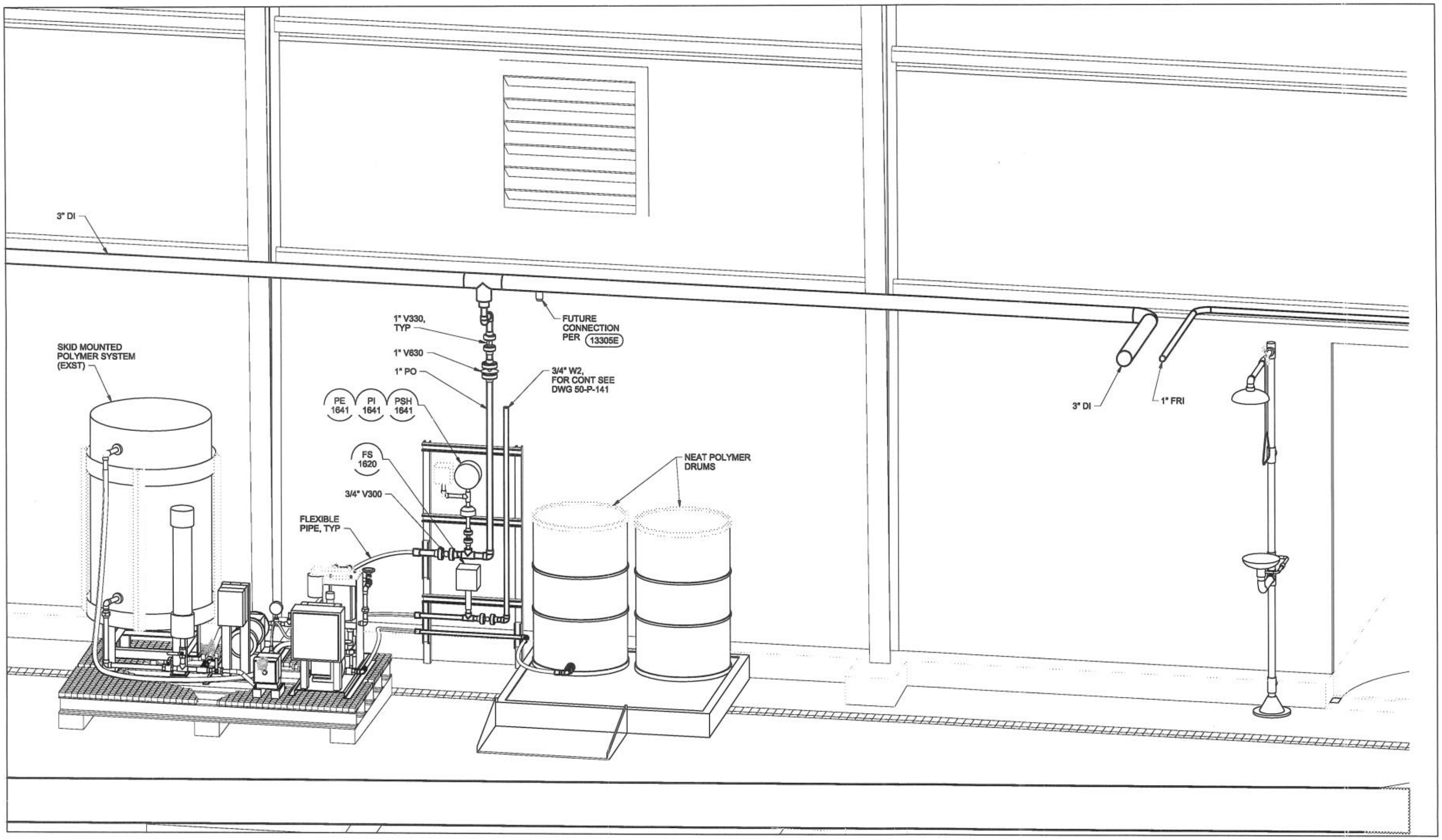
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

CH2MHILL

TREATMENT FACILITY
MECHANICAL
DETAILS

SHEET 60
DWG 50-M-401
DATE
PROJ

FILENAME: $FILENAME
PLOT DATE: $PLOTDATE
PLOT TIME: $PLOTTIME



DETAIL 2
NTS 50-M-141

DSGN					
DR					
CHK	1	1/05/09	Removed 1" FI/SA Line		
APVD	NO.	DATE	REVISION	BY	APVD

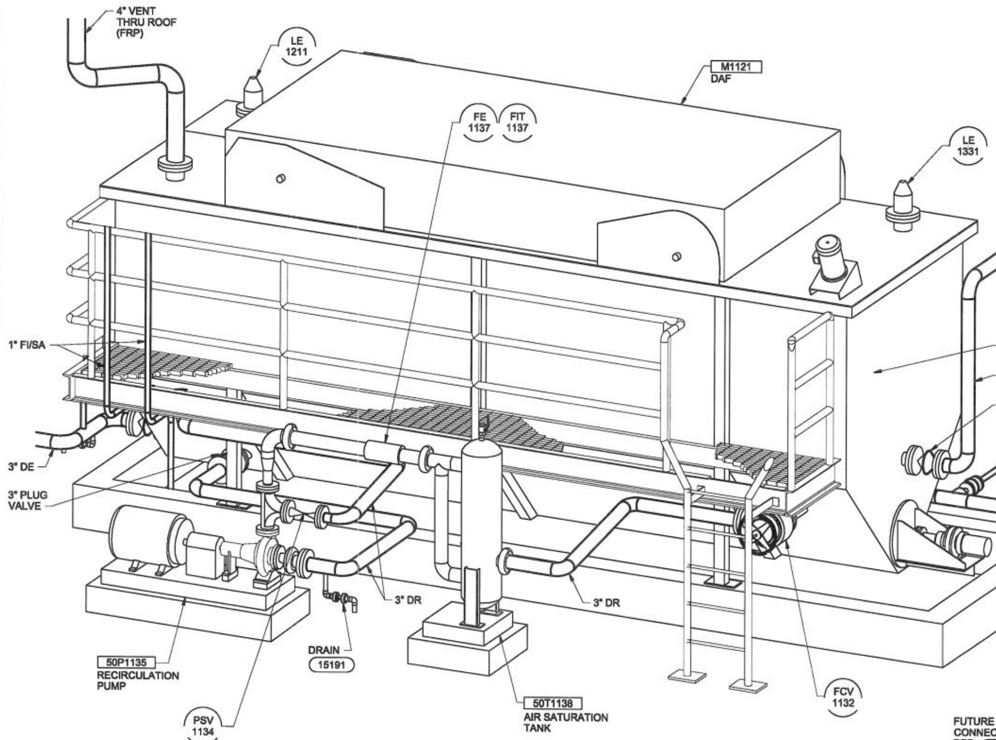
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

CH2MHILL

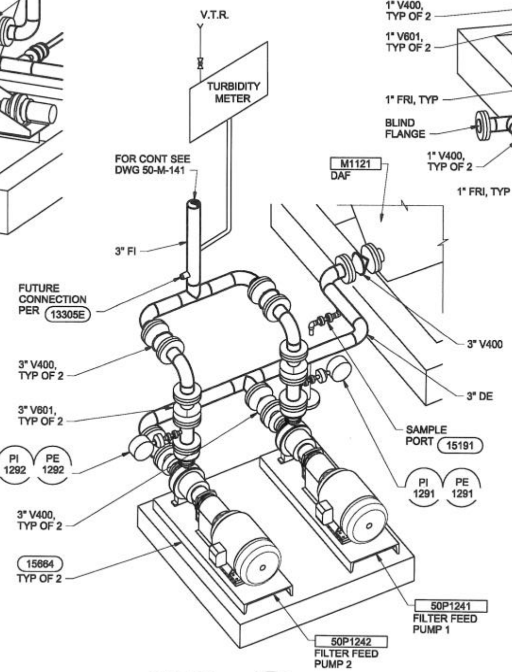
TREATMENT FACILITY
MECHANICAL DETAILS

SHEET	61
DWG	50-M-402
DATE	
PROJ	

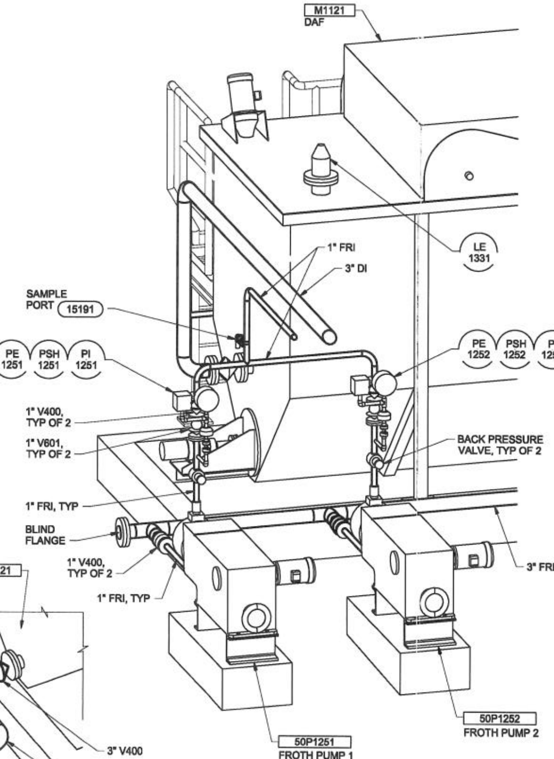
FILENAME: $FILENAME PLOT DATE: $PLOTDATE PLOT TIME: $PLOTTIME



DETAIL 3
NTS 50-M-141



DETAIL 5
NTS 50-M-141



DETAIL 4
NTS 50-M-141

NOTES:

1. ALL PIPING, VALVES AND EQUIPMENT ASSOCIATED WITH THE DAF RECYCLE SYSTEM ARE PROVIDED BY THE DAF SYSTEM SUPPLIER. CONTRACTOR TO PROVIDE ALL OTHER PIPING, VALVES AND EQUIPMENT TO MAKE A COMPLETE SYSTEM.

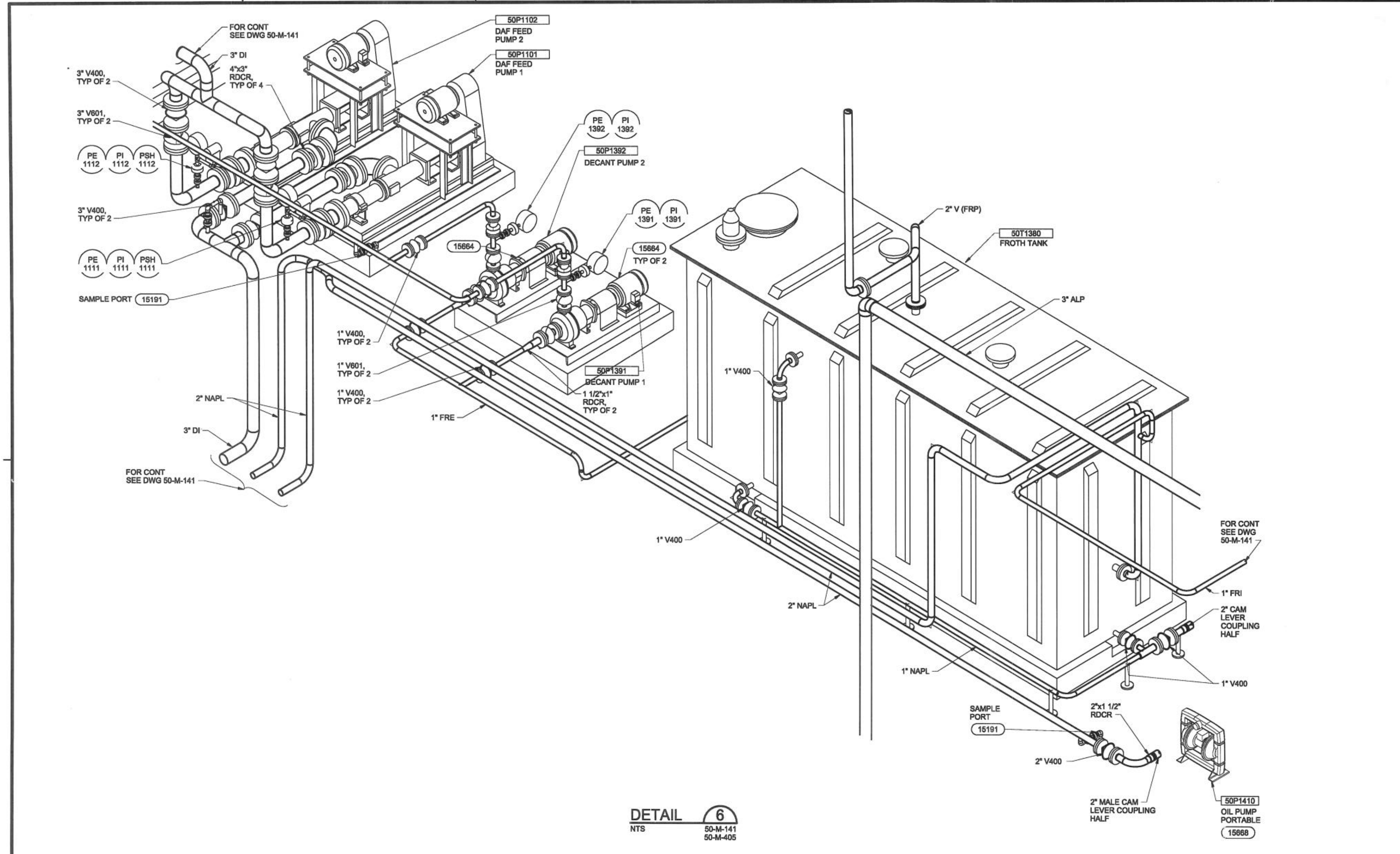
DSGN							VERIFY SCALE
DR							BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.
CHK							
APVD		NO.	DATE	REVISION	BY	APVD	

CH2MHILL

TREATMENT FACILITY
MECHANICAL
DETAILS

SHEET	62
DWG	50-M-403
DATE	
PROJ	

FILENAME: $FILENAME PLOT DATE: $PLOTDATE PLOT TIME: $PLOTTIME



DETAIL 6
NTS
50-M-141
50-M-405

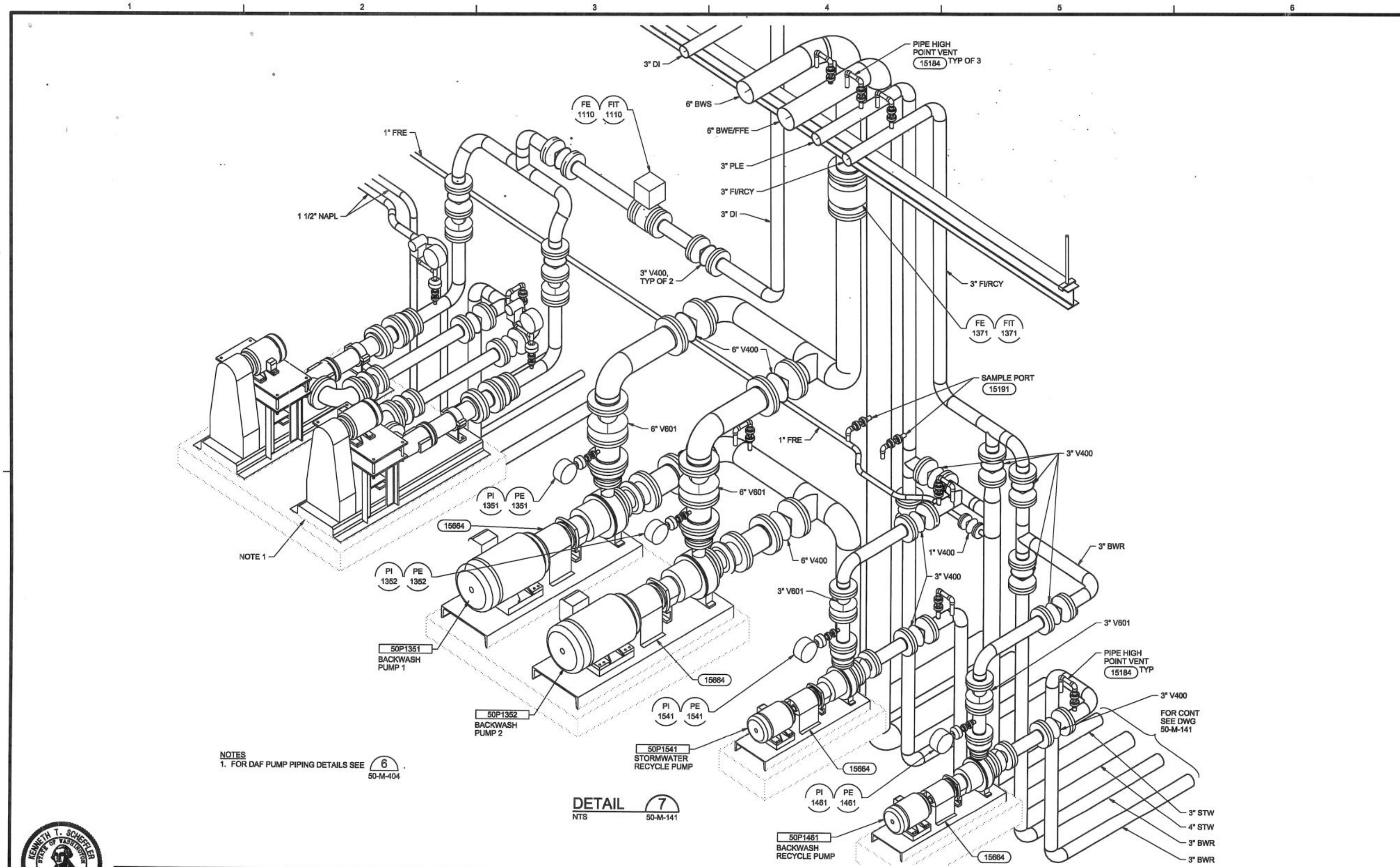
DSGN							VERIFY SCALE
DR							BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.
CHK	1	1/04/09	Changed 1 1/2" NAPL Lines to 2" NAPL Lines Changed 1 1/2" V400 Valve to 2" V400 Valve	ROW			
APVD	NO.	DATE	REVISION	BY	APVD		

CH2MHILL

TREATMENT FACILITY
MECHANICAL
DETAILS

SHEET	63
DWG	50-M-404
DATE	
PROJ	

FILENAME: $FILENAME PLOT DATE: $PLOTDATE PLOT TIME: $PLOTTIME



NOTES
1. FOR DAF PUMP PIPING DETAILS SEE 6 50-M-404.

DETAIL 7 50-M-141
NTS

KENNETH T. SCHEFFLER, STATE OF WASHINGTON, REGISTERED PROFESSIONAL ENGINEER
EXPIRES 05/17/06

DSGN GT HICKMAN						VERIFY SCALE
DR ER BROWN						BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
CHK MW DAVIS						IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.
APVD KT SCHEFFLER	NO.	DATE	REVISION	BY	APVD	

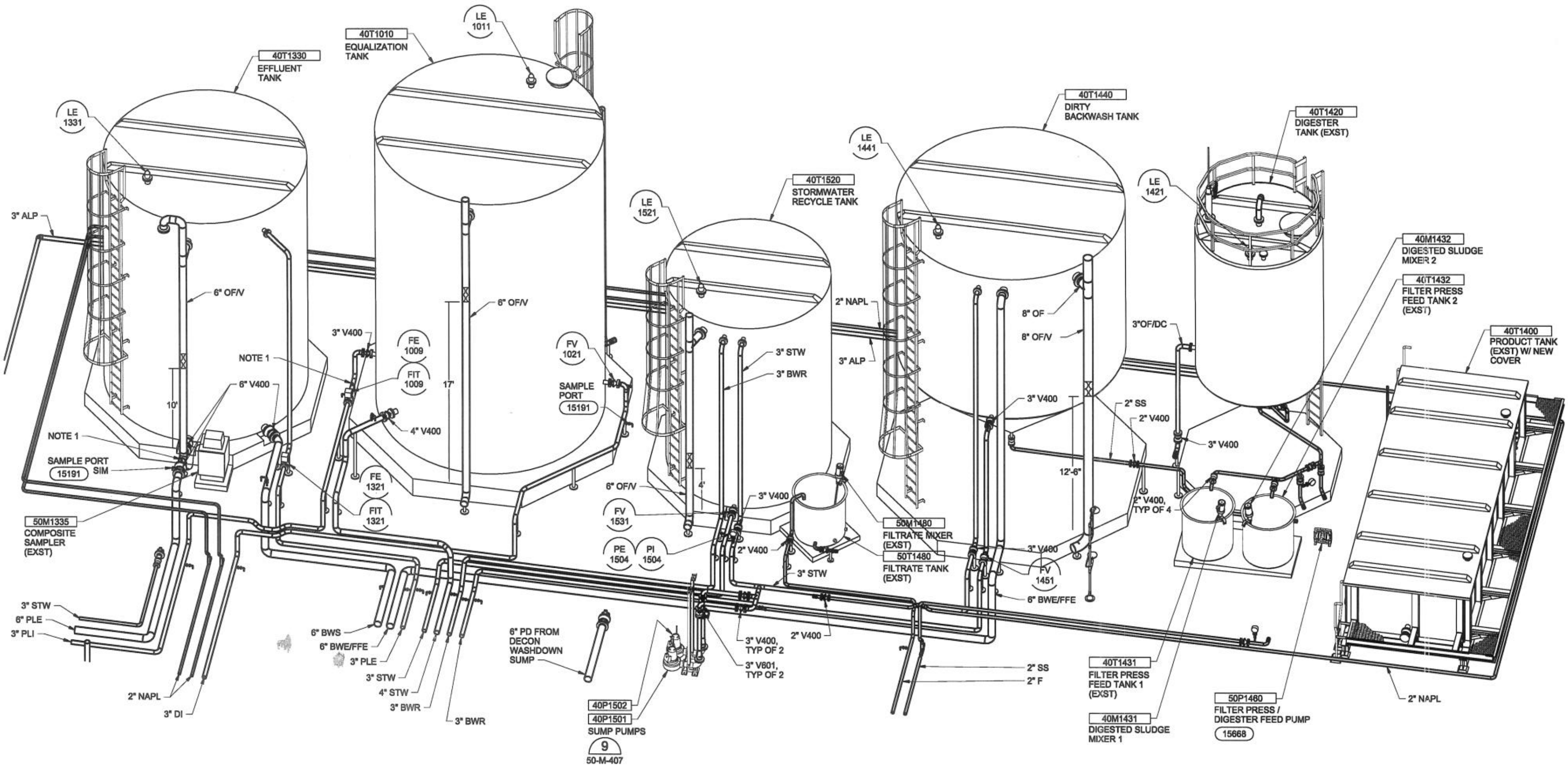
CH2MHILL

US ENVIRONMENTAL PROTECTION AGENCY
WYCKOFF GROUNDWATER TREATMENT PLANT
BAINBRIDGE ISLAND, WA

TREATMENT FACILITY
MECHANICAL
DETAILS

SHEET	64
DWG	50-M-405
DATE	JANUARY 4 2006
PROJ	316783.FD.B

FILENAME: 50nm405d_316783.dgn PLOT DATE: 01/03/2006 PLOT TIME: 6:40:52 PM



NOTES:

1. PROVIDE FUTURE CONNECTION PER (13305E).
2. DIRTY BACKWASH TANK SKIRT AND DIGESTER TANK SKIRT NOT SHOWN FOR CLARITY.

DETAIL (8)
NTS 50-M-142

DSGN		NO.	DATE	REVISION	BY	APVD
DR						
CHK						
APVD						

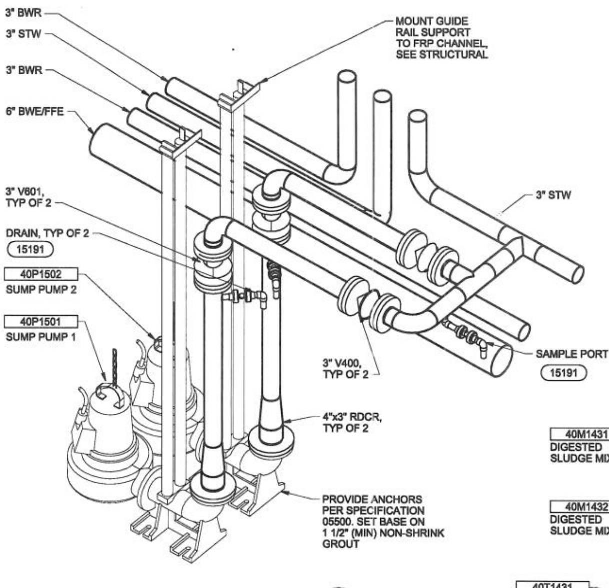
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

CH2MHILL

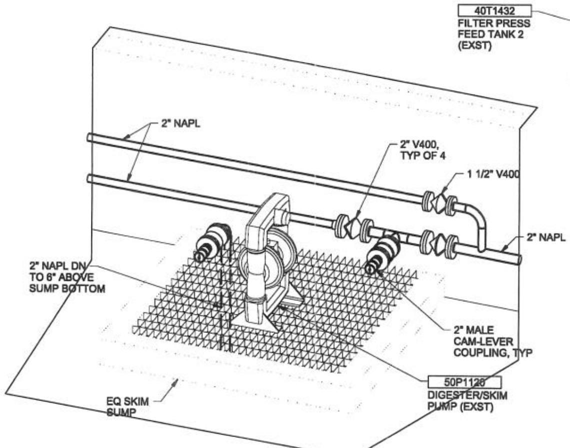
TREATMENT FACILITY
MECHANICAL
DETAILS

SHEET	65
DWG	50-M-406
DATE	
PROJ	

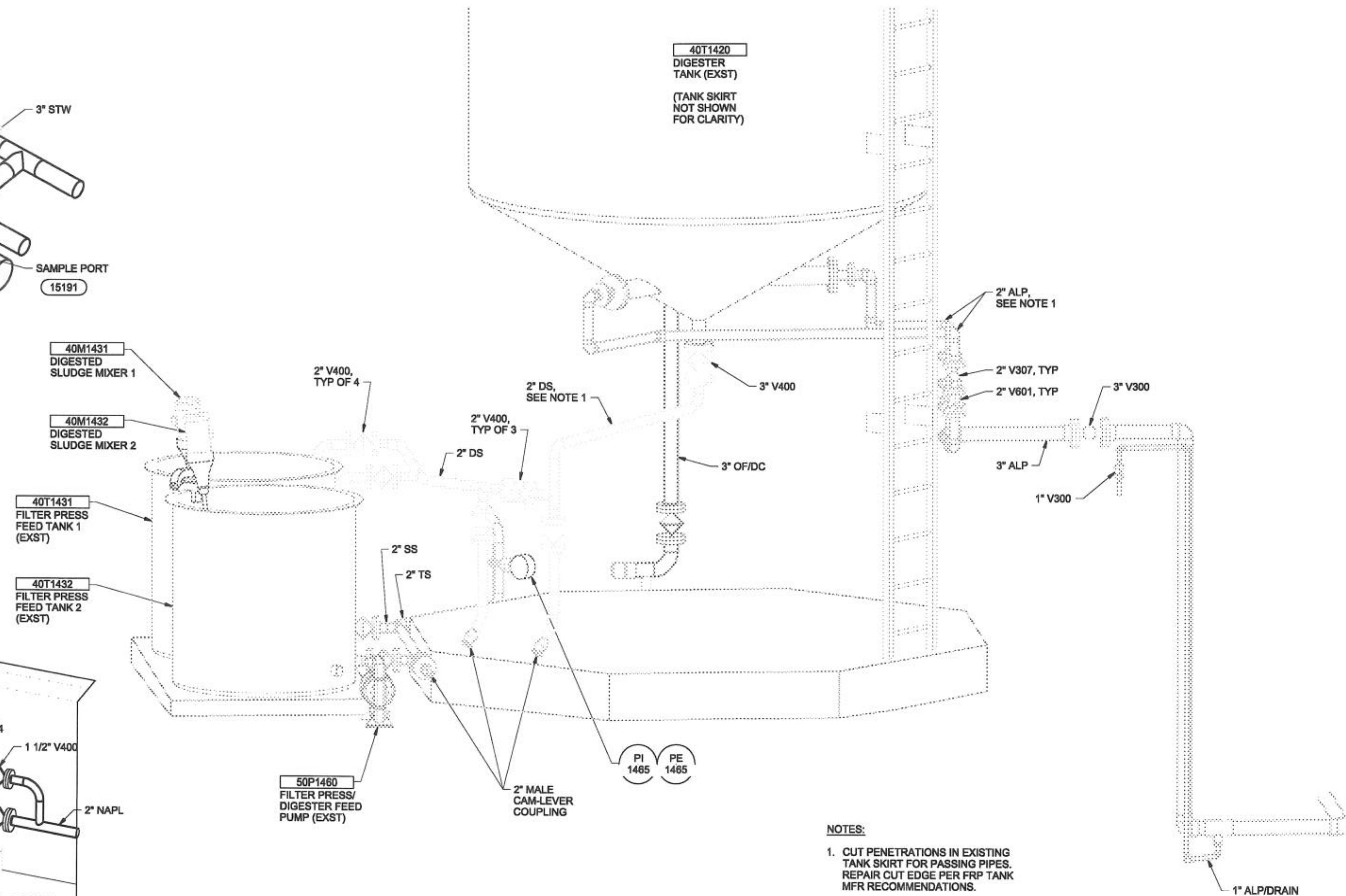
FILENAME: $FILENAME PLOT DATE: $PLOTDATE PLOT TIME: $PLOTTIME



DETAIL 9
NTS
50-M-142
50-M-406



DETAIL 10
NTS
50-M-142



NOTES:

1. CUT PENETRATIONS IN EXISTING TANK SKIRT FOR PASSING PIPES. REPAIR CUT EDGE PER FRP TANK MFR RECOMMENDATIONS.

DETAIL 11
NTS
50-M-142

DSGN		NO.	DATE	REVISION	BY	APVD
DR						
CHK						
APVD						

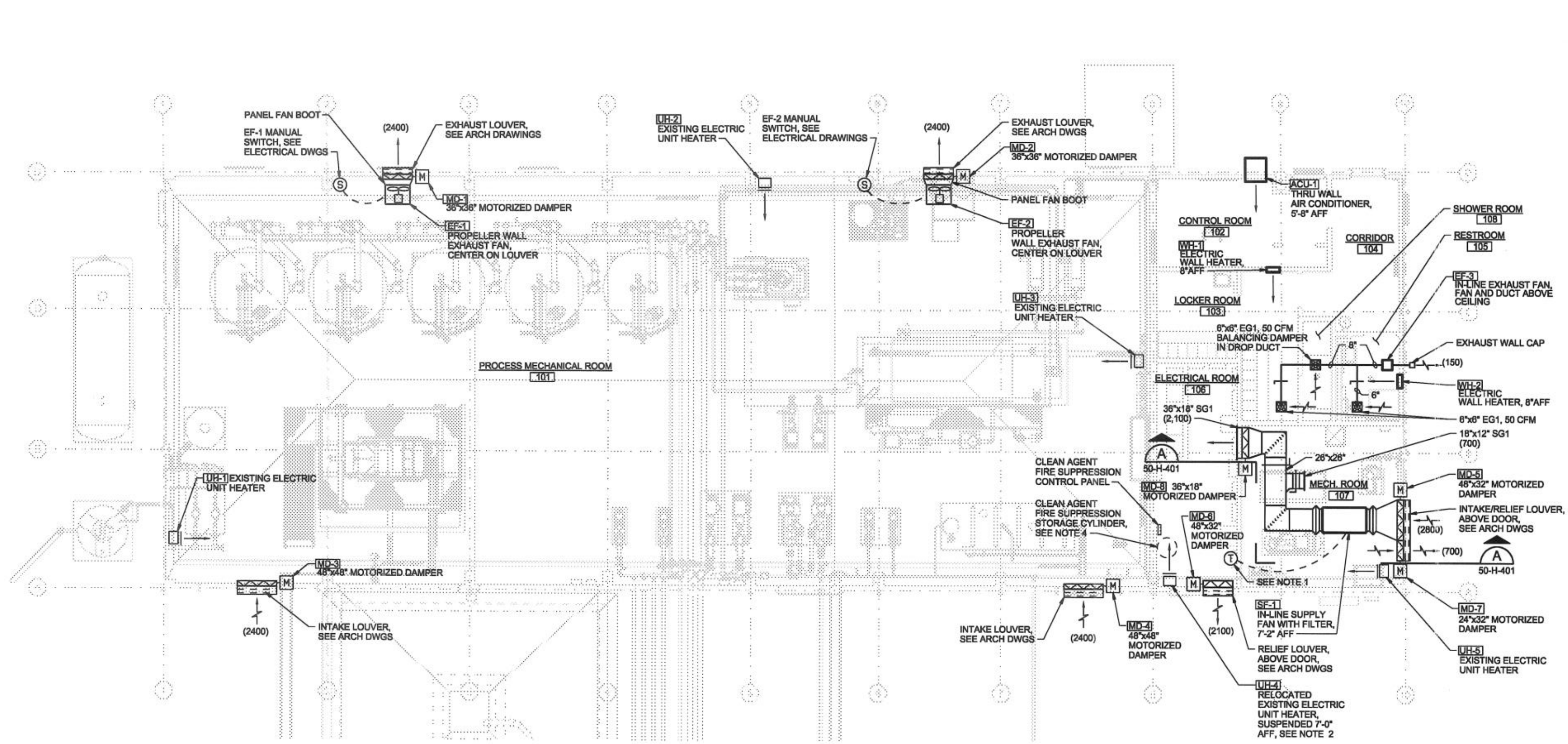
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

CH2MHILL

TREATMENT FACILITY
MECHANICAL DETAILS

SHEET	66
DWG	50-M-407
DATE	
PROJ	

FILENAME: $FILENAME PLOT DATE: $PLOTDATE PLOT TIME: $PLOTTIME



NOTES:

1. SF-1 THERMOSTAT (TSH-1), 120 VOLT, 2 POSITION, 50 TO 90 DEGREES F DIAL, EXTERNAL ADJUSTMENTS, ADJUSTABLE SENSITIVITY, NON-LOCKING WIRE PROTECTIVE GUARD, HONEYWELL T6051 OR EQUAL.
2. RELOCATE EXISTING ELECTRIC UNIT HEATER AND RELATED THERMOSTAT FROM NORTHWEST CORNER OF CONTROL ROOM TO LOCATION SHOWN.
3. SEE ELECTRICAL DRAWINGS FOR CONTROL WIRING DIAGRAMS FOR VENTILATION FAN SYSTEMS.
4. FOR FIRE SUPRESSION SYSTEM SEE SPECIFICATION SECTION 13935.

HVAC PLAN
3/16"=1'-0"

THEODORE JAMES PRICE — STATE OF WASHINGTON — REGISTERED PROFESSIONAL ENGINEER
EXPIRES 8/03/05

DSGN	KL WELP
DR	KL WELP
CHK	TJ PRICE
APVD	KT SCHEFFLER

NO.	DATE	REVISION	BY	APVD

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

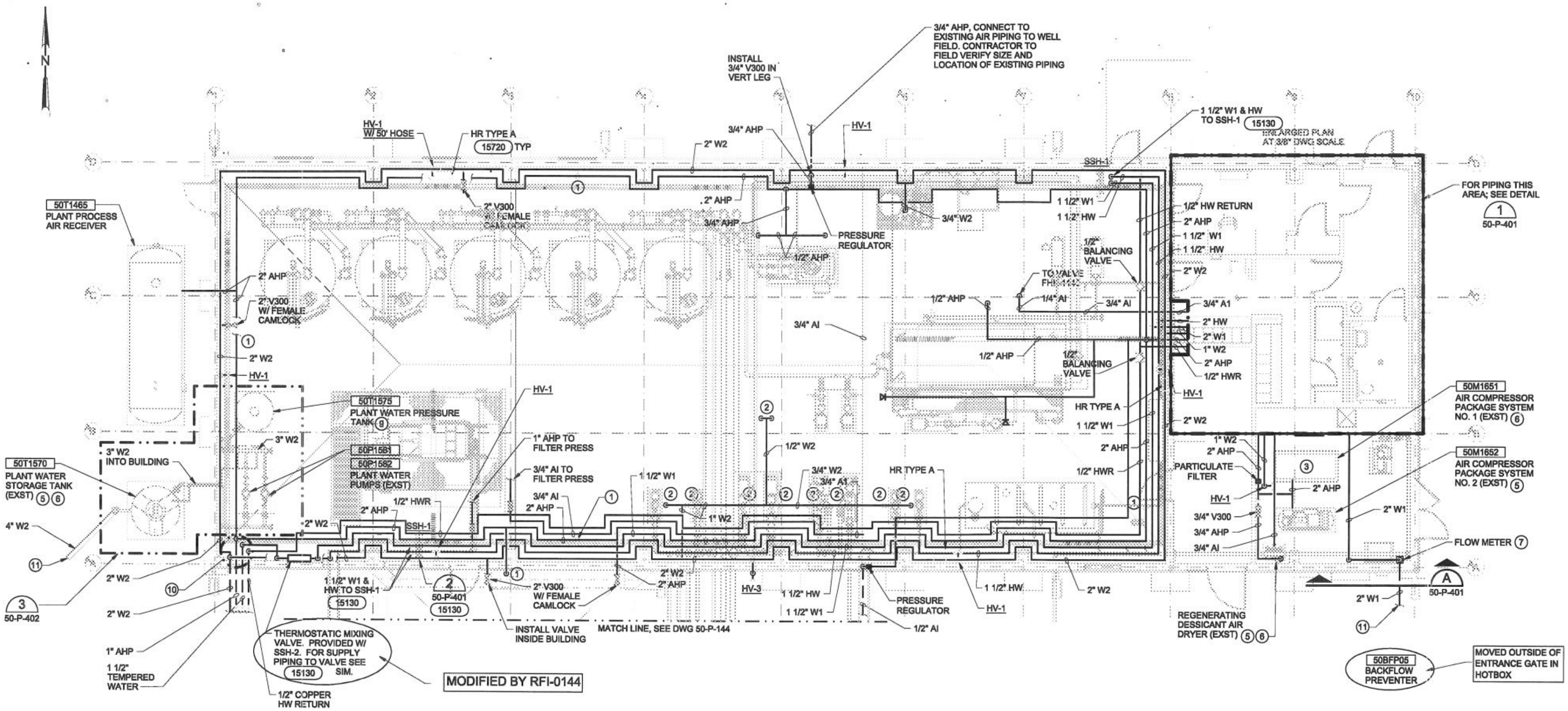
CH2MHILL

US ENVIRONMENTAL PROTECTION AGENCY
WYCKOFF GROUNDWATER TREATMENT PLANT
BAINBRIDGE ISLAND, WA

TREATMENT FACILITY
HVAC
PLAN

SHEET	67
DWG	50-H-141
DATE	JANUARY 4 2006
PROJ	316783.FD.B

FILENAME: 50nh141d_316783.dgn PLOT DATE: 01/03/2006 PLOT TIME: 6:44:26 PM



1. AIR STATION - SEE 15100
2. 1/2" W2 PIPING DROP FOR PUMP SEAL; SEE 15664
3. CONTRACTOR TO RUN PIPING TO SUIT TO CONNECT UP TO EXISTING COMPRESSORS.
4. PIPING ALONG WALLS IN PROCESS AREAS SHOWN SPACED OUT FOR CLARITY; CONTRACTOR TO STACK PIPING AND RUN TO SUIT.
5. SEE DWG 05-C-100 AND SPECIFICATION 01645 FOR EXISTING EQUIPMENT RELOCATION INFORMATION.
6. SEE DWG 50-DME-141 FOR EXISTING EQUIPMENT LOCATION.
7. CONTRACTOR TO COORDINATE REQUIREMENTS OF FLOW METER WITH CITY OF BAINBRIDGE ISLAND. CONTRACTOR TO PROVIDE FLOWMETER PER CITY REQUIREMENTS.
8. DO NOT RUN PIPING IN FRONT OF LOUVERS.
9. SEE SPECIFICATION 15440 FOR DETAILS.
10. PROVIDE V300 IN VERTICAL LEG OF PIPE PRIOR TO LEAVING THE BUILDING.
11. SEE DWG 05-CY-101 FOR CONTINUATION.

TREATMENT BUILDING PLAN

3/16"=1'-0"

DSGN		NO.	DATE	REVISION	BY	APVD
DR						
CHK						
APVD						

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

CH2MHILL

TREATMENT FACILITY
PLUMBING
TREATMENT BUILDING
SERVICE PIPING PLAN

SHEET	69
DWG	50-P-141
DATE	
PROJ	

FILENAME: $FILENAME PLOT DATE: $PLOTDATE PLOT TIME: $PLOTTIME

FANS

15830

SYMBOL	SERVICE	TYPE	FAN DATA: AIRFLOW MAXIMUM CFM	AIRFLOW @ SP IN. WG	AIRFLOW MINIMUM CFM	SPEED RPM	DRIVE TYPE	MAXIMUM BHP	SOUND DATA: MAX. FAN SOUND POWER LEVEL dB (RE 10^{-12} W) @ MID OCTAVE BAND FREQUENCY (Hz) 63	125	250	500	1K	2K	4K	8K	LwA	dBA	SONES	ELECTRICAL DATA: MOTOR HP	MOTOR RPM	ENCLOSURE	VOLT	PH	MAXIMUM DIMENSIONS: PHYSICAL SIZE INCHES L	W	H	WEIGHT LBS.	MANUFACTURER AND MODEL NO.	APPLICABLE REMARKS
SF-1	ELECTRICAL ROOM VENTILATION	INLINE FAN, CENTRIFUGAL, SQUARE	2,800	0.90	2,800	962	BELT	0.817	76	77	76	73	70	68	62	55	76	76	12.5	1	1725	TEFC	460	3	32	30	45	356	COOK; 195SQN-B	A
EF-1	PROCESS MECH RM VENTILATION	WALL FAN, PROPELLER, HEAVY DUTY	2,400	0.35	2,400	898	BELT	0.325	84	84	78	73	69	65	62	55	76	76	14.5	1/2	1725	TEFC	120	1	23	31	31	205	COOK; 24XMWH	A
EF-2	PROCESS MECH RM VENTILATION	WALL FAN, PROPELLER, HEAVY DUTY	2,400	0.35	2,400	898	BELT	0.325	84	84	78	73	69	65	62	55	76	76	14.5	1/2	1725	TEFC	120	1	23	31	31	205	COOK; 24XMWH	A
EF-3	LOCKER/SHOWER/RESTROOM VENT	CABINET FAN, CENTRIFUGAL	150	0.25	150	1,174	DIRECT	58 WATTS	58	52	50	46	33	24	27	31	47	47	1.5	2.2 AMPS	1174	STANDARD	120	1	14	12	11	29	COOK; GN-320	A

REMARKS:

A: SEE SPECIFICATION FOR REQUIRED ACCESSORIES.

ROOM AIR CONDITIONER

15730

SYMBOL	LOCATION	INDOOR FAN DATA: SUPPLY AIR CFM	OUTSIDE AIR CFM	DX COOLING DATA: TOTAL BTU/H	EER	ELEC HEAT DATA: TOTAL BTU/H	kW	UNIT ELECTRICAL DATA: AMPS	VOLT	PH	UNIT DIMENSIONS: INCHES H	W	D	MAX WEIGHT LBS.	MANUFACTURER AND MODEL NO.	REMARKS
ACU-1	CONTROL ROOM 102	310	40	12,000	11.0	10,700	3.5	16.0	230	1	16	26	28	111	FRIEDRICH; ES12L33	A, B, C, D

REMARKS:

A. THROUGH THE WALL SLEEVE
B. FRESH AIR INTAKE AND EXHAUST VENTS
C. FILTER AND HOUSING
D. THREE SPEED COOLING AND HEATING AND FAN ONLY SETTINGS

ELECTRIC WALL HEATER

15760

SYMBOL	SERVING	AIRFLOW CFM	ELECTRIC DATA: CAPACITY BTUH	CAPACITY kW	AMPS	VOLT	PH	MAX. UNIT DIMENSIONS: PHYSICAL SIZE INCHES H	W	D	WEIGHT LBS	MANUFACTURER AND MODEL NO.	APPLICABLE REMARKS
WH-1	LOCKER ROOM 103	100	13,650	4.0	16.7	240	1	20	16	5.5	-	QMARK; CWH-3404	A
WH-2	RESTROOM 105	100	6,830	2.0	16.7	240	1	20	16	5.5	-	QMARK; CWH-3404	A

REMARKS:

A: RECESSED MOUNT

SEQUENCE OF OPERATION

ELECTRICAL ROOM VENTILATION COOLING:

ON CALL FOR COOLING FROM THE ELECTRICAL ROOM THERMOSTAT, TSH-1, MOTORIZED DAMPERS MD-5, 6, 7, [illegible] SHALL OPEN, THEN SUPPLY FAN SF-1 SHALL START. WHEN THE THERMOSTAT IS SATISFIED THE FAN SHALL STOP AND THE DAMPERS SHALL CLOSE. AN ALARM SIGNAL FROM THE ELECTRICAL ROOM FIRE SUPPRESSION SYSTEM SHALL OVERRIDE THE THERMOSTAT, STOPPING THE FAN AND CLOSING THE DAMPERS.

PROCESS MECHANICAL ROOM VENTILATION COOLING:

WHEN THE MANUAL START SWITCH FOR EXHAUST FAN EF-1 IS TURNED ON, MOTORIZED DAMPERS MD-1 AND MD-3 SHALL OPEN AND EF-1 SHALL START. WHEN SWITCHED OFF THE FAN SHALL STOP AND THE DAMPERS SHALL CLOSE.

WHEN THE MANUAL START SWITCH FOR EXHAUST FAN EF-2 IS TURNED ON, MOTORIZED DAMPERS MD-2 AND MD-4 SHALL OPEN AND EF-2 SHALL START. WHEN SWITCHED OFF THE FAN SHALL STOP AND THE DAMPERS SHALL CLOSE.

LOCKER, SHOWER, RESTROOM VENTILATION:

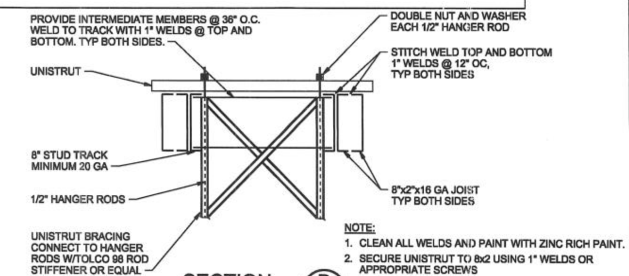
EXHAUST FAN EF-1 SHALL START WHEN THE LIGHTS ARE TURNED ON IN THE LOCKER ROOM OR THE RESTROOM. THE FAN SHALL CONTINUE TO OPERATE UNTIL 5 MINUTES AFTER THE LIGHTS ARE SWITCHED OFF IN BOTH ROOMS.

CONTROL ROOM HEATING AND COOLING:

THE CONTROL ROOM WILL BE HEATED AND COOLED BY AIR CONDITIONING UNIT ACU-1, CONTROLLED BY ACU-1 INTEGRAL CONTROLS.

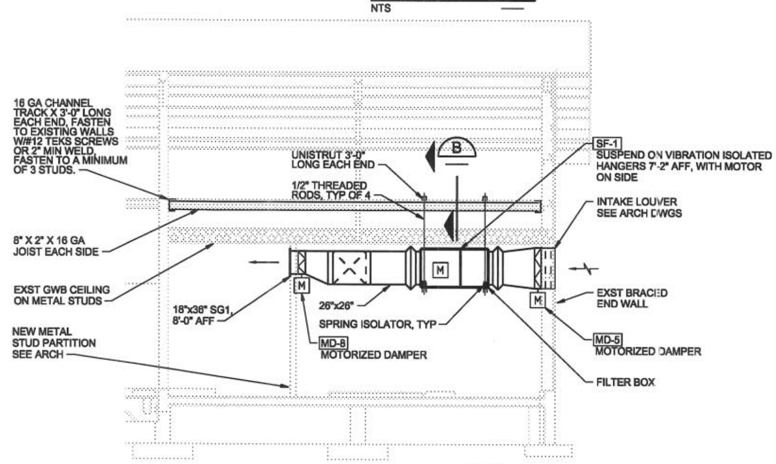
HEATING, GENERAL:

HEATING FOR THE PROCESS MECHANICAL, ELECTRICAL, MECHANICAL, LOCKER, AND RESTROOM IS PROVIDED BY UNIT HEATERS AND WALL HEATERS. THESE HEATERS ARE INDIVIDUALLY CONTROLLED BY INTEGRAL OR WALL MOUNTED THERMOSTATS.



SECTION B
NTS

NOTE:
1. CLEAN ALL WELDS AND PAINT WITH ZINC RICH PAINT.
2. SECURE UNISTRUT TO 8x2 USING 1" WELDS OR APPROPRIATE SCREWS



NOTE:
PROVIDE SEISMIC BRACING TO WITHSTAND MOTION IN EACH HORIZONTAL DIRECTION, Fp=325#

SECTION A
1/4"=1'-0"
50-H-141

THEODORE JAMES PRICE — STATE OF WASHINGTON — REGISTERED PROFESSIONAL ENGINEER
EXPIRES 8/03/06

DSGN KL WELP						
DR KL WELP						
CHK TJ PRICE						
APVD KT SCHEFFLER	NO.	DATE	REVISION	BY	APVD	

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

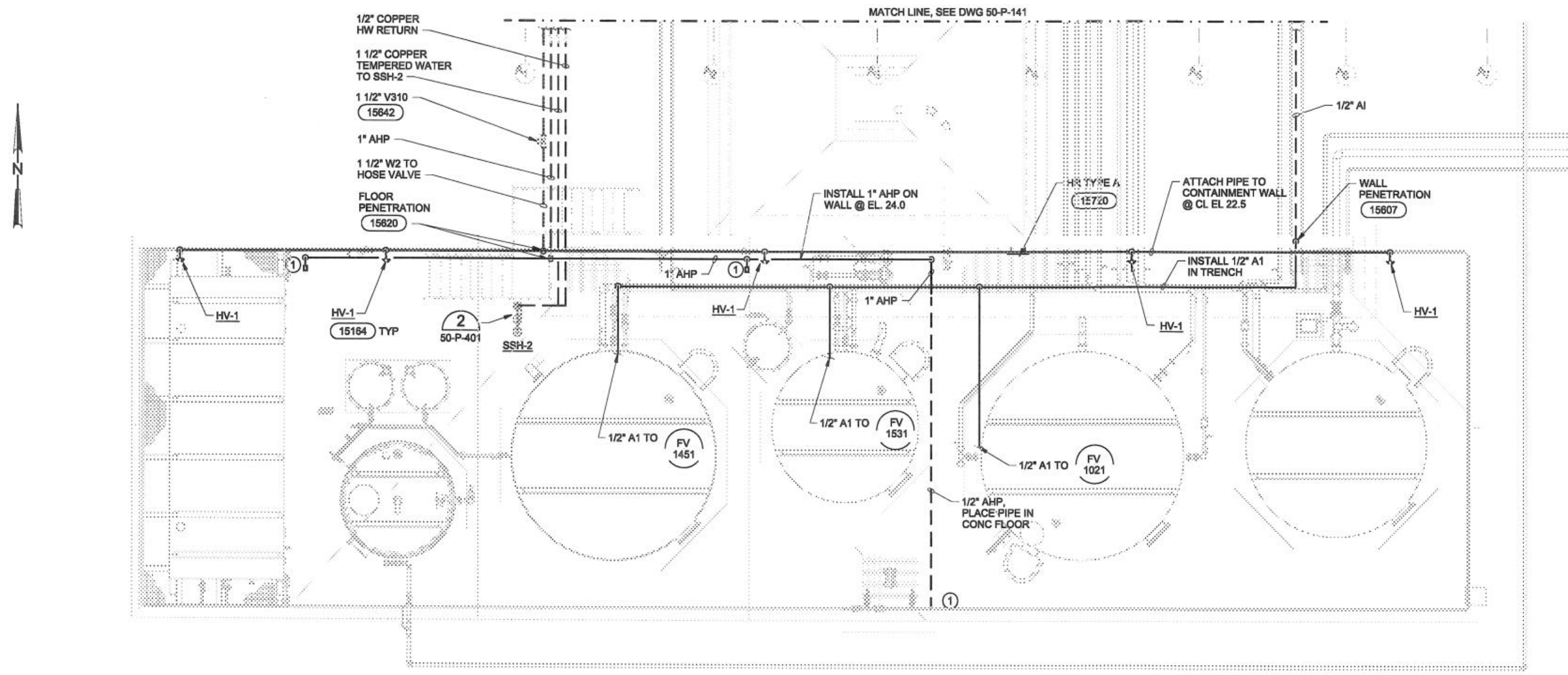
CH2MHILL

US ENVIRONMENTAL PROTECTION AGENCY
WYCKOFF GROUNDWATER TREATMENT PLANT
BAINBRIDGE ISLAND, WA

TREATMENT FACILITY
HVAC
EQUIPMENT SCHEDULES
AND SECTION

SHEET	68
DWG	50-H-401
DATE	JANUARY 4 2006
PROJ	316783.FD.B

FILENAME: 50nh401d_316783.dgn PLOT DATE: 01/03/2006 PLOT TIME: 6:45:13 PM



(1) AIR STATION (15100).

TANK FARM PLAN

3/16"=1'-0"

DSGN							
DR							
CHK		1	1/06/09	All HV-2 Fittings Changed to HV-1 Fittings per RFI 0115	ROW		
APVD		NO.	DATE	REVISION	BY	APVD	

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING.

0 1"

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

CH2MHILL

TREATMENT FACILITY

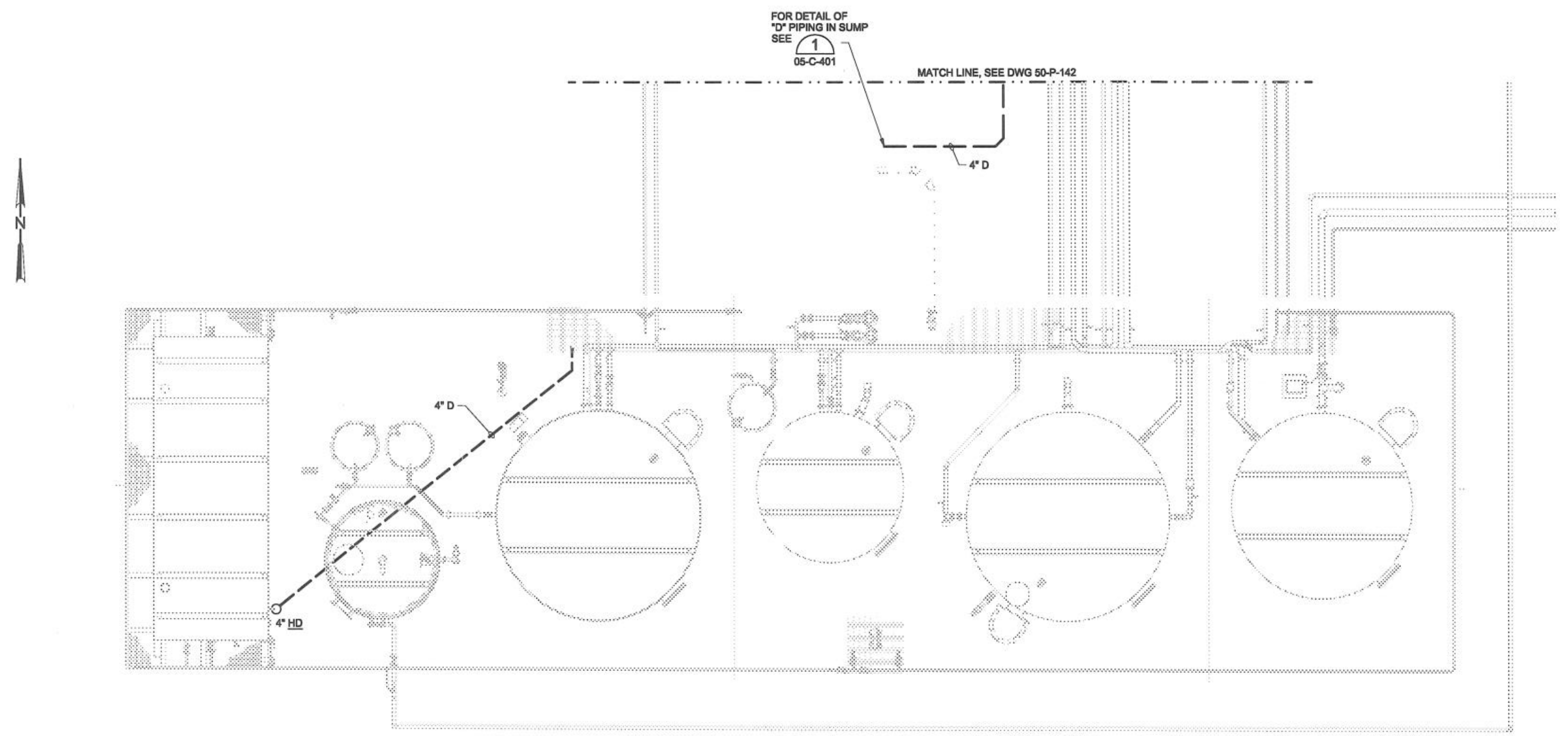
PLUMBING

TANK FARM

SERVICE PIPING PLAN

SHEET	71
DWG	50-P-143
DATE	
PROJ	

FILENAME: $FILENAME PLOT DATE: $PLOTDATE PLOT TIME: $PLOTTIME



TANK FARM PLAN

3/16"=1'-0"

DSGN					
DR					
CHK					
APVD	NO.	DATE	REVISION	BY	APVD

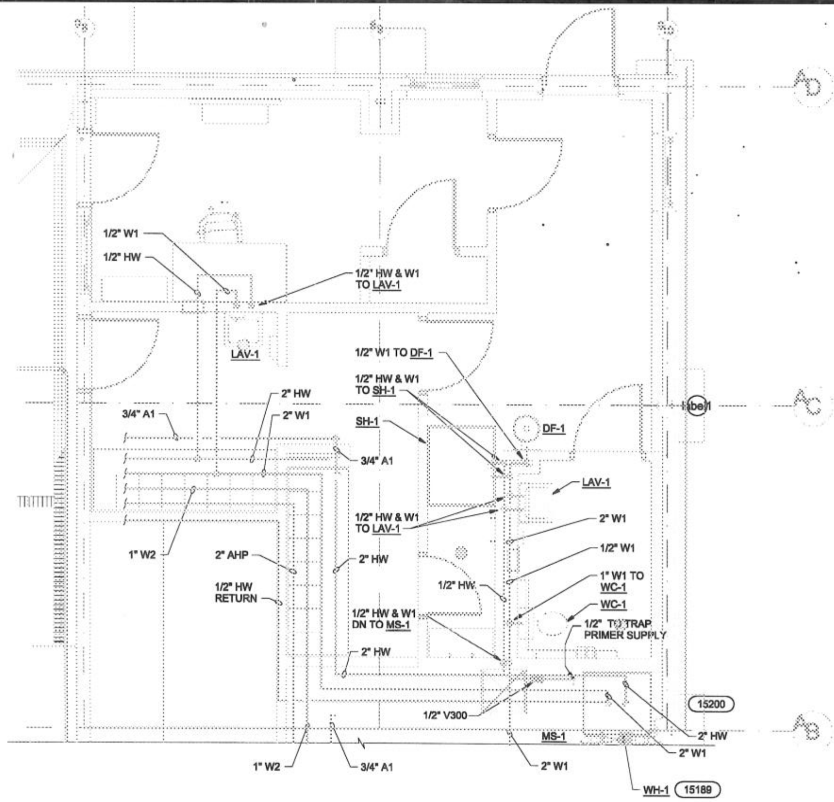
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

CH2MHILL

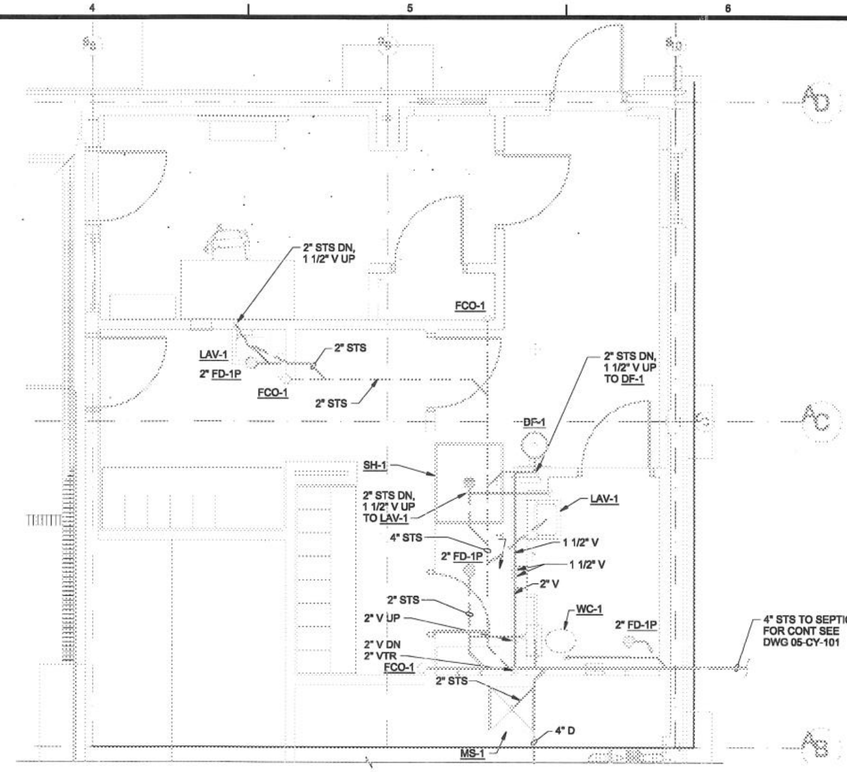
TREATMENT FACILITY
PLUMBING
TANK FARM
PROCESS DRAIN AND VENT PLAN

SHEET	72
DWG	50-P-144
DATE	
PROJ	

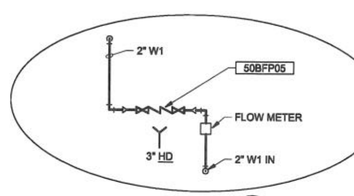
FILENAME: $FILENAME PLOT DATE: $PLOTDATE PLOT TIME: $PLOTTIME



SERVICE PIPING ENLARGED PLAN (1)
3/8"=1'-0"
50-P-141



DRAIN AND VENT ENLARGED PLAN (2)
3/8"=1'-0"
50-P-142



SECTION (A)
NTS
50-P-141

BACKFLOW PREVENTOR MOVED OUTSIDE OF ENTRANCE GATE IN HOTBOX

DSGN		NO.	DATE	REVISION	BY	APVD	VERIFY SCALE BAR IS ONE INCH ON ORIGINAL DRAWING. 0 — 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.	CH2MHILL	TREATMENT FACILITY PLUMBING ENLARGED PLANS	SHEET	73
DR										DWG	50-P-401
CHK										DATE	
APVD										PROJ	

FILENAME: $FILENAME PLOT DATE: $PLOTDATE PLOT TIME: $PLOTTIME

APPENDIX D
Screen Captures

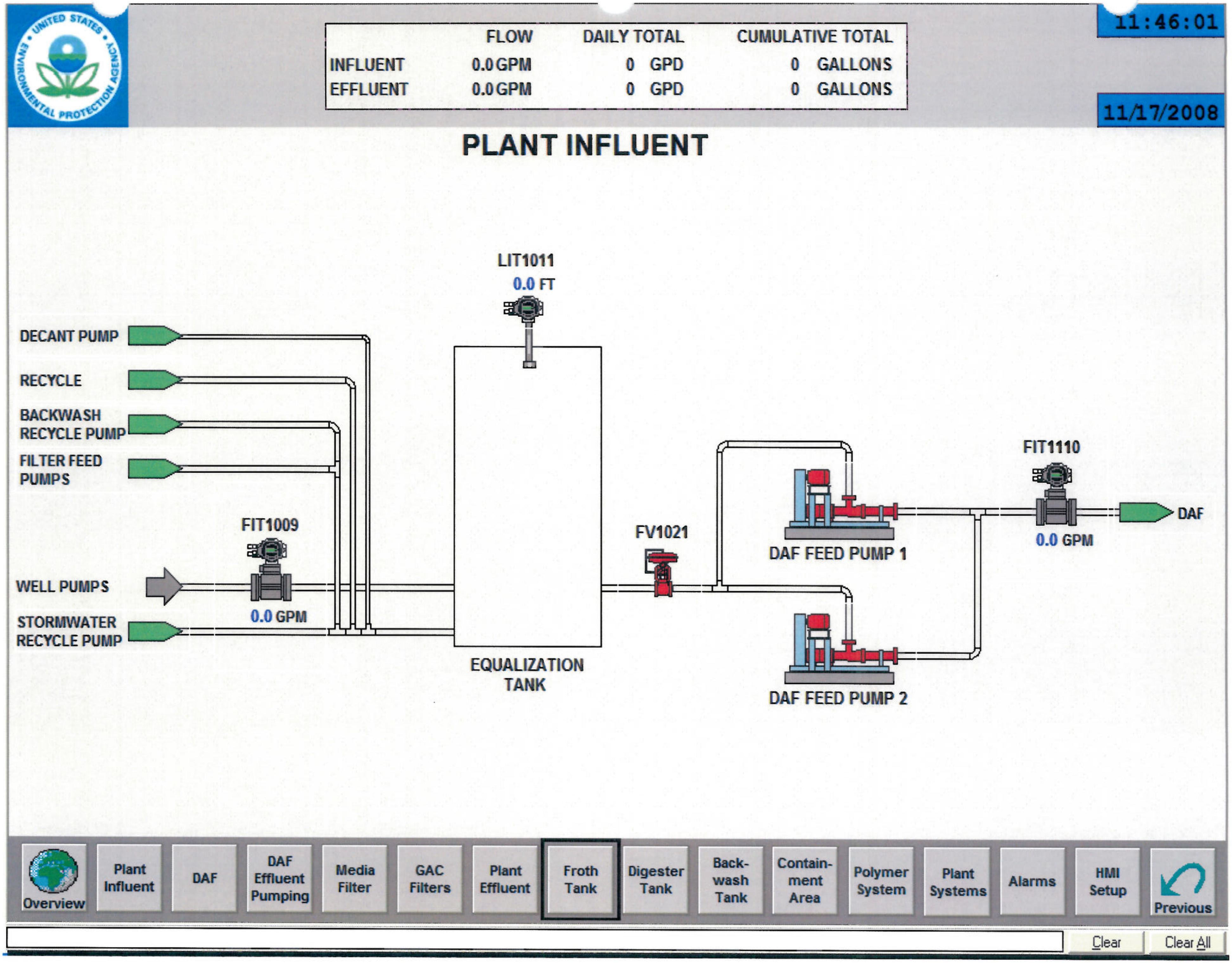
	FLOW	DAILY TOTAL	CUMULATIVE TOTAL
INFLUENT	0.0 GPM	0 GPD	0 GALLONS
EFFLUENT	0.0 GPM	0 GPD	0 GALLONS

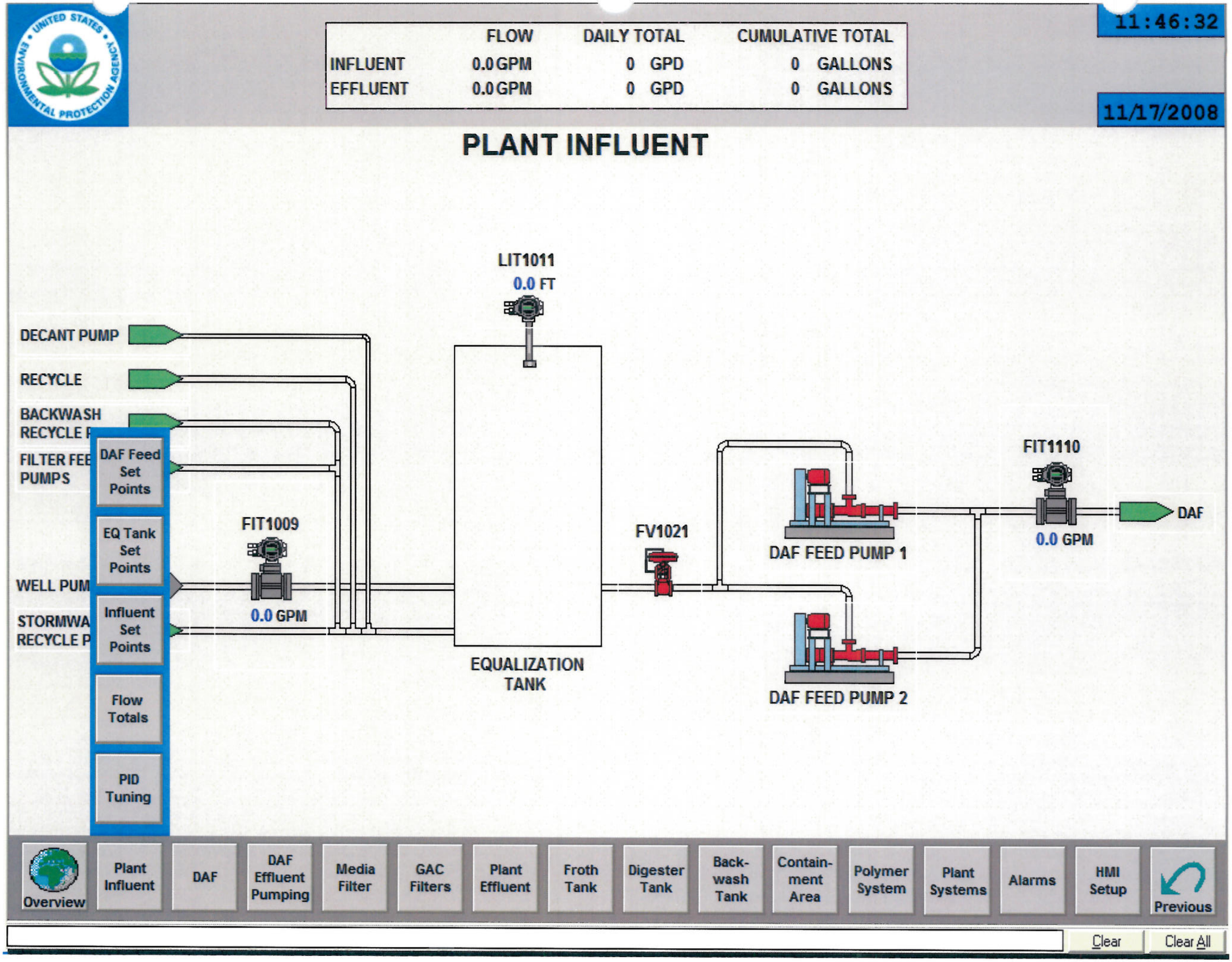
11:45:12

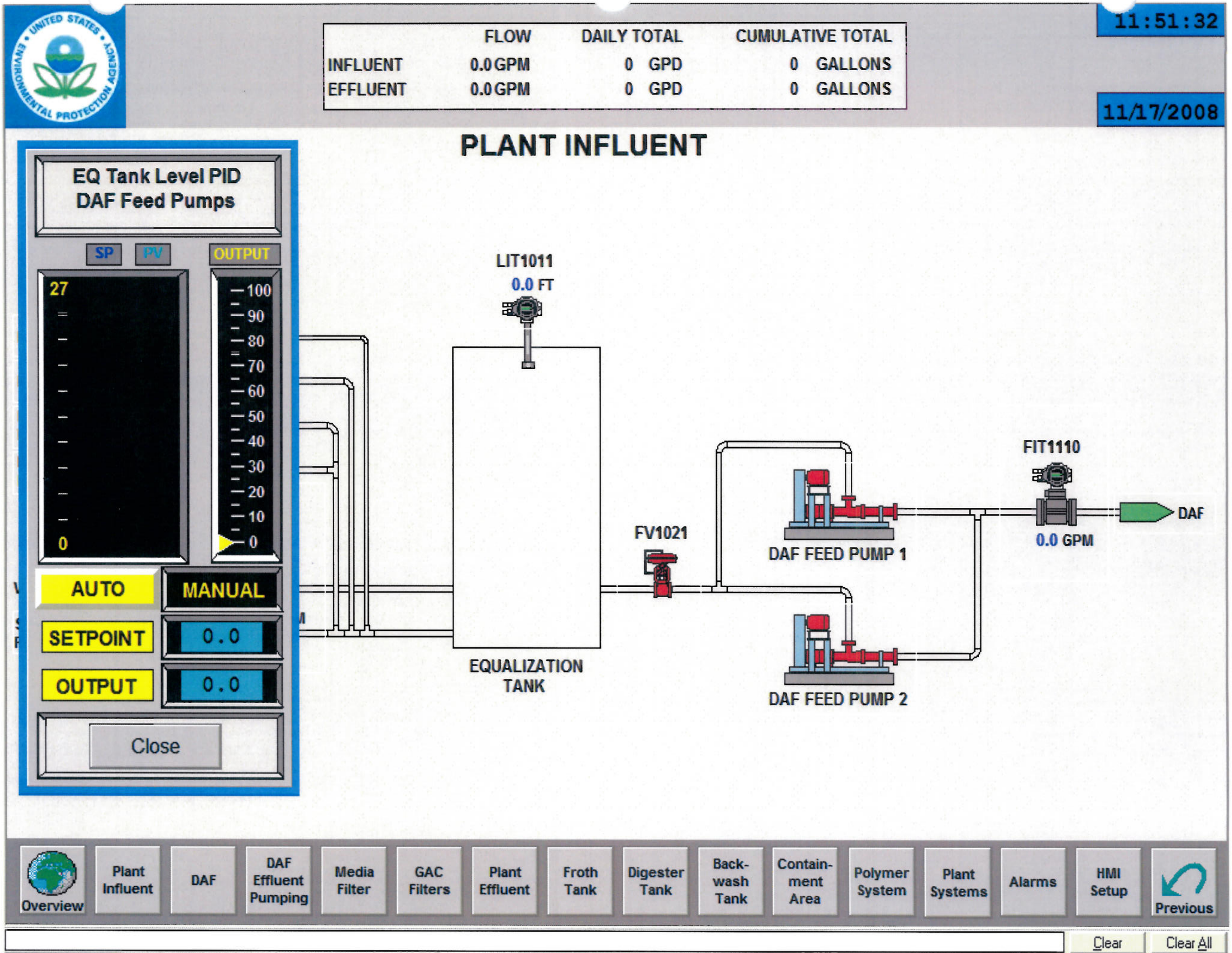
11/17/2008

Overview | Plant Influent | DAF | DAF Effluent Pumping | Media Filter | GAC Filters | Plant Effluent | Froth Tank | Digester Tank | Back-wash Tank | Contain-ment Area | Polymer System | Plant Systems | Alarms | HMI Setup | Previous

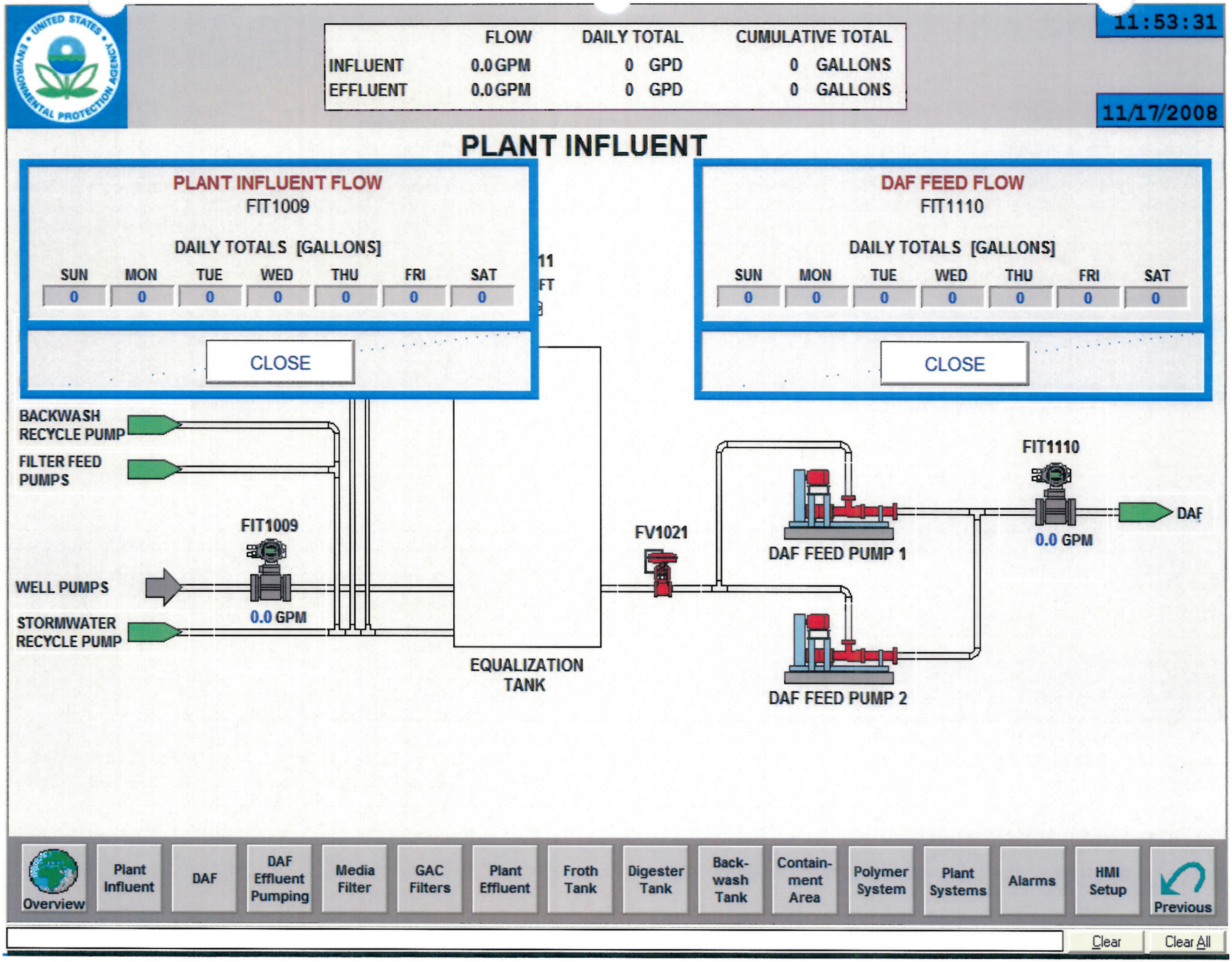
Clear | Clear All


11:46:01
11/17/2008
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0 GPM 0 GPD 0 GALLONS
EFFLUENT 0.0 GPM 0 GPD 0 GALLONS
PLANT INFLUENT
LIT1011
0.0 FT
DECANT PUMP
RECYCLE
BACKWASH RECYCLE PUMP
FILTER FEED PUMPS
FIT1009
WELL PUMPS
0.0 GPM
STORMWATER RECYCLE PUMP
EQUALIZATION TANK
FV1021
DAF FEED PUMP 1
DAF FEED PUMP 2
FIT1110
0.0 GPM
DAF
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All

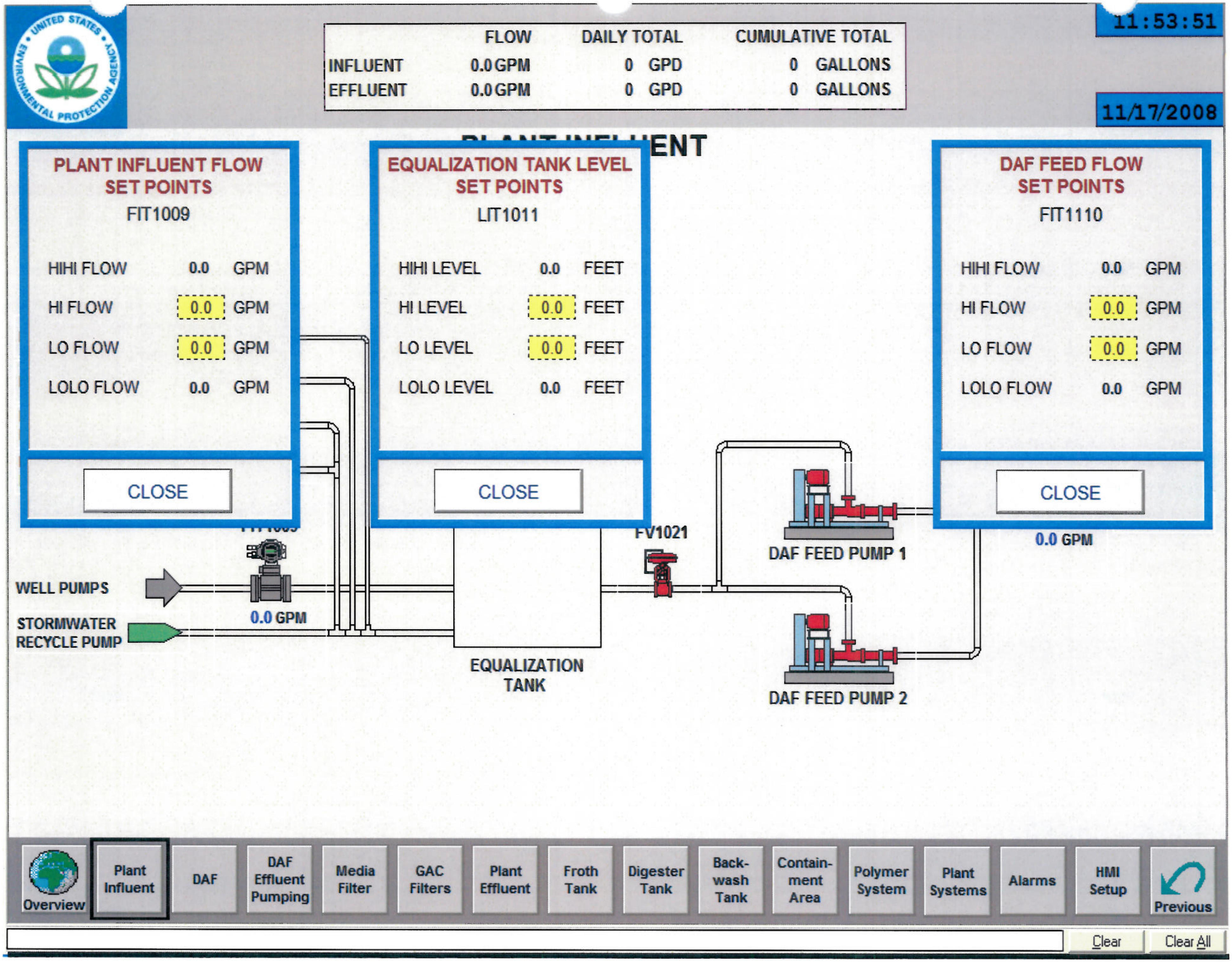

FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0GPM 0 GPD 0 GALLONS
EFFLUENT 0.0GPM 0 GPD 0 GALLONS
11:46:32
11/17/2008
PLANT INFLUENT
LIT1011
0.0 FT
DECANT PUMP
RECYCLE
BACKWASH RECYCLE P
FILTER FEE PUMPS
WELL PUM
STORMWA RECYCLE P
DAF Feed Set Points
EQ Tank Set Points
Influent Set Points
Flow Totals
PID Tuning
FIT1009
0.0 GPM
EQUALIZATION TANK
FV1021
DAF FEED PUMP 1
DAF FEED PUMP 2
FIT1110
0.0 GPM
DAF
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All

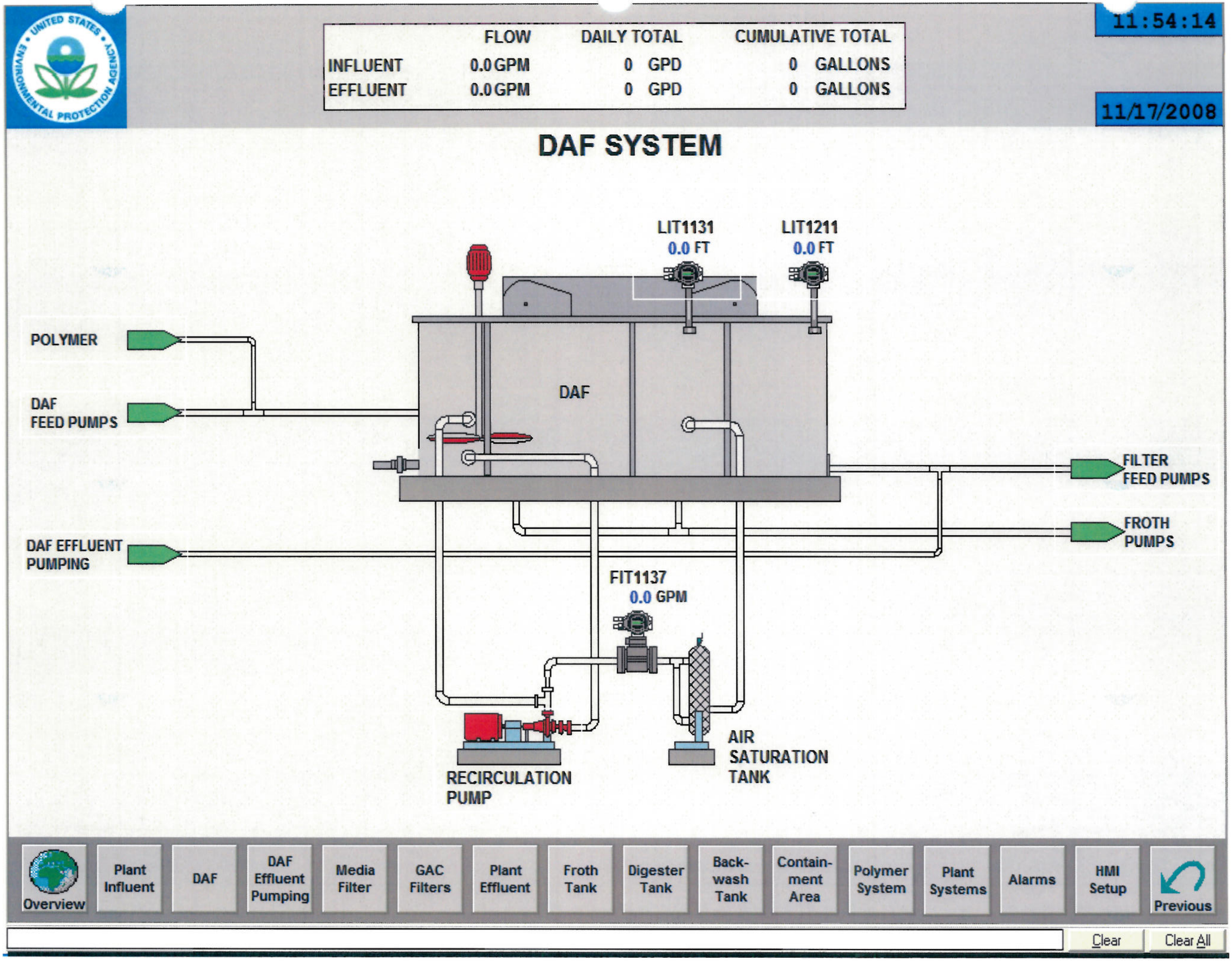


11:51:32
11/17/2008
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0 GPM 0 GPD 0 GALLONS
EFFLUENT 0.0 GPM 0 GPD 0 GALLONS
PLANT INFLUENT
EQ Tank Level PID
DAF Feed Pumps
SP
PV
OUTPUT
27
0
100
90
80
70
60
50
40
30
20
10
0
AUTO
MANUAL
SETPOINT
0.0
OUTPUT
0.0
Close
LIT1011
0.0 FT
EQUALIZATION TANK
FV1021
DAF FEED PUMP 1
DAF FEED PUMP 2
FIT1110
0.0 GPM
DAF
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All

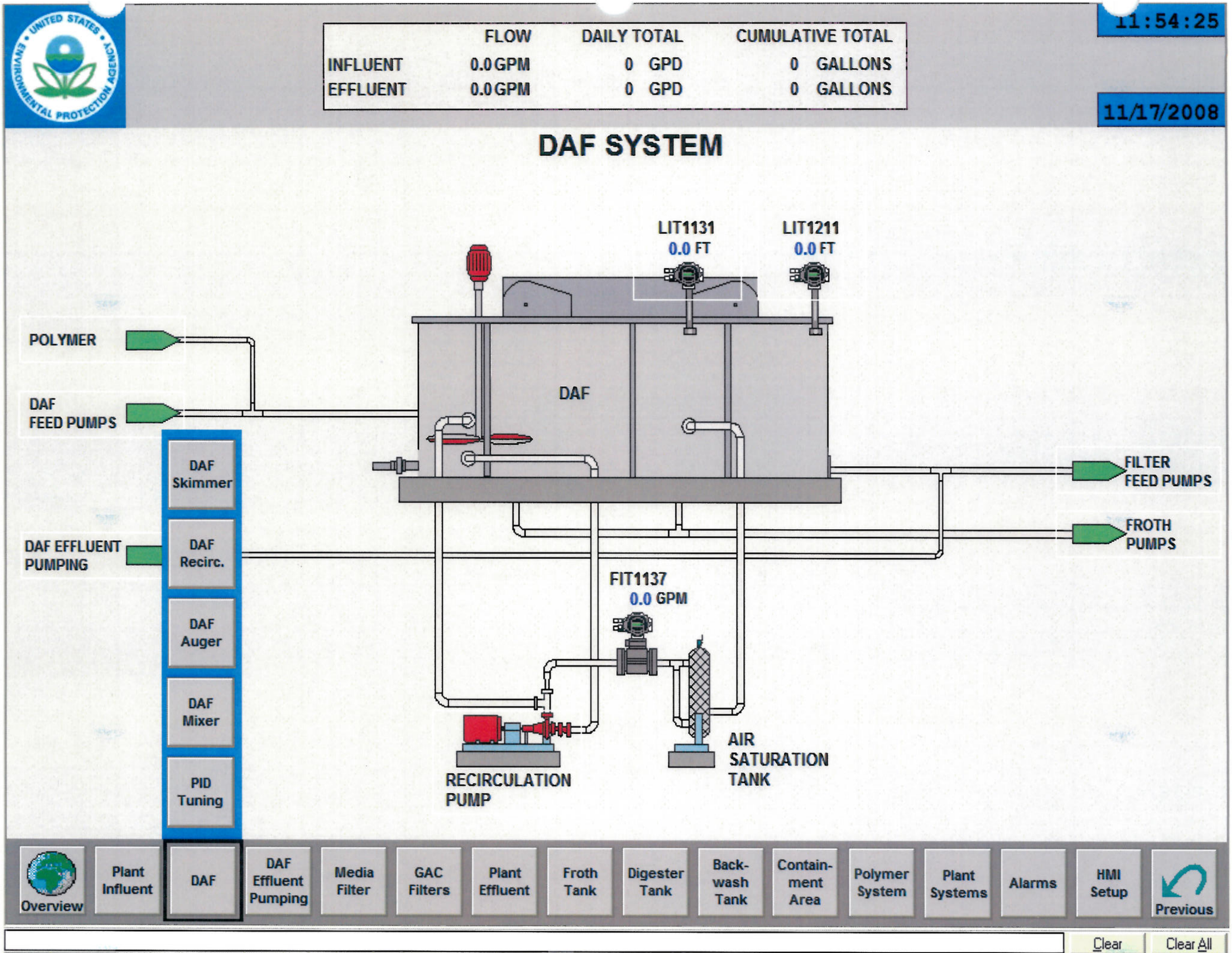


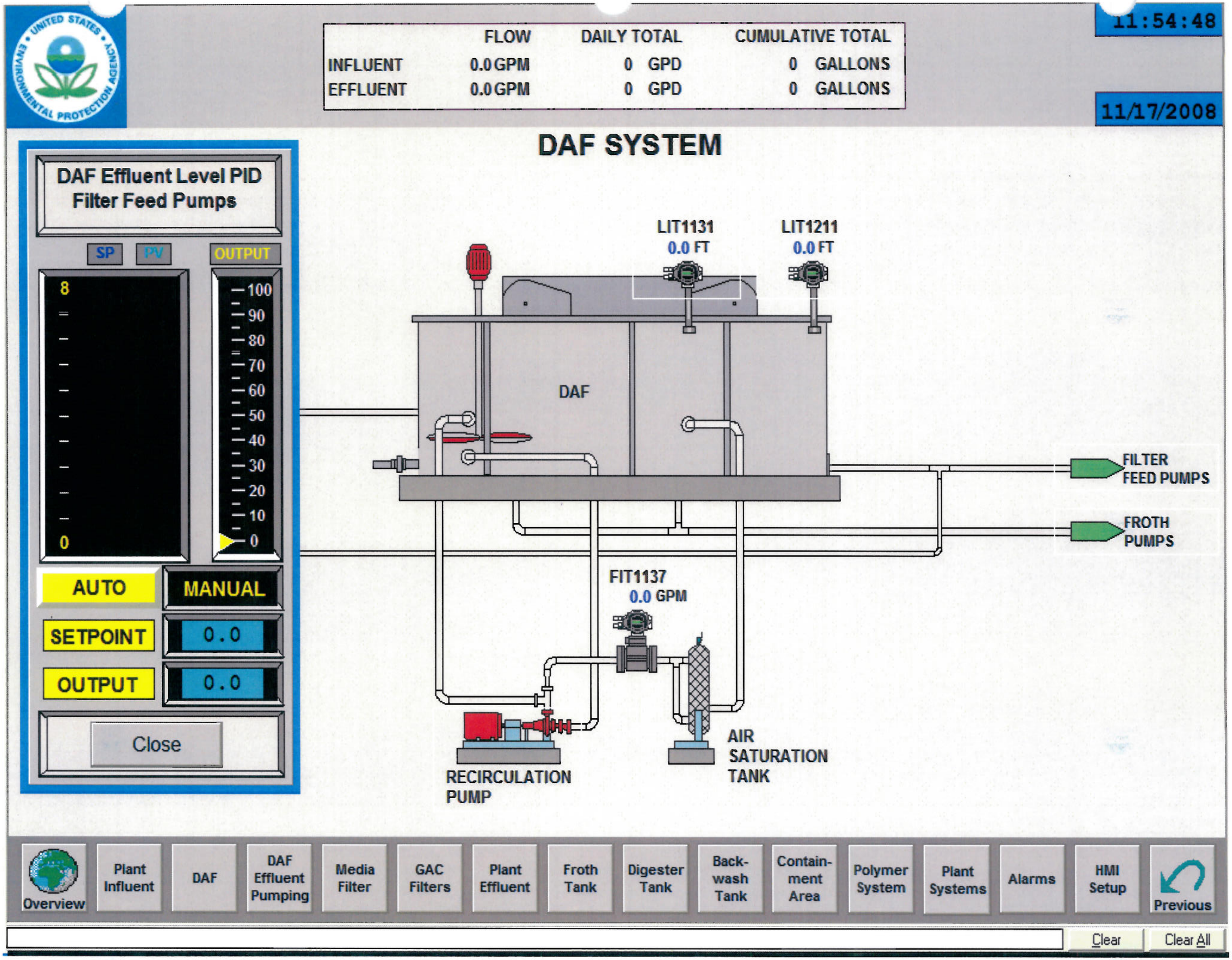
11:53:31
11/17/2008
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0GPM 0 GPD 0 GALLONS
EFFLUENT 0.0GPM 0 GPD 0 GALLONS
PLANT INFLUENT
PLANT INFLUENT FLOW
FIT1009
DAILY TOTALS [GALLONS]
SUN MON TUE WED THU FRI SAT
0 0 0 0 0 0 0
CLOSE
DAF FEED FLOW
FIT1110
DAILY TOTALS [GALLONS]
SUN MON TUE WED THU FRI SAT
0 0 0 0 0 0 0
CLOSE
BACKWASH RECYCLE PUMP
FILTER FEED PUMPS
WELL PUMPS
STORMWATER RECYCLE PUMP
FIT1009
0.0 GPM
EQUALIZATION TANK
FV1021
DAF FEED PUMP 1
DAF FEED PUMP 2
FIT1110
0.0 GPM
DAF
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All


11:53:51
11/17/2008
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0 GPM 0 GPD 0 GALLONS
EFFLUENT 0.0 GPM 0 GPD 0 GALLONS
PLANT INFLUENT FLOW SET POINTS
FIT1009
HIHI FLOW 0.0 GPM
HI FLOW 0.0 GPM
LO FLOW 0.0 GPM
LOLO FLOW 0.0 GPM
CLOSE
EQUALIZATION TANK LEVEL SET POINTS
LIT1011
HIHI LEVEL 0.0 FEET
HI LEVEL 0.0 FEET
LO LEVEL 0.0 FEET
LOLO LEVEL 0.0 FEET
CLOSE
DAF FEED FLOW SET POINTS
FIT1110
HIHI FLOW 0.0 GPM
HI FLOW 0.0 GPM
LO FLOW 0.0 GPM
LOLO FLOW 0.0 GPM
CLOSE
0.0 GPM
WELL PUMPS
STORMWATER RECYCLE PUMP
0.0 GPM
EQUALIZATION TANK
FV1021
DAF FEED PUMP 1
DAF FEED PUMP 2
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All

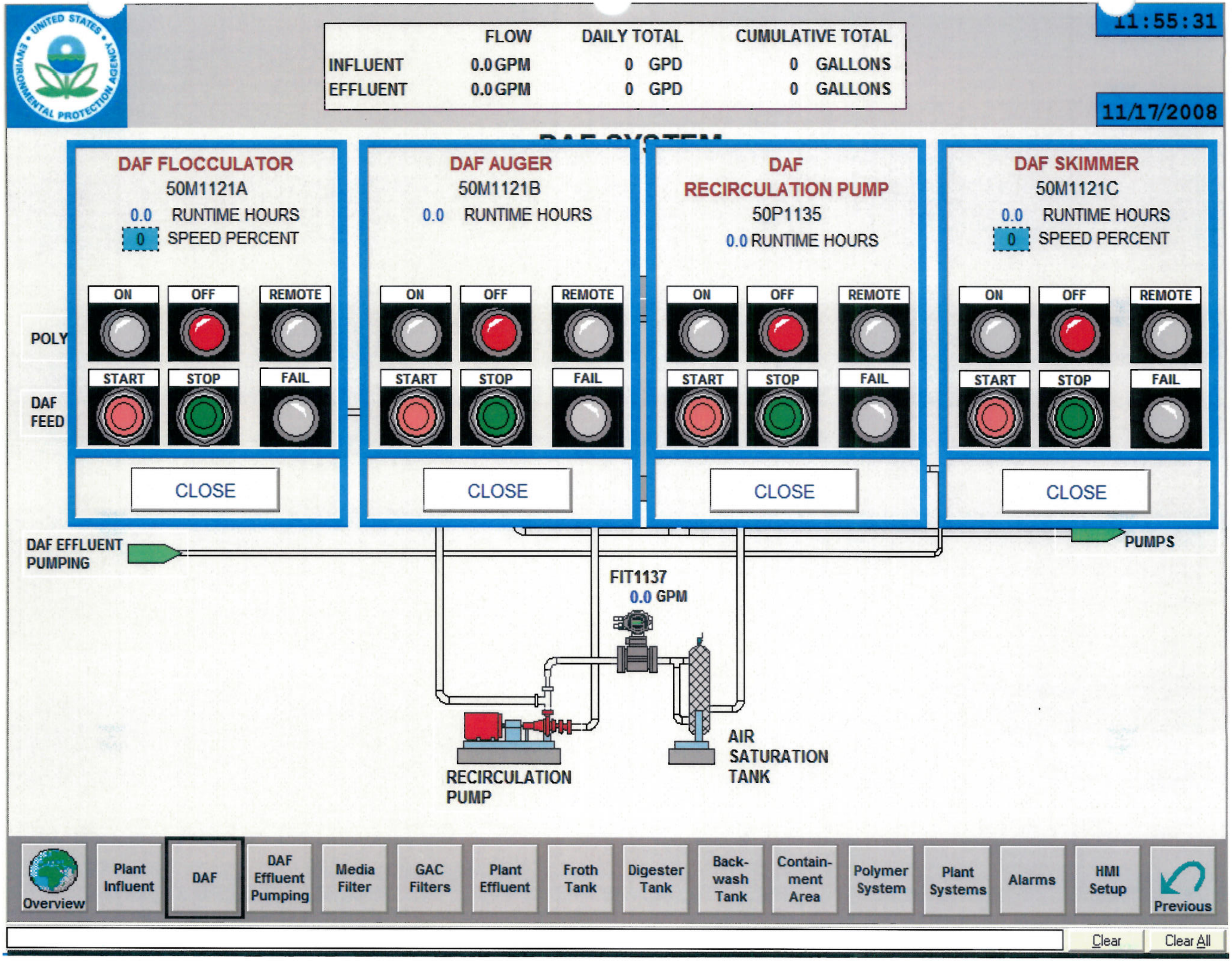


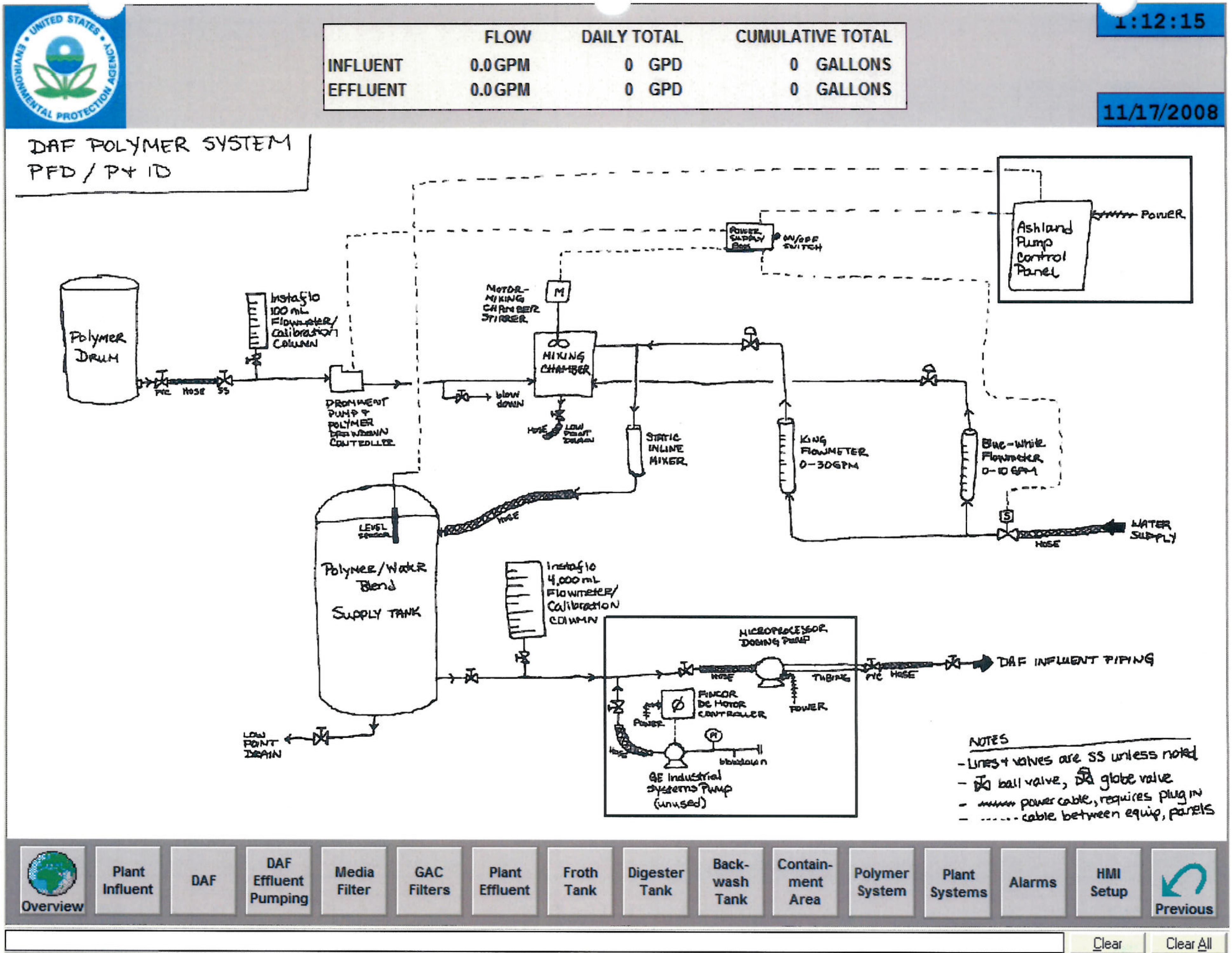
11:54:14
11/17/2008
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0 GPM 0 GPD 0 GALLONS
EFFLUENT 0.0 GPM 0 GPD 0 GALLONS
DAF SYSTEM
LIT1131 0.0 FT
LIT1211 0.0 FT
POLYMER
DAF FEED PUMPS
DAF
DAF EFFLUENT PUMPING
FILTER FEED PUMPS
FROTH PUMPS
FIT1137 0.0 GPM
RECIRCULATION PUMP
AIR SATURATION TANK
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All


11:54:25
11/17/2008
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0GPM 0 GPD 0 GALLONS
EFFLUENT 0.0GPM 0 GPD 0 GALLONS
DAF SYSTEM
LIT1131
0.0 FT
LIT1211
0.0 FT
POLYMER
DAF FEED PUMPS
DAF
DAF EFFLUENT PUMPING
FILTER FEED PUMPS
FROTH PUMPS
FIT1137
0.0 GPM
AIR SATURATION TANK
RECIRCULATION PUMP
DAF Skimmer
DAF Recirc.
DAF Auger
DAF Mixer
PID Tuning
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All

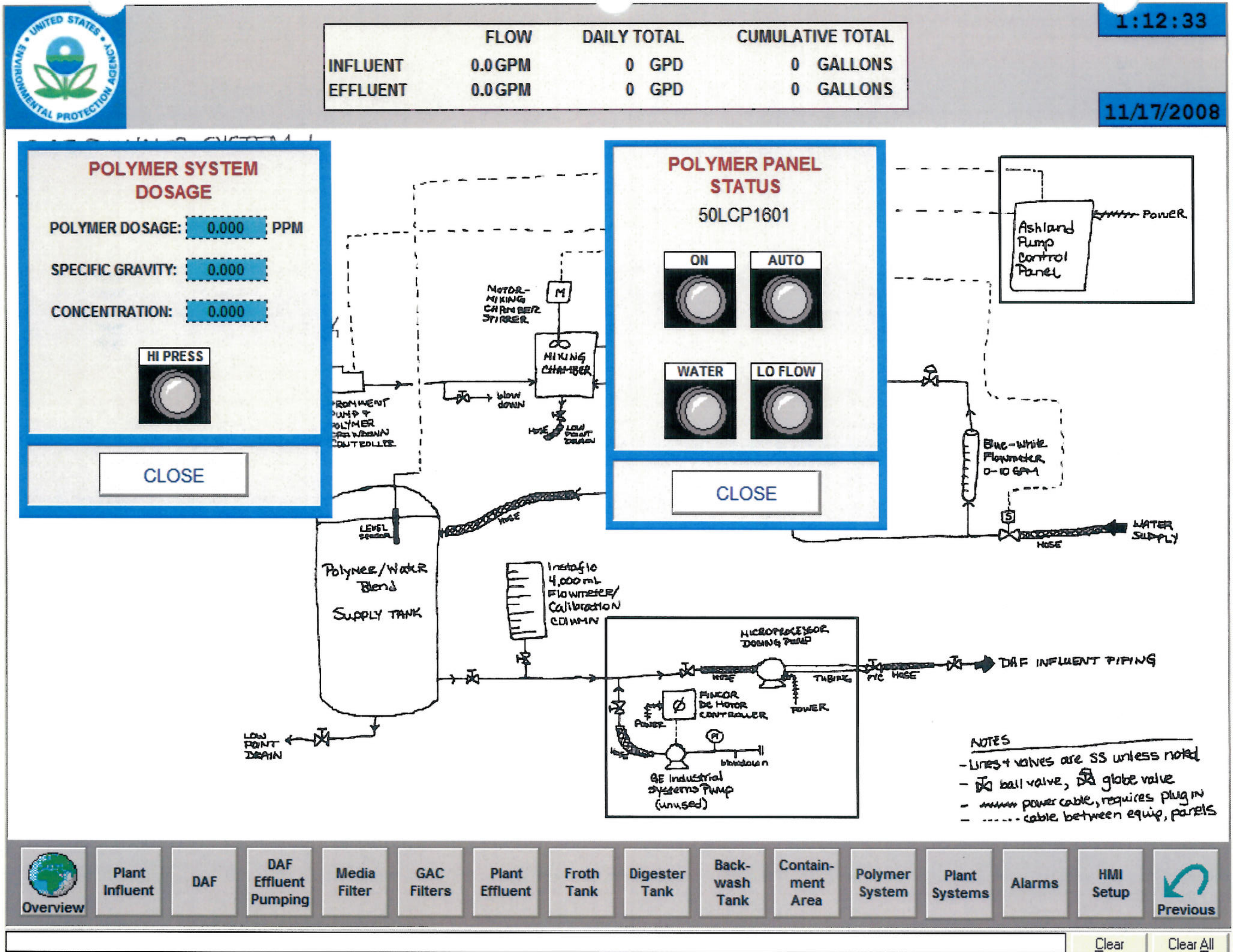


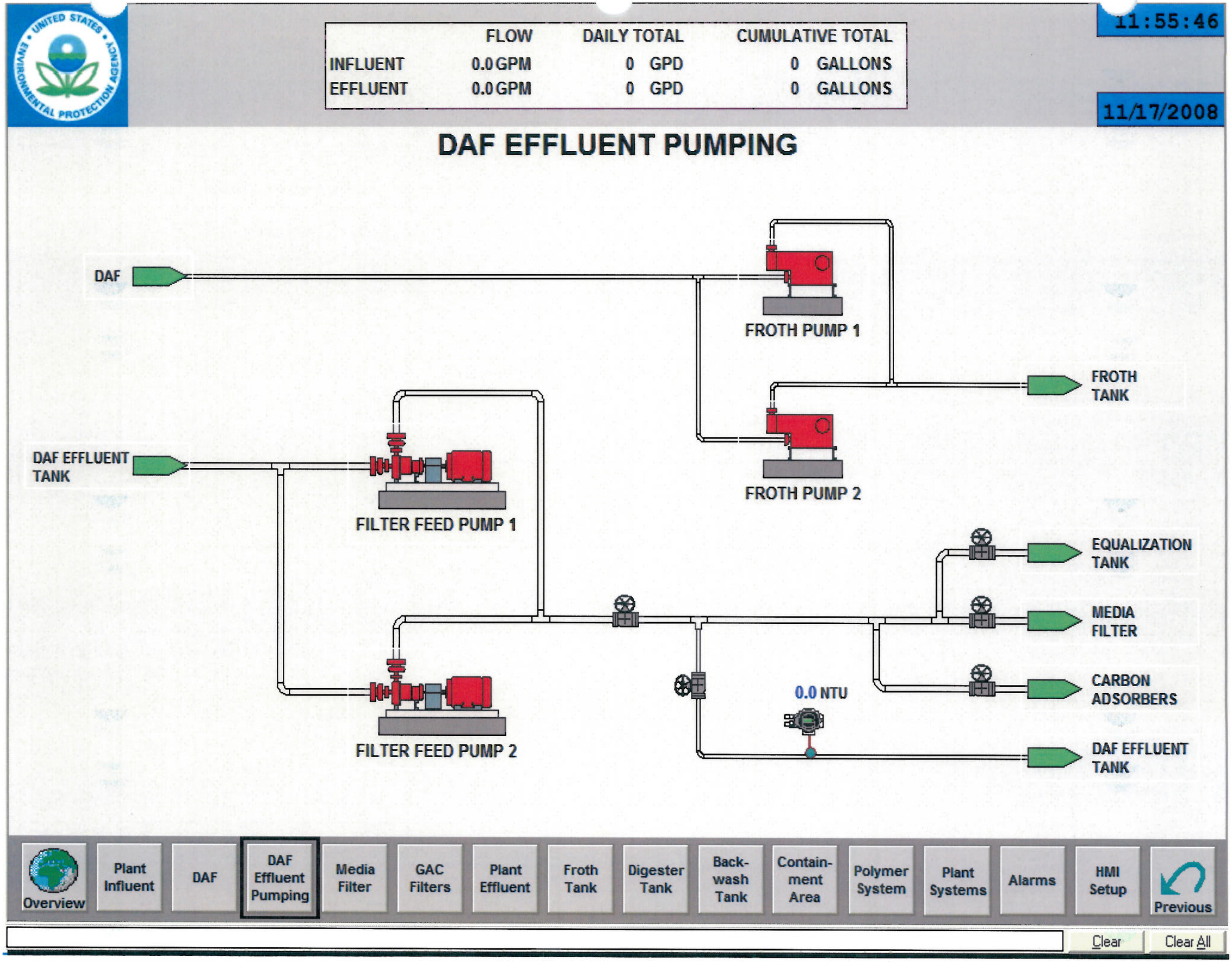
11:54:48
11/17/2008
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0 GPM 0 GPD 0 GALLONS
EFFLUENT 0.0 GPM 0 GPD 0 GALLONS
DAF SYSTEM
DAF Effluent Level PID
Filter Feed Pumps
SP
PV
OUTPUT
8
0
100
90
80
70
60
50
40
30
20
10
0
AUTO
MANUAL
SETPOINT
0.0
OUTPUT
0.0
Close
LIT1131
0.0 FT
LIT1211
0.0 FT
DAF
FILTER FEED PUMPS
FROTH PUMPS
FIT1137
0.0 GPM
AIR SATURATION TANK
RECIRCULATION PUMP
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All


11:55:31
11/17/2008
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0 GPM 0 GPD 0 GALLONS
EFFLUENT 0.0 GPM 0 GPD 0 GALLONS
DAF FLOCCULATOR
50M1121A
0.0 RUNTIME HOURS
0 SPEED PERCENT
ON
OFF
REMOTE
START
STOP
FAIL
CLOSE
DAF AUGER
50M1121B
0.0 RUNTIME HOURS
ON
OFF
REMOTE
START
STOP
FAIL
CLOSE
DAF
RECIRCULATION PUMP
50P1135
0.0 RUNTIME HOURS
ON
OFF
REMOTE
START
STOP
FAIL
CLOSE
DAF SKIMMER
50M1121C
0.0 RUNTIME HOURS
0 SPEED PERCENT
ON
OFF
REMOTE
START
STOP
FAIL
CLOSE
POLY
DAF FEED
DAF EFFLUENT PUMPING
PUMPS
FIT1137
0.0 GPM
RECIRCULATION PUMP
AIR SATURATION TANK
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All

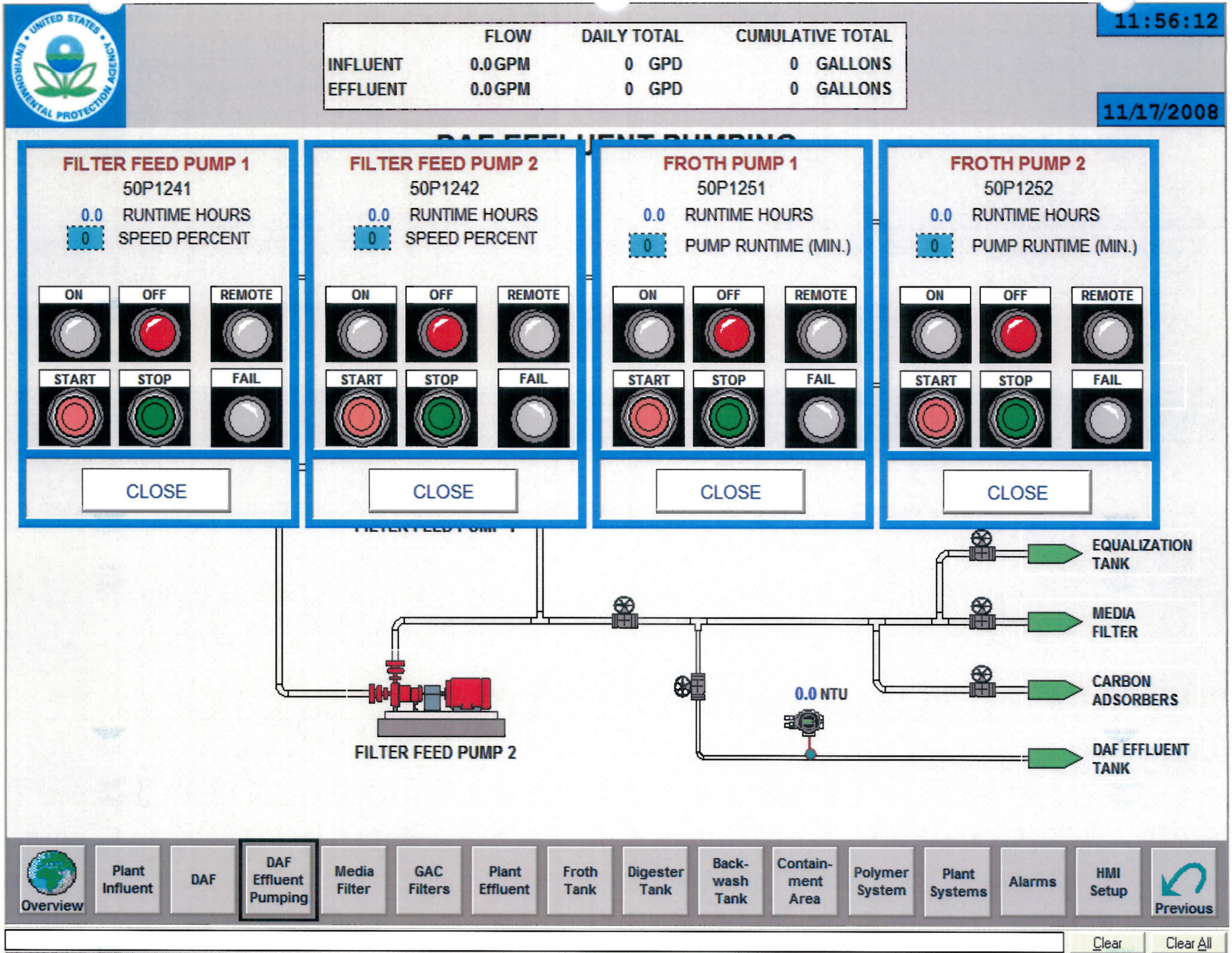


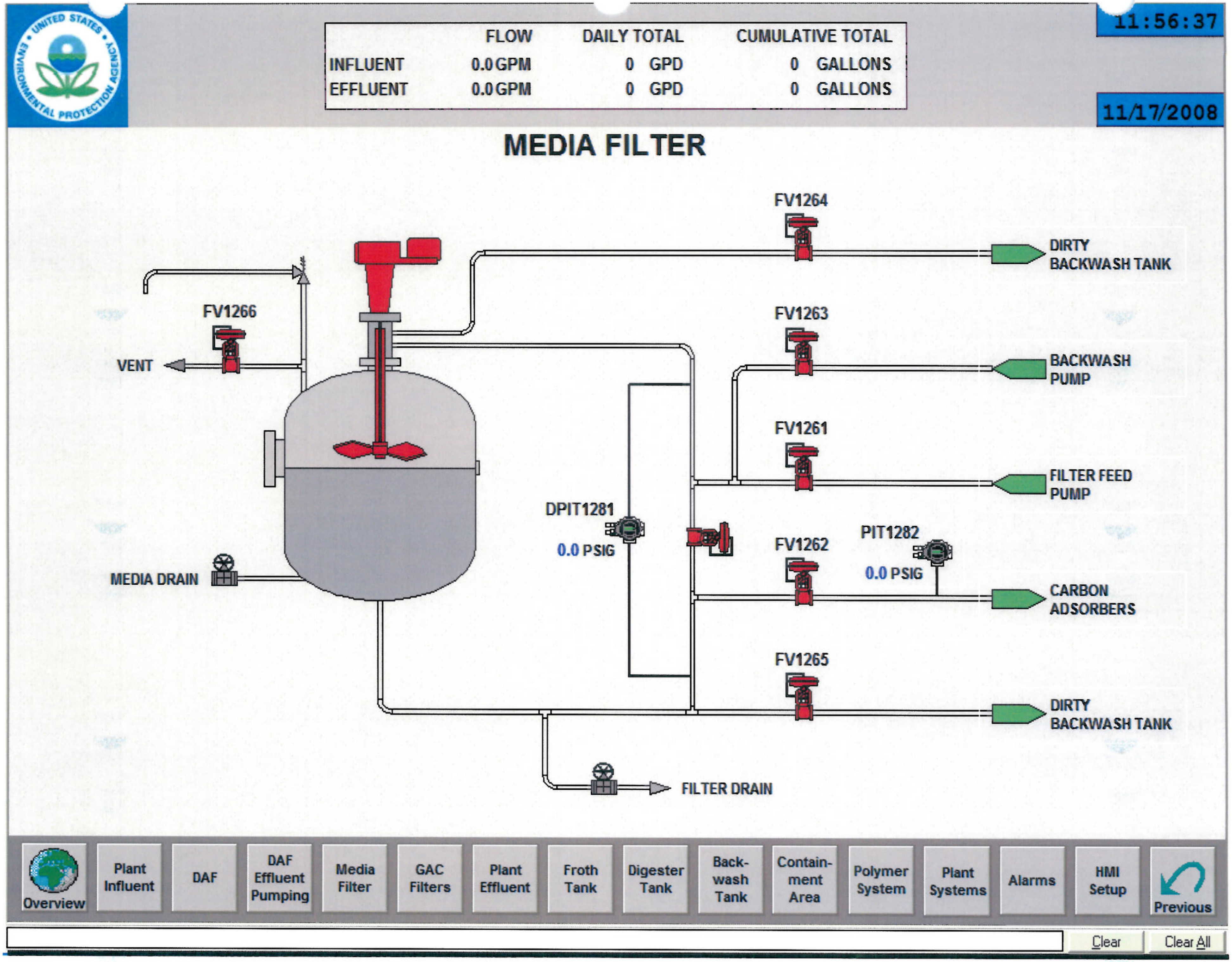
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0 GPM 0 GPD 0 GALLONS
EFFLUENT 0.0 GPM 0 GPD 0 GALLONS
1:12:15
11/17/2008
DAF POLYMER SYSTEM
PFD / P+ID
Polymer Drum
P/C
HOSE
SS
Instaflo 100 mL Flowmeter/ Calibration Column
PROMINENT PUMP & POLYMER DRAWDOWN CONTROLLER
blow down
MOTOR-MIXING CHAMBER STIRRER
M
MIXING CHAMBER
HOSE
LOW POINT DRAIN
POWER SUPPLY BOX
ON/OFF SWITCH
Ashland Pump Control Panel
POWER
STATIC INLINE MIXER
KING FLOWMETER 0-30GPM
Blue-white Flowmeter 0-10 GPM
S
WATER SUPPLY
HOSE
LEVEL SENSOR
Polymer/Water Blend
SUPPLY TANK
LOW POINT DRAIN
Instaflo 4,000 mL Flowmeter/ Calibration COLUMN
MICROPROCESSOR DOSING PUMP
TUBING
POWER
FINCOR DC MOTOR CONTROLLER
GE Industrial Systems Pump (unused)
blowdown
DAF INFLUENT PIPING
NOTES
- Lines + valves are SS unless noted
- ball valve, globe valve
- power cable, requires plug in
- cable between equip, panels
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All


1:12:33
11/17/2008
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0 GPM 0 GPD 0 GALLONS
EFFLUENT 0.0 GPM 0 GPD 0 GALLONS
POLYMER SYSTEM DOSAGE
POLYMER DOSAGE: 0.000 PPM
SPECIFIC GRAVITY: 0.000
CONCENTRATION: 0.000
HI PRESS
CLOSE
POLYMER PANEL STATUS
50LCP1601
ON
AUTO
WATER
LO FLOW
CLOSE
Ashland Pump Control Panel
POWER
MOTOR-MIXING CHAMBER STIRRER
M
MIXING CHAMBER
blow down
HOSE
LOW POINT DRAIN
LEVEL SENSOR
Polymer/Water Blend
Supply Tank
HOSE
Blue-white Flowmeter 0-10 GPM
S
WATER SUPPLY
Instaflo 4,000 mL Flowmeter/ Calibration Column
MICROPROCESSOR DOSING PUMP
HOSE
TUBING
POWER
FINCOR DC MOTOR CONTROLLER
POWER
blowdown
GE Industrial Systems Pump (unused)
PVC
HOSE
DAF INFLUENT PIPING
LOW POINT DRAIN
NOTES
- Lines + valves are SS unless noted
- ball valve, globe valve
- power cable, requires plug in
- cable between equip, panels
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All

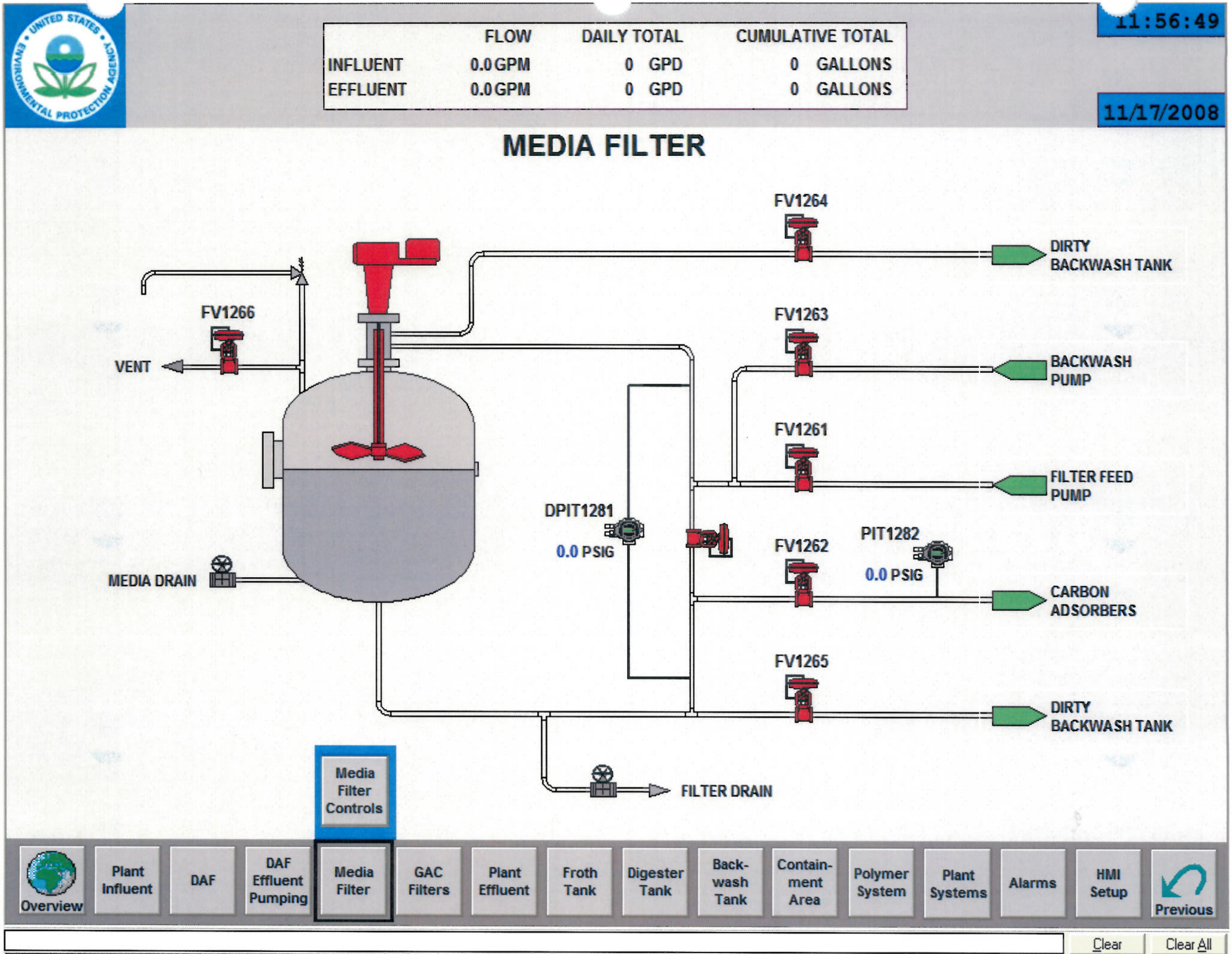


11:55:46
11/17/2008
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0GPM 0 GPD 0 GALLONS
EFFLUENT 0.0GPM 0 GPD 0 GALLONS
DAF EFFLUENT PUMPING
DAF
FROTH PUMP 1
FROTH PUMP 2
FROTH TANK
DAF EFFLUENT TANK
FILTER FEED PUMP 1
FILTER FEED PUMP 2
EQUALIZATION TANK
MEDIA FILTER
CARBON ADSORBERS
0.0 NTU
DAF EFFLUENT TANK
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All

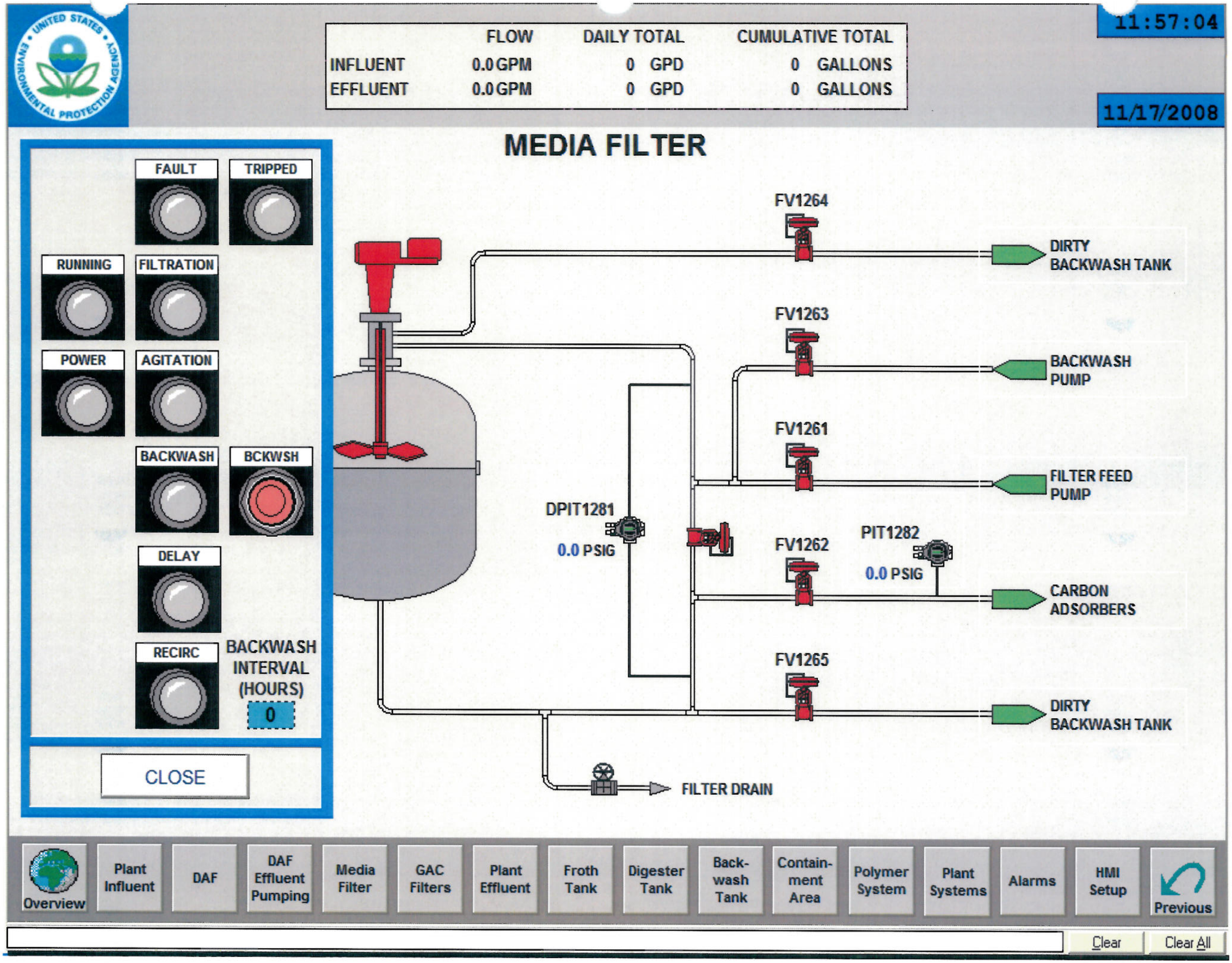

FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0GPM 0 GPD 0 GALLONS
EFFLUENT 0.0GPM 0 GPD 0 GALLONS
11:56:12
11/17/2008
FILTER FEED PUMP 1
50P1241
0.0 RUNTIME HOURS
0 SPEED PERCENT
ON
OFF
REMOTE
START
STOP
FAIL
CLOSE
FILTER FEED PUMP 2
50P1242
0.0 RUNTIME HOURS
0 SPEED PERCENT
ON
OFF
REMOTE
START
STOP
FAIL
CLOSE
FROTH PUMP 1
50P1251
0.0 RUNTIME HOURS
0 PUMP RUNTIME (MIN.)
ON
OFF
REMOTE
START
STOP
FAIL
CLOSE
FROTH PUMP 2
50P1252
0.0 RUNTIME HOURS
0 PUMP RUNTIME (MIN.)
ON
OFF
REMOTE
START
STOP
FAIL
CLOSE
EQUALIZATION TANK
MEDIA FILTER
CARBON ADSORBERS
DAF EFFLUENT TANK
0.0 NTU
FILTER FEED PUMP 2
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All



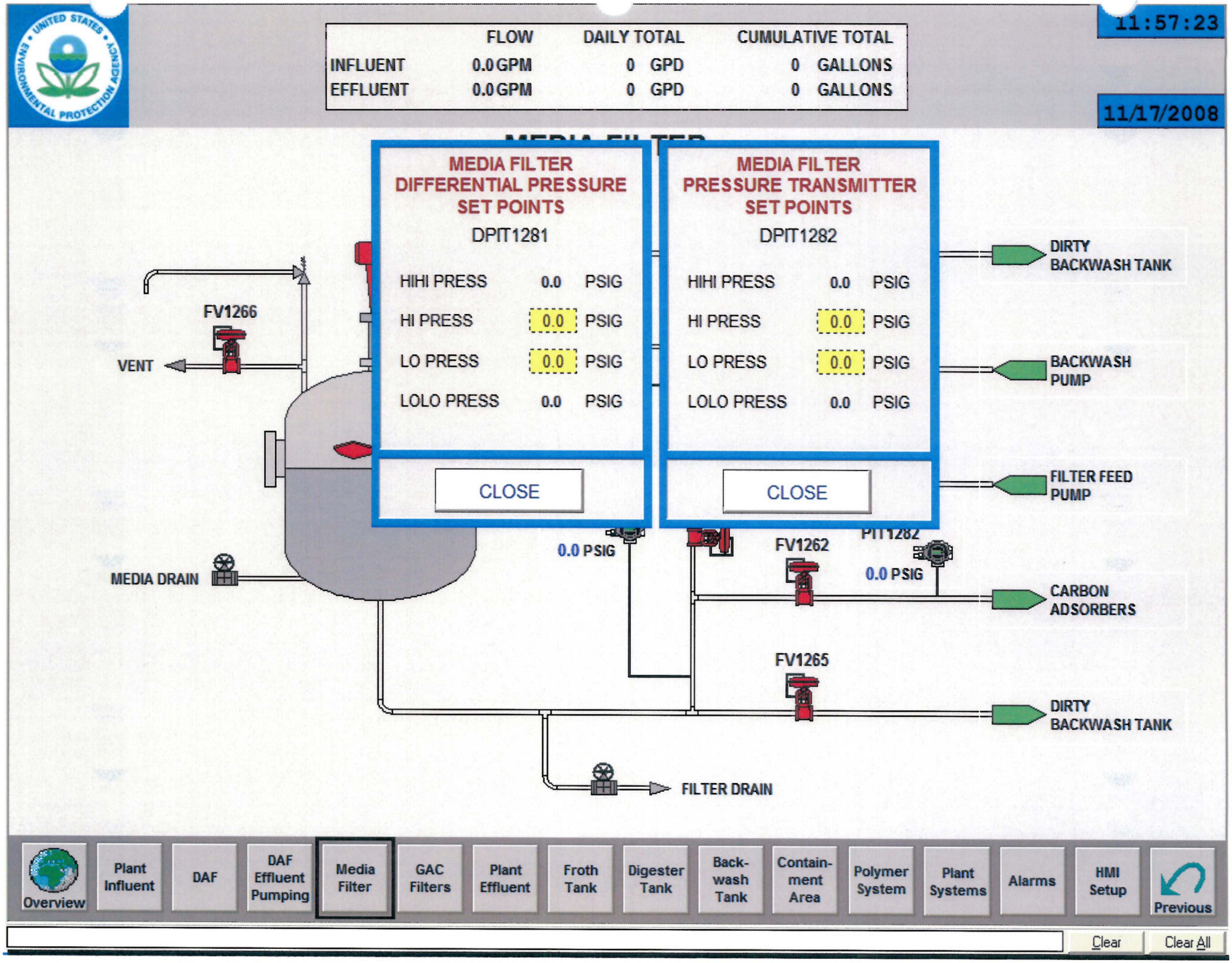
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0 GPM 0 GPD 0 GALLONS
EFFLUENT 0.0 GPM 0 GPD 0 GALLONS
11:56:37
11/17/2008
MEDIA FILTER
FV1264
DIRTY BACKWASH TANK
FV1266
VENT
FV1263
BACKWASH PUMP
FV1261
FILTER FEED PUMP
DPIT1281
0.0 PSIG
PIT1282
0.0 PSIG
FV1262
CARBON ADSORBERS
MEDIA DRAIN
FV1265
DIRTY BACKWASH TANK
FILTER DRAIN
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All



11:56:49
11/17/2008
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0 GPM 0 GPD 0 GALLONS
EFFLUENT 0.0 GPM 0 GPD 0 GALLONS
MEDIA FILTER
FV1266
VENT
MEDIA DRAIN
FV1264
DIRTY BACKWASH TANK
FV1263
BACKWASH PUMP
FV1261
FILTER FEED PUMP
DPIT1281
0.0 PSIG
FV1262
PIT1282
0.0 PSIG
CARBON ADSORBERS
FV1265
DIRTY BACKWASH TANK
FILTER DRAIN
Media Filter Controls
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All



UNITED STATES • ENVIRONMENTAL PROTECTION AGENCY
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0 GPM 0 GPD 0 GALLONS
EFFLUENT 0.0 GPM 0 GPD 0 GALLONS
11:57:04
11/17/2008
MEDIA FILTER
FAULT
TRIPPED
RUNNING
FILTRATION
POWER
AGITATION
BACKWASH
BCKWSH
DELAY
RECIRC
BACKWASH INTERVAL (HOURS)
0
CLOSE
FV1264
DIRTY BACKWASH TANK
FV1263
BACKWASH PUMP
FV1261
FILTER FEED PUMP
DPIT1281
0.0 PSIG
PIT1282
0.0 PSIG
FV1262
CARBON ADSORBERS
FV1265
DIRTY BACKWASH TANK
FILTER DRAIN
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All

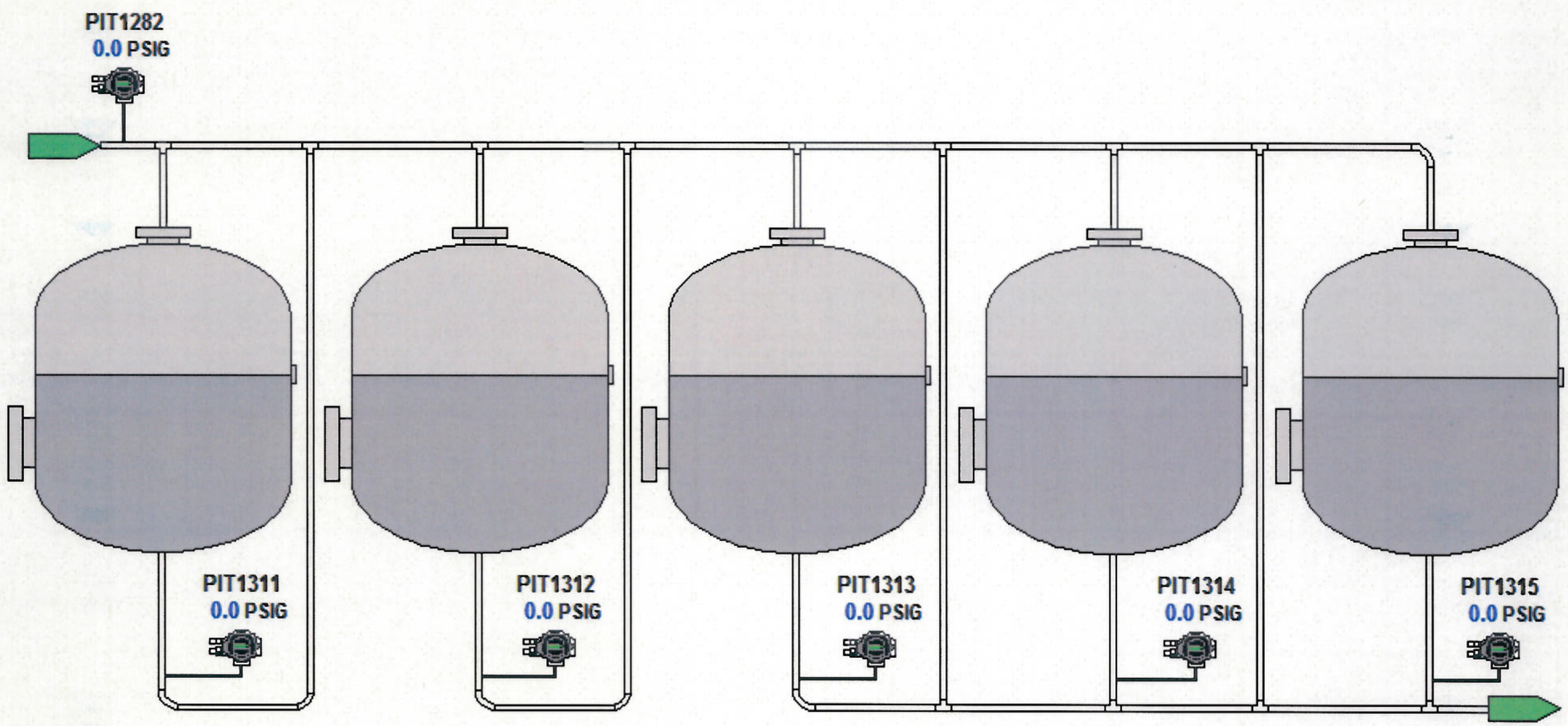

11:57:23
11/17/2008
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0 GPM 0 GPD 0 GALLONS
EFFLUENT 0.0 GPM 0 GPD 0 GALLONS
MEDIA FILTER
DIFFERENTIAL PRESSURE
SET POINTS
DPIT1281
HIHI PRESS 0.0 PSIG
HI PRESS 0.0 PSIG
LO PRESS 0.0 PSIG
LOLO PRESS 0.0 PSIG
CLOSE
MEDIA FILTER
PRESSURE TRANSMITTER
SET POINTS
DPIT1282
HIHI PRESS 0.0 PSIG
HI PRESS 0.0 PSIG
LO PRESS 0.0 PSIG
LOLO PRESS 0.0 PSIG
CLOSE
FV1266
VENT
MEDIA DRAIN
0.0 PSIG
FV1262
0.0 PSIG
FV1265
FILTER DRAIN
DIRTY BACKWASH TANK
BACKWASH PUMP
FILTER FEED PUMP
CARBON ADSORBERS
DIRTY BACKWASH TANK
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All

	FLOW	DAILY TOTAL	CUMULATIVE TOTAL
INFLUENT	0.0GPM	0 GPD	0 GALLONS
EFFLUENT	0.0GPM	0 GPD	0 GALLONS

11:57:48

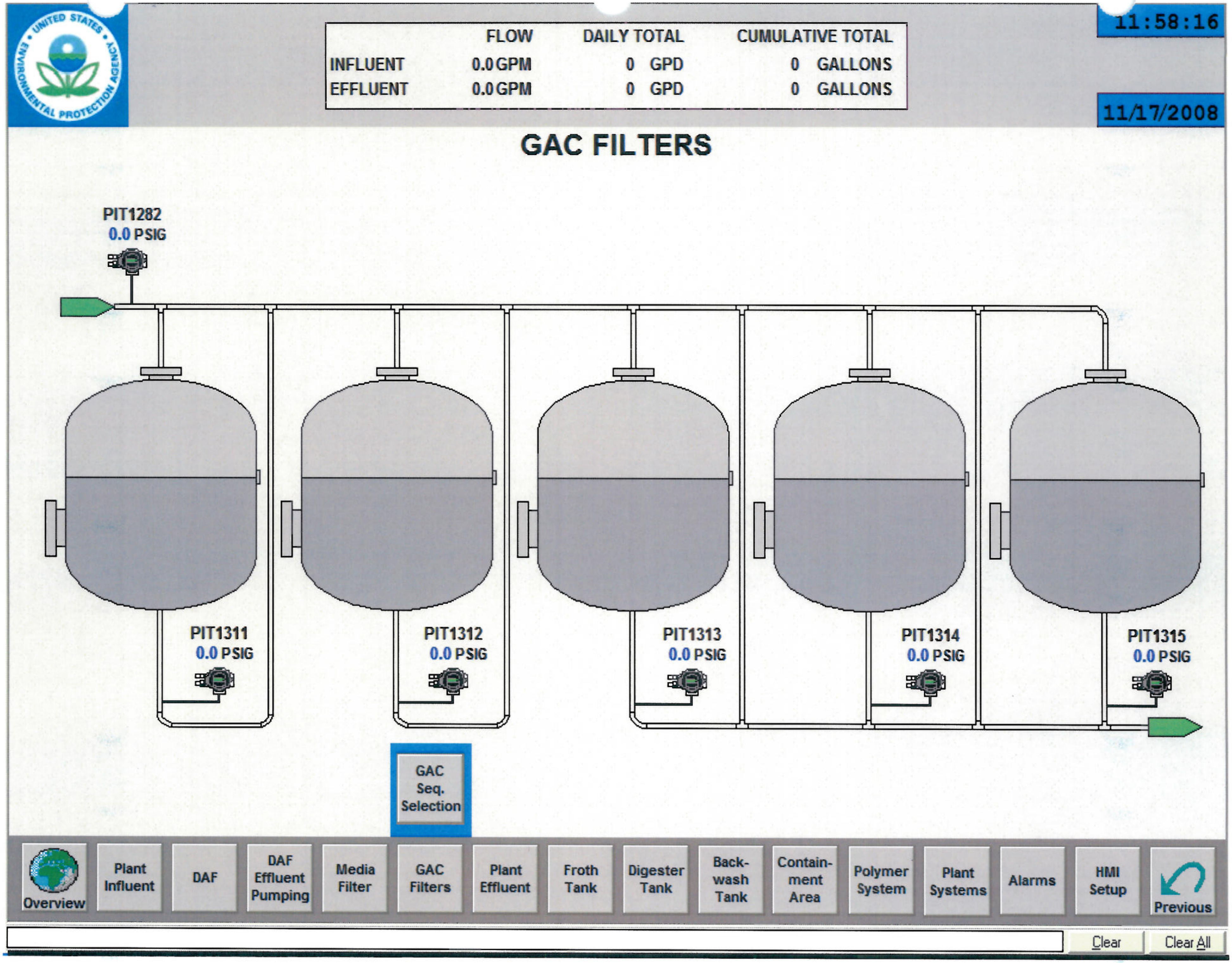
11/17/2008

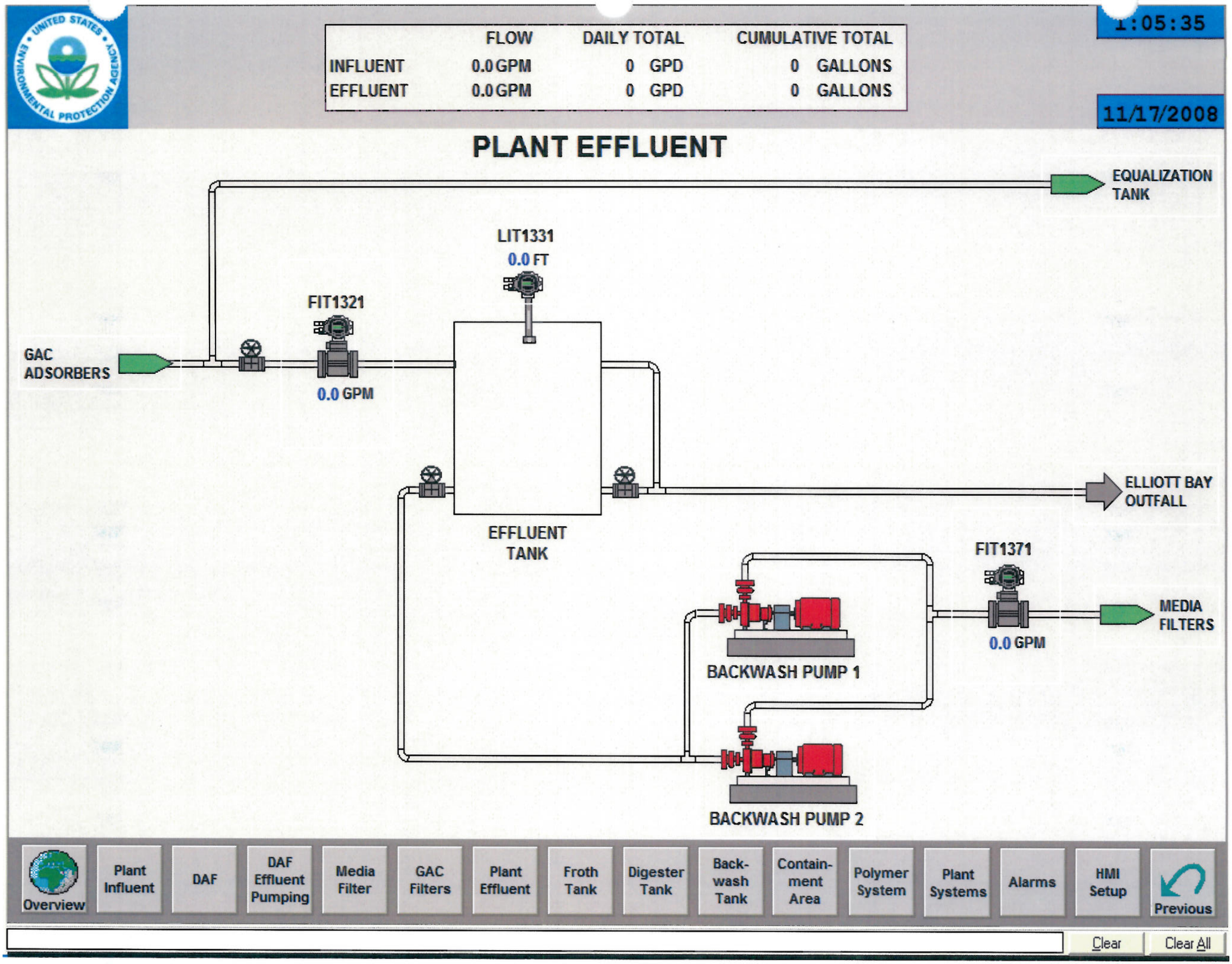
GAC FILTERS

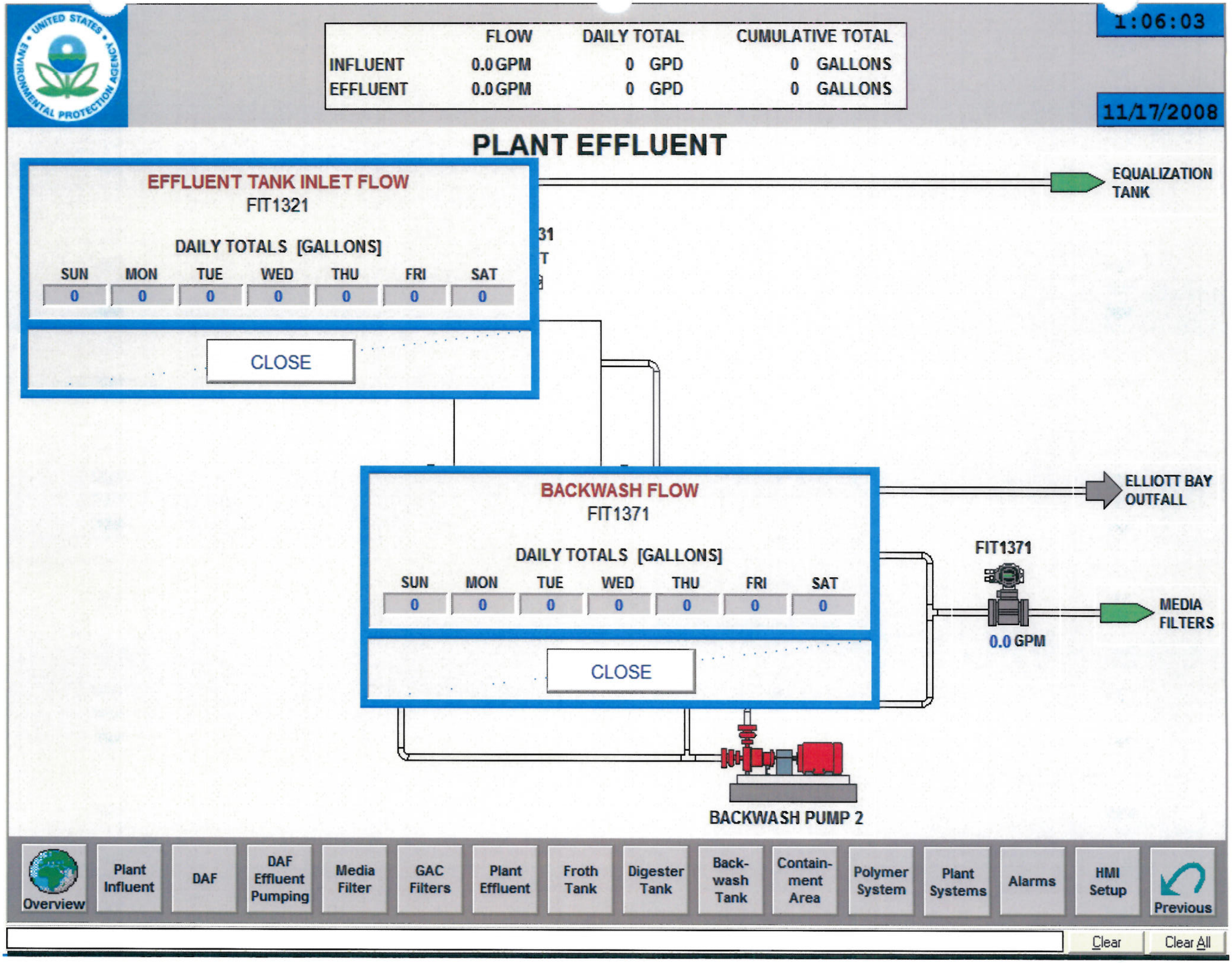


Overview | Plant Influent | DAF | DAF Effluent Pumping | Media Filter | GAC Filters | Plant Effluent | Froth Tank | Digester Tank | Back-wash Tank | Contain-ment Area | Polymer System | Plant Systems | Alarms | HMI Setup | Previous

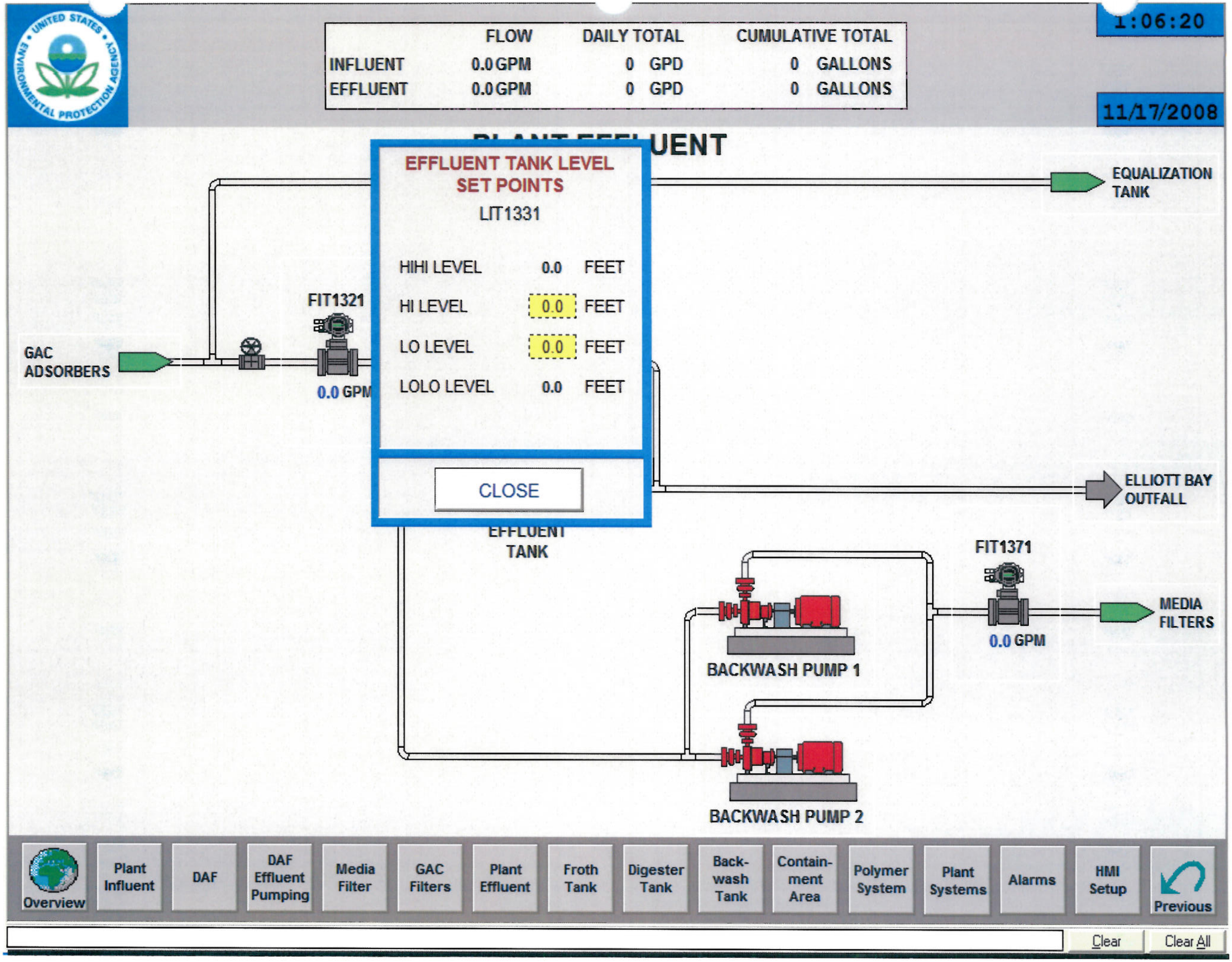
Clear | Clear All

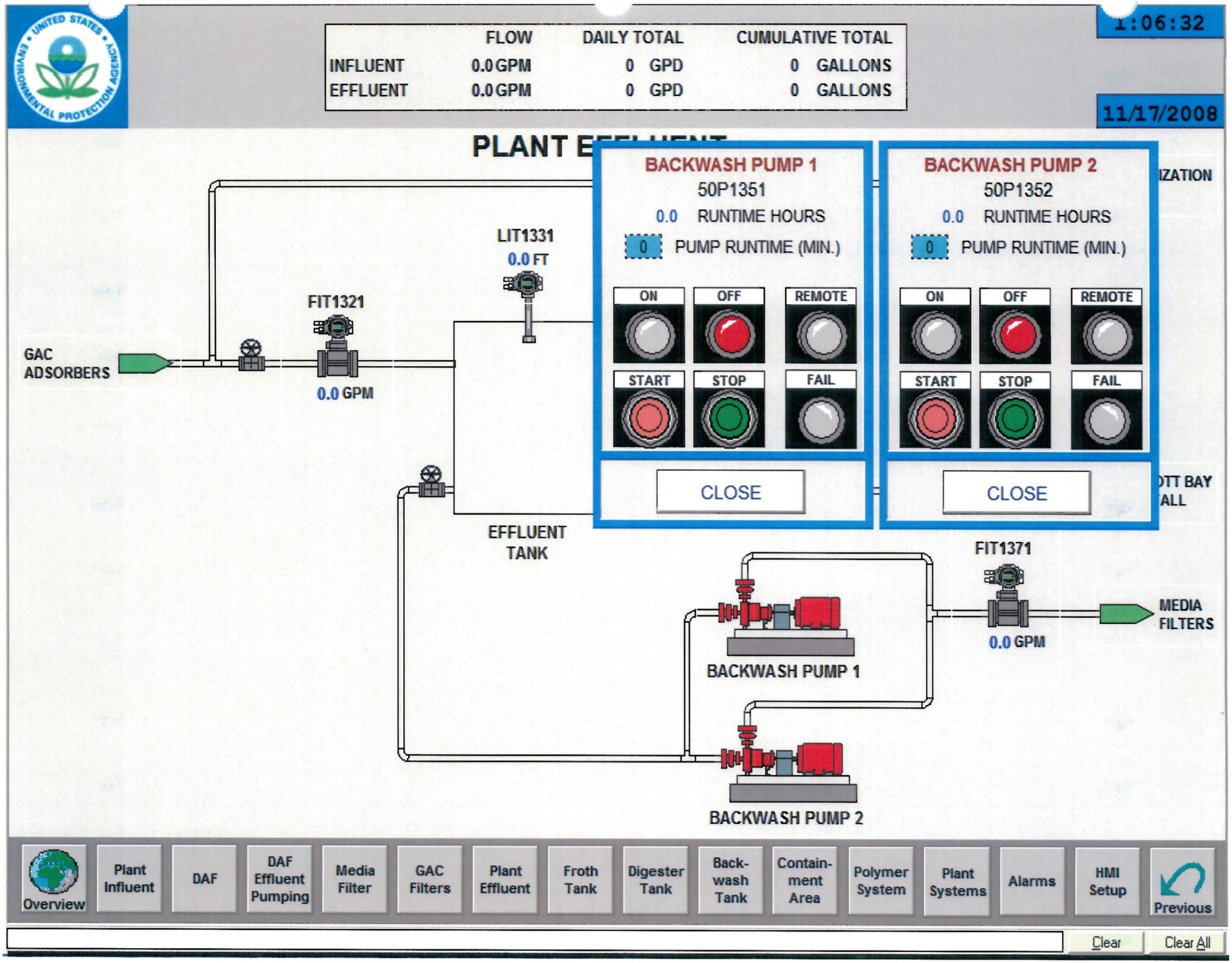

FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0GPM 0 GPD 0 GALLONS
EFFLUENT 0.0GPM 0 GPD 0 GALLONS
11:58:16
11/17/2008
GAC FILTERS
PIT1282
0.0 PSIG
PIT1311
0.0 PSIG
PIT1312
0.0 PSIG
PIT1313
0.0 PSIG
PIT1314
0.0 PSIG
PIT1315
0.0 PSIG
GAC Seq. Selection
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All

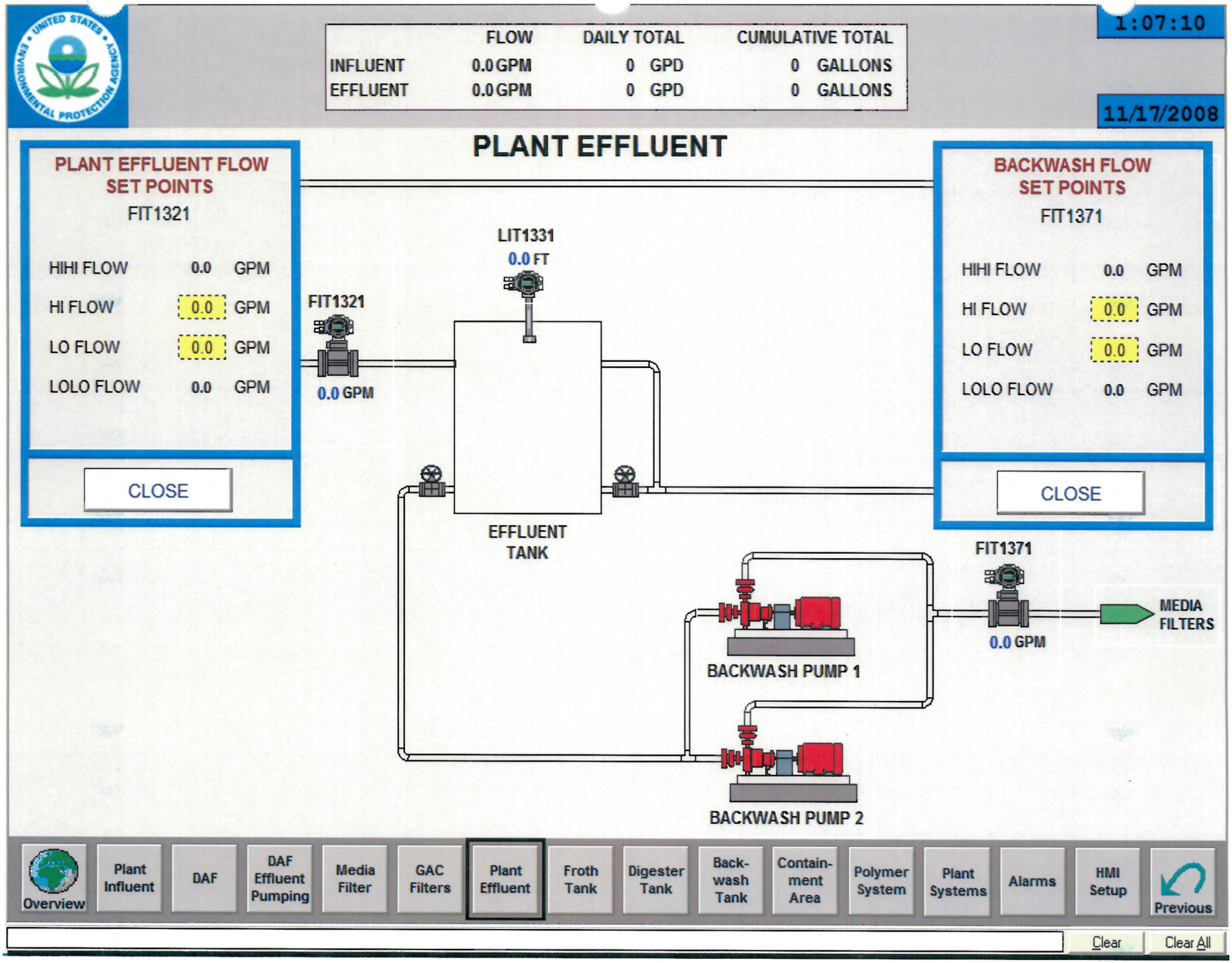

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0GPM 0 GPD 0 GALLONS
EFFLUENT 0.0GPM 0 GPD 0 GALLONS
1:05:35
11/17/2008
PLANT EFFLUENT
EQUALIZATION TANK
LIT1331
0.0 FT
FIT1321
GAC ADSORBERS
0.0 GPM
EFFLUENT TANK
ELLIOTT BAY OUTFALL
FIT1371
MEDIA FILTERS
0.0 GPM
BACKWASH PUMP 1
BACKWASH PUMP 2
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All



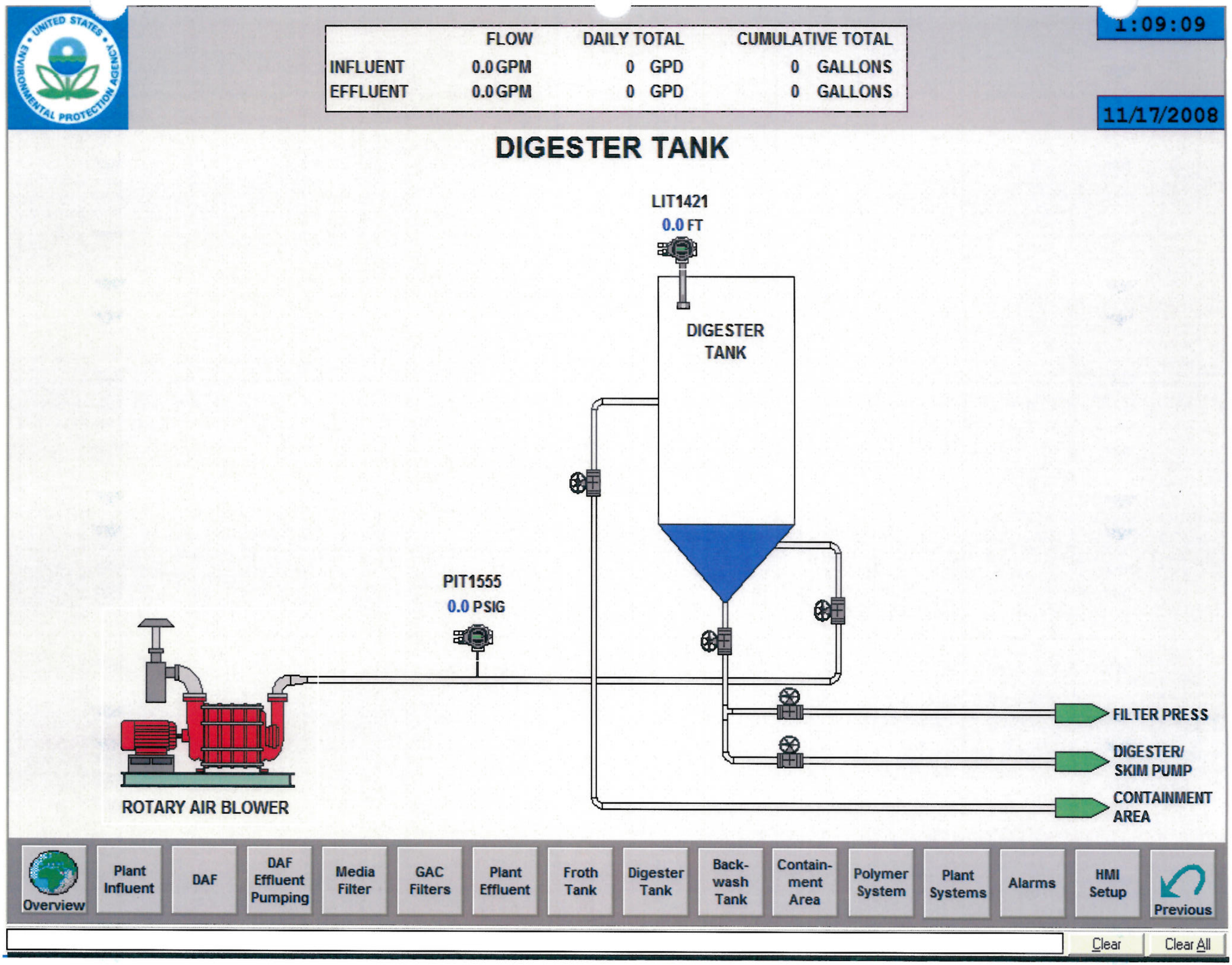
1:06:03
11/17/2008
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0 GPM 0 GPD 0 GALLONS
EFFLUENT 0.0 GPM 0 GPD 0 GALLONS
PLANT EFFLUENT
EFFLUENT TANK INLET FLOW
FIT1321
DAILY TOTALS [GALLONS]
SUN MON TUE WED THU FRI SAT
0 0 0 0 0 0 0
CLOSE
EQUALIZATION TANK
BACKWASH FLOW
FIT1371
DAILY TOTALS [GALLONS]
SUN MON TUE WED THU FRI SAT
0 0 0 0 0 0 0
CLOSE
ELLIOTT BAY OUTFALL
FIT1371
MEDIA FILTERS
0.0 GPM
BACKWASH PUMP 2
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All


1:06:20
11/17/2008
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0GPM 0 GPD 0 GALLONS
EFFLUENT 0.0GPM 0 GPD 0 GALLONS
EFFLUENT TANK LEVEL SET POINTS
LIT1331
HIHI LEVEL 0.0 FEET
HI LEVEL 0.0 FEET
LO LEVEL 0.0 FEET
LOLO LEVEL 0.0 FEET
CLOSE
EQUALIZATION TANK
GAC ADSORBERS
FIT1321
0.0 GPM
EFFLUENT TANK
ELLIOTT BAY OUTFALL
FIT1371
0.0 GPM
MEDIA FILTERS
BACKWASH PUMP 1
BACKWASH PUMP 2
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All

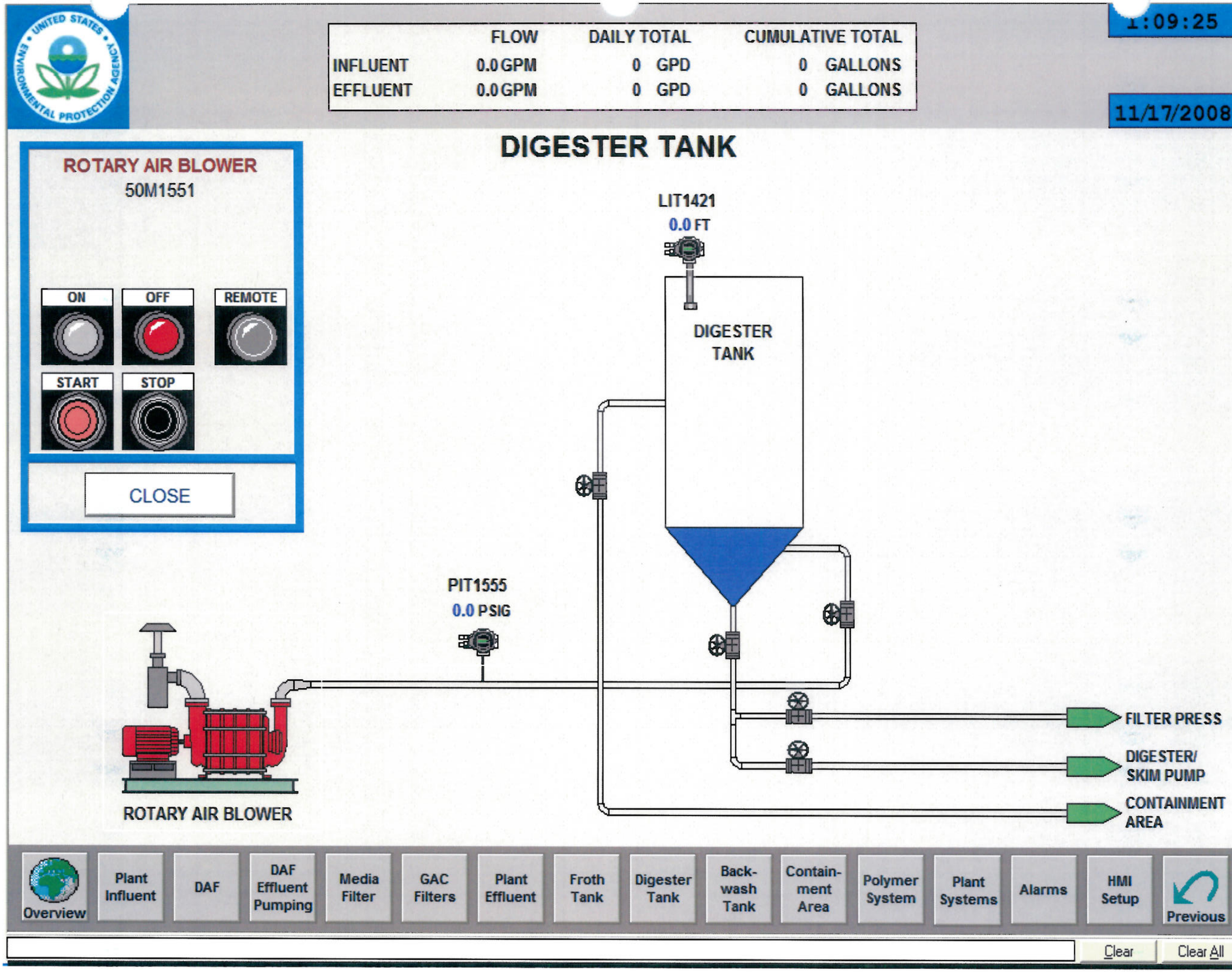

1:06:32
11/17/2008
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0GPM 0 GPD 0 GALLONS
EFFLUENT 0.0GPM 0 GPD 0 GALLONS
PLANT E
BACKWASH PUMP 1
50P1351
0.0 RUNTIME HOURS
0 PUMP RUNTIME (MIN.)
ON
OFF
REMOTE
START
STOP
FAIL
CLOSE
BACKWASH PUMP 2
50P1352
0.0 RUNTIME HOURS
0 PUMP RUNTIME (MIN.)
ON
OFF
REMOTE
START
STOP
FAIL
CLOSE
IZATION
TT BAY
ALL
GAC ADSORBERS
FIT1321
0.0 GPM
LIT1331
0.0 FT
EFFLUENT TANK
FIT1371
0.0 GPM
MEDIA FILTERS
BACKWASH PUMP 1
BACKWASH PUMP 2
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All



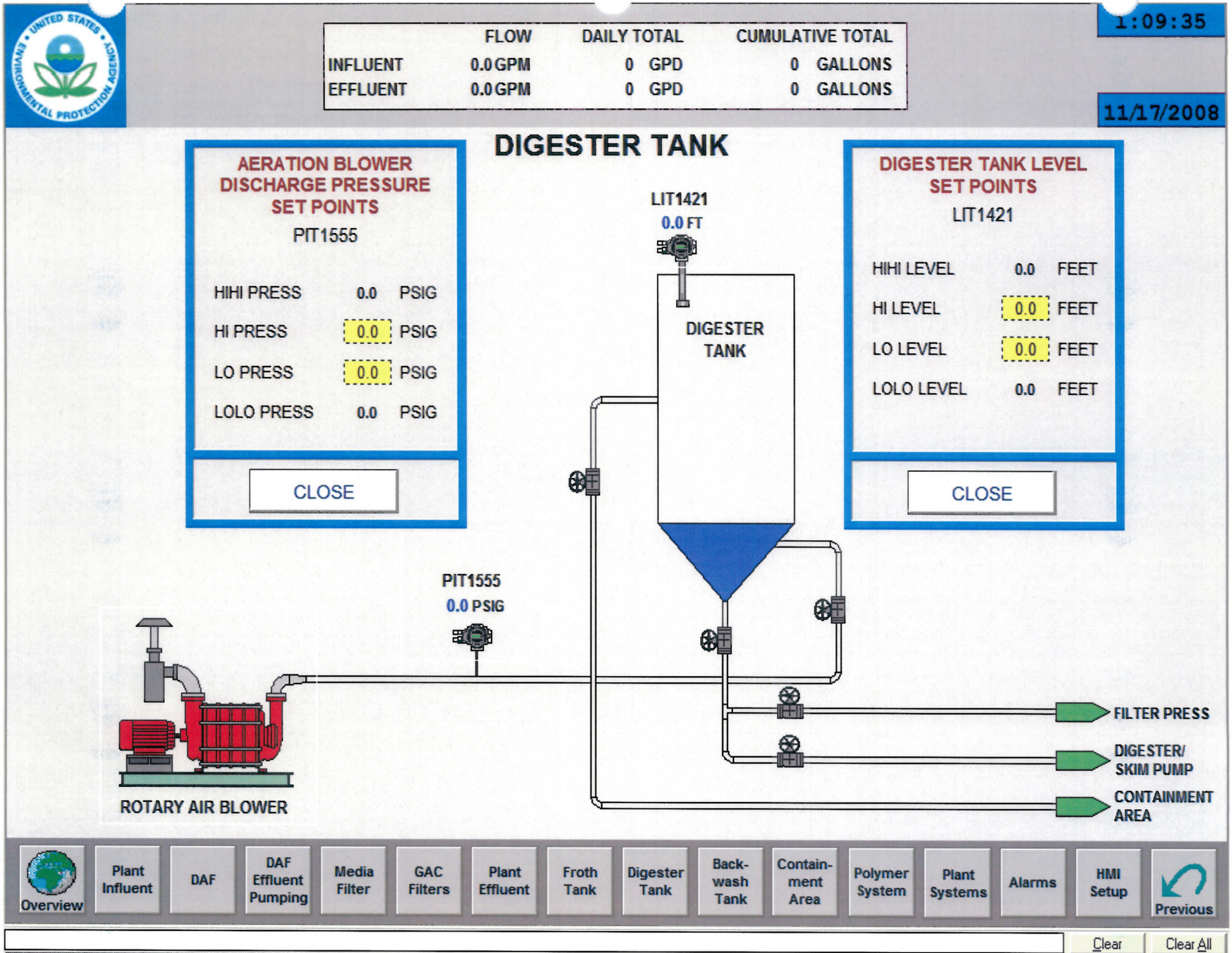
1:07:10
11/17/2008
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0GPM 0 GPD 0 GALLONS
EFFLUENT 0.0GPM 0 GPD 0 GALLONS
PLANT EFFLUENT
PLANT EFFLUENT FLOW SET POINTS
FIT1321
HIHI FLOW 0.0 GPM
HI FLOW 0.0 GPM
LO FLOW 0.0 GPM
LOLO FLOW 0.0 GPM
CLOSE
FIT1321
0.0 GPM
LIT1331
0.0 FT
EFFLUENT TANK
BACKWASH FLOW SET POINTS
FIT1371
HIHI FLOW 0.0 GPM
HI FLOW 0.0 GPM
LO FLOW 0.0 GPM
LOLO FLOW 0.0 GPM
CLOSE
FIT1371
0.0 GPM
MEDIA FILTERS
BACKWASH PUMP 1
BACKWASH PUMP 2
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All



1:09:09
11/17/2008
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0 GPM 0 GPD 0 GALLONS
EFFLUENT 0.0 GPM 0 GPD 0 GALLONS
DIGESTER TANK
LIT1421
0.0 FT
DIGESTER TANK
PIT1555
0.0 PSIG
ROTARY AIR BLOWER
FILTER PRESS
DIGESTER/ SKIM PUMP
CONTAINMENT AREA
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All



1:09:25
11/17/2008
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0 GPM 0 GPD 0 GALLONS
EFFLUENT 0.0 GPM 0 GPD 0 GALLONS
DIGESTER TANK
ROTARY AIR BLOWER
50M1551
ON
OFF
REMOTE
START
STOP
CLOSE
LIT1421
0.0 FT
DIGESTER TANK
PIT1555
0.0 PSIG
ROTARY AIR BLOWER
FILTER PRESS
DIGESTER/ SKIM PUMP
CONTAINMENT AREA
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All

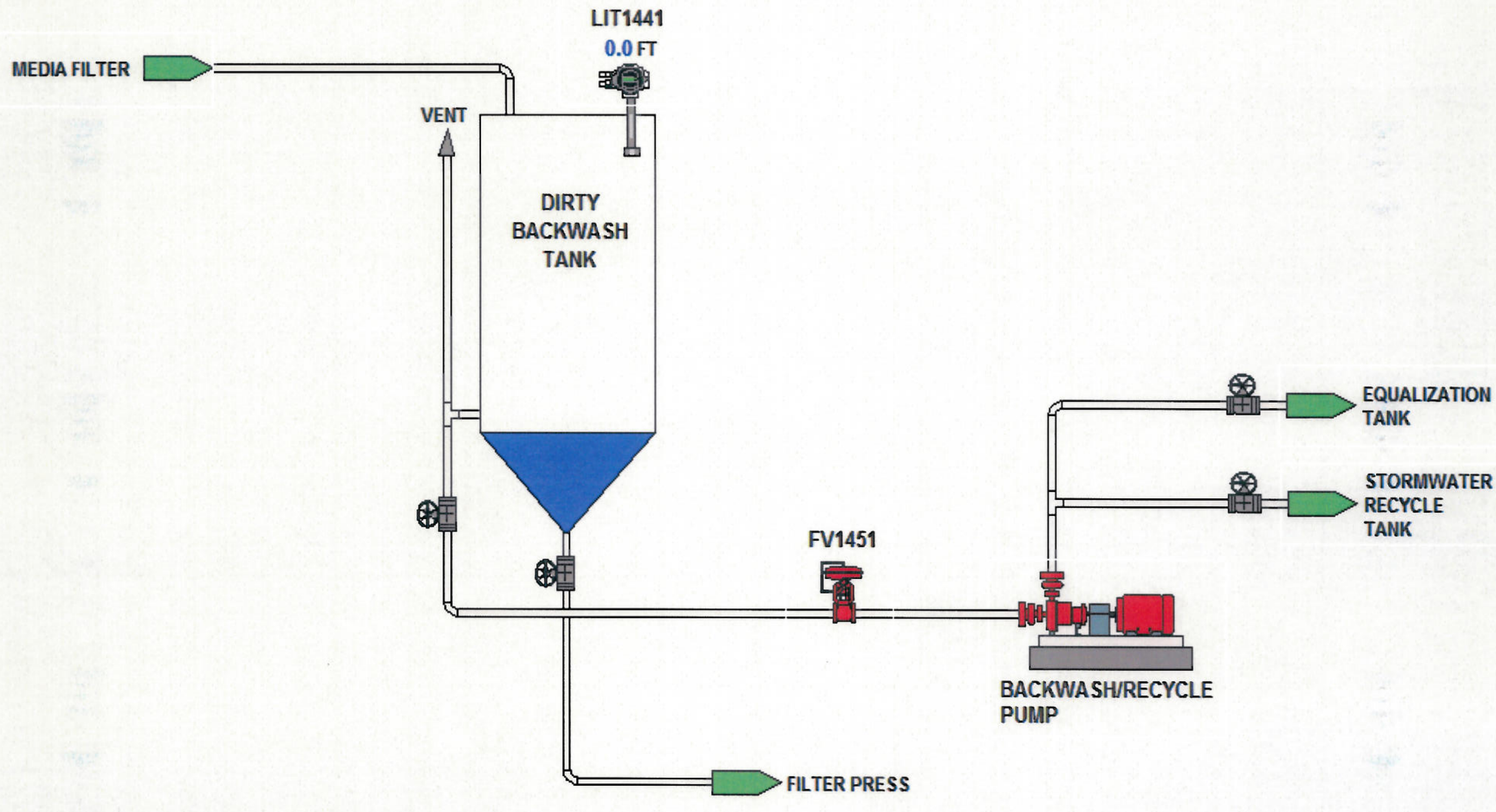

1:09:35
11/17/2008
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0GPM 0 GPD 0 GALLONS
EFFLUENT 0.0GPM 0 GPD 0 GALLONS
DIGESTER TANK
AERATION BLOWER DISCHARGE PRESSURE SET POINTS
PIT1555
HIHI PRESS 0.0 PSIG
HI PRESS 0.0 PSIG
LO PRESS 0.0 PSIG
LOLO PRESS 0.0 PSIG
CLOSE
DIGESTER TANK LEVEL SET POINTS
LIT1421
HIHI LEVEL 0.0 FEET
HI LEVEL 0.0 FEET
LO LEVEL 0.0 FEET
LOLO LEVEL 0.0 FEET
CLOSE
LIT1421
0.0 FT
DIGESTER TANK
PIT1555
0.0 PSIG
ROTARY AIR BLOWER
FILTER PRESS
DIGESTER/ SKIM PUMP
CONTAINMENT AREA
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All

	FLOW	DAILY TOTAL	CUMULATIVE TOTAL
INFLUENT	0.0GPM	0 GPD	0 GALLONS
EFFLUENT	0.0GPM	0 GPD	0 GALLONS

1:09:47

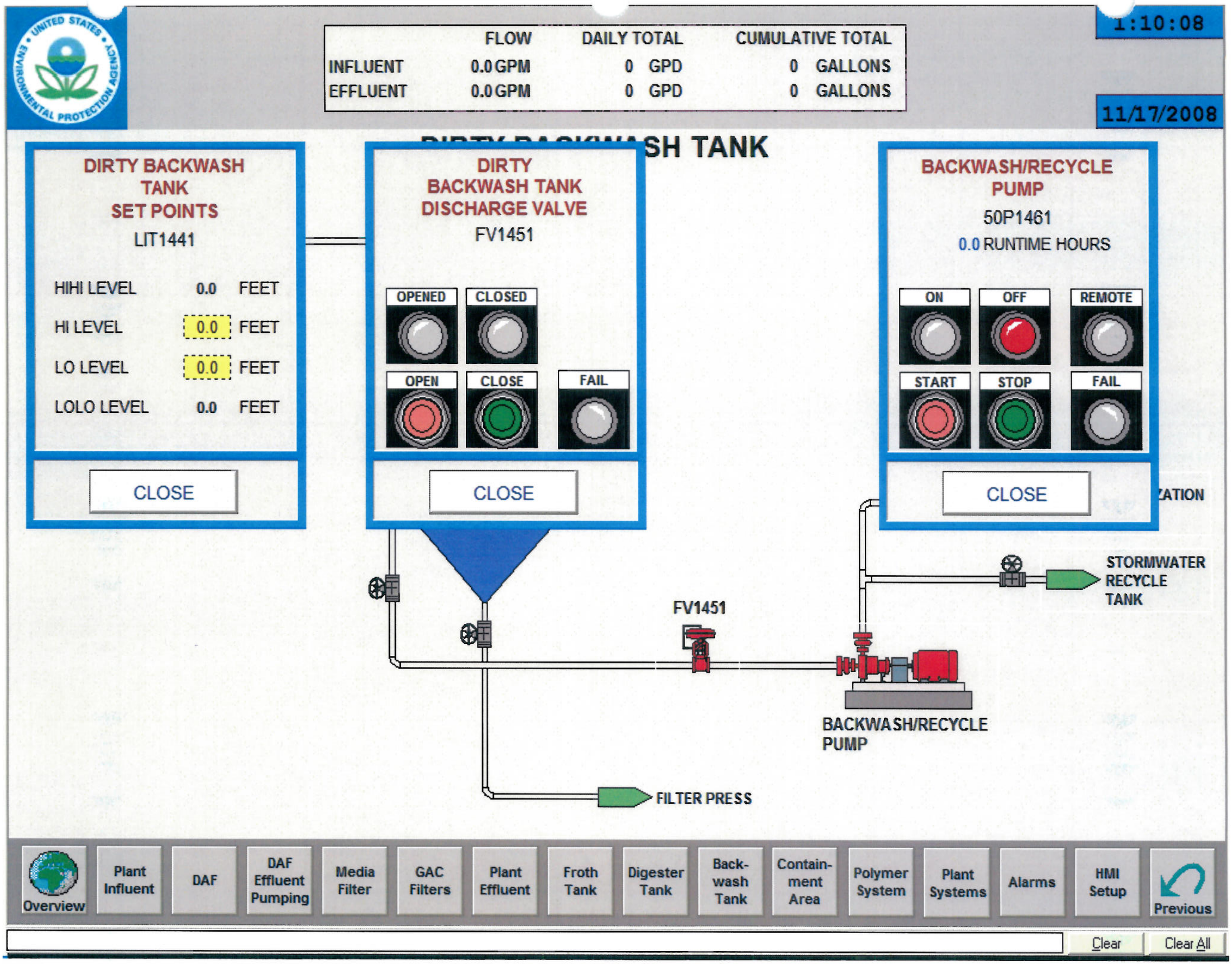
11/17/2008

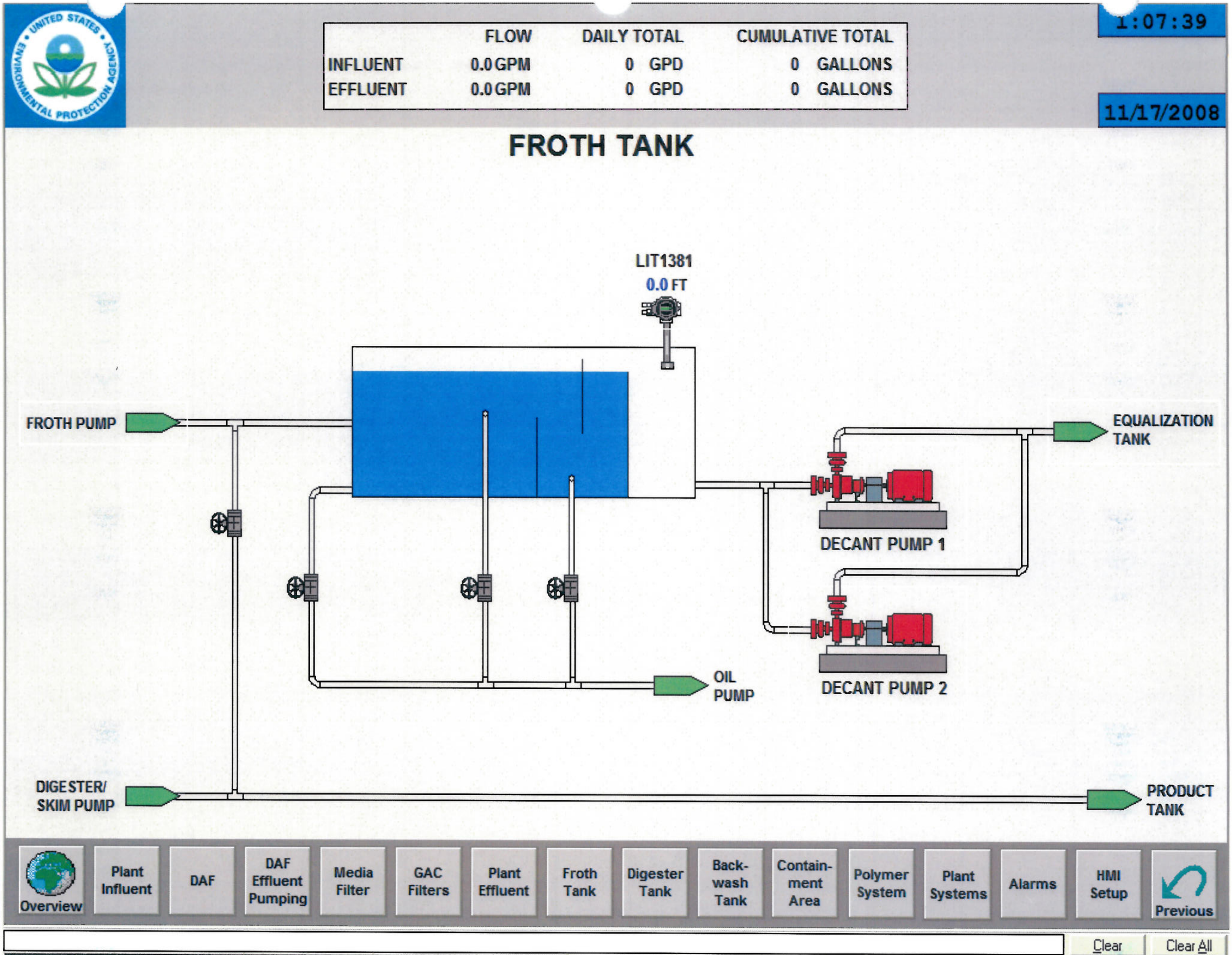
DIRTY BACKWASH TANK



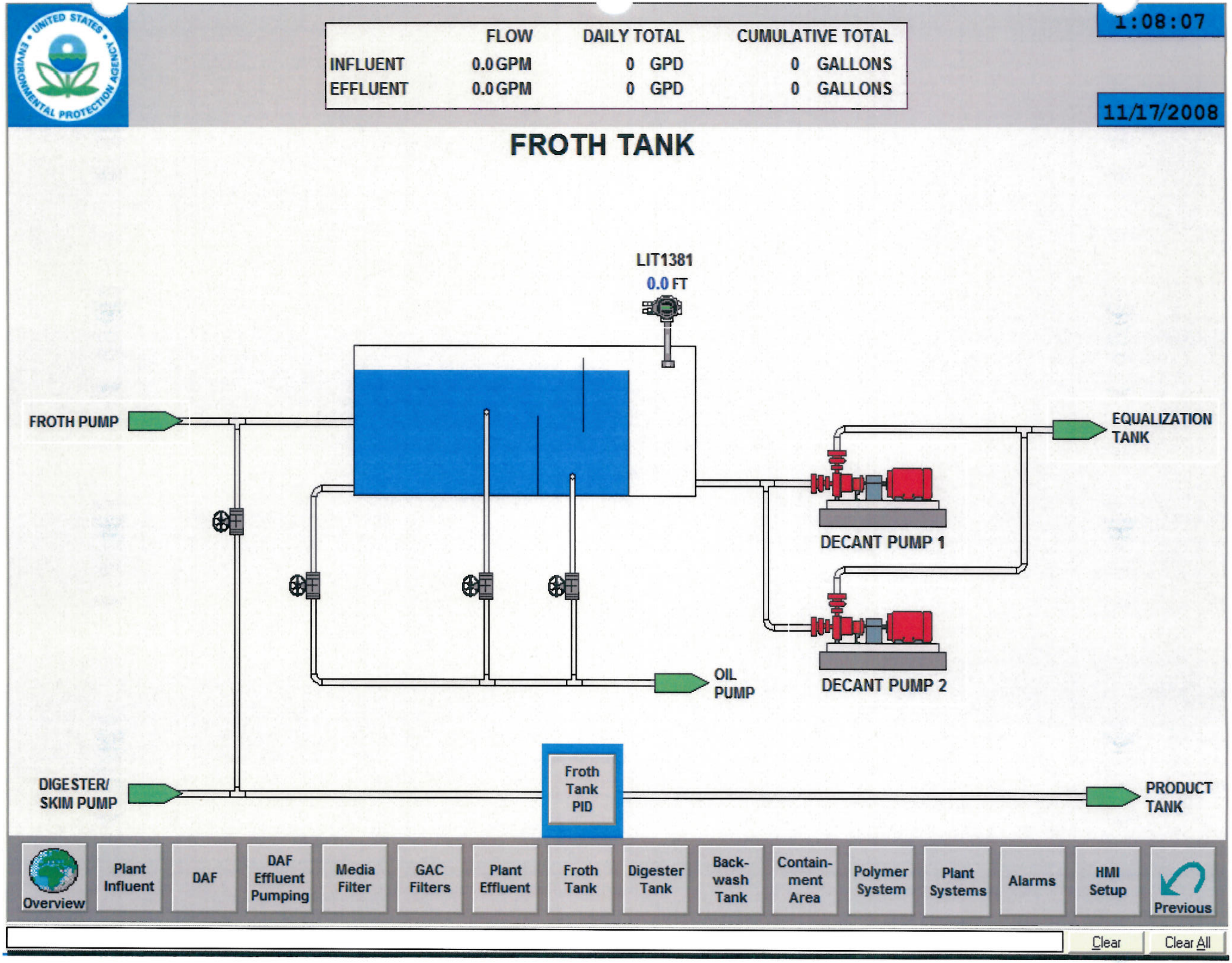
Overview | Plant Influent | DAF | DAF Effluent Pumping | Media Filter | GAC Filters | Plant Effluent | Froth Tank | Digester Tank | Back-wash Tank | Contain-ment Area | Polymer System | Plant Systems | Alarms | HMI Setup | Previous

Clear | Clear All

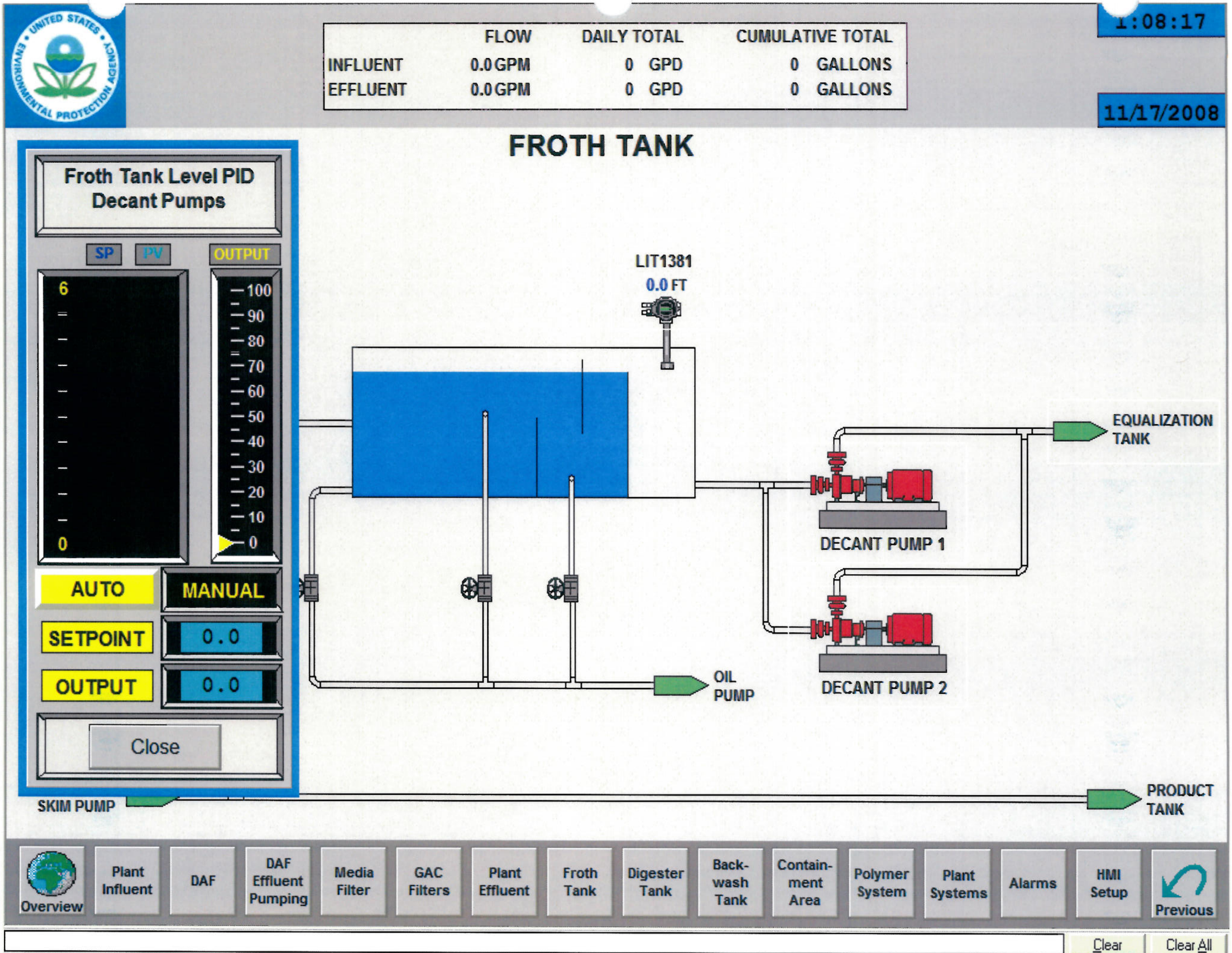

1:10:08
11/17/2008
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0GPM 0 GPD 0 GALLONS
EFFLUENT 0.0GPM 0 GPD 0 GALLONS
SH TANK
DIRTY BACKWASH TANK SET POINTS
LIT1441
HIHI LEVEL 0.0 FEET
HI LEVEL 0.0 FEET
LO LEVEL 0.0 FEET
LOLO LEVEL 0.0 FEET
CLOSE
DIRTY BACKWASH TANK DISCHARGE VALVE
FV1451
OPENED
CLOSED
OPEN
CLOSE
FAIL
CLOSE
BACKWASH/RECYCLE PUMP
50P1461
0.0 RUNTIME HOURS
ON
OFF
REMOTE
START
STOP
FAIL
CLOSE
ZATION
STORMWATER RECYCLE TANK
FV1451
BACKWASH/RECYCLE PUMP
FILTER PRESS
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All



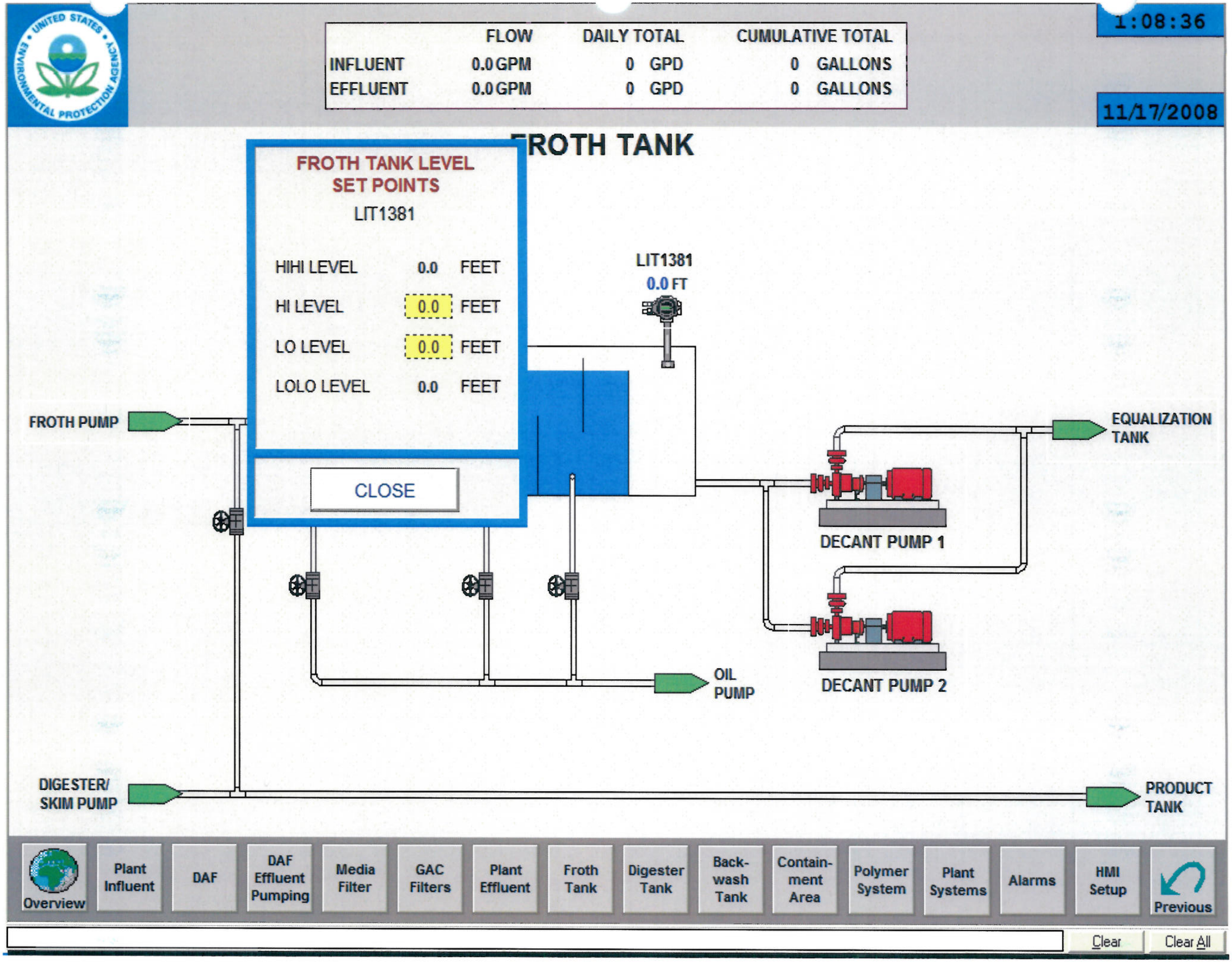
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0GPM 0 GPD 0 GALLONS
EFFLUENT 0.0GPM 0 GPD 0 GALLONS
1:07:39
11/17/2008
FROTH TANK
LIT1381
0.0 FT
FROTH PUMP
EQUALIZATION TANK
DECANT PUMP 1
DECANT PUMP 2
OIL PUMP
DIGESTER/ SKIM PUMP
PRODUCT TANK
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All

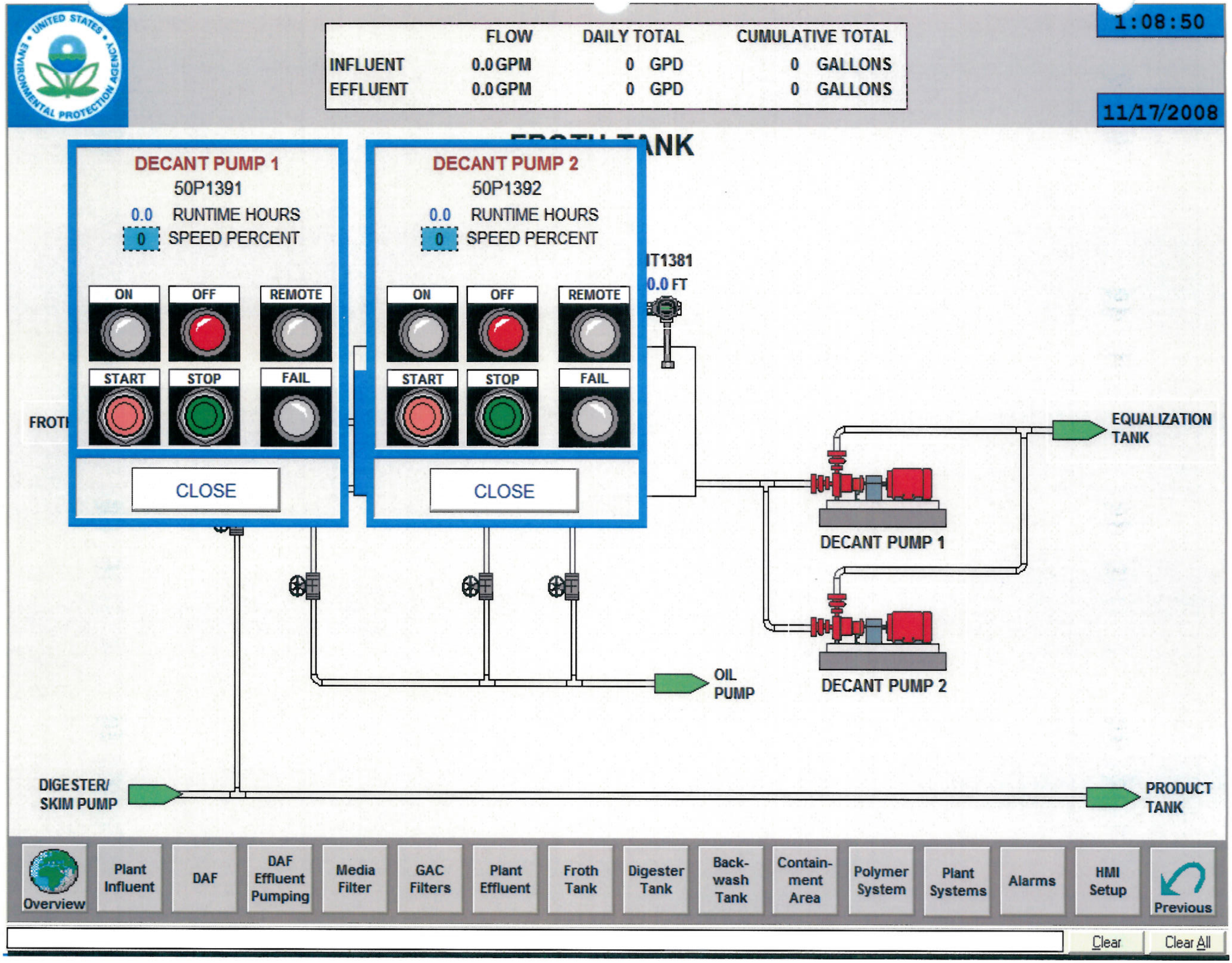


1:08:07
11/17/2008
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0 GPM 0 GPD 0 GALLONS
EFFLUENT 0.0 GPM 0 GPD 0 GALLONS
FROTH TANK
LIT1381
0.0 FT
FROTH PUMP
EQUALIZATION TANK
DECANT PUMP 1
DECANT PUMP 2
OIL PUMP
DIGESTER/ SKIM PUMP
PRODUCT TANK
Froth Tank PID
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All

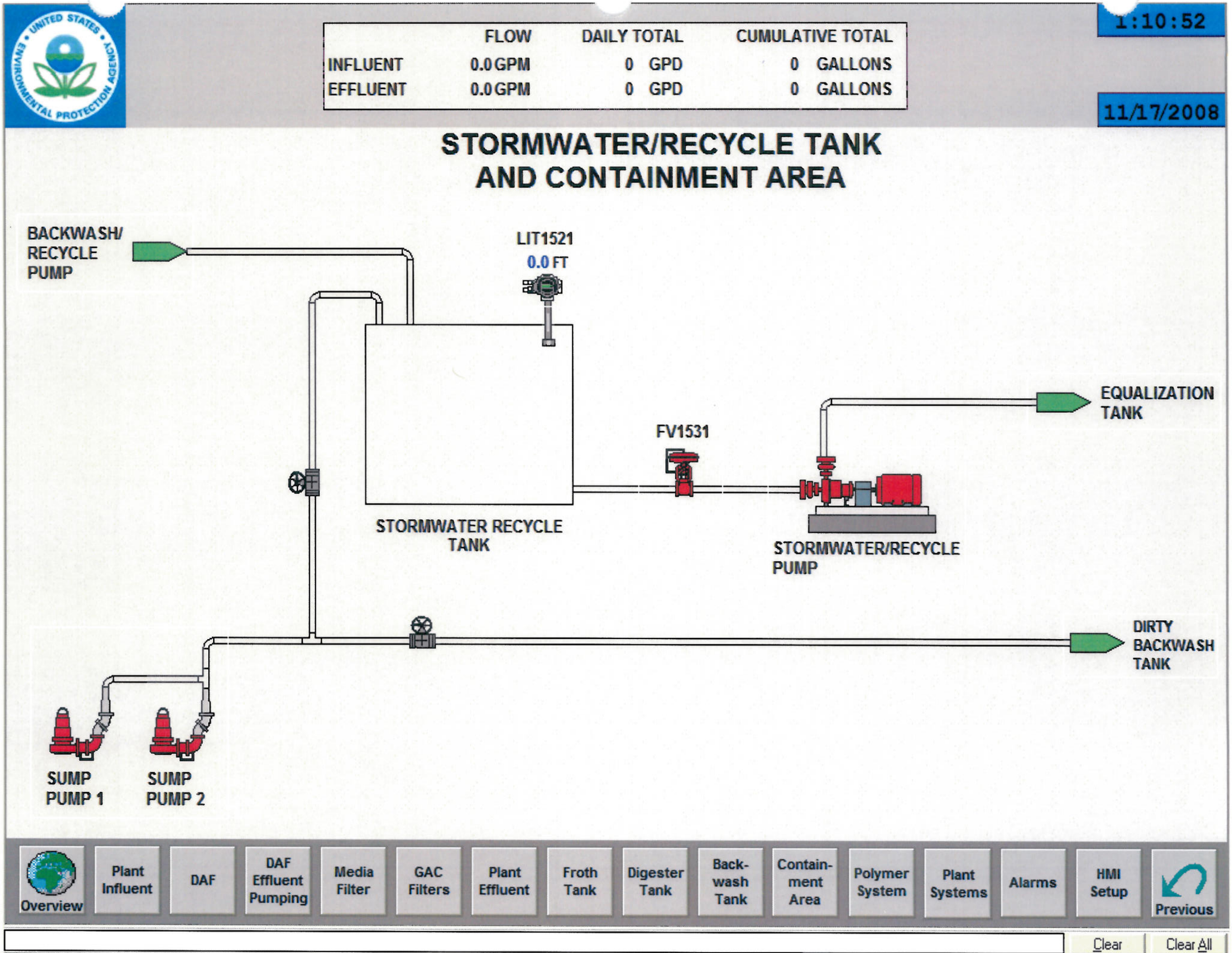


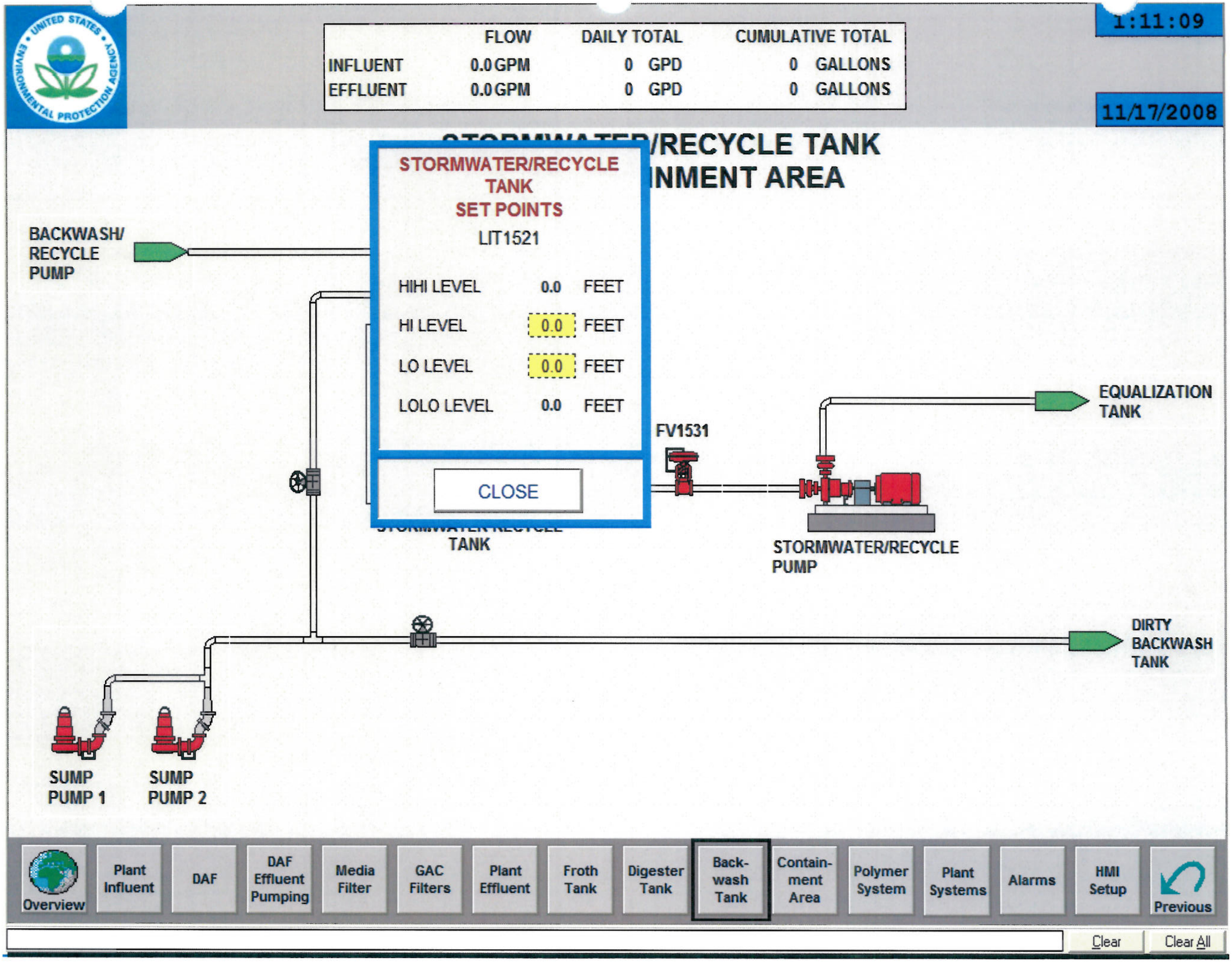
1:08:17
11/17/2008
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0 GPM 0 GPD 0 GALLONS
EFFLUENT 0.0 GPM 0 GPD 0 GALLONS
FROTH TANK
Froth Tank Level PID
Decant Pumps
SP
PV
OUTPUT
6
0
100
90
80
70
60
50
40
30
20
10
0
AUTO
MANUAL
SETPOINT
0.0
OUTPUT
0.0
Close
LIT1381
0.0 FT
EQUALIZATION TANK
DECANT PUMP 1
DECANT PUMP 2
OIL PUMP
SKIM PUMP
PRODUCT TANK
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All

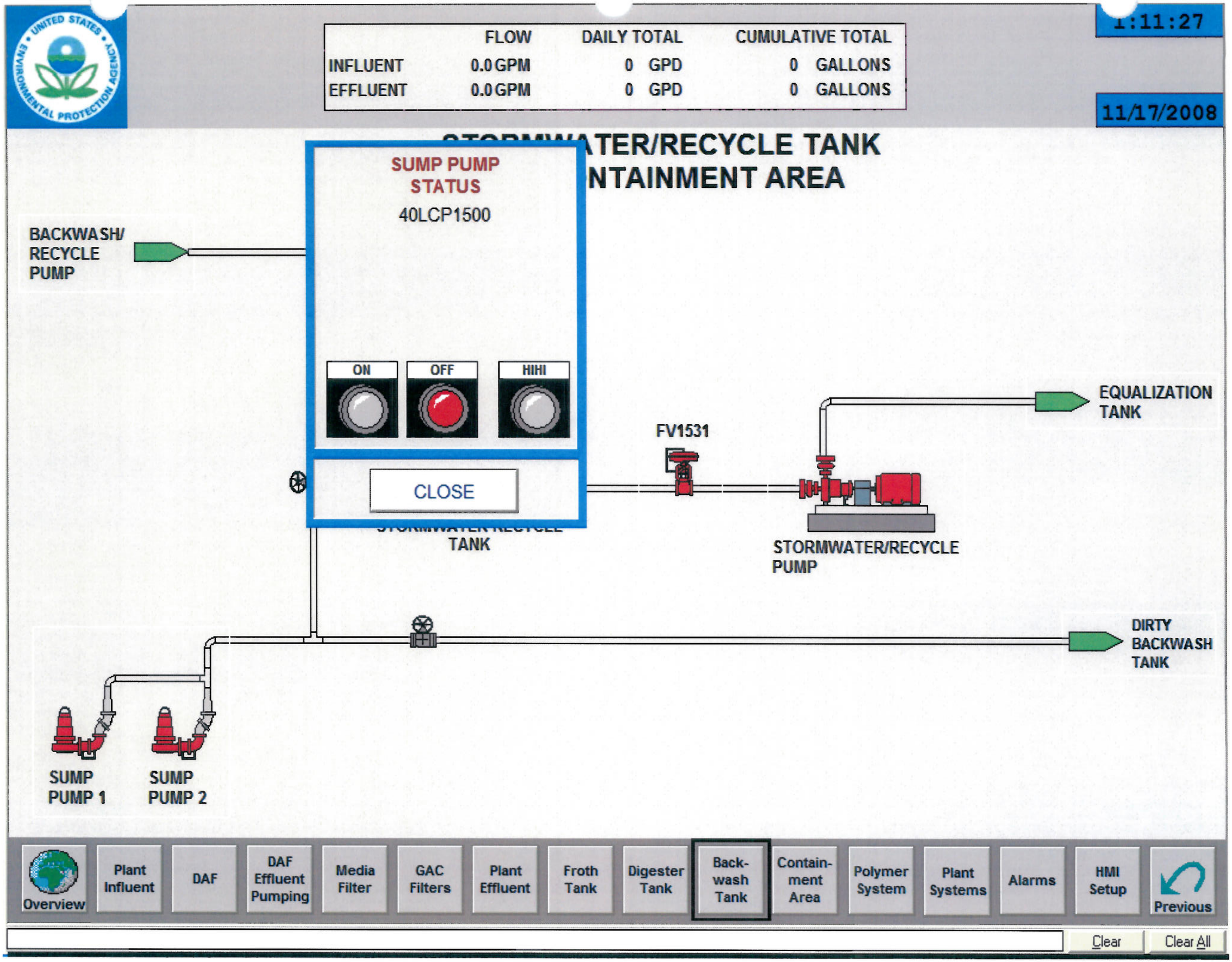

1:08:36
11/17/2008
FLOW DAILY TOTAL CUMULATIVE TOTAL
INFLUENT 0.0GPM 0 GPD 0 GALLONS
EFFLUENT 0.0GPM 0 GPD 0 GALLONS
FROTH TANK
FROTH TANK LEVEL SET POINTS
LIT1381
HIHI LEVEL 0.0 FEET
HI LEVEL 0.0 FEET
LO LEVEL 0.0 FEET
LOLO LEVEL 0.0 FEET
CLOSE
LIT1381
0.0 FT
FROTH PUMP
EQUALIZATION TANK
DECANT PUMP 1
DECANT PUMP 2
OIL PUMP
DIGESTER/ SKIM PUMP
PRODUCT TANK
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All



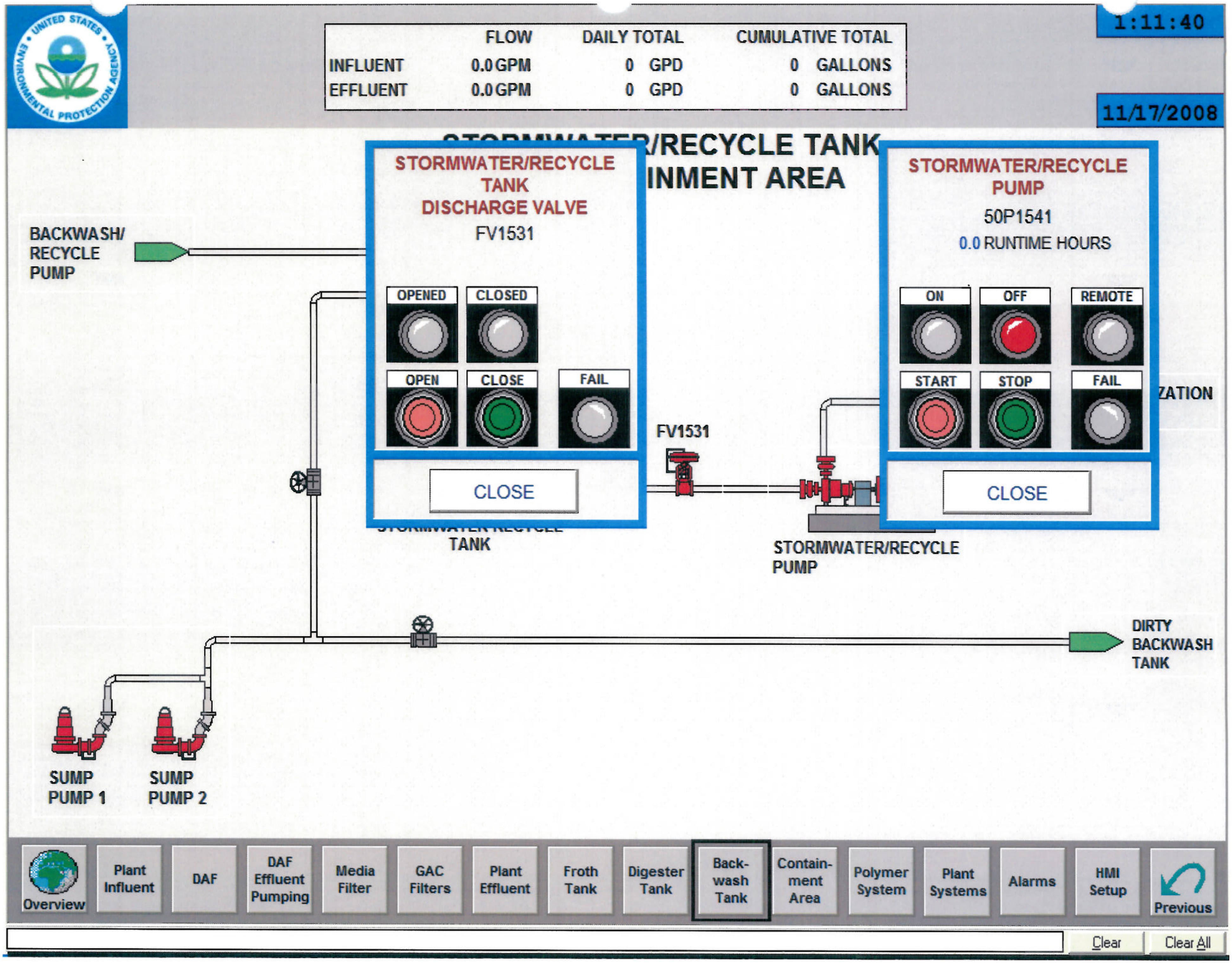
1:08:50
11/17/2008
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0GPM 0 GPD 0 GALLONS
EFFLUENT 0.0GPM 0 GPD 0 GALLONS
DECANT PUMP 1
50P1391
0.0 RUNTIME HOURS
0 SPEED PERCENT
ON
OFF
REMOTE
START
STOP
FAIL
CLOSE
DECANT PUMP 2
50P1392
0.0 RUNTIME HOURS
0 SPEED PERCENT
ON
OFF
REMOTE
START
STOP
FAIL
CLOSE
LIT1381
0.0 FT
EQUALIZATION TANK
DECANT PUMP 1
DECANT PUMP 2
OIL PUMP
DIGESTER/ SKIM PUMP
PRODUCT TANK
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All


1:10:52
11/17/2008
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0 GPM 0 GPD 0 GALLONS
EFFLUENT 0.0 GPM 0 GPD 0 GALLONS
STORMWATER/RECYCLE TANK AND CONTAINMENT AREA
BACKWASH/ RECYCLE PUMP
LIT1521
0.0 FT
STORMWATER RECYCLE TANK
FV1531
EQUALIZATION TANK
STORMWATER/RECYCLE PUMP
DIRTY BACKWASH TANK
SUMP PUMP 1
SUMP PUMP 2
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All

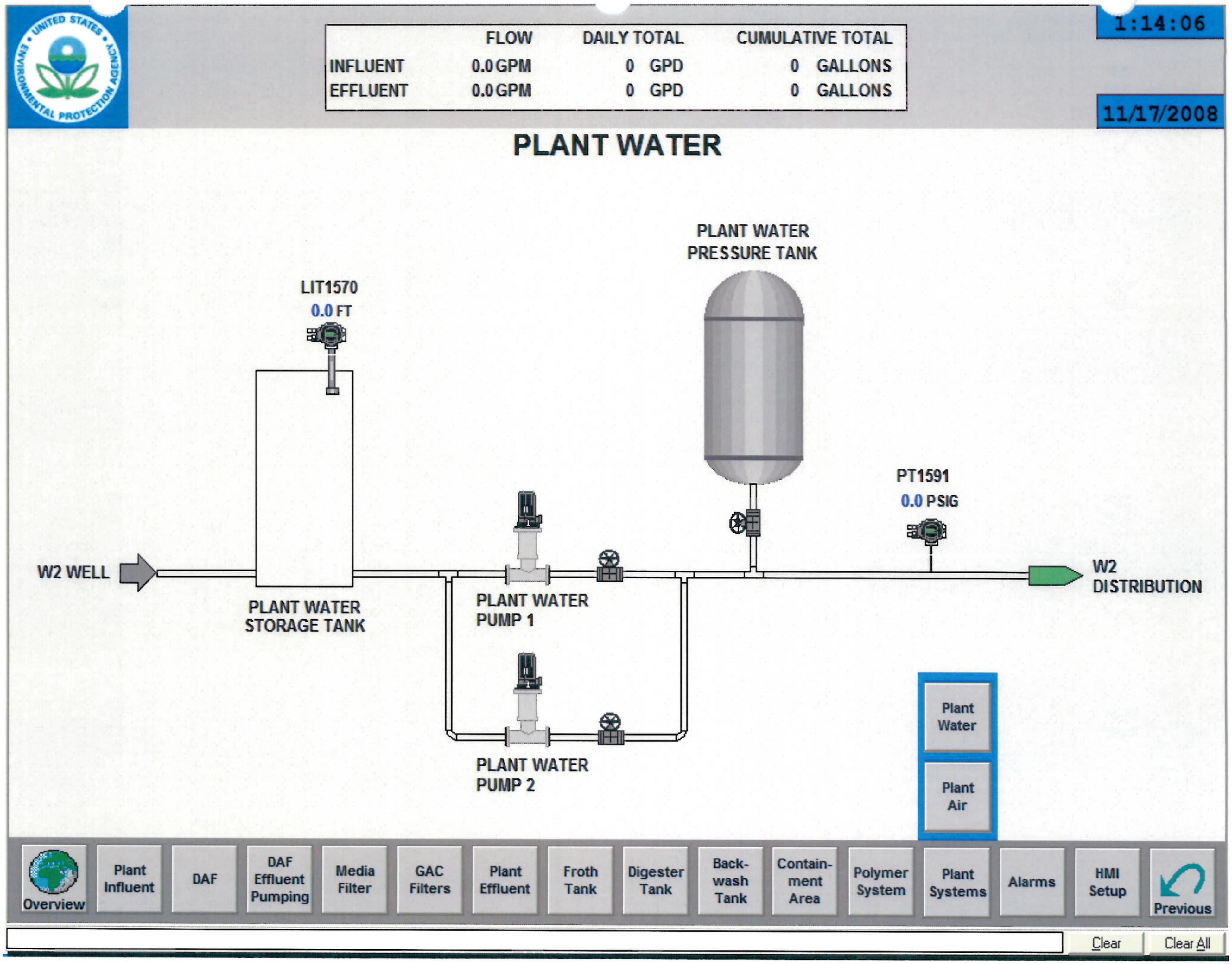

FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0 GPM 0 GPD 0 GALLONS
EFFLUENT 0.0 GPM 0 GPD 0 GALLONS
1:11:09
11/17/2008
/RECYCLE TANK
NMENT AREA
STORMWATER/RECYCLE
TANK
SET POINTS
LIT1521
HIHI LEVEL 0.0 FEET
HI LEVEL 0.0 FEET
LO LEVEL 0.0 FEET
LOLO LEVEL 0.0 FEET
CLOSE
TANK
BACKWASH/
RECYCLE
PUMP
FV1531
EQUALIZATION
TANK
STORMWATER/RECYCLE
PUMP
DIRTY
BACKWASH
TANK
SUMP
PUMP 1
SUMP
PUMP 2
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All

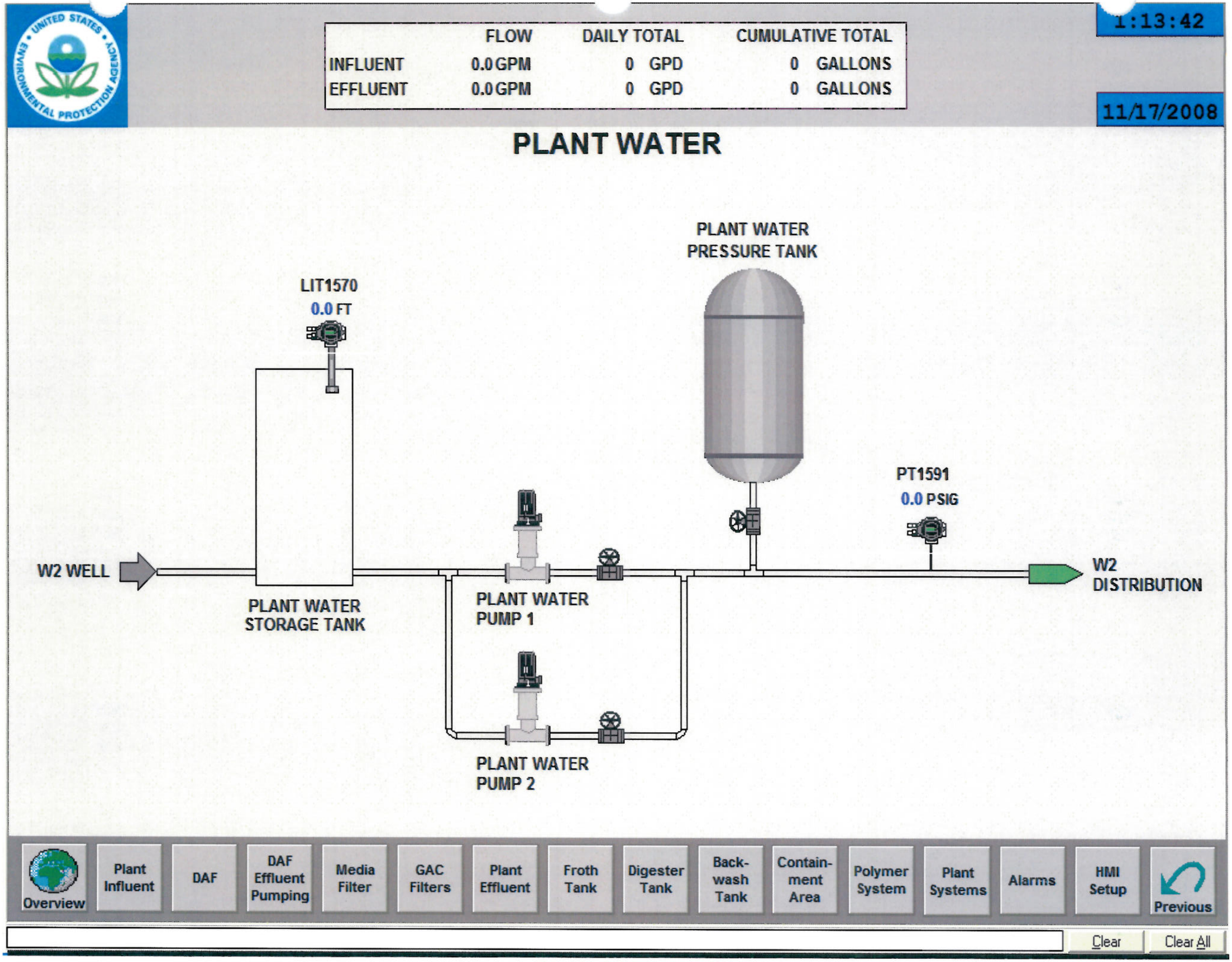


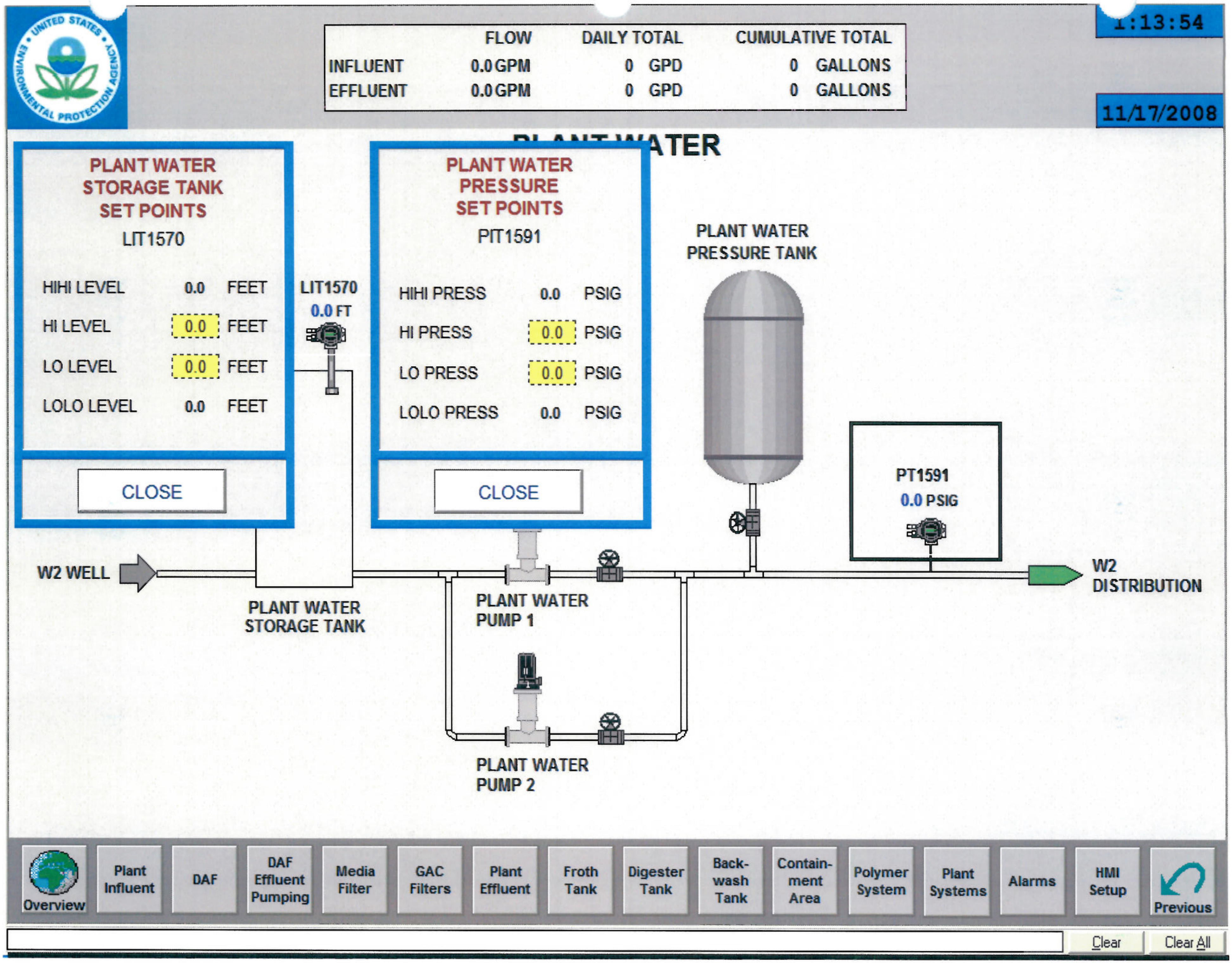
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0GPM 0 GPD 0 GALLONS
EFFLUENT 0.0GPM 0 GPD 0 GALLONS
1:11:27
11/17/2008
STORMWATER/RECYCLE TANK
CONTAINMENT AREA
SUMP PUMP
STATUS
40LCP1500
ON
OFF
HIHI
CLOSE
BACKWASH/
RECYCLE
PUMP
TANK
FV1531
EQUALIZATION
TANK
STORMWATER/RECYCLE
PUMP
DIRTY
BACKWASH
TANK
SUMP
PUMP 1
SUMP
PUMP 2
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All



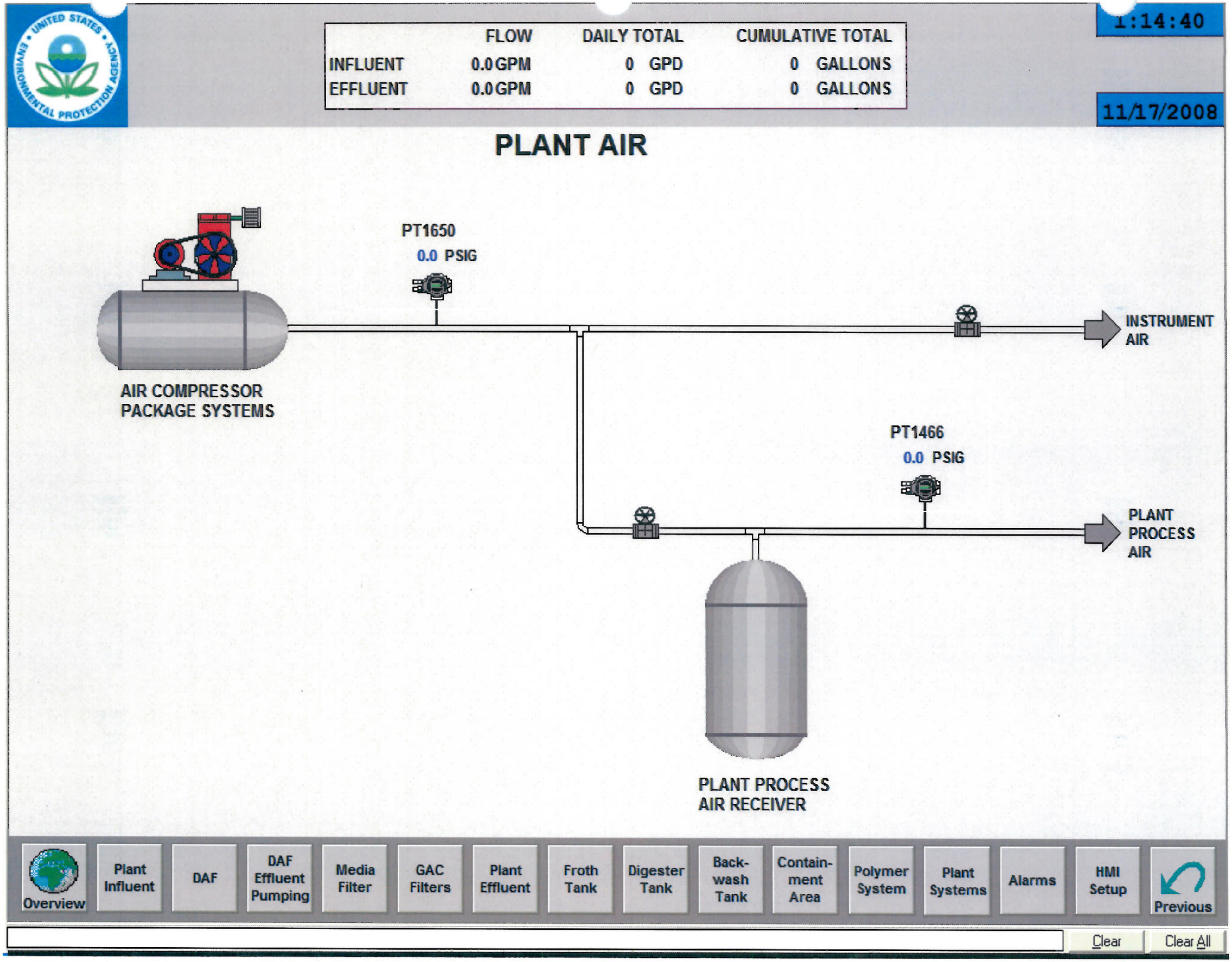
1:11:40
11/17/2008
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0 GPM 0 GPD 0 GALLONS
EFFLUENT 0.0 GPM 0 GPD 0 GALLONS
INMENT AREA
STORMWATER/RECYCLE TANK DISCHARGE VALVE
FV1531
OPENED
CLOSED
OPEN
CLOSE
FAIL
CLOSE
STORMWATER/RECYCLE PUMP
50P1541
0.0 RUNTIME HOURS
ON
OFF
REMOTE
START
STOP
FAIL
CLOSE
BACKWASH/ RECYCLE PUMP
FV1531
TANK
STORMWATER/RECYCLE PUMP
ZATION
DIRTY BACKWASH TANK
SUMP PUMP 1
SUMP PUMP 2
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All


1:14:06
11/17/2008
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0 GPM 0 GPD 0 GALLONS
EFFLUENT 0.0 GPM 0 GPD 0 GALLONS
PLANT WATER
PLANT WATER PRESSURE TANK
LIT1570
0.0 FT
PT1591
0.0 PSIG
W2 WELL
PLANT WATER STORAGE TANK
PLANT WATER PUMP 1
PLANT WATER PUMP 2
W2 DISTRIBUTION
Plant Water
Plant Air
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All

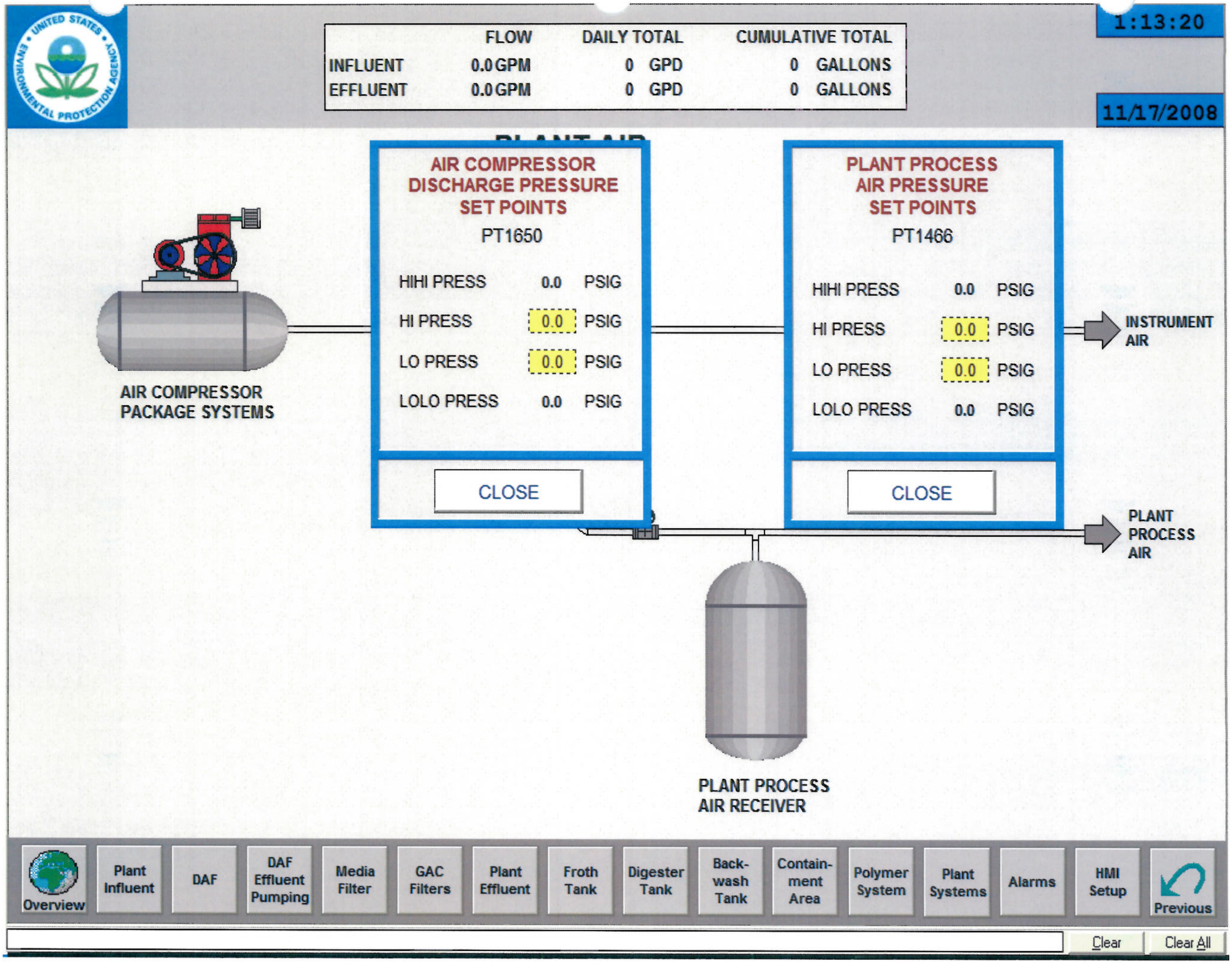

1:13:42
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0 GPM 0 GPD 0 GALLONS
EFFLUENT 0.0 GPM 0 GPD 0 GALLONS
11/17/2008
PLANT WATER
PLANT WATER PRESSURE TANK
LIT1570
0.0 FT
PT1591
0.0 PSIG
W2 WELL
W2 DISTRIBUTION
PLANT WATER STORAGE TANK
PLANT WATER PUMP 1
PLANT WATER PUMP 2
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All



1:13:54
11/17/2008
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0 GPM 0 GPD 0 GALLONS
EFFLUENT 0.0 GPM 0 GPD 0 GALLONS
PLANT WATER
PLANT WATER STORAGE TANK SET POINTS
LIT1570
HIHI LEVEL 0.0 FEET
HI LEVEL 0.0 FEET
LO LEVEL 0.0 FEET
LOLO LEVEL 0.0 FEET
CLOSE
LIT1570
0.0 FT
PLANT WATER PRESSURE SET POINTS
PIT1591
HIHI PRESS 0.0 PSIG
HI PRESS 0.0 PSIG
LO PRESS 0.0 PSIG
LOLO PRESS 0.0 PSIG
CLOSE
PLANT WATER PRESSURE TANK
PT1591
0.0 PSIG
W2 WELL
PLANT WATER STORAGE TANK
PLANT WATER PUMP 1
PLANT WATER PUMP 2
W2 DISTRIBUTION
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All



1:14:40
11/17/2008
FLOW
DAILY TOTAL
CUMULATIVE TOTAL
INFLUENT 0.0 GPM 0 GPD 0 GALLONS
EFFLUENT 0.0 GPM 0 GPD 0 GALLONS
PLANT AIR
PT1650
0.0 PSIG
AIR COMPRESSOR PACKAGE SYSTEMS
INSTRUMENT AIR
PT1466
0.0 PSIG
PLANT PROCESS AIR
PLANT PROCESS AIR RECEIVER
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All



1:13:20
11/17/2008
FLOW DAILY TOTAL CUMULATIVE TOTAL
INFLUENT 0.0GPM 0 GPD 0 GALLONS
EFFLUENT 0.0GPM 0 GPD 0 GALLONS
AIR COMPRESSOR DISCHARGE PRESSURE SET POINTS
PT1650
HIHI PRESS 0.0 PSIG
HI PRESS 0.0 PSIG
LO PRESS 0.0 PSIG
LOLO PRESS 0.0 PSIG
CLOSE
PLANT PROCESS AIR PRESSURE SET POINTS
PT1466
HIHI PRESS 0.0 PSIG
HI PRESS 0.0 PSIG
LO PRESS 0.0 PSIG
LOLO PRESS 0.0 PSIG
CLOSE
AIR COMPRESSOR PACKAGE SYSTEMS
INSTRUMENT AIR
PLANT PROCESS AIR
PLANT PROCESS AIR RECEIVER
Overview
Plant Influent
DAF
DAF Effluent Pumping
Media Filter
GAC Filters
Plant Effluent
Froth Tank
Digester Tank
Back-wash Tank
Contain-ment Area
Polymer System
Plant Systems
Alarms
HMI Setup
Previous
Clear
Clear All

1:15:10

11/17/2008

	FLOW	DAILY TOTAL	CUMULATIVE TOTAL
INFLUENT	0.0GPM	0 GPD	0 GALLONS
EFFLUENT	0.0GPM	0 GPD	0 GALLONS

Alarm Date	Alarm Time	Tag Description	Alarm Label	Ack Time	Tagname

Ack Current | Ack All | Filter | Sort

ACKNOWLEDGE ALL | RETURN

Overview | Plant Influent | DAF | DAF Effluent Pumping | Media Filter | GAC Filters | Plant Effluent | Froth Tank | Digester Tank | Back-wash Tank | Contain-ment Area | Polymer System | Plant Systems | Alarms | HMI Setup | Previous

Clear | Clear All

1:15:53

11/17/2008

	FLOW	DAILY TOTAL	CUMULATIVE TOTAL
INFLUENT	0.0GPM	0 GPD	0 GALLONS
EFFLUENT	0.0GPM	0 GPD	0 GALLONS

Disable	Description	Alarm	Disable	Description	Alarm
☐	Fire Alarm Control Panel SUPERVISORY	SUPERVISORY	☐	FORTH PUMP 2	On
☐	Fire Alarm Control Panel ALARM	ALARM	☐	PLANT AIR LOW	On
☐	Fire Alarm Control Panel TROUBLE	TROUBLE	☐	HDBF INLET VALVE	On
☐	Plant Influent Flow	Plant Influent	☐	HDBF DISCHARGE VALVE	On
☐	EQ TANK LEVEL	EQ TANK LEVEL	☐	HDBF BACKWASH SUPPLY VALVE	On
☐	EQ TANK DISCHARGE VALVE	EQ TANK DISCHAR	☐	HDBF BACKWASH DISCHARGE VALVE	On
☐	DAF EMERGENCY EYEWASH	DAF EMERGENCY E	☐	HDBF RECIRCULATION VALVE	On
☐	DAF FEED PUMP 1	W1101A\Fail_Dis	☐	HDBF VENT VALVE	On
☐	DAF FEED PUMP 2	On	☐	HDBF DIFFERENTIAL PRESSURE	On
☐	DAF FEED FLOW	On	☐	HDBF BACKFLOW VALVE	On
☐	DAF MIXER	On	☐	HDBF DISCHARGE PRESSURE	On
☐	DAF FROTH LEVEL	On	☐	GAC FILTER 1 INLET PRESSURE	On
☐	DAF RECYCLE FLOW VALVE	On	☐	GAC FILTER 1 DISCHARGE PRESSURE	On
☐	DAF RECYCLE PUMP	On	☐	GAC FILTER 2 DISCHARGE PRESSURE	On
☐	DAF RECYCLE FLOW	On	☐	GAC FILTER 3 DISCHARGE PRESSURE	On
☐	DAF EFFLUENT CHAMBER LEVEL	On	☐	GAC FILTER 4 DISCHARGE PRESSURE	On
☐	FILTER PRESS EMERGENCY EYEWASH	On	☐	GAC FILTER 5 DISCHARGE PRESSURE	On
☐	CONTAINMENT AREA EYEWASH	On	☐	EFFLUENT TANK INLET FLOW	On
☐	FILTER FEED PUMP 1	On	☐	EFFLUENT TANK LEVEL	On
☐	FILTER FEED PUMP 2	On	☐	W2 WELL PUMP	On
☐	DAF EFFLUENT TURBIDITY	On	☐	PLANT WATER TANK LEVEL	On
☐	FROTH PUMP 1	On			

Overview | Plant Influent | DAF | DAF Effluent Pumping | Media Filter | GAC Filters | Plant Effluent | Froth Tank | Digester Tank | Back-wash Tank | Contain-ment Area | Polymer System | Plant Systems | Alarms | HMI Setup | Previous

Clear | Clear All

	FLOW	DAILY TOTAL	CUMULATIVE TOTAL
INFLUENT	0.0GPM	0 GPD	0 GALLONS
EFFLUENT	0.0GPM	0 GPD	0 GALLONS

1:33:36

11/17/2008

HMI SETUP PARAMETERS

The following parameters set the HIGH and LOW scaling values to be used in the PLC to scale the raw data from the instruments into values which are more easily understood by human operators.

INSTRUMENT:	ENGINEERING UNITS LOW VALUE	ENGINEERING UNITS HIGH VALUE	
FIT1009	0	150	GPM
LIT1011	0	27	FEET
FIT1110	0	150	GPM
LIT1131	0	5.4	FEET
FIT1137	0	130	GPM
LIT1211	0	7.7	FEET
AIT1245	0	200	NTU
DPIT1281	0	300	PSI
PT1282	0	100	PSI
PT1310	0	100	PSI
PT1311	0	100	PSI
PT1312	0	100	PSI

INSTRUMENT:	ENGINEERING UNITS LOW VALUE	ENGINEERING UNITS HIGH VALUE	
PT1313	0	100	PSI
PT1314	0	100	PSI
PT1315	0	100	PSI
FIT1321	0	150	GPM
LIT1331	0	22	FEET
FIT1371	0	700	GPM
LIT1381	0	6	FEET
LIT1421	0	14	FEET
LIT1441	0	14	FEET
PT1466	0	150	PSI
LIT1521	0	18	FEET
PIT1555	0	5	PSI
LIT1570	10	0	FEET
PT1591	0	100	PSI
PT1650	0	150	PSI

CLOSE

Clear Clear All

APPENDIX E

Major Process Equipment
Maintenance Summary Forms

Maintenance Summary Form

11305 - Sump Pumps No. 1 and 2 Model NP3102X-643

MAINTENANCE SUMMARY FORM – 11305

PROJECT: Wyckoff Replace Groundwater Treatment Plant CONTRACT NO.: W912DW-06-R-0014

1. EQUIPMENT ITEM: Sump Pumps No. 1 and 2 Model NP3102X-643

2. MANUFACTURER: ITT FLYGT

3. EQUIPMENT/TAG NUMBER(S): 40P1501 and 40P1502

4. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS): 230

5. NAMEPLATE DATA (hp, voltage, speed, etc.): 5HP, 460V, 3PH

6. MANUFACTURER'S LOCAL REPRESENTATIVE: Whitney Equipment CO.

a. Name: BILL CARLSON Telephone: 425-486-9499

b. Address: 21222 - 30th DR. SE, SUITE 110, BOTHELL, WA 98021

7. MAINTENANCE REQUIREMENTS –

Qualifications and Training of Personnel: All personnel responsible for service, maintenance, inspection, installation and operation must have the appropriate training. Responsibility and supervision of personnel must be strictly enforced by the end user. If training is required, it can be provided by the manufacturer/representative. Furthermore, it is the responsibility of the end user to ensure that personnel fully understand the operating instructions.

Maintenance Operation Comments	**Frequency**	**Lubricant (If Applicable)**
Inspect visible parts on pump, pump casing and impeller for wear	Annually	n/a
Check lubricant/coolant level and condition, change as necessary	Annually	Mobil Whiterex 309
Check cables and cable entry for wear and tightness	Annually	n/a
Inspect pump voltage draw and meggar readings	Monthly	n/a
Check function of level sensors, starter and monitoring equipment	Annually	n/a
Check rotation direction of pump	When reconnecting	n/a
Check pipes, valves peripheral equipment	Annually	n/a
Check cooling system	Annually	n/a

8. LUBRICANT LIST: See listed above

9. RECOMMENDED SPARE PARTS FOR OWNER'S INVENTORY

Part No.	Description	Unit	Quantity	Unit Cost
592 01 103	Inner Mechanical Seal			245.00
592 01 04	Outer Mechanical Seal			320.00
80 32 32	O-ring kit			65.00
83 15 73	Upper Bearing			21.00
83 36 90	Lower Bearing			48.00

Maintenance Summary Form

11312 - Filter Feed Pumps

MAINTENANCE SUMMARY FORM - 11312

PROJECT: Wyckoff Replace Groundwater Treatment Plant CONTRACT NO.: W912DW-06-R-0014

1. EQUIPMENT ITEM: FILTER FEED PUMPS 811S 1.5 x 1.8

2. MANUFACTURER: GRISWOLD

3. EQUIPMENT/TAG NUMBER(S): 50P1241 & 50P1242

4. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS): 423 LBS.

5. NAMEPLATE DATA (hp, voltage, speed, etc.): 7.5 HP, 460V, 3 PH, 3600 RPM, 1.15 Service Factor

6. MANUFACTURER'S LOCAL REPRESENTATIVE: Cascade Machinery & Electric, Inc.

   a. Name: _____ Telephone: 206-762-0500

   b. Address: 4600 East Marginal Way South, PO Box 3575 Seattle, WA 98124

7. MAINTENANCE REQUIREMENTS

Qualifications and Training of Personnel: All personnel responsible for service, maintenance, inspection, installation and operation must have the appropriate training. Responsibility and supervision of personnel must be strictly enforced by the end user. Furthermore, it is the responsibility of the end user to ensure that personnel fully understand the operating instructions.
*NOTE: Maintenance and monitoring intervals should be shortened in severe service locations

Maintenance Operation Comments	Frequency*	Lubricant (If Applicable)
Bearing and Lubricant Condition: bearing temperatures, lubricant level, and vibration. Oil level should be mid-point of the bulls eye sight glass. Lubricant should be clear with no signs of frothing.	Routinely	✦
Shaft seal condition: Mechanical seals should show no signs of leakage	Routinely	
Overall pump vibration, check bearing alignment	Routinely	
Pump discharge pressure – a gradual decrease in developed head can indicate the need for Impeller adjustment	Annually	
Check foundation and hold down bolts	Quarterly	

Oil change	Quarterly or after 2000 hrs. of operation, which ever comes first.	✦
Shaft alignment	Quarterly	
Pump flow rate	Annually	
Motor Amp Drain	Annually	
Vibration signature	Annually	
Motor Bearing Lubrication	15,700 hrs. of service	❋

8. LUBRICANT LIST

Reference Symbol	MFR (Name)	MFR (Name)	MFR (Name)	MFR (Name)	Or Equal
✦	ISO Grade VG 68 or equal	Chevron GTS Oil 68	Exxon Terrestic 68 or Nuto 68	Mobil DTE Heavy-Medium	Philips Mangus 315
✦	Shell Tellus Oil 68	Sunoco Sunvis 968	Amoco Industrial 68	Royal Purple – Synfilm GT VG 68	
❋	PolyRex EM Grease ESSO/EXXON				

9. RECOMMENDED SPARE PARTS FOR OWNER'S INVENTORY

Part No.	Description	Unit	Quantity	Unit Cost
21280-40-91	Impeller	Each	1	560.00
22049-4-1	Shaft Seal	Each	1	229.25
RK-3196S	Repair Kit	Each	1	137.75
K-3196S-8	Maintenance Kit	Each	1	32.50
Note: Identify parts provided by this Contract with two asterisks.				

Maintenance Summary Form

11312 - Backwash Pumps 1 and 2

MAINTENANCE SUMMARY FORM - 11312

PROJECT: Wyckoff Replace Groundwater Treatment Plant CONTRACT NO.: W912DW-06-R-0014

1. EQUIPMENT ITEM: BACKWASH PUMPS 1 & 2, TYPE 811-4x3-10

2. MANUFACTURER: GRISWOLD

3. EQUIPMENT/TAG NUMBER(S): 50P1351 & 50P1352

4. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS): 814 LBS.

5. NAMEPLATE DATA (hp, voltage, speed, etc.): 15 HP, 460V, 3 PH, 1800 RPM, 1.15 Service Factor

6. MANUFACTURER'S LOCAL REPRESENTATIVE: Cascade Machinery & Electric, Inc.

a. Name: _____ Telephone: 206-762-0500

b. Address: 4600 East Marginal Way South, PO Box 3575 Seattle, WA 98124

7. MAINTENANCE REQUIREMENTS

Qualifications and Training of Personnel: All personnel responsible for service, maintenance, inspection, installation and operation must have the appropriate training. Responsibility and supervision of personnel must be strictly enforced by the end user. Furthermore, it is the responsibility of the end user to ensure that personnel fully understand the operating instructions.
*NOTE: Maintenance and monitoring intervals should be shortened in severe service locations

Maintenance Operation Comments	**Frequency***	**Lubricant (If Applicable)**
Bearing and Lubricant Condition: bearing temperatures, lubricant level, and vibration. Oil level should be mid-point of the bulls eye sight glass. Lubricant should be clear with no signs of frothing.	Routinely	✦
Shaft seal condition: Mechanical seals should show no signs of leakage	Routinely	
Overall pump vibration, check bearing alignment	Routinely	
Pump discharge pressure – a gradual decrease in developed head can indicate the need for Impeller adjustment	Annually	
Check foundation and hold down bolts	Quarterly	

Oil change	Quarterly or after 2000 hrs. of operation, which ever comes first.	✦
Shaft alignment	Quarterly	
Pump flow rate	Annually	
Motor Amp Drain	Annually	
Vibration signature	Annually	
Motor Lubrication	20,000 hrs. of service	❋

8. LUBRICANT LIST

Reference Symbol	**MFR (Name)**	**MFR (Name)**	**MFR (Name)**	**MFR (Name)**	**Or Equal**
✦	ISO Grade VG 68 or equal	Chevron GTS Oil 68	Exxon Terrestic 68 or Nuto 68	Mobil DTE Heavy-Medium	Philips Mangus 315
✦	Shell Tellus Oil 68	Sunoco Sunvis 968	Amoco Industrial 68	Royal Purple – Synfilm GT VG 68	
❋	PolyRex EM Grease ESSO/EXXON				

9. RECOMMENDED SPARE PARTS FOR OWNER'S INVENTORY

Part No.	Description	Unit	Quantity	Unit Cost
21273-60-91	Impeller	Each	1	947.75
2213-4-1	Shaft Seal	Each	1	351.65
RK-3196-M	Repair Kit	Each	1	276.25
K-3196M-8	Maintenance Kit	Each	1	40.50

Note: Identify parts provided by this Contract with two asterisks.

Maintenance Summary Form

11312 - Decant Pumps 1 and 2

MAINTENANCE SUMMARY FORM - 11312

PROJECT: Wyckoff Replace Groundwater Treatment Plant CONTRACT NO.: W912DW-06-R-0014

1. EQUIPMENT ITEM: DECANT PUMPS 1 & 2, TYPE 811LF- 1.5 x 1-8

2. MANUFACTURER: GRISWOLD

3. EQUIPMENT/TAG NUMBER(S): 50P1391 & 50P1392

4. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS): 232 LBS.

5. NAMEPLATE DATA (hp, voltage, speed, etc.): .75 HP, 460V, 3 PH, 1800 RPM, 1.15 Service Factor

6. MANUFACTURER'S LOCAL REPRESENTATIVE: Cascade Machinery & Electric, Inc.

a. Name: _____ Telephone: 206-762-0500

b. Address: 4600 East Marginal Way South, PO Box 3575 Seattle, WA 98124

7. MAINTENANCE REQUIREMENTS

Qualifications and Training of Personnel: All personnel responsible for service, maintenance, inspection, installation and operation must have the appropriate training. Responsibility and supervision of personnel must be strictly enforced by the end user. Furthermore, it is the responsibility of the end user to ensure that personnel fully understand the operating instructions.
*NOTE: Maintenance and monitoring intervals should be shortened in severe service locations

Maintenance Operation Comments	Frequency*	Lubricant (If Applicable)
Bearing and Lubricant Condition: bearing temperatures, lubricant level, and vibration. Oil level should be mid-point of the bulls eye sight glass. Lubricant should be clear with no signs of frothing.	Routinely	✦
Shaft seal condition: Mechanical seals should show no signs of leakage	Routinely	
Overall pump vibration, check bearing alignment	Routinely	
Pump discharge pressure – a gradual decrease in developed head can indicate the need for Impeller adjustment	Annually	
Check foundation and hold down bolts	Quarterly	

Oil change	Quarterly or after 2000 hrs. of operation, which ever comes first.	✦
Shaft alignment	Quarterly	
Pump flow rate	Annually	
Motor Amp Drain	Annually	
Vibration signature	Annually	
Motor Lubrication	20,000 hrs. of service	❋

8. LUBRICANT LIST

Reference Symbol	MFR (Name)	MFR (Name)	MFR (Name)	MFR (Name)	Or Equal
✦	ISO Grade VG 68 or equal	Chevron GTS Oil 68	Exxon Terrestic 68 or Nuto 68	Mobil DTE Heavy-Medium	Philips Mangus 315
✦	Shell Tellus Oil 68	Sunoco Sunvis 968	Amoco Industrial 68	Royal Purple – Synfilm GT VG 68	
❋	PolyRex EM Grease ESSO/EXXON				

9. RECOMMENDED SPARE PARTS FOR OWNER'S INVENTORY

Part No.	Description	Unit	Quantity	Unit Cost
21280-40-91	Impeller	Each	1	560.00
22049-4-1	Shaft Seal	Each	1	229-25
RK-3196-S	Repair Kit	Each	1	137.75
K-3196S-8	Maintenance Kit	Each	1	32.50
Note: Identify parts provided by this Contract with two asterisks.				

Maintenance Summary Form

11312 - Backwash Recycle Pump 1

MAINTENANCE SUMMARY FORM - 11312

PROJECT: Wyckoff Replace Groundwater Treatment Plant CONTRACT NO.: W912DW-06-R-0014

1. EQUIPMENT ITEM: BACKWASH RECYCLE PUMP 1, TYPE 811- 3 x 2-6

2. MANUFACTURER: GRISWOLD

3. EQUIPMENT/TAG NUMBER(S): 50P1461

4. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS): 240 LBS.

5. NAMEPLATE DATA (hp, voltage, speed, etc.): 2 HP, 460V, 3 PH, 1800 RPM, 1.15 Service Factor

6. MANUFACTURER'S LOCAL REPRESENTATIVE: Cascade Machinery & Electric, Inc.

a. Name: _____ Telephone: 206-762-0500

b. Address: 4600 East Marginal Way South, PO Box 3575 Seattle, WA 98124

7. MAINTENANCE REQUIREMENTS

Qualifications and Training of Personnel: All personnel responsible for service, maintenance, inspection, installation and operation must have the appropriate training. Responsibility and supervision of personnel must be strictly enforced by the end user. Furthermore, it is the responsibility of the end user to ensure that personnel fully understand the operating instructions.

*NOTE: Maintenance and monitoring intervals should be shortened in severe service locations

Maintenance Operation Comments	**Frequency***	**Lubricant (If Applicable)**
Bearing and Lubricant Condition: bearing temperatures, lubricant level, and vibration. Oil level should be mid-point of the bulls eye sight glass. Lubricant should be clear with no signs of frothing.	Routinely	✦
Shaft seal condition: Mechanical seals should show no signs of leakage	Routinely	
Overall pump vibration, check bearing alignment	Routinely	
Pump discharge pressure – a gradual decrease in developed head can indicate the need for Impeller adjustment	Annually	
Check foundation and hold down bolts	Quarterly	

Oil change	Quarterly or after 2000 hrs. of operation, which ever comes first.	✦
Shaft alignment	Quarterly	
Pump flow rate	Annually	
Motor Amp Drain	Annually	
Vibration signature	Annually	
Motor Lubrication	20,000 hrs. of service	❋

8. LUBRICANT LIST

Reference Symbol	MFR (Name)	MFR (Name)	MFR (Name)	MFR (Name)	Or Equal
✦	ISO Grade VG 68 or equal	Chevron GTS Oil 68	Exxon Terrestic 68 or Nuto 68	Mobil DTE Heavy-Medium	Philips Mangus 315
✦	Shell Tellus Oil 68	Sunoco Sunvis 968	Amoco Industrial 68	Royal Purple – Synfilm GT VG 68	
❋	PolyRex EM Grease ESSO/EXXON				

9. RECOMMENDED SPARE PARTS FOR OWNER'S INVENTORY

Part No.	Description	Unit	Quantity	Unit Cost
21335-20-91	Impeller	Each	1	517.85
22049-4-1	Shaft Seal	Each	1	229.25
RK-3196-S	Repair Kit	Each	1	137.75
K-3196S-6	Maintenance Kit	Each	1	30.60
Note: Identify parts provided by this Contract with two asterisks.				

Maintenance Summary Form

11312 - Storm Water Recycle Pump 1

MAINTENANCE SUMMARY FORM - 11312

PROJECT: Wyckoff Replace Groundwater Treatment Plant CONTRACT NO.: W912DW-06-R-0014

1. EQUIPMENT ITEM: STORMWATER RECYCLE PUMP 1, TYPE 811- 3 x 1.5-6

2. MANUFACTURER: GRISWOLD

3. EQUIPMENT/TAG NUMBER(S): 50P1541

4. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS): 224 LBS.

5. NAMEPLATE DATA (hp, voltage, speed, etc.): 1 HP, 460V, 3 PH, 1800 RPM, 1.15 Service Factor

6. MANUFACTURER'S LOCAL REPRESENTATIVE: Cascade Machinery & Electric, Inc.

a. Name: _____ Telephone: 206-762-0500

b. Address: 4600 East Marginal Way South, PO Box 3575 Seattle, WA 98124

7. MAINTENANCE REQUIREMENTS

Qualifications and Training of Personnel: All personnel responsible for service, maintenance, inspection, installation and operation must have the appropriate training. Responsibility and supervision of personnel must be strictly enforced by the end user. Furthermore, it is the responsibility of the end user to ensure that personnel fully understand the operating instructions.
*NOTE: Maintenance and monitoring intervals should be shortened in severe service locations

Maintenance Operation Comments	**Frequency***	**Lubricant (If Applicable)**
Bearing and Lubricant Condition: bearing temperatures, lubricant level, and vibration. Oil level should be mid-point of the bulls eye sight glass. Lubricant should be clear with no signs of frothing.	Routinely	✦
Shaft seal condition: Mechanical seals should show no signs of leakage	Routinely	
Overall pump vibration, check bearing alignment	Routinely	
Pump discharge pressure – a gradual decrease in developed head can indicate the need for Impeller adjustment	Annually	
Check foundation and hold down bolts	Quarterly	

Oil change	Quarterly or after 2000 hrs. of operation, which ever comes first.	✦
Shaft alignment	Quarterly	
Pump flow rate	Annually	
Motor Amp Drain	Annually	
Vibration signature	Annually	
Motor Lubrication	20,000 hrs. of service	❋

8. LUBRICANT LIST

Reference Symbol	**MFR (Name)**	**MFR (Name)**	**MFR (Name)**	**MFR (Name)**	**Or Equal**
✦	ISO Grade VG 68 or equal	Chevron GTS Oil 68	Exxon Terrestic 68 or Nuto 68	Mobil DTE Heavy-Medium	Philips Mangus 315
✦	Shell Tellus Oil 68	Sunoco Sunvis 968	Amoco Industrial 68	Royal Purple – Synfilm GT VG 68	
❋	PolyRex EM Grease ESSO/EXXON				

9. RECOMMENDED SPARE PARTS FOR OWNER'S INVENTORY

Part No.	Description	Unit	Quantity	Unit Cost
21293-20-91	Impeller	Each	1	477.00
22049-4-1	Shaft Seal	Each	1	229.25
RK-3196-S	Repair Kit	Each	1	137.75
K-3196S-6	Maintenance Kit	Each	1	30.60

Note: Identify parts provided by this Contract with two asterisks.

Maintenance Summary Form

11315 - DAF Feed Pumps No. 1 and 2

MAINTENANCE SUMMARY FORM – 11315 (includes 1.03.B.6, Item 14)

PROJECT: Wyckoff Replace Groundwater Treatment Plant CONTRACT NO.: W912DW-06-R-0014

1. EQUIPMENT ITEM: DAF Feed Pumps No. 1 and 2

2. MANUFACTURER: NETZSCH- NEMO Pump, Model NM053SY01L07V

3. EQUIPMENT/TAG NUMBER(S) : 50P1101 and 50P1102

4. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS):

5. NAMEPLATE DATA (hp, voltage, speed, etc.): 3HP, 460V, 1800 rpm

6. MANUFACTURER'S LOCAL REPRESENTATIVE: Triangle Pump & Equipment, Inc.

a. Name: David Flack Telephone: 503-656-1473

b. Address: 14940 SE 82nd Drive, PO Box 950, Clackamas, OR 97015

7. MAINTENANCE REQUIREMENTS -

Qualifications and Training of Personnel: All personnel responsible for service, maintenance, inspection, installation and operation must have the appropriate training. Responsibility and supervision of personnel must be strictly enforced by the end user. If training is required, it can be provided by the manufacturer/representative. Furthermore, it is the responsibility of the end user to ensure that personnel fully understand the operating instructions.

Maintenance Operation Comments	**Frequency**	**Lubricant (If Applicable)**
Pumps – should be flushed or cleaned	As needed to remove buildup of medium deposits	N/A
Pump Lubrication	Quarterly	
Lubricating the Pin joint with SM-Pin Seals – It is advisable to change the oil and check the seals of the pin joints.	-When replacing worn joints -When disassembling the pump Amount: 1.22 fl oz. per joint	● With SM-pin joint seal (8235) of EDPM ◘
Shaft Sealing through Single Mechanical Seal – If excessive leaks occur the spring tension and the seal surfaces should be checked,	Replace seal as necessary.	N/A
Motor Cleanliness – motor should be kept clean and free from dust, debris and oil. A jet of compressed air can be used to remove non-abrasive dust from the fan cover and	Monthly or as required by conditions	N/A

any accumulated grime from the fan and cooling fins. Terminal boxes should be cleaned and their terminals free from oxidation, in perfect mechanical condition and all unused space dust free.		
Motor Lubrication: Motor noise should be measured to check for unusual noises. A uniform hum is a sign that the bearing is running perfectly.	Periodically when motor is overhauled or disassembled	■ (Lithium based Grease)
V-Belt lining Inspection	Quarterly	N/A
V-Belts Drives, sheave alignment and bearing wear - Inspection	Quarterly	N/A

8. LUBRICANT LIST

Reference Symbol	MFR (Name)	MFR (Name)	MFR (Name)	MFR (Name)	Or Equal
List symbols used in No. 7 above.	List equivalent lubricants, as distributed by each manufacturer for the specific use recommended.				
●	SHELL Omala 460				
◘	Klubersynth GH 6-320				
■	ESSO Alvania R3	ESSO Beacon 2	Atlantic Litholine 2	Texaco Multi-Fak 2	

9. RECOMMENDED SPARE PARTS FOR OWNER'S INVENTORY - 1.03.B.6, Item 14

Part No.	Description	Unit	Quantity	Unit Cost
107171	3V x 850 Cogged Drive Belt	Each	2	18.87
NDB4825456	Coupling Rod	Each	1	418.25
NDB4958699	Rotor	Each	1	1387.05
Viton NDB4955093	Stator	Each	1	434.10
512279	Ring Retainer / Circlip	Each	2	5.00
NDB4825299	Conn. Rod Pin	Each	2	57.35
892841	Pin Retainer Sleeve	Each	1	80.00
862347	Pin Retainer Sleeve	Each	1	95.90
877421	Clamp Ring	Each	2	39.15
516041	O-ring	Each	1	12.35
517020	O-ring	Each	4	12.95
591718	O-ring	Each	1	5.00
Viton 879897	SM Seal	Each	2	93.85
PZ3756375	Pencil Anode	Each	4	3.25
BH5375	Brass Head	Each	4	3.20
Note: Identify parts provided by this Contract with two asterisks.				

Maintenance Summary Form

11235 - Tank Mixers

MAINTENANCE SUMMARY FORM – 11235 1.04.B

PROJECT: Wyckoff Replace Groundwater Treatment Plant CONTRACT NO.: W912DW-06-R-0014

1. EQUIPMENT ITEM: Digested Sludge Mixers 1 & 2

2. MANUFACTURER: Neptune C-2.0

3. EQUIPMENT/TAG NUMBER(S): 40M1431, 40M1432

4. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS): N/A

5. NAMEPLATE DATA (hp, voltage, speed, etc.): ½ HP., 115/230V, 1PH., 1800 RPM

6. MANUFACTURER'S LOCAL REPRESENTATIVE: APSCO Inc.

a. Name: Elaine Stone Telephone: 425-822-3335

b. Address: PO Box 2639, Kirkland, WA 98083

7. MAINTENANCE REQUIREMENTS

Qualifications and Training of Personnel: All personnel responsible for service, maintenance, inspection, installation and operation must have the appropriate training. Responsibility and supervision of personnel must be strictly enforced by the end user. Furthermore, it is the responsibility of the end user to ensure that personnel fully understand the operating instructions.

Maintenance Operation Comments	Frequency	Lubricant (If Applicable)
Check motor housing screws, clamp screw and shaft collar set screw.	After first 10 days of operation, monthly after that.	
Upper ball bearing	Re-grease as needed	■

8. LUBRICANT LIST

Reference Symbol	MFR (Name)	MFR (Name)	MFR (Name)	MFR (Name)	Or Equal
■	Lubri-plate 1200-2 Multi-Purpose grease, 3 oz.				

9. RECOMMENDED SPARE PARTS FOR OWNER'S INVENTORY

Part No.	Description	Unit	Quantity	Unit Cost
100395	Ball Bearing	Each	1	
100362	Inner race and needle bearing	Each	1	
100363	Oil Seal	Each	1	
100369	Washer spherical set	Each	1	
Note: Identify parts provided by this Contract with two asterisks.				

Maintenance Summary Form

11240 - Froth Feed Pumps 1 and 2

MAINTENANCE SUMMARY FORM 11240

PROJECT: Wyckoff Replace Groundwater Treatment Plant CONTRACT NO.: W912DW-06-R-0014

1. EQUIPMENT ITEM: Froth Feed Pumps 1 and 2

2. MANUFACTURER: Milton Roy, Mil Royal CMCH 561

3. EQUIPMENT/TAG NUMBER(S): 50P1251, 50P1252

4. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS): 1225 LBS.

5. NAMEPLATE DATA (hp, voltage, speed, etc.): 2HP, 460V, 3 PH, 1725 RPM, 1.15 Service Factor

6. MANUFACTURER'S LOCAL REPRESENTATIVE: Fine Line Instrument

   a. Name: _____ Telephone: 425-861-1110

   b. Address: 17371 NE 67th Court, Suite B3, Redmond, WA 98052

7. MAINTENANCE REQUIREMENTS

Qualifications and Training of Personnel: All personnel responsible for service, maintenance, inspection, installation and operation must have the appropriate training. Responsibility and supervision of personnel must be strictly enforced by the end user. Furthermore, it is the responsibility of the end user to ensure that personnel fully understand the operating instructions.

Maintenance Operation Comments	**Frequency**	**Lubricant (If Applicable)**
Check Drive Gear Oil Level	Monthly, add as needed	• AGMA #7 Comp.
Change gear drive lubricant and clean magnetic filter below crosshead chamber	Every 6 months or 2500 service hours whichever occurs first. Recommended after initial 90 days in service.	• AGMA #7 Comp
Lubricate drive motor	Annually	• AGMA #7 Comp.
Check valves self cleaning pump hot detergent solution for 15 minutes, follow with water flushing.	As needed	
Supply tank & piping clean & flush	Annually	
Suction line strainer cleaning	As required or needed	

Ball check valves, flush with clean liquid	As often as necessary for accurate metering.	
HPD Liquid End Displacement Chamber	Every 6 months, 2500 service hours	* Zurnpreen 15 A

8. LUBRICANT LIST

Reference Symbol	**MFR (Name)**	**MFR (Name)**	**MFR (Name)**	**Or Equal**
List symbols used in No. 7 above.	List equivalent lubricants, as distributed by each manufacturer for the specific use recommended.			
•	AGMA#7 Comp Drive gear Lube			
*	Zurnpreen 15A Hydraulic Oil			

9. RECOMMENDED SPARE PARTS FOR OWNER'S INVENTORY

Part No.	Description	Unit	Quantity	Unit Cost
RPM Kit	Routine Maintenance Kit	Each	1	$1785.00
302 Parts Kit	Disassembly Tool	Each	1	$1000.00
2980068099	Diaphragm	Each	1	$305.00
Note: Identify parts provided by this Contract with two asterisks.				

Maintenance Summary Form

11374 - Rotary Air Blower

MAINTENANCE SUMMARY FORM - 11374

PROJECT: Wyckoff Replace Groundwater Treatment Plant CONTRACT NO.: W912DW-06-R-0014

1. EQUIPMENT ITEM: ROTARY AIR BLOWER

2. MANUFACTURER: ROOTS M/N RO-32-U-RAI BLOWER

3. EQUIPMENT/TAG NUMBER(S): 50m1551

4. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS): 500 LBS.

5. NAMEPLATE DATA (hp, voltage, speed, etc.): 7.5 HP, 460V, 3 PH, 3600 RPM

6. MANUFACTURER'S LOCAL REPRESENTATIVE: ROGERS MACHINERY COMPANY, INC.

a. Name: KEN WYNN Telephone: 206-763-2530

b. Address: 7800 FIFTH AVENUE SOUTH, SEATTLE, WA 98108

7. MAINTENANCE REQUIREMENTS

Qualifications and Training of Personnel: All personnel responsible for service, maintenance, inspection, installation and operation must have the appropriate training. Responsibility and supervision of personnel must be strictly enforced by the end user. Furthermore, it is the responsibility of the end user to ensure that personnel fully understand the operating instructions.

Maintenance Operation Comments	**Frequency**	**Lubricant (If Applicable)**
Lubrication of Blower Bearings and Gears	Check daily for 1st month, Monthly thereafter	◙
Check for increases or changes in vibration and noise	Check daily for 1st month, Weekly thereafter	
Recording of operating temps and pressures	Weekly	
Motor Lubricant	Sealed, 3-5 years	
Belts and Drives	Quarterly	
Grease lubricated drive ends	Weekly	☐

8. LUBRICANT LIST

Reference Symbol	**MFR (Name)**	**MFR (Name)**	**MFR (Name)**	**MFR (Name)**	**Or Equal**
◙	Roots Synthetic Oil ISO-VG-320 (Gear end capacity is 16 fl. oz.)				
☐	Shell Darina EP NLGI grade 2				

9. RECOMMENDED SPARE PARTS FOR OWNER'S INVENTORY

Part No.	**Description**	**Unit**	**Quantity**	**Unit Cost**
651040RK	3" KIT (includes items below)	KIT		
63889021	GEAR ASSEMBLY 3 ½" URAI T/	Each	1	
12957003	PLUG OPENING FOR 2.0474	Each	1	
62752021	GASKET, GRBX 3 1/2" URAI TS9	Each	2	
10987002	BRG, BALL	Each	3	
10222035	BRG, ROLLER	Each	1	
10319007	NUT, HEX ESNA 5/8-16	Each	2	
10005157	SEAL, LIP (VITON) 13/16" SF	Each	4	
11540003	SCR CAP HEXH NYL ¼-20X	Each	4	
10005172	SEAL, LIP FOR GREASE LUBE	Each	1	
T20082001	SEAL, LIP FOR DSL	Each	1	

Note: Identify parts provided by this Contract with two asterisks.

Maintenance Summary Form

11318 - Air Operated Diaphragm Pump

MAINTENANCE SUMMARY FORM - 11318

PROJECT: Wyckoff Replace Groundwater Treatment Plant CONTRACT NO.: W912DW-06-R-0014

1. EQUIPMENT ITEM: AIR OPERATED DIAPHRAGM PUMP

2. MANUFACTURER: WILDEN , MODEL P400, 04-10973

3. EQUIPMENT/TAG NUMBER(S): 50P1510

4. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS): _____

5. NAMEPLATE DATA (hp, voltage, speed, etc.): 15 GPM, Total Dynamic Head 11ft., Suction Lift 20 ft., Air Consumption 10 CFM 18PSI, Max shutoff pressure (ft.) 50

6. MANUFACTURER'S LOCAL REPRESENTATIVE: ARGO INTERNATIONAL, INC.

a. Name: Steve Telephone: 503-794-9686

b. Address: 13481 SE JOHNSON RD. PORTLAND, OR 97222

7. MAINTENANCE REQUIREMENTS

Qualifications and Training of Personnel: All personnel responsible for service, maintenance, inspection, installation and operation must have the appropriate training. Responsibility and supervision of personnel must be strictly enforced by the end user.

Maintenance Operation Comments	**Frequency**	**Lubricant (If Applicable)**
Inspect visible parts for wear	Quarterly	n/a
P400 is Pre-lubricated, requires no inline lubrication		n/a
Insure Proper Air Pressure	As need to control discharge flow rate.	n/a
Check pipes, valves & equipment	Annually	

8. LUBRICANT LIST –**N/A**

Reference Symbol	**MFR (Name)**	**MFR (Name)**	**MFR (Name)**	**MFR (Name)**	**Or Equal**
List symbols used in No. 7 above.	List equivalent lubricants, as distributed by each manufacturer for the specific use recommended.				
Not Applicable					

9. RECOMMENDED SPARE PARTS FOR OWNER'S INVENTORY

WILDEN OIL PUMP #P400-04-10973 - PRIMARY WEAR PARTS

Part No.	**Description**	**Unit**	**Quantity**	**Unit Cost**
04-2000-20-700	Pro-Flo Valve Assembly	Each	1	
04-3500-52-700	Gasket, Muffler	Each	1	
04-2600-52-700	Gasket, Air Valve	Each	1	
04-3880-99	Removable Pilot Sleeve Assembly	Each	1	
08-3210-55-225	Shaft Seal	Each	2	
04-3526-52	Gasket, Center Block, Pro-Flo	Each	2	
04-1010-55	Primary Diaphragm	Each	2	
04-1060-51	Backup Diaphragm	Each	2	
04-1080-55	Ball Valve	Each	4	
04-1125-01	Valve Seat	Each	4	
04-1205-55	Valve Seat O-Ring	Each	4	
Note: Identify parts provided by this Contract with two asterisks.				

Maintenance Summary Form

11203 - GAC Tanks 1,2,3,4,5

MAINTENANCE SUMMARY FORM - 11203

PROJECT: Wyckoff Replace Groundwater Treatment Plant CONTRACT NO.: W912DW-06-R-0014

1. EQUIPMENT ITEM: GAC Tanks 1, 2, 3, 4, 5

2. MANUFACTURER: TIGG Corporation

3. EQUIPMENT/TAG NUMBER(S): 50M1301, 50M1302, 50M1303, 50M1304, 50M1305

4. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS): 55,834.52 lbs. (complete with water and carbon)

5. NAMEPLATE DATA (hp, voltage, speed, etc.): Vessel MAWP 80 PSI at 140° F, MDMT - 20° F at 150 PSI

6. MANUFACTURER'S LOCAL REPRESENTATIVE: TIGG Corporation

a. Name: Bill Bland Telephone: 412-257-9580, ext. 107

b. Address: 800 Old Pond Rd. #706, Bridgeville, PA 15017

7. MAINTENANCE REQUIREMENTS

Qualifications and Training of Personnel: All personnel responsible for service, maintenance, inspection, installation and operation must have the appropriate training. Responsibility and supervision of personnel must be strictly enforced by the end user. Furthermore, it is the responsibility of the end user to ensure that personnel fully understand the operating instructions.

Maintenance Operation Comments	**Frequency**	**Lubricant (If Applicable)**
Internal inspection of a vessel	Each time carbon is removed	
Inspect the lining to verify no damage	Each time carbon is removed	
Inspect the underdrain laterals in the collector to ensure they are intact and not plugged.	Each time carbon is removed	
Check pressure gauges	Quarterly	
Inspection of piping and valves for signs of wear and/or leakage	Quarterly	

8. LUBRICANT LIST – N/A

9. RECOMMENDED SPARE PARTS FOR OWNER'S INVENTORY: **11203 1.04.C.3, 1.04.C.4**

Part No.	Description	Unit	Quantity	Unit Cost
1	Underdrain Nozzles with Washers	Each	5	25.00
2	80 PSI Rupture Disks	Each	5	150.00
3	Manway Gaskets 14x18 Elliptical Top	Each	5	400.00
4	Manway Gaskets 24" Side Manway	Each	5	610.00
Note: Identify parts provided by this Contract with two asterisks.				

Maintenance Summary Form

16260 - Low Voltage Adjustable Frequency Drives

MAINTENANCE SUMMARY FORM -16260

PROJECT: Wyckoff Replace Groundwater Treatment Plant CONTRACT NO.: W912DW-06-R-0014

1. EQUIPMENT ITEM: Low Voltage Adjustable Frequency Drives

2. MANUFACTURER: ABB Ach 550-PC-03A3-4, ABB ACH550-PC-06A9-4, ABB ACH550-PC-015A-4

3. EQUIPMENT/TAG NUMBER(S): 50AFD1391, 50AFD1392, 50AFD1101, 50AFD1102, 50AFD1241, 50AFD1242

4. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS): N/A

5. NAMEPLATE DATA (hp, voltage, speed, etc.): 1,3, 10 HP, 460V, 3PH, Variable Speed. 3,4,8, 14 FLA, 15,15, 30 AMP Fuses

6. MANUFACTURER'S LOCAL REPRESENTATIVE: Washington Air Reps

a. Name: Christian Vornheder Telephone: 425-562-1150

b. Address: 3290 16th Pl. SE. Bellevue, WA 98007

7. MAINTENANCE REQUIREMENTS

Qualifications and Training of Personnel: All personnel responsible for service, maintenance, inspection, installation and operation must have the appropriate training. Responsibility and supervision of personnel must be strictly enforced by the end user. Furthermore, it is the responsibility of the end user to ensure that personnel fully understand the operating instructions.

Maintenance Operation Comments	**Frequency**	**Lubricant (If Applicable)**
Heatsink temperature check and cleaning, O&M pg. 283 of 332	Depends on dustiness of environment, every 6-12 months	
Main cooling fan replacement, O&M pg. 284 of 332	Every five years	
Internal enclosure cooling fan replacement (IP 54/UL Type 12 units), O&M pg. 285 of 332	Every three years	
Capacitor change (Frame sizes R5 and R6) O&M pg. 285 of 332	Every ten years	
Replace battery in the Assistant control panel, O&M pg. 286 of 332	Every ten years	

8. LUBRICANT LIST

Reference Symbol	MFR (Name)	MFR (Name)	MFR (Name)	MFR (Name)	Or Equal
N/A					

9. RECOMMENDED SPARE PARTS FOR OWNER'S INVENTORY

Part No.	Description	Unit	Quantity	Unit Cost
KTK-R-15	Fuse	Each	12	9.30
KTK-R-30	Fuse	Each	6	9.30
FNQR 1.5	Control Fuse	Each	6	11.37
64738984	Control Panel	Each	1	258.00
3AUA0000010561	Control Board Kit	Each	1	780.45
3AUA0000000145	Fan	Each	1	55.72
3AUA0000000146	Fan	Each	1	55.72
Note: Identify parts provided by this Contract with two asterisks.				

APPENDIX F

List of Local Spare Parts Supply Vendors

ALASKAN COPPER & BRASS 3223 6TH AVENUE SOUTH SEATTLE, WA 98134 206-623-5800 206-382-7335 (Fax) CONTACT: WENDY AUSTIN	Stainless Steel: Plate, Angle, Flat-Bar, Pipe, Spacers. Aluminum: Plate
ARGO INTERNATIONAL CORP. 13481 S.E. JOHNSON ROAD PORTLAND, OR 97222 503-794-9686 503-794-8336 (Fax) CONTACT: JOHN KING	Module/Air: Filter-Regulator
C.M. HOSKINS 13035 LAKE CITY WAY NE SEATTLE, WA 98125 206-366-1 100 206-366-3076 (Fax) CONTACT: AL BURY	Mercer: Expansion Joints Linkseal
CAIN BOLT & GASKET 7724 7TH AVENUE SOUTH SEATTLE, WA 98108 206-763-6460 206-763-6878 (Fax) CONTACT: TOM REID	Fasteners: Bolts, Nuts, Washers Gaskets All-Thread U-Bolts
COLUMBIA HYDRONICS 12828 GATEWAY DRIVE BUILDING #5 TUKWILA, WA 98168 206-241-0500 206-241-0520 (Fax)	Bell & Gossett: Pumps, Timers, Aqua-Stats
CONSOLIDATED SUPPLY 805 N.W. 42ND STREET SEATTLE, WA 98107 206-784-0047 206-784-0775 (Fax) CONTACT: MARCY ZEIGER	American Standard Fixtures Powers Controls Haws Emergency Equipment Chicago Faucet PPP Trap Primers Watts Regulator Co. W.E. Anderson: Flow-Switch McGuire Tubular Products Oatey: Shower Drain Sloan Valve Company Stern-Williams Aqua-Glass J.R. Smith Sioux-Chief
FASTENAL COMPANY 1463 DAWN ROAD, #B BREMERTON, WA 98311 360-479-1777	Brady: Fiberglass Signs and Pipe Markers

360-479-1741 (Fax) CONTACT: COLT PASSEY	
FERGUSON ENTERPRISES 26382 12 TREES LANE POULSBO, WA 98370 360-697-1510 360-598-3371 (Fax) CONTACT: KENT MORNINGSTAR	Trumbull: Polywrap Tape Romac: Saddles Mueller: Hydrants Tolco: Hangers/Strut Stand-On: Supports Hammond Valves Henry-Pratt: Valves Hot-Box
FIBERGRATE COMPOSITE 900 FM 205 STEPHENVILLE, TX 76401 254-977-1371 254-977-1318 (Fax) CONTACT: JERRY BOLES	Fiberglass: Grating and Structural Members
FITTINGS, INC. 5979 FOURTH AVENUE SEATTLE, WA 98108 206-767-4670 206-762-9034 (Fax) CONTACT: CHARLIE WALKER	Snap-Tite: Quick Disconnects
FLORIDA MARKING PRODUCTS 555 DOG TRACK ROAD LONGWOOD, FL 32750 407-834-3000 407-834-3900 (Fax) CONTACT: CLYDE PLUNKETT	Stainless Steel Valve-Tags
GRATING-PACIFIC LLC 18340 ANDOVER PARK WEST TUKWILA, WA 98188 206-575-3001 206-575-6455 (Fax) CONTACT: TERRY JOHNSON	Stainless Steel Wire Cloth
H.D. FOWLER COMPANY 4590 STATE HWY. 3 BREMERTON, WA 98312 360-377-4507 360-377-4516(Fax) CONTACT: DONALD SCOTT	Tencate-Mirafi: Geo-Fiber
ED. SUPPLY WATERWORKS 10708 GOLDEN GIVEN ROAD E. TACOMA, WA 98445 253-531-1144 253-531-9561 (Fax) CONTACT: CRAIG FRESHOUR	Clow: Flap-Valves

HALEY CORROSION PRODUCTS 22713 NW 36TH AVENUE RIDGEFIELD, WA 98642 360-887-1824 360-887-1825 (Fax) CONTACT: JEFF NEMETH	Nil-Cor: Valves
HARRINGTON PLASTICS 4322 5 104TH PLACE SEATTLE, WA 98178 206-725-9100 206-723-4252 (Fax) CONTACT: GENE YOST	Bondstrand: Fiberglass Pipe, Fittings, and Strut PTFE: Strips
HILTI PO BOX 21148 TULSA, OK 74121 800-879-8000 800-879-7000 (Fax) CONTACT: ROB MATTHEWS	Fasteners: Anchors
KELLER SUPPLY 3701 W. LOXIE EAGANS BLVD. BREMERTON, WA 98312 360-373-7700 360-479-0758 (Fax) CONTACT: GARY HOGGINS	Spears: Valves
NORTHWEST STEEL & PIPE 3736 SOUTH TACOMA WAY TACOMA, WA 98409 253-473-8888 253-473-2882 (Fax) CONTACT: LANCE WELLS	Carbon Steel: Flat-Bar, Angle, Square & Rectangular Tube, and I-Beam.
PARAMOUNT SUPPLY CO. 1401 THORNE ROAD TACOMA, WA 98421 253-383-3111 253-383-9360 (Fax) CONTACT: DAN BRISTOL	Brass Pipe Gaskets: Durlon/Guylon Durco: Valves Babbitt: Chainwheels Gauges: Ashcroft Apollo: Ball Valves Pete's Plugs PVC Fittings Stockham: Valves
PLATT ELECTRIC SUPPLY 5233 AUTO CENTER WAY BREMERTON, WA 98312 360-377-3877 360-377-0418 (Fax) CONTACT: TIFFANY SCHMIDT	Cutler-Hammer
PORTLAND BOLT & MFG. 3441 NW GUAM STREET	Wilson Sleeves

PORTLAND, OR 97210 503-227-5488 503-227-4634 (Fax) CONTACT: JOE THOMPSON	
PUGET SOUND PIPE & SUPPLY 7816 SOUTH 202ND STREET KENT, WA 98032 253-796-9350 253-796-9355 (Fax) CONTACT: SCOTT ETHERINGTON	Westape: Pipe-Wrap Trerice: Gauges/Thermometers Anvil: Hangers/Strut Pipe: Black & Stainless Steel Fittings: Black & Stainless Steel Nipples: Stainless Steel Weld Fittings & Flanges: Carbon & Stainless Steel
RYAN HERCO PRODUCTS 22405 72ND AVENUE SOUTH KENT, WA 98032 253-395-1141 253-395-0995 (Fax) CONTACT: DICK WARNKEE	Teflon Tubing Tygon Tubing Hose Clamps Poly Bulkhead Fittings PVC: Valves, Fittings, Pipe
SEATTLE FLUID SYSTEM TECH. 3240 118TH AVENUE SE SUITE B-103 BELLEVUE, WA 98005 425-825-1115 425-825-1705 (Fax) CONTACT: MELISA BAILEY	Swagelok: Cushion Clamps
SPECIFICATION SALES, INC. 1126 8TH STREET KIRKLAND, WA 98033 425-576-0278 425-576-0748 (Fax) CONTACT: BRAD SANCHEZ	Elmdor: Access Panels
STACY PLUMBING SUPPLY 2903 WILKESON STREET TACOMA, WA 98411 253-272-3163 253-272-1912 (Fax) CONTACT: MIKE MINITTI	Amtrol: Expansion Tanks AO Smith: Water Heaters Apollo: Ball Valves Haws: Emergency Equipment Sioux-Chief Tolco: Hangers/Strut Malleable Iron Fittings Brass Fittings Nipples: Black & Brass
TIMCO, INC. 1926 PORT OF TACOMA ROAD TACOMA, WA 98421 253-272-0397 253-627-3780 (Fax) CONTACT: BILL SHOOPMAN	Hose Assemblies: Air & Discharge Stainless Steel Flex Hoses Stainless Steel Cam-Lock Ftgs. Wika: Gauges Hose Clamps
UTILITY VAULT/OLD CASTLE PO BOX 588	Concrete Products: Curb Stops

AUBURN, WA 98071 253-839-3500 253-735-4201 (Fax) CONTACT: KAI JOHNSON	
WHITE CAP CONSTRUCTION SUPPLY 18211 EAST VALLEY HIGHWAY KENT, WA 98032 253-779-4100 253-779-4101 (Fax) CONTACT: JERRY OLSEN	Euclid: Grout BASF: Grout