GAMETI
Water Treatment Plant
Operation and Maintenance Manual

Bundled Water Treatment Plant Project

Project #: 10338

Prepared for:

Government of Northwestern Territories

By: AWC Water Solutions Ltd.

OPERATION AND MAINTENANCE MANUAL

FOR

GAMETI

BUNDLED WATER TREATMENT PLANT PROJECT

PROJECT NUMBER – 10338

Submitted to:	Submitted by:
Government of Northwestern Territories Department of Public Works and Services Stuart M. Hodgson Building Third Floor, 5009 – 49th Street Yellowknife, NT X1A 2L9 Attn: Troy Bourque Phone: 867-767-9049 Ext. 32165	**AWC Water Solutions Ltd.** 9087A 198 St, Langley, V1M 3B1 Main contacts: Jainish Patel Project Manager Phone: 604 638 0760 Email: jainishp@awcwater.com Kaushik Biswas Senior Water/Wastewater Engineer Phone: 604 363 4967 Email: kaushikb@awcwater.com

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Plan prepared: July 5, 2019

Mackenzie Valley Land and Water Board

Template updated: March 2018

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Operation & Maintenance Plan Templates for Municipal Water Licences: Water Treatment Plant

If you have any questions about this document, please contact your regional Manager of Community Infrastructure Planning.

1. Site Description

Date this plan was prepared: July 5, 2019

Where is the Water Treatment Plant (WTP) located?

Community: Gamèti

Latitude: 64.11

Longitude: -117.32

Which coordinate system was used for these coordinates?

- (•) Decimal Degrees
- ( ) Degrees, Decimal Minutes
- ( ) Universal Transverse Mercator (UTM)

☑ Location Map Attached

Map to include drawing scale, north arrow, and site access/roads.

Date of Commissioning of WTP: 2019 yyyy/mm/dd (if date is unknown, estimate year)

2. WTP Staff

Provide the name, contact information, and role for each staff member.

Name	Phone	Email
Judal Dominicata	867-997-3441	sao@gameti.org

Role/Responsibilities: Senior Administrative Officer

Name	Phone	Email
Louisa Wetrade	867-997-3441	finance@gameti.org

Role/Responsibilities: Assistant Senior Administrative Officer

Name	Phone	Email
Justin Gon	867-997-3441	

Role/Responsibilities

Shop Manager

3. Security and Control

How is public access to the facility controlled? (Check any that apply.)

- ☐ No control
- ☐ Chain-link fence around reservoir
- ☑ Locked man-door
- ☐ Other:

Is the following signage posted at the WTP? (Check any that apply.)

- ☑ Name of facility
- ☑ Notification of restriction of public access
- ☑ Warning signage regarding chemicals used in the treatment process

4. Facility Design

Facility design shall be provided in the form of a piping and instrumentation diagram (P&ID) and general arrangement views of the equipment and facility prepared by a Professional Engineer or Geoscientist registered with NAPEG, who has expertise in the subject area. Attach one of the following drawing options with the documents you are submitting. As-built drawings are preferred, if available. All drawings are required to have scales and north arrows (for plan views).

Indicate what type of drawings are attached:

○ As-built drawings ◉ Design drawings ○ Other:

5. Raw Water Sources

Name of **primary** raw water source (if applicable). Note that if you have a second water source, there will be a place to add information for the secondary source later in this section. For now, enter the information for the source that is used most often.

Rae Lakes

Type of raw water source (check any that apply):

☑ Lake ☐ River ☐ Groundwater ☐ Other:

Average annual quantity of water drawn from the source:

11,900 m^3/year

For **river** sources, what is the flow rate of the river? m^3/d

For **lake** sources, what is the size (area) of the lake? 8170000 m^2

When does the ice on the water source normally **freeze up**? December

When does the ice on the water source normally **break up**? April

What is the flow rate of raw water being withdrawn from the **primary** source? 1.89 L/s

Does raw water from the **primary** source fill a reservoir (i.e. seasonal or annual fill), or does it go directly to the treatment system, tanks, or trucks?

◯ Reservoir fill ◉ Direct to treatment, tanks, or trucks

If the primary source is used to fill a reservoir, how many times per year is the reservoir filled?

fills/year

During which months is the reservoir filled? (Skip if not filling a reservoir.)

☐ All Months

☐ January ☐ February ☐ March ☐ April ☐ May ☐ June

☐ July ☐ August ☐ September ☐ October ☐ November ☐ December

How long does it take to fill the reservoir? (Skip if not filling a reservoir.) Days

If the primary source is used to supply the treatment system, tanks, or trucks directly, how many days per week is water drawn from the source? (Skip if a reservoir is used.)

6 days/week

How many times does the intake pump run on an average delivery day? (Skip if a reservoir is used.)

2-3 times/day

What type of intake is used for the **primary** water source?

- [x] Inclined shaft (submersible pump and discharge pipe inside a larger casing pipe)
- [ ] Gravity-fed wetwell (gravity fed well from which raw water is drawn – NOT a storage well filled by a pump from the source)
- [ ] Groundwater well
- [ ] Infiltration gallery
- [ ] Temporary/seasonal surface intake (pump and piping are removed from the source after use or at the end of the season)
- [ ] Other (specify):

Provide the opening size for the mesh on the fish screen at the end of the intake in the water (the smallest dimension of the openings in the mesh): 3 mm

Is a Source Water Protection Plan (SWPP) in place for the **primary** raw water source?

(•) Yes ( ) No

If **yes**, provide the following information for the plan:

Prepared by (name of company or person that wrote the plan):

Title of document:

Operation and Maintenance Plan Water Treatment Plant- Version 2

Completion date: 2018/08/01 yyyy/mm/dd

Location of document (where is the plan kept, or where can a copy be obtained?):

Water Truckfill Station

If **no**, what is being done to protect the **primary** raw water source?

N/A

Identify the type of raw water storage (check any that apply):

☑ None ☐ Reservoir ☐ Storage Tank ☐ Other: _____

Raw water storage capacity: _____ m^3

Name of **secondary or alternate** raw water source (if applicable). This could include a source used seasonally, during maintenance, when there are problems with the primary source, or any other backup raw water source. If only one water source is used, skip to Section 6.

_____

Type of raw water source (check any that apply):

☐ Lake ☐ River ☐ Groundwater ☐ Other: _____

Average annual quantity of water drawn from the source:

_____ m^3/year

For **river** sources, what is the flow rate of the river? _____ m^3/d

For **lake** sources, what is the size (area) of the lake? _____ m^2

When does the ice on the water source normally **freeze up**? January

When does the ice on the water source normally **break up**? January

What is the flow rate of raw water being withdrawn from the **secondary** source? _____ L/s

Does raw water from the **primary** source fill a reservoir (i.e. seasonal or annual fill), or does it go directly to the treatment system, tanks, or trucks?

○ Reservoir fill ○ Direct to treatment, tanks, or trucks

If the secondary source is used to fill a reservoir, how many times per year is the reservoir

_____ fills/year

During which months is the reservoir filled? (Skip if not filling a reservoir.)

☐ All Months

☐ January ☐ February ☐ March ☐ April ☐ May ☐ June

☐ July ☐ August ☐ September ☐ October ☐ November ☐ December

How long does it take to fill the reservoir? (Skip if not filling a reservoir.) _____ Days

If the secondary source is used to supply the treatment system, tanks, or trucks directly, how many days per week is water drawn from the source? (Skip if a reservoir is used.)

_____ days/week

How many times does the intake pump run on an average delivery day? (Skip if a reservoir is used.)

_____ times/day

What type of intake is used for the **secondary** water source?

- ☐ Inclined shaft (submersible pump and discharge pipe inside a larger casing pipe)
- ☐ Gravity-fed wetwell (gravity fed well from which raw water is drawn – NOT a storage well filled by a pump from the source)
- ☐ Groundwater well
- ☐ Infiltration gallery
- ☐ Temporary/seasonal surface intake (pump and piping are removed from the source after use or at the end of the season)
- ☐ Other (specify): _____

Provide the opening size for the mesh on the fish screen at the end of the intake in the water (the smallest dimension of the openings in the mesh): _____ mm

Is a Source Water Protection Plan (SWPP) in place for the **secondary** raw water source? (Skip this question if no secondary source is used.)

○ Yes ○ No

If **yes**, provide the following information for the plan:

Prepared by (name of company or person that wrote the plan):

Title of document:

Completion date: _____ yyyy/mm/dd

Location of document (where is the plan kept, or where can a copy be obtained?):

If **no**, what is being done to protect the **secondary** raw water source?

Explain the reasons or situations where the secondary raw water source is used, including the time of year for seasonal sources (skip this question if no secondary source is used):

6. Water Treatment Process

Indicate any **pre-treatment** processes that are used at the WTP. (Check any that apply.)

☑ Screen ☐ pH adjustment ☐ Gravity settling ☐ Other:

Indicate any treatment technologies that are used at the WTP. (Check any that apply.)

☐ Coagulation and Flocculation

(A chemical is added to the water to make particles of dirt stick together and sink.)

List chemical(s) added:

Clarification (methods to help particles settle out after they are stuck together)

☐ Gravity ☐ Inclined plate ☐ Settling tubes ☐ Dissolved air floatation (DAF)

☐ Other:

Filtration (filters use various methods to trap particles and remove them from the water)

☐ Slow sand ☐ Rapid rate gravity ☐ Rapid rate pressure ☐ Bag/cartridge

☐ Other:

Membrane Filtration (a material with tiny holes is used to strain particles from the water)

☐ Microfiltration ☑ Ultrafiltration ☐ Nanofiltration ☐ Reverse osmosis

☐ Membrane of unknown type

☐ Other:

Additional Treatment Processes

☐ Activated carbon ☐ Ion exchange (softening or targeted removal)

☐ Other:

Iron and/or Manganese Removal

☐ Greensand ☐ Oxidation/filtration

☐ Other:

Indicate what types of disinfection are done at the facility. (Check any that apply.)

☑ Chlorination

○ Solid ◉ Liquid ○ Gas

☐ Ozonation

☐ Ultraviolet Radiation (UV)

☐ Other:

Water Demand, Production and Distribution:

Total annual water usage:

10,740 m^3/year

Identify the water distribution methods used (check any that apply):

☐ Piped (underground or utilidor) ☑ Trucked ☐ Other:

Identify the type of treated water storage (check any that apply):

☐ None ☐ Reservoir ☑ Storage Tank ☐ Other:

Treated water storage capacity:

31 m^3

7. WTP Waste Production

Skip this section if the WTP does not produce sludge.

Is sludge composition data available? (Lab report, engineering study, etc. showing what substances are in the sludge.)

○ Yes ○ No

If yes, please attach the data to this document when submitting.

☐ Sludge composition data attached

Estimate monthly quantity of sludge disposal: No sludge m^3/month

How is the sludge disposed of?

- ○ Discharged to sewage system or lagoon
- ○ Direct discharge to waterbody (lake, river, etc)
- ○ Discharged onto land
- ○ Mechanical dewatering
- ○ Evaporative sludge drying (sludge is spread out to air dry before disposal)
- ◉ Other: NO SLUDGE PRODUCED

Skip this section if the WTP does not produce wastewater from backwashing, regeneration (e.g. for softeners), or a reject water stream from membrane filtration.

Estimate monthly quantity of filter backwash, regeneration and/or membrane reject wastewater disposal:

37.2 m^3/month

How is the backwash/regeneration/membrane reject water disposed of?

- ○ Discharged to sewage system or lagoon
- ○ Direct discharge to waterbody (lake, river, etc)
- ○ Exfiltration
- ◉ Discharged onto land
- ○ Other:
- ○ Combination (describe):

Indicate if any of the following waste streams are produced at the plant. Provide the annual quantity and the disposal method for each. (Check any that apply.) **Skip** this section if no waste is generated at the WTP.

Check the items that apply:	Method of Disposal	Quantity per year	Units
☐ Spent cartridges or other disposable filters	(choose or type)		(choose or type)
☐ Spent media and/or resin	(choose or type)		(choose or type)
☐ Expired reagents such as DPD	(choose or type)		(choose or type)
☐ Expired calibration standards	(choose or type)		(choose or type)
☑ Chemical waste (specify):			
Analyzer wastewater	Hazardous material disposal	94	cubic metres (m3
CIP Waste	Hazardous material disposal	2.75	cubic metres (m3
	(choose or type)		(choose or type)
☐ Other*:			
	(choose or type)		(choose or type)

*Do not include regular municipal waste (garbage, such as paper towels and packaging) or wastewater from a sink or washroom that is discharged to the municipal system (trucked or piped).

8. WTP O&M and Record-Keeping

Does the WTP have an existing O&M Plan or Manual?

◉ Yes ○ No

If yes, please provide the following information for the plan:

Prepared by (name of company or person that wrote the plan):

AWC Water Solutions Ltd.

Title of document:

Gameti Operation and Maintenance Manual Version 3.0

Completion date: 2019/07/04 yyyy/mm/dd

Location of document (where is the plan kept, or where can a copy be obtained?):

Water Treatment Plant

The following are record keeping requirements related to O&M of the WTP and should be filed as an annual report with the MVLWB no later than the date stipulated in the water license for the previous year. The annual report should include the following items:

- Monthly and annual quantities of fresh water obtained from all sources, reported in cubic metres.
  How and where is this recorded? Weekly Test Sheet at WTP
  Where are these records kept? Water Treatment Plant
- A summary of modifications and/or major maintenance work carried out on the WTP, including all associated structures. Check your water licence for specific requirements regarding modifications.
  How and where is this recorded? Recorded by SAO and Hamlet Foreman
  Where are these records kept? SAO Office
- A list of spills and unauthorized discharges.
  How and where is this recorded? Environmental Health Office and Spill Report Database
  Where are these records kept? SAO Office
- A summary of any studies requested by the MVLWB that relate to water treatment waste disposal or water use and a brief description of any future studies planned.
  How and where is this recorded? Recorded by SAO
  Where are these records kept? SAO Office

Are records of repairs kept?

◉ Yes ○ No

Are records of upgrades kept?

◉ Yes ○ No

9. Surveillance Network Program

Annex A of the Community's water licence, "the Surveillance Network Program", outlines the requirements for water quality/quantity monitoring for the Water Treatment Plant.

10. Additional Comments or Notes

If there is any additional information that was not covered or didn't fit in the sections above, please include it here.

Refer to the attached memo on Gameti WTP- Backwash water quality.

The Mackenzie Valley Land and Water Board

www.mvlwb.com

Box 2130
7th Floor - 4922 48th Street
Yellowknife, NT X1A 2P6

Phone: (867) 669-0506
Fax: (867) 873-6610

Warns against an unsafe situation or practice that, if not avoided, could result in property damage and loss of effectiveness.

Warns against an unsafe situation or practice that, if not avoided, could result in damage to or destruction of equipment, loss of effectiveness, or health hazards to personnel.

Warns against an unsafe situation or practice that, if not avoided, could result in severe injury or death.

Warns against an unsafe situation or practice that, if not avoided, will result in severe injury or death.

List of Acronyms

CIP	Clean in Place
CT	Chlorine Contact Time
EPA	Environmental Protection Agency
EQ	Equalization
FGH	Fort Good Hope
GCDWQ	Guidelines for Canadian Drinking Water Quality
GEP	Good Engineering Practice
GNWT	Government of Northwest Territories
H&SS	Health and Social Services
HDPE	High Density Polyethylene
HMI	Human Machine Interface
HOA	Hand-Off-Auto
HVAC	Heating, Ventilation and Air Conditioning
IP	Internet Protocol
MACA	Municipal and Community Affairs
MIT	Membrane Integrity Test
MSDS	Material Safety Data Sheets
N/A	Not Applicable
NaOCl	Sodium Hypochlorite
NaOH	Sodium Hydroxide
NTU	Nephelometric Turbidity Unit
NT	Northwest Territories
O&M	Operation and Maintenance
P&ID	Piping and Instrumentation Diagram
PFD	Process Flow Diagram
PLC	Programmable Logic Controller
RFP	Request for Proposal
S&C	Standards and Criteria
TBD	To Be Determined
TCU	True Colour Unit
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
UPS	Uninterrupted Power Supply
USB	Universal Serial Bus
VFD	Variable Frequency Drive
WTP	Water Treatment Plant
ZW1	ZeeWeed or SUEZ Membrane Skid

1 General Description

Title: Bundled Water Treatment Plant Project
Location: Gameti, NT
Program Department: Municipal and Community Affairs (MACA)
Program Division: Community Operations

1.1 Project Background

The Guidelines for Canadian Drinking Water Quality (GCDWQ) are continuously updated and have been adopted in the Northwest Territories (NWT) under the Public Health Act and Water Supply System Regulations. The regulations currently require filtration for most drinking water systems. The community of Gameti have older chlorination-only truckfill station that do not comply with the current requirements of the GCDWQ. Thus, in an effort to improve the infrastructure, the Government of Northwest Territories (GNWT) implemented the replacement of these truckfill stations with Water Treatment Plants (WTPs), that include filtration and disinfection systems and are capable of meeting the GCDWQ.

1.2 Project Representative

OWNER	**GOVERNMENT OF THE NORTHWEST TERRITORIES** Public Works and Services Procurement Shared Services 5009 49th Street (1st Floor, Stuart M. Hodgson Building) Yellowknife, NT X1A 2L9	Troy W Bourque Project Officer Phone: 867-767-9049 Ext. 32165 Cell: 867-444-0903 Fax: 867-873-0357
CONTRACTOR	**AWC WATER SOLUTIONS** 9087A, 198 St., Langley, BCV1M 3B1	Jainish Patel Project Manager Office: 604 936 4217 Cell: 604 364 9546 jainishp@awcwater.com Kaushik Biswas Process Lead EngineerOffice: 604 936 4217 Ext. 529 Cell: 604-363-4967 kaushikb@awcwater.com

SUB-CONTRACTORS	**STANTEC ARCHITECTURE LTD.** 2nd Floor 4910 53 Street, PO Box 1777, Yellowknife NT X1A 2P4	Arlen Foster Senior Associate, Civil Team Lead, Northern Canada Direct: 867 920-2882 Ext. 249 Mobile: 867 446-0568 Fax: 867 920-4319 arlen.foster@stantec.com
	ROWE'S CONSTRUCTION 25 Studney Drive Hay River, NT X0E 0R6	Jack Rowe President Phone: 867-874-3243 Fax: 867-874-6558 jrowe@rowes.ca
	SUEZ WATER 3239 Dundas Street West Oakville, ON L6M 4B2	Andrew Brower Project Manager andrew.brower@ge.com

1.3 Revision **Data**

This manual has been updated to include:

Date	Description of Change
5th July 2019	Submission

1.4 Distribution of Volumes

Set 1: Water Treatment Plant, Gameti, NT
Set 2: Public Works and Service Library, GNWT, Yellowknife, NT
Set 3: Community Operations, Department of Municipal and Community Affairs, GNWT, Yellowknife, NT
Set 4: Electronically e-Builder

2 Process Criteria

2.1 General

Gameti is located at 64º16'35.05''N latitude and 117º19'12.62''W longitude. It is located 273 km (by air) northwest of Yellowknife, while in winter it's a 213 km trip via ice road. The community is settled on a forested peninsula jutting into Rae Lake, approximately halfway between Great Slave Lake and Great Bear Lake. The population of Gameti is 301 residents (as per NWT Bureau of Statistics, July 1st, 2018).

2.2 New Facility

The new facility has been designed for the year 2039 with consideration of community demand designed into the system. The treatment unit for this Water Treatment Plant (WTP) is the SUEZ Ultrafiltration Membrane system. Effort has been put into keeping the "dry" utility type equipment separate from the "wet" process area by providing a separate room. Structurally, the building skid is integral with the building frame, providing rigidity in a trestle type design. This design reduces the weight and depth required for the skid rails and provides the robustness required for transportation and placing at site. All design components presented in this O&M Manual have been designed to meet the applicable standards, codes, and guidelines.

The community is accessible by road from Yellowknife (via ice road) only during winter.

2.3 Water Treatment Goals

The treated water objectives for the Gameti WTP shall be consistent with those as outlined in the Guidelines for Canadian Drinking Water Quality (GCDWQ).

2.3.1 Raw Water Source and Treated Water Objective

The raw water source for the new Water Treatment Plant (WTP) is Rae Lake (1.5 km east of the community). The raw water quality of this source and the associated GCDWQ objectives for each parameter are summarized in the following table:

Table 2. 1: Raw water quality and treatment objectives from RFP.

GUIDELINES FOR CANADIAN DRINKING WATER QUALITY			
Parameters	**Units**	**Test Results**	**Aesthetic Objective**
Color	TCU	< 2-5	≤ 15
Iron	mg/L	< 0.06 – 0.088	≤ 13
Manganese	mg/L	< 0.004 – 0 .006	≤ 0.05
pH	-	7.76 – 8.12	6.5 – 8.5
TDS	mg/L	170 - 130	≤ 500
TOC	mg/L	4 – 5.5	-
Turbidity - Membranes	NTU	0.2 -0.7	0.1 (99% of time)
Protozoa	Log Reduction	N/A	
Viruses	Log Reduction	N/A	

The Health and Social Services (H&SS) in the NWT are responsible for ensuring safe drinking water quality and supplies for the communities and its people. Health is the regulator and is responsible for enforcing the Public Health Act, Water Supply System Regulations, General Sanitation Regulations, and the GCDWQ. All guidelines as such will be adhered to.

2.3.2 Treated Water Samples and Results

Treated water samples are taken and analyzed by an analytical laboratory during the pre-commissioning and commissioning phases of the project. The sample location is (a sample port) at the end of the process train (SV-071). The following tables outline the comparison between the treated water quality results with the GCDWQ objectives during the Pre-Commissioning (TBD) and Final Commissioning (TBD) stages:

Table 2. 2: Treated Water Results and GCDWQ Objectives during Pre-Commissioning.

GUIDELINES FOR CANADIAN DRINKING WATER QUALITY			
Parameters	**Units**	**Test Results**	**Aesthetic Objective**
Color	TCU		≤ 15
Iron	mg/L		≤ 13
Manganese	mg/L		≤ 0.05
pH	-		6.5 – 8.5
TDS	mg/L		≤ 500
TOC	mg/L		-
Turbidity - Membranes	NTU		0.1 (99% of time)
Protozoa	Log Reduction		
Viruses	Log Reduction		

Table 2. 3: Treated Water Results and GCDWQ Objectives during Final Commissioning.

GUIDELINES FOR CANADIAN DRINKING WATER QUALITY			
Parameters	**Units**	**Test Results**	**Aesthetic Objective**
Color	TCU		≤ 15
Iron	mg/L		≤ 13
Manganese	mg/L		≤ 0.05
pH	-		6.5 – 8.5
TDS	mg/L		≤ 500
TOC	mg/L		-
Turbidity - Membranes	NTU		0.1 (99% of time)
Protozoa	Log Reduction		
Viruses	Log Reduction		

2.3.3 Sampling Requirements and Frequencies

Routine testing frequencies and sampling locations for in-plant analyses will be approved by GNWT Health and Social Service Authority prior to implementation. The suggested daily tests are free chlorine residual (and total chlorine for GNWT weekly log sheet), pH, and turbidity.

The requirements of the Chief Medical Health Officer and the GNWT are that a specific sampling and testing protocol will be followed. A summary table of the testing parameters, water source and frequencies are available in this O&M.

3 Process System

This chapter describes the design criteria for the WTP and details on the process system employed.

3.1 Design Criteria

The design criteria of the Gameti WTP satisfy the standards, guidelines, and technical requirements as outlined in the RFP.

The following sources were used in developing the design:

- Guidelines for Canadian Drinking Water Quality (GCDWQ), Health Canada
- Northwest Territories Bureau of Statistics
- MACA Standards and Criteria 1993
- AWWA Standard C653-03 for disinfection of water treatment plants
- AWWA Standard C652-02 for disinfection of water storage facilities
- Procedure for Disinfection of Drinking Water in Ontario, 2nd Revision, June 4th, 2006
- EPA Disinfection Profiling and Benchmarking Technical Guidance Manual
- PWS Good Engineering Practices for Northern Water and Sewer Facilities (GEPNWSF)
- Project Terms of Reference
- General Terms of Reference for a Community Water and Sanitation Services Study, MACA, 1986 (MACA GTOR)
- PWS Good Building Practice for Northern Facilities, 2nd Edition, 2009
- National Building Code of Canada
- Canadian Electrical Code
- Safety Act and General Safety Regulations
- NWT Public Health Act
- NWT Public Water Supply Regulations
- National Plumbing Code
- National Fire Code
- National Fire Prevention Act and Regulations
- Canadian Standards Association (CSA) B-139-09 Installation Code for Oil Burning Equipment
- ANSI/NSF Standard 60 for water treatment chemicals
- ANSI/NSF Standard 61 for products and components
- ANSI/NSF Standards 42 & 53 for performance of water treatment devices

- IEEE Standard 519 for harmonic control in electrical power systems

Table 3. 1: Gameti Design Criteria

Gameti		
Overall Flows	Plant Design Flow	114L/m (6.8 m^3/hr)
	Fire Flow	1000L/m
	Truck-fill Flow	1000L/m
Raw Water Pumps	Max. flow of 1000L/m @ 197 kPa or TDH of 20m of water column	2 (1 duty, 1 shelf spare)
Pre-screening	Dual Mesh Basket Strainers	0.5mm perforations
Flocculation	Detention Time	10 minutes
	Tank Volume	1,134L (300 Gallons)
	Chemical dosing	Coagulant (Alum or PAC if required)
	Mixing	By air at 30-40 scfm air flow
Membrane Filtration	Design Permeate Flow	114L/min
	Design Recovery	95%
	Design raw water temperature	0.5°C
	Maximum Flow	151L/min (40gpm)
	Operating pH range	5.0 – 9.5
	Membrane Type	Low-pressure immersed hollow fibre
	Membrane System Model	Suez Ultrafiltration Z-Box S6
	Membrane Type	ZW 1000
	Module Surface Area	500 ft^2
	Pore Size (absolute/nominal)	0.1 micron / 0.02 micron
	Modules per Trains:	6
	Total Number of Trains	1
	Module Spaces per Train	6
	Total Module Quantity	6
	Log Removal for Cysts/Oocysts Reduction	3
Membrane Tank	Quantity of Tanks	1
	Tank Dimensions	35-inch x 36-inch x 44-inch
Permeate Pump	Quantity	1
	Motor Hp and Type	2HP and ANSI Centrifugal
Backpulse Tank	Quantity of Tanks	1
	Tank Dimensions	35-inch x 21-inch x 51-inch
Power	208 V / 3 Ph / 60 Hz	
Control Circuit	120 V / 1 Ph / 60 Hz	
	Type	Regenerative

Blowers for Membrane Aeration and Flocculation Air Supply	Quantity	2 (1 duty, 1 standby)
	Motor HP	3.4HP
	Flow	65scfm at 25kPa (3.6 psi)
Compressors for Pneumatic Actuator Air Supply and Membrane Integrity Testing	Type	Oli-free Dual Piston Pump System
	Quantity	2 (1 duty, 1 standby)
	Motor HP	2HP
	Flow (Includes air dryer and filters)	5.3 scfm at 625kPa (90 psi)
Chemical Dosing	**Coagulant (Future if required)**	
	Type	Liquid Alum (48%) or Polyaluminum Chloride (100%)
	Dosage	10 – 20 mg/L
	Pumps Supplied	None (for future if required)
	Primary Disinfection	
	Type	Chlorine or Sodium Hypochlorite (12%)
	Dosage	0.5 – 1.5 mg/L
	Pumps Supplied	1
	Log Removal for Virus Reduction	4
	Secondary (EQ Top-up) Disinfection	
	Type	Chlorine or Sodium Hypochlorite (12%)
	Dosage	0.5 - 1 mg/L
	Pumps Supplied	1
	Fire Flow Disinfection	
	Type	Chlorine or Sodium Hypochlorite (12%)
	Dosage	1 – 2 mg/L
	Pumps Supplied	1
	Shelf spare	1
Storage Volumes	Fire Storage (L)	-
	Emergency Storage (L)	-
	Flocculation Tank (L)	1,134
	Equalization Storage (L)	27,000
	Dead Storage (L)	1,000
	CT Storage (L)	7,900
	Wastewater Tank (L)	1,134
	Process Water (L)	500

3.2 Treatment Type and Process Employed

The main treatment process for this WTP is ultrafiltration membranes. This was chosen as the best solution to provide the highest confidence in treated water quality with the fewest process steps and lowest operating costs. Due to the increasingly stringent regulatory requirements to provide pathogen-free drinking water quality, the ultrafiltration membrane system guarantees a turbidity of less than 0.1 NTU for 99% of the time with no exceedance greater than 0.3 NTU and a 3-log removal credit for cysts/oocysts (e.g. *Giardia* and *Cryptosporidium*). There are also high removal rates of TOC (up to 75%) and colour (up to 95%) achieved at drinking water plants using immersed ultrafiltration membranes in combination with a coagulant and pH control (note: pH control not required at this Plant and provision for the coagulant addition has been made considering future projections). A reduced flocculation retention time is common with ultrafiltration membranes, thus reducing the size of the Flocculation tank and overall process footprint, chemical consumption and operating costs. Finally, the membrane system is a substitute for convention (and large) clarifiers, which eliminates excessive and constant coagulation adjustment and optimization to achieve a settleable floc and reduces overall footprint of process equipment.

The proposed water treatment plant for Gameti consists of the following components in process flow sequence:

- Raw Water Pump - 1,000 L/min: in a casing, drawing from lake water source and controlled by a Variable Frequency Drive (VFD)
- Provision for future injection of coagulant (Alum or Polyaluminum Chloride) for pre-treatment and in-line mixing by static mixer
- Flocculation Tank (Floc Tank) – 1,134 L; mixing and flocculation energy supplied by aeration
- Membrane Ultrafiltration Unit including permeate pump
- Injection of chlorine/sodium hypochlorite for disinfection and in-line mixing by static mixer
- Chlorine Contact Tank (CT Tank) – 7,900 L: provides contact volume to meet disinfection requirements for 4-Log removal and/or inactivation of viruses
- Equalization Tank (EQ Tank) – 27,000 L: provides volume to fill a water truck
- Truck-fill Pump - 1,000 L/min: discharges treated water into water truck

Additionally, other items and processes include:

- Freeze protection on raw water intake and truck-fill arm
- Fire flow by-pass
- Chemical dosing systems (pre-treatment, disinfection, top-up and fire flow)
- Control valves
- Flow meters
- Water level sensors
- On-line analyzers
- Sump discharge
- Wastewater storage tank and pump-out

A PLC control system integrates and controls the membrane unit process. If necessary, the plant can be run manually by activating the Hand-Off-Auto (HOA) switches on the PLC. By selecting the "Hand" option, it enables the operator to by-pass the PLC when various pieces of equipment need to be run manually. However, the membrane unit on its own, cannot be run manually and relies on the PLC for operation.

If there is an interruption of power, the entire plant will go on standby except for the control system which is powered by a UPS until the emergency generator takes over. When power is restored by the stand-by generator or utility services the treatment process will restart at the same point in the operating sequence that it was at when the power outage occurred.

3.3 Raw Water Pumping System and Fire Flow

An intake line with a pump is used to transfer water from the lake to the WTP for treatment at a rate of 1,000 L/min. A submersible pump is mounted on their own pump sled and inserted into the casing. The intake line is heat traced with redundant cables to prevent the line from freezing. The line is also back-flushed on a routine-basis by manually opening/closing valves and directing raw water discharge from one pump and down the casing of the other pump.

Normal operation is for the Raw Water Pump to fill the Floc Tank at the process flow rate of 114 L/min. The level in the floc tank is maintained constant while the treated water storage tank determines if the plant needs to turn on the raw water pumps. A combination of VFD and modulating butterfly valve are used to turn down the pump discharge rate from 1,000 L/min to 114 L/min.

The pumps react (in automatic mode) to the water level in the Floc Tank. The Floc Tank water level is sensed by a hydrostatic pressure level sensor and three specific control levels provided:

- High Level (Raw Water Pump off)
- Low Level (Raw Water Pump on)
- High/High (major alarm and pump shutdown)

Temperature and pressure indication are provided on the discharge of the Raw Water Pumps along the raw water line leading to the Floc Tank.

A secondary function of the Raw Water Pump is to provide fire flow directly to a fire tanker truck, by-passing the treatment plant at a rate of 1,000 L/min. This bypass is initiated by selecting the appropriate button on the control panels, located on the building exterior and on the truck-fill arm. Since this operation is of the highest priority, it will interrupt the normal water treatment plant production, when applicable.

When the bypass mode is chosen the Raw Water Pump starts (or continues to run) and flow is diverted around the process train via the fire flow bypass line to the truck-fill arm. This diversion is accomplished by opening and closing a pair of electric actuated butterfly valves. When in bypass mode, the raw water without treatment will be dosed with chlorine (sodium hypochlorite) to achieve a free chlorine residual of at least 0.5 mg/L prior to entering the fire truck.

3.4 Screening and Pre-Treatment

The raw water from the Raw Water Pump passes through 0.5 mm perforated basket strainers (one duty, one stand-by). The plant will have the provision to inject coagulant (in future) through an in-line static mixer prior to the Floc Tank. The coagulant assists in treatment of the raw water by making a more filterable solid. The coagulant dosage is manually set, as only minor dosage changes are anticipated over long periods. For the dosing pump to operate, it requires a permissive signal that water is flowing into the Floc Tank. The signal is derived from the flow meter located on the discharge of the Raw Water Pump.

The water level in the Floc Tank is maintained at a constant level to provide sufficient head for gravity flow to the membrane tanks while maintaining the required process flow rate of 114 L/min. This is accomplished by monitoring the Floc Tank level with hydrostatic pressure level indicator. The discharge line of the Raw Water Pump also includes a magnetic flow meter as well as an on-line raw water turbidity analyzer and pH analyzer.

The Floc Tank provides a (volume/through-flow) residence time of about 7 to 10 minutes. Flocculation residence time within that range is consistent with the end target of a pin-point floc for removal by the membrane.

Mixing in the Floc Tank and associated energy requirements is provided by an aeration diffuser assembly in the tank. The air supply requires a permissive signal from the flow meter confirming that there is water flow into the Floc Tank.

3.5 Membrane Ultrafiltration Process Unit

From the Floc Tank, the water flows by gravity at the required process flow rate into the membrane tanks, which are part of the skid mounted membrane filtration unit. The skid mounted units also include the backpulse storage tanks, the permeate pump, associated piping, valves and a junction box. The control panel includes all membrane associated electrical items including motor starters. A feeder is installed from the distribution panel in the generator room to the membrane control panel.

The membrane tanks contain thousands of immersed, hollow membrane fibres in 6 modules. Flow through the membrane is from outside to inside of the hollow fibres; this flow is induced by applying a slight vacuum to the ends of the fibres.

A key item on the membrane skid is the Permeate Pump. In filtration mode, this pump creates the suction on the hollow fibres and determines, by its output, the instantaneous plant production flow of filtered water. The output of this pump is controlled by a manual throttling valve in its discharge line, in conjunction with a magnetic flow meter in the same line, which also displays the instantaneous process flow rate. There are high-high and low-low flow alarms for the Permeate Pump, which notifies the operator of these conditions and shutdowns the system, if necessary. This is included in the PLC program and control documents.

As the membrane fouls, the increased head loss causes a drop in the flow rate; thus, the membranes operate in a declining rate mode. Consequently, the manual throttling valve requires periodic adjustment. Opening the valve increases the flux and TMP on the membrane fibres and negatively affects the filtration performance of the membranes. An alarm is triggered when the permeate flow rate varies from the high and low set points and notifies the operator that the control valve needs to be

adjusted. However, because of the reasonably good raw water quality, little if any need for adjustment between backwashes is anticipated. Additional information on the maintenance interval to check the permeate pump flow rate and position of this valve are outlined in the O&M Manual.

Periodically, the membrane unit switches automatically into backwash mode and is "offline" for approximately six minutes. Initiation of a backwash is when a predetermined volume of water has passed through the membranes. This volume is measured by the in-line magnetic flow meter on the Permeate Pump discharge.

Backwash is achieved by reversal of valves and the Permeate Pump then acting to produce backwash flow—also termed "backpulsing"—drawing from two 424 L backpulse storage tanks and using approximately 160 L (320 L/min for 30 seconds) for each backwash cycle. There is also a low-low set point for the backpulse tanks to protect the Permeate Pump.

Each backwash consists of scouring the outside of the membrane fibres with air, backpulsing the membranes with water and gravity draining the membrane tanks to waste. Approximately 620 L of wastewater is produced after each backwash operation.

Once the membrane tanks are empty, the backwash drain valve is closed and the inlet feed valve is re-opened to refill the membrane tanks from the Floc Tank. Once the membrane tanks are full, the process will then return to its production mode. During the refill of the membrane tanks, the Raw Water Pump is sequenced to start once the membrane tanks drain and operates at a higher flow rate to ensure a rapid refill. From start to finish a backwash will typically take about six minutes (includes backpulse, draining and refilling of the membrane tanks) and five backwashes per operational day are anticipated.

Over longer time periods, the membranes will be further fouled by organic and non-organic substances, thus necessitating chemical cleaning—termed: "Clean-In-Place" (CIP). A CIP is carried out entirely manually and initiated by operator decision. This is on a time basis, typically at one month to three-month intervals, or indicated to operator by an alarm derived from a Trans-Membrane Pressure (TMP) monitor or a failed Membrane Integrity Test (MIT).

The CIP procedure is performed immediately following the draining of the membrane tanks to waste after a backwash. The membrane tanks are filled with filtered water via a flexible hose from the domestic water system instead of a hard-piped system due to the infrequency of a CIP. This line is fed with both hot and cold water, but the temperature does not need to be maintained throughout the CIP process. Then the chemicals are manually dosed directly into the membrane tanks. There are two CIP procedures — one with 500 mg/L sodium hypochlorite for removal of organic foulants and the other with 2 g/L citric acid for removal of inorganic foulants. These two types of chemical recovery cleans must be performed separately for safety reasons.

Once dosed, the membranes soak for typically 6 hours or over-night. At the end of the cleaning process, the neutralization and dechlorination chemicals: sodium hydroxide and VITA-D-CHLOR™ Neutral, respectively are manually dosed directly into the membrane tanks. Neutralization and dechlorination is confirmed by measuring pH and chlorine levels with portable analyzers. When the chlorine and pH reach acceptable ranges for discharge, the tank contents are discharged to a sump within the building. The sump has a sump pump which pumps the wastewater to the wastewater holding tank. The wastewater from the holding tank is emptied and hauled by a truck to the nearby lagoon for final

disposal. All of the wastewater containing chemicals produced from the plant are released into the sump which is hauled by a truck to the nearby lagoon. A complete step-by-step CIP procedure for each type of CIP recovery clean is provided in the O&M Manual.

Periodically, a membrane integrity testing (MIT) is done on the membrane units. The MIT operation is conducted offline. The inlet valve is closed stopping inflow from the Floc Tank and the membrane tank levels are drawn down to the MIT level by the Permeate Pump. The isolation valve is then closed and the piping and hollow fibres are pressurized with air. The air displaces the water from the fibres back into the tank until the internal pressure has stabilized. The air supply valve is then closed and the pressure decay is recorded over the duration of the test (20 minutes). The results of this test are output as a pressure decay rate, which are used to calculate the log-reduction value by the PLC and to detect any physical flaws in the membranes, such as breaches. For repair of physical flaws, refer to the SUEZ O&M Manual.

Compressed air for MIT tests are supplied from two dedicated compressors (duty/standby).

An extensive description of the membrane filtration operation is included in the next sections of this O&M Manual.

3.6 Disinfection

The filtered production water is pumped by the Permeate Pump to the Chlorine Contact Tank (CT Tank). This tank provides the requisite combination of contact time (T) and residual concentration of free chlorine (C) for 4-Log virus inactivation.

The contact volume is provided by a 7,900 L tank with a perforated inlet baffle, interior baffles to promote serpentine flow and an overflow weir outlet into the EQ Tank. At the outlet of the GE skid, sodium hypochlorite is dosed via an in-line static mixer. The hypochlorite dosing pump shall dose chlorine at 1 -4 mg/L however adjustment to the actual dosage may be required to achieve a free chlorine residual of 0.5 mg/L at the outlet of the CT Tank. An initial dosage will be determined during commissioning. A chlorine residual analyzer, sampling from the outlet of the CT Tank, indicates the free residual concentration “C” and the dosage is adjusted automatically to achieve the required free residual of 0.5 mg/L. It is anticipated that the chlorine demand in the filtered water will not vary much and once the correct dosage is determined only periodic checks and adjustments are required.

The chlorine residual analyzer generates an alarm if the chlorine residual falls below or above a set value. The CT Tank has an overflow weird outlet to allow free fall into the Equalization Tank and thus the CT Tank remains full during plant operation and maintains the required contact volume.

3.7 Equalization Tank & Truck Fill

The EQ Tank permits a truck to be filled at a higher flow rate than the plant production flow rate. Level sensing by pressure transducer instrumentation indicates the volume retained in the EQ Tank at any one time plus three control levels:

- High (EQ Tank full. Stops production flow from treatment plant and puts plant into Standby mode)
- High/High (major alarm; prior to overflow)
- Low/Low (minor alarm; truck-fill pump shutdown)

There is also a low-low redundant switch to protect the Truck-Fill Pump.

The minimum free chlorine residual required in the truck-fill flow is 0.2 mg/L. Free chlorine residual in the EQ tank may dissipate due to long periods of no truck-fill flow—say, over a weekend.

A combination of flow out of the EQ tank (as determined from the flowmeter) and an analyzer detection of less than 0.2 mg/ L initiates the start of a dedicated chlorine dosing pump to provide "top-up" of the chlorine residual to the minimum requirement of 0.2 mg/L. The pump automatically provides the appropriate dosage for a truck-fill operation with inadequate chlorine residual.

When the Truck-Fill Pump stops, water left in the pipe will drain back to the EQ tank through an electrically operated solenoid valve located on the drain line.

The Truck-Fill Pump also directs treated water back to the intake casing for back-flush purposes after dechlorination (by flowing through sodium bisulphite pucks). The manual valve on the discharge line to the truck-fill arm is closed and the manual valve on the flushing line is opened.

3.8 Wastewater Sump and Storage

The process and housekeeping wastes are piped to the sub-floor, fully-insulated wastewater sump. The sump pump periodically starts and stops depending on its associated level set-points and pumps the wastes to the Wastewater Tank. The Wastewater Tank has a pressure level sensor connected to the PLC to display its volume. The Wastewater Tank is sized to require a pump-out from the wastewater vacuum truck approximately every day of operation based upon anticipated in-plant waste volumes. However, the required frequency of pump-out also depends on day to day operation.

3.9 Typical Plant Operational Sequence

This subsection is provided to give an overview of a typical operating sequence.

Initial Conditions:

- Plant is in Standby mode. No process unit is operating.
- EQ Tank is full. Truck is on delivery run.

Typical Operation:

- Water truck arrives for fill.
- Driver starts Truck-Fill Pump with exterior push button (one on building exterior and one on the truck-fill arm) and EQ Tank level starts to fall.
- Residual chlorine analyzer starts chlorine dosage pump for "top-up", if analyzer detects a residual of less than 0.2 mg/L of free chlorine leaving EQ Tank.
- Permeate Pump starts together with all associated systems when the EQ Tank level drops to a pre-determined point.
- When flow into CT Tank is confirmed by flow switch on CT Tank entry line, chlorine dosing pump starts to dose at outlet of the GE skid. The Raw Water Pump starts and comes under the control (for flow rate) of its VFD and the Floc Tank level.
- When flow of treated water fills the EQ Tank, the plant stops production and returns to Standby mode.

- The Truck-Fill Pump is either stopped manually by the truck driver at the exterior control station or automatically by the EQ Tank reaching its low or low-low, shut-off level.

3.10 Flow Meters and Analyzers: Summary

There are four magnetic flow meters:

- Raw water flow (measured as inflow to the Floc Tank)
- Filtered water flow (measured as discharge of Permeate Pump)
- Treated water flow (measured as discharge of Truck-Fill Pump)
- Fire flow (measured along the Fire Flow by-pass line)

There are two free chlorine residual and pH analyzers (combined unit):

- Samples from effluent of CT Tank (i.e. sample waters at weir outlet)
- Samples from EQ Tank recycle line (i.e. sample waters at EQ Tank outlet)

There is one pH analyzer (local display only):

- Samples raw water before Floc Tank

There are three turbidity analyzers:

- On raw water before Floc Tank
- On effluent of membrane filtration unit (i.e. filtered water)
- On effluent from EQ Tank (i.e. water delivered to truck)

3.11 Chlorination Summary

There are three chlorine dosing pumps:

- Pump #1: Dedicated to dosing to flow influent to CT Tank.
- Pump #2: Dedicated to dosing the fire flow during the plant bypass mode through the injection point on the truck-fill line.
- Pump #3: Dedicated as the “top-up” pump for normal truck-filling mode and chlorine residual in EQ tank effluent readings that are below a free chlorine residual of 0.2 mg/L.

All chemical dosages will be reported to the PLC.

3.12 Freeze Protection

The new redundant electric freeze protection is provided for both the well intakes and truck-fill arm systems. The raw water intake pipes are heat traced with heat tracing cables (one duty and one stand-by) and one controller, which is initially set at a temperature of 1°C and can be adjusted. The truck-fill arm system is mechanically controlled with an ambient temperature sensor and a thermostat with a set point of 1°C, but can be adjusted. The heat trace cables are contained within insulation. The intake pipes have aluminum tape along the length to assist with heat distribution, but the steel truck-fill pipe

does not require it. The intake pipes are also protected from over temperature by a line sensing thermostat to prevent damage to the HDPE.

3.13 Clean in Place (CIP)

Clean in Place chemicals are used on a monthly basis (or every three months if organic and inorganic fouling is not severe or observed) in order to remove foulants that the daily physical backwashes cannot address. The two CIP chemicals utilized are: sodium hypochlorite (NaOCl) for a "maintenance" clean and citric acid for a "recovery" clean. For each chemical, the CIP process must be performed separately. The elapsed time between the two types of CIP procedures (maintenance and recovery) is between one day and one month later, depending on the existing fouling conditions.

The provision of chlorine for CIP is accounted for in the overall WTP inventory in Overall Chlorine Requirements. The six-month supply of the citric acid required for CIP is supplied with one 20 L pail.

The Operator shall follow the steps outlined in the SUEZ O&M Manual for the instructions on CIP/Recovery Cleans or contact a SUEZ representative to assist with the CIP.

The mixture of sodium hypochlorite (chlorine) and citric acid may create a hazardous chlorine gas, posing a severe safety hazard to all personnel within the Plant. Under no circumstances should these chemicals be permitted to come into contact with one another.

1. Switch the SUEZ Z-Box S6 Unit to OFF at the HMI in the Mode of Operation tab.
2. Turn the HOA for Permeate/Water Demand to OFF on the PLC cabinet.
3. On the HMI, switch flow valve to OPEN to drain the membrane tanks to waste by gravity. Once the membrane tank is drained, switch this valve to CLOSE.
4. Use service water to fill the membrane tanks to cleaning level (level above membranes).
5. Manually dose the cleaning chemical (either sodium hypochlorite or citric acid) into the membrane tank. Add the cleaning solution to the membrane tank by removing the lid on the top of the membrane tank or removing the 2" NPT mushroom cap from one of the nozzles on top of the membrane tank.
    a. If cleaning with sodium hypochlorite, use a 500 mg/L solution to clean the membranes. Add approximately 2.03 L of 12% sodium hypochlorite.
    b. If cleaning with citric acid, use 2000 mg/L solution to clean the membranes. Add approximately 1.8 L of 50% citric acid.
6. Open the aeration valve (SOV-202) from the air blower just long enough to stir the contents of the membrane tank.
7. Allow the membranes to soak for 4 to 6 hours or even overnight for sodium hypochlorite and 30 minutes to 1 hour for citric acid. This soak time will be determined during start-up and the Operator will be trained with the required knowledge. This soak time may be adjusted during future operation.
8. Once the soak time has elapsed, neutralize the cleaning solution prior to discharge to the sump only, refer to the next section of this O&M and the SUEZ Manual for steps on how to neutralize the spent CIP chemical solution.

3.14 Neutralization

Neutralization chemicals are manually dosed (with the use of a beaker and funnel) directly into the membrane tanks after each CIP process in order to neutralize the pH and dechlorinate the chlorine in the CIP chemicals. Mixing of the neutralization reagents is achieved with the blower air system available to the membrane tanks. The final pH and free chlorine residual are verified with portable analyzers and must meet waste quality objectives (i.e. neutral and dechlorinated) before being drained to the wastewater sump. More details of the procedure for neutralizing the CIP waste is outlined in the SUEZ O&M Manual.

Sodium hydroxide is used to neutralize the citric acid and VITA-D-CHLOR™ Neutral is used to dechlorinate the sodium hypochlorite from the CIP waste.

The six months (180 days) supply of the sodium hydroxide is provided by means of a 20 L pail of aqueous solution, whereas the VITA-D-CHLOR™ Neutral is provided by means a 12 kg pail of powdered chemical.

1. When the soak time has elapsed, manually dose the appropriate neutralization chemical into the membrane tank.
    a. To neutralize a sodium hypochlorite solution, add approximately 650 mL of VITAD-CHLOR™ Neutral solution (follow instructions on the package for mixing the powder with potable water to make the required concentration of solution) and 150 mL of 50% sodium hydroxide.
    b. To neutralize a citric acid solution, add approximately 700 mL of 50% sodium hydroxide.
2. Use aeration from the air blower to mix the membrane tank contents for approximately 2 minutes.
3. Measure both pH and chlorine levels using handheld instruments. Confirm that the free chlorine residual is less than 1 mg/L and the pH is between 6.5 and 8.0. If necessary, add additional chemicals to adjust either the chlorine residual or the pH.
4. Once neutralization has been confirmed, ensure the membrane tank drain valve leading to the sump is open and the overland discharge valve is closed.
5. Drain the used chemical solution by gravity to waste by opening the membrane tank drain valve on the HMI screen. The wastewater from CIP shall be sent to the nearby sump for offsite disposal to nearby lagoon.
6. Once the tank is empty, close the drain valve on the HMI screen.
7. Switch the Z-BOX S6 Unit to ON in the Modes of Operation tab.

3.15 Compressed Air System

The compressed air system for the WTP consists of dual air compressors (one duty, one stand by) that alternate every eight hours and could operate at 5.3 CFM @ 90 psi (max. capacity), a 910 L suspended-horizontal air receiving tank to store the compressed air, and a non-cycling refrigerated air dryer to ensure moisture removal for the entire air system. The compressed air system provides air for the SUEZ Membrane Skid in terms of treatment mechanics, valve operation, Membrane Integrity Tests for log

inactivation credit, and backpulse scouring during a backwash cycle. The compressors run automatically to maintain a specific air pressure inside the receiving tank throughout an operational day. The compressed air system is also equipped with low pressure switches that notify the Operator when the system pressure drops below the set point, which might indicate that Operator intervention / servicing is required.

3.16 Air Blower System

The air blower system for the WTP consists of dual air blowers (one duty, one stand by). The blower system provides air for the aeration and mixing within the Flocculation Tank, and the SUEZ Membrane Skid in terms of treatment mechanics (CIP).

The blower run automatically to maintain the specific aeration in the flocculator tank throughout the normal water treatment operation. During CIP and neutralization operations in the membrane tank, solenoid valve (SOV – 202) has to be turned open in-order to stir the contents inside.

3.17 Valves and Instrumentation

3.17.1 Valves

There are a variety of values used throughout the WTP, such as: ball, diaphragm, solenoid, control (including motor operated), butterfly, and needle.

Ball valves (also known as Hand Valve in P&ID) are valves with a spherical disc, which is the part of the valve which controls the flow. They are easy to repair and operate.

Diaphragm valves (also known as Hand Valve in P&ID) consists of a valve body with two or more ports, a diaphragm, and a “saddle” or seat upon which the diaphragm closes the valve. Their application is generally as shut-off valves in process systems.

Solenoid valves (also known as Flow Valve in P&ID) an electromechanical valve for use with liquid or gas. The valve is controlled by an electric current through a solenoid: in the case of a two-port valve the flow is switched on or off; in the case of a three-port valve, the outflow is switched between the two outlet ports.

Control valves control conditions such as flow, pressure, and water level by fully or partially opening or closing in response to signals received from controllers that compare a set point to a process variable whose value is provided by sensors or transmitters that monitor changes in such conditions. The opening or closing of control valves is done by means of electric systems. Positioners are used to control the opening or closing of the actuator based on Electric Signals. These control signals are based on 4-20 mA signals, with 4 mA meaning closed/off and 20 mA meaning open/on.

Butterfly valves (type of control valve in P&ID) can be used for isolating or regulating flow. The closing mechanism takes the form of a disk. Operation is similar to that of a ball valve, which allows for quick shut off. Unlike a ball valve, the disc is always present within the flow; therefore, a pressure drop is always induced in the flow, regardless of valve position.

Needle valves (type of control valve in P&ID) are a type of valve having a small port and a threaded, needle-shaped plunger. It allows precise regulation of flow, although it is generally only capable of relatively low flow rates.

3.17.2 Instrumentation

There are various analyzers and instrumentation to measure process variables such as flow, free chlorine residual, pH, and turbidity. These are positioned throughout the process train in appropriate locations so that the Operator can assess the performance of the system.

There are four magnetic flow meters:

- Raw water flow (measured as inflow to the Floc Tank)
- Filtered water flow (measured as discharge of Permeate Pump)
- Treated water/Firewater flow (measured as discharge of Truck-Fill Pump)

There are two free chlorine residual and pH analyzers (combined unit):

- Samples from weir outlet of CT Tank
- Samples from EQ Tank outlet (i.e. samples water at EQ Tank outlet)

There is one pH analyzer (local display only):

- Samples raw water before Floc Tank

There are three turbidity analyzers:

- On raw water before Floc Tank
- On effluent of membrane filtration unit (i.e. filtered water)
- On effluent from EQ Tank (i.e. water delivered to truck)

3.18 Laboratory Equipment and Consumables

Standard laboratory equipment/apparatus and auxiliary supplies are provided for water quality sampling, testing and monitoring. The following table outlines the applicable items from the laboratory inventory as specified by the project Terms of Reference.

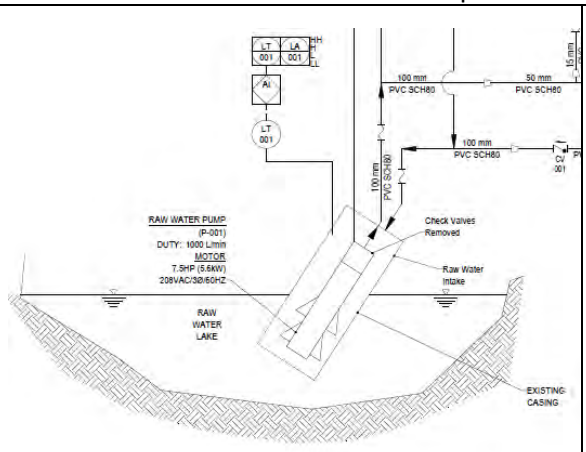
Quantity	Description
Laboratory Consumables	
1	HACH 2100P Turbidimeter, Part # 46500-00
1	HACH Sample Cells Package of 6, Part # 24347-6
1	HACH Chlorine Pocket Colorimeter, Part # 58700-00
1	Sample Cell Glass 10 mL 25X60mm Part #2427606 for low range test
1	1cn 10MI Cells DR2010 Part #4864302
1	Pocket Pro pH tester with calibration solution
2	Silicon Oil
2	Sample cell oiling cloth
1	Beakers, polypropylene, 1000 mL (3/pkg)
1	Beakers, polypropylene, 50 mL (12/pkg)
1	Graduated cylinder, 100mL
1	Graduated cylinder, 500mL
1	Graduated cylinder, 1000mL
1	Pitchers, graduated - 1000mL
1	Pitchers, graduated - 500mL
1	250 mL flask (6/pkg)
2	Screw on caps for 250 mL flask
2	Wash bottle, polypropylene, 500 mL
1	Acculab VI series electronic scale
2	Syringe - 10 cc
2	Syringe - 1cc
2	Laboratory grade brushes to clean sample vials
2	Laboratory grade brushes to clean sample vials
1	Rack to hold sample vials
1	Lint free wipes
1	4L each of distilled water
Additional WTP Equipment and Supplies	
1	Dust Broom and Dustpan
1	Drive Socket Set
1	Combination Wrench Set
1	Screwdriver Set (all sizes and tip types, as required)
1	Extra Large Slot Screwdriver

2	Pipe Wrenches
1	Tank/Pipe Scrub Brush
1	Wet/Dry Shop Vacuum
1	Ladder (6 Feet with non-conducting material)
1	Garbage Cans
1	Desktop Computer
1	Telephone with Wireless Handheld and Answering Machine
1	Potable Speakers
1	Colour Printer and Fax Machine
4	Printer Cartridges

3.19 Process Train Components and Photos

The following section includes a brief description of each unit process along with associated photos of each stage.

3.19.1 Reservoir and Intake

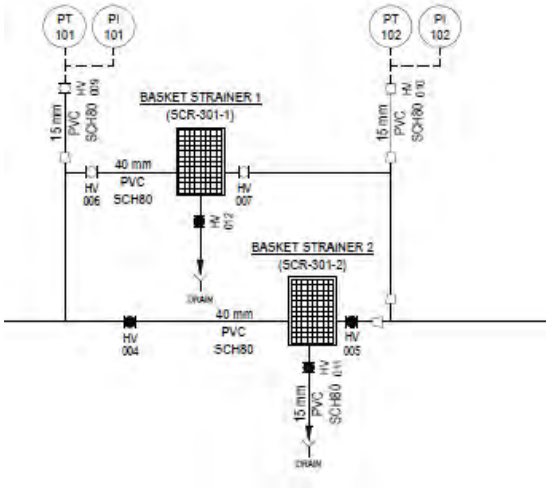
<table>
<tr><td colspan="2">The Raw Water Pumps delivers raw water from the Reservoir to the WTP for treatment at a rate of 1,000 L/min (and is also controlled by VFD to match process flow rate). The Raw Water Pump also provides fire water that bypasses the process when the start/stop buttons are selected on the red Fire Water control panel.</td></tr>
<tr><td> 

Reservoir and Intake on P&ID</td><td> 
Submersible Raw Water Pump</td></tr>
<tr><td></td><td> 

Truck Fill (Grey) and Fire Flow (Red) Control Panels</td></tr>
</table>

3.19.2 Basket Strainers

The raw water from the Raw Water Pumps passes through 0.5 mm perforated mesh basket strainers (one duty and one spare). Periodic cleaning of the basket strainers is required.



Basket Strainer on P&ID

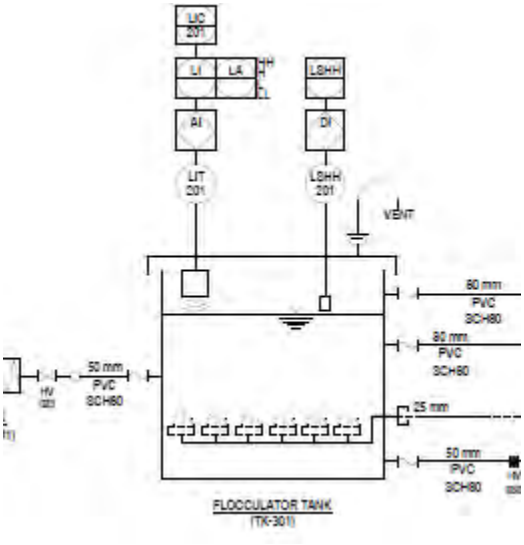
Basket Strainer

Basket Strainer Manufacturer's Nameplate

Basket Strainer in the WTP (On Wall Beside the Floc Tank)

3.19.3 Flocculation Tank

The Flocculation (Floc) Tank allows for the coagulant to mix with the raw water to create a “pinpoint floc.” This makes filtration easier. Mixing is provided by means of aeration. Blower air system feeds a diffuser located at the bottom of the Floc Tank.



Flocculation Tank on P&ID

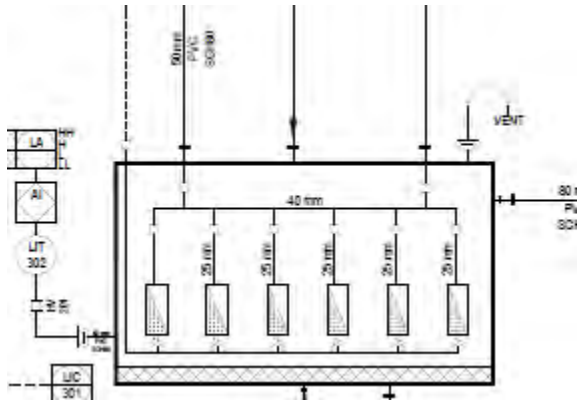
Air Blower in WTP for aeration

Flocculation Tank in WTP

Flocculation Tank in WTP

3.19.4 SUEZ Z-BOX S6 Membrane Unit

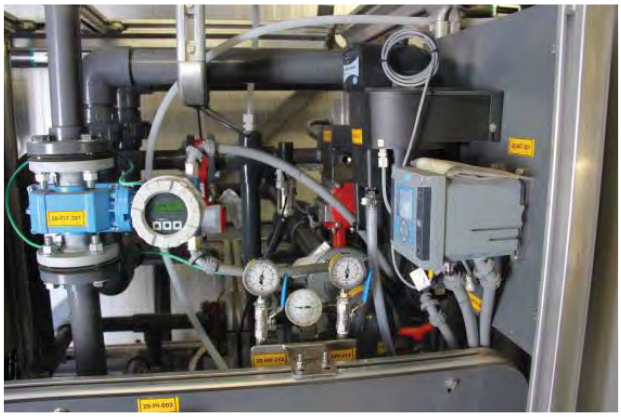
The SUEZ Z-BOX S6 Membrane Skid has one membrane tank, one back pulse tank, a Permeate Pump, and junction box. The Permeate Pump creates a suction (or vacuum) on the ends of thousands of immersed, hollow membrane fibers and pulls the pre-treated raw water through 0.02 micron pores. The larger particles remain on the outside of the membranes and are discarded during a backwash cycle, while the filtered/treated water passes through and out to the CT Tank.



SUEZ Membrane Skid on PID

SUEZ Membrane Skid in WTP

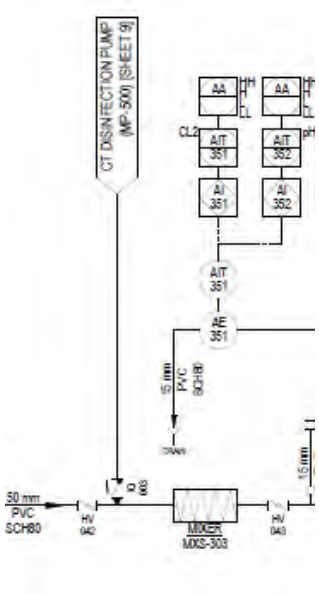
SUEZ Membrane Skid in WTP



SUEZ Membrane Skid in WTP

3.19.5 Chlorine Disinfection System

Treated water from the SUEZ Membrane Skid requires chlorine disinfection to kill or inactivate viruses that might be in the water. Sodium hypochlorite is dosed prior to the CT Tank through an injection quill and in-line static mixer. The chlorine dose yields a free chlorine residual of 0.5 mg/L after 24 minutes of retention time, which is required for adequate disinfection as per standards (CT of 12 mg·min/L).



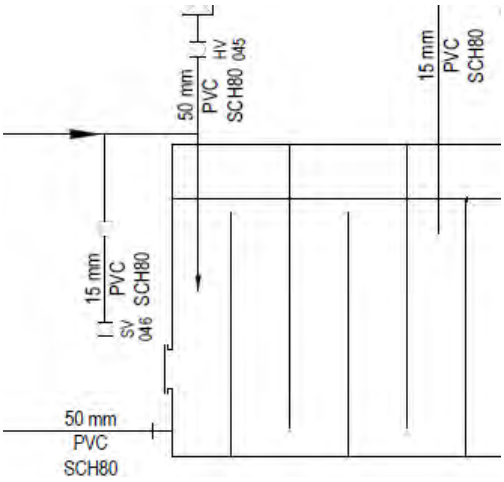
Chlorine Injection after Membrane Filtration on P&ID

Chlorine Metering Pump in WTP

Chlorine Metering Pump

3.19.6 CT Tank

The Chlorine Contact Tank (CT Tank) provides the required contact time for the free chlorine residual in order to achieve the 4-Log virus inactivation. The contact volume is provided by a 7,900 L tank with a perforated inlet baffle, interior baffles to promote serpentine flow, and an overflow weir outlet into the EQ Tank thus maintaining the required volume for disinfection.



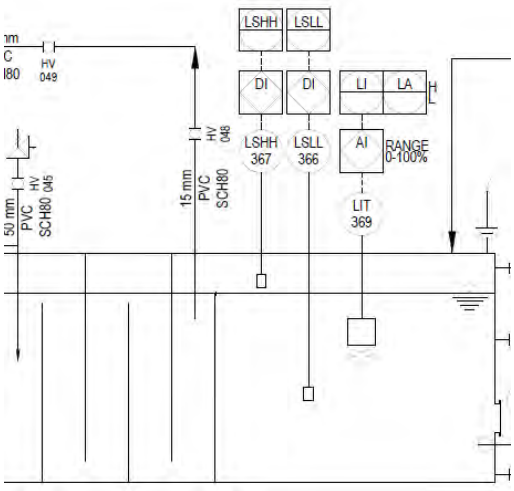
CT Tank on P&ID

CT Tank During Fabrication

CT Tank in WTP

3.19.7 EQ Tank

The Equalization (EQ) Tank stores 27,000 L of treated water for consumption. The level in the EQ Tank increases and decreases throughout the work day. When the high level is reached, the production stops and when the low level is achieved, the Truck Fill pump stops. The treated water quality is monitored in the EQ Tank by a turbidity analyzer and free chlorine residual and pH analyzer. The minimum free chlorine residual required in the water truck is 0.2 mg/L. If this is not achieved, a "top-up" chlorine metering pump doses the line to ensure adequate free chlorine residual / secondary disinfection during distribution.



EQ Tank on P&ID

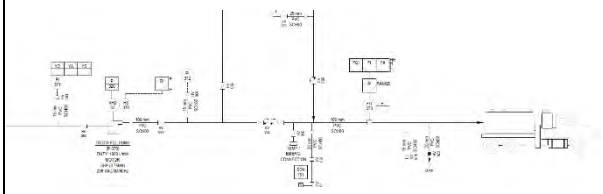
EQ Tank in WTP

EQ Tank in WTP

EQ Tank in WTP

3.19.8 Truck Fill Pump and Arm

The Truck Fill Pump draws from EQ Tank and delivers treated water to the water truck through the Truck Fill Arm. This Pump is controlled by 'start' and 'stop' push buttons mounted on the grey Treated Water control panels. One panel is located on the building exterior and the other on the Truck Fill Arm. The Pump also stops on an EQ Tank low level and water in the Truck Fill arm drains back to the Raw Water Tank. The Truck fill Pump also discharges treated water back to the intake casing for back-flush purposes. Dechlorinated water must be verified prior to an intake casing flush operation.



Truck Fill Pump and Arm on P&ID

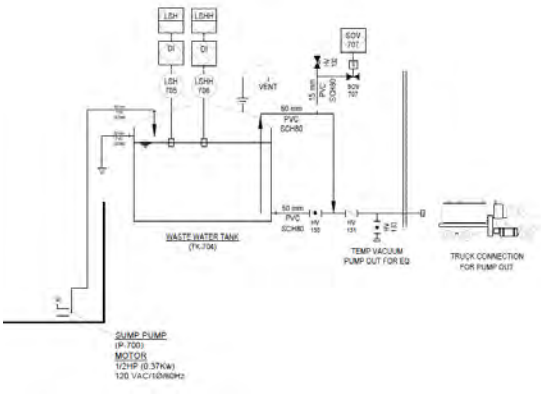
Truck Fill Arm on WTP

Treated Water (grey) and Fire Water (red) Control Panels

Truck Fill Pump in WTP

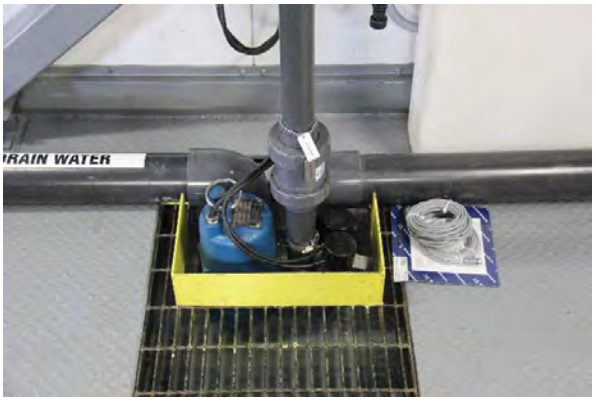
3.19.9 Wastewater Sump and Tank

Any wastes generated in the WTP are directed to the Wastewater Sump and then transferred to the plastic Wastewater Tank by the Sump Pump. The Wastewater Tank has a usable volume of 1,134 L. The various waste volumes include process uses such as analyzers, Clean in Place (CIP), backwash, and in-plant uses such as testing, cleaning and general housekeeping. A vacuum truck is required to empty the Tank whenever it is full and a Camlock connection outside of the Plant is provided for this purpose. There is also an emergency shutoff / siphon break in case the flow needs to be interrupted or stopped before the Tank is empty.



Wastewater Tank on P&ID

Wastewater Tank Connection (Outside)



Sump Pump

4 Non-Process Systems

Auxiliary services to the treatment process train consist of electrical system (building, and freeze protection on raw water intake line and truck-fill arm), UPS, ATS and emergency generator, utility meter, diesel fuel system (furnace and HVAC), potable water, and phone/remote access dial-in.

4.1 Electrical

The building lights, PLC, and operating systems are powered with electricity from the Gameti community power supply. The community operates with three phase power. The building is heated with a diesel furnace, but in case of power failure, furnace failure or diesel supply depletion the emergency generator will operate the three unit heaters to keep the WTP from freezing until the system has returned to normal service.

The WTP power specifications are as follows:

- 200 A
- 120/208 V
- 3 PH
- 60 Hz

The stand-by generator power output specifications are as follows:

- 50 kW
- 120/208 V
- 3 PH
- 60 Hz
- 70 kWm

The WTP is equipped with new redundant electric freeze protection capabilities on both the intake and truck-fill arm systems. The raw water system is heat traced with heat tracing cables (one duty and one stand-by) and one controller, which is initially set at a temperature of 1°C and can be adjusted. The truck-fill arm system is mechanically controlled with an ambient temperature sensor and a thermostat with a set point of 1°C, but can be adjusted. The intake pipes have aluminum tape along the length to assist with heat distribution, but the steel truck-fill pipe does not require it. The intake pipes are also protected from over temperature by a line sensing thermostat to prevent damage to the HDPE.

4.2 Emergency Generators, ATS and UPS

If there is an interruption of power, the Plant will stop except for the control system which will be powered by an Uninterrupted Power Supply (UPS) until power is restored (by the emergency generator or utility services). The treatment process will restart at the same point in the operating sequence that it was at when the power outage occurred. The transfer of power is controlled by the Automatic Transfer Switch (ATS).

4.3 Utility Meter

The buildings' utilities are monitored through the Northwest Territories Power Corporation (NTPC) meter. It is mounted on the exterior of the building. The WTP electricity usage is recorded with this meter and only NTPC personnel may use this equipment or provide services related to this equipment.

4.4 Diesel Fuel System

The WTP uses a diesel fuel system (Arctic Grade) to feed the furnace and generator. There is an exterior horizontal fuel storage tank. The fuel is pumped into the building by means of diesel transfer pumps into day tanks for each of the furnace and the generator. There is a stand-by diesel transfer pump for the generator as per code requirements. The level of the outdoor fuel tank is monitored by means of a level transmitter connected to the PLC and there is also a vent alarm (also known as a "whistle") on a spare vent connection, which aids in preventing an overflow event during filling.

4.5 Heating

The diesel furnace provides heat to the building and is distributed via HVAC ducts. The supply and return vents are situated throughout the building to provide an adequate circulation of air at the required temperature. Thermostats control the process and generator room temperatures, but it is also controlled, monitored and regulated by the PLC. There are low and high temperature alarms for both the rooms. The furnace diesel supply is provided by a diesel day tank and a diesel transfer pump.

There are unit heaters in the generator room and the process room to provide adequate heating during a power outage or if the furnace is temporarily out of service. In that case, the unit heaters will be powered by the stand-by generator and will provide electric heat until the system is back up and running under normal operating conditions.

4.6 Potable Water System

Water is required for various process units such as chlorine analyzers, turbidity meters, backpulse tank, housekeeping and hot water. The Potable Water Pump with an internal pressurized bladder draws from the EQ Tank and pumps water to the Hot Water Tank, wash down bib, flexible hose (for CIP), and the mop and the lab sinks.

4.7 Telephonic Lines (Landline and Remote Access)

4.7.1 Telephonic Service Provider

The telephone service provider for the WTP is NorthwesTel. There are four phone lines at the site: one for the auto-dialer, one for the PLC/Electrical Panel and AWC's remote access, and one for regular phone usage within the plant. For telephone related inquiries, please contact NorthwesTel Customer Service at: +1-888 423-2333.

4.7.2 WTP- Data Logging System

The WTP will automatically log various process parameters throughout the operational day and this information is accessible via local and remote means. The data is logged every five minutes in Comma Separated Values (CSV) format that is stored both on the internal memory of the PLC and on an external USB flash memory stick. Locally, the Operator has an option to download the logged data directly from the HMI via USB port that is suitable for an external memory storage device. This device is accessible without opening the PLC cabinet door. The name of the file incorporates the date and time that file was created so that chronological organization is possible.

For remote access to the HMI and process parameters log files, a web browser software package is required (FTP site). This remote access is through dial-up, which is provided by the local communication company for the WTP site. Each Panel View Plus HMI station will be assigned a unique IP address, so by entering the associated IP address into the web browser software the guest machine can log in to the HMI station and look at the screens or download the process parameters log files. At the end of the session, the guest machine will terminate the remote access to the HMI station.

5 Operation and Control of Unit Processes

Notices, Cautions, Warnings, and Dangers emphasize important and critical instructions with associated procedures. Notes, cautions and warnings are defined as follows:

Notices:

Highlights an essential operating or maintenance procedure, condition or statement.

Caution:

Highlights an operating or maintenance procedure, practice, or condition, statement, etc., that, if not strictly observed, could result in damage to or destruction of equipment, loss of effectiveness, or health hazards to personnel.

Warning:

Highlights an operating or maintenance procedure, practice, condition, or statement, etc., that, if not strictly observed, could result in injury to or death of personnel.

Danger:

Highlights an unsafe situation or practice that, if not avoided, will result in severe injury or death.

5.1 System Composition

The SUEZ Ultrafiltration Membrane Skid is the treatment system at the WTP. There is also a coagulant used during pre-treatment (provision made, if needed in future) and chlorine is used to achieve the required disinfection prior to community consumption. The distribution system consists of one 12,700 L community water trucks drawing from a 27,000 L Equalization Tank.

A PLC and HOA switches (on the PLC doors) control the WTP. The system runs automatically, but manual operation for certain items is an option. Alarms are activated when the process parameters go beyond their set points. For minor alarms, an alarm banner on the HMI is displayed and the PLC light and alarm beacon are activated. Whereas when major alarms occur, the Operator is notified through a call-out/auto-dialer and exterior strobe system.

5.1.1 Process Flow Sequence and Control Narrative

The process steps are raw water intakes, pre-treatment, flocculation/aeration, membrane filtration, CT disinfection, equalization, and truck-fill. The other modes of operation include fire flow by-pass and intake casing flush.

The step-by-step flow sequence for normal operation is as follows:

- Water truck Operator selects the green START button on the grey treated water box on either the exterior or truck fill arm control panel
- Process motor-operated fire flow control valve ZV-003 closes, if not already closed
- Submersible Raw Water Pump P-001 pumps raw water into WTP by at a flow rate between 120 L/min and 1,000 L/min
- The Variable Frequency Drive (VFD) controls the speed of the Raw Water Pump based upon the level in the Flocculation Tank and the Membrane Skid flow rate
- The positioner (analog on/off) valve FCV-002 opens to 100%
- Raw water passes through a magnetic flow meter FIT-100,
- Raw water passes through hand valves HV-006/HV-004 and HV-007/HV-005 on either side of the Basket Strainer SCR-301-1/SCR-301-2
- Raw water pH is measured by the pH analyzer AIT-103
- Raw water is measured by the turbidity meter AIT-104
- Pre-treated water flows into the Flocculation Tank TK-301
- The water level is measured by the level transmitter LIT-201
- The tank is aerated by the alternating Air Blower System
- Pre-treated water flows by gravity through level control valve FCV-301 into the membrane tanks MT-300
- The Permeate Pump 20-P-310 creates a vacuum on the membrane fibers and the permeate/treated water is drawn through the pores
- Treated water passes through magnetic flow meter FIT-310 and is also measured by turbidity meter AIT-313
- Treated water passes through flow switch ZV-314, which is linked to CT Disinfection Pump MP-500
- Treated water passes through check valve CV-041
- Treated water is injected with sodium hypochlorite (chlorine) from the CT Disinfection Pump through injection quill IQ-003 and is blended by static mixer MXS-303
- Chlorinated water flows into the CT Tank TK-002 and overflows the weir into the Equalization Tank TK-002
- The Recirculation Pump 20-P-360 pumps treated water from the weir outlet and its pH/free chlorine is measured by the pH/chlorine analyzer AIT-366/AIT-365 (located on the analyzer panel)
- The water level is measured by the level transmitter LIT-369
- The level switch LSLL-366 is a redundant level control for low-low scenarios
- If free chlorine residual is less than 0.2 mg/L as measured by the EQ chlorine analyzer, the Top Up Disinfection Pump MP-402 will inject chlorine through injection quill IQ-004 into the suction line of the Truck Fill Pump
- Treated and chlorinated water is pumped by the Truck Fill Pump P-370 through a double check-valve/backflow preventer CV-062 and into the community water truck through the Truck Fill Arm
- The treated and chlorinated water flow is totalized by the magnetic flow meter FIT-373, which is also linked to the Top Up Disinfection Pump as a permissive

- When the Truck Fill Pump stops, water in the Truck Fill Arm drains back into the casing flush line through a solenoid that is linked to the Pump

The step-by-step flow sequence for fire flow operation is as follows:

- Water truck Operator selects the green START button on the red fire water box at exterior or truck fill arm control panel
- Process motor-operated valve FCV-002 closes and fire flow motor control valve ZV-003 opens
- Submersible Raw Water Pump P-001 pumps raw water into WTP bypass at 1,000 L/min
- Chlorine is injected by the Fire Flow Disinfection Pump MP-501 through an injection quill IQ-001 into the line and is blended with static mixer MXS-101
- Chlorinated fire flow water passes through magnetic flow meter FIT-004, which is linked to the Fire Flow Disinfection Pump and totalizes the fire flow volume
- Chlorinated fire flow water passes through check valve CV-069, into the main process line and flows through the magnetic flow meter FIT-373 and into the fire water truck through the Truck Fill Arm

The step-by-step flow sequence for intake casing flush operation is as follows:

- Verify that chlorine residual is 0.0 mg/L in the EQ Tank by looking at the EQ Tank ph/chlorine analyzer
- Re-verify that free chlorine residual is 0.0 mg/L with a manual test (sample water from HV-054 and test with HACH Pocket Colorimeter)
- If free chlorine residual is NOT 0.0 mg/L, then casing flush CANNOT occur
- If free chlorine residual is 0.0 mg/L, then proceed with steps
- Close hand valves on either side of the backflow preventer CV-062
- Open hand valve HV-065
- Manually turn on the Truck Fill Pump P-370 by switch HOA switch to HAND
- After 5 minutes, turn the Truck Fill Pump HOA to OFF
- Close hand valve HV-065
- Open hand valves on either side of the backflow preventer CV-062
- Return to normal operation

5.1.2 Isometric Piping of Plant

Isometrics are provided by a set of 14 drawings showing the pipe and equipment orientation with instrumentation and tag numbers for all items (refer to Appendix).

5.1.3 PFD for Domestic Water and Diesel System

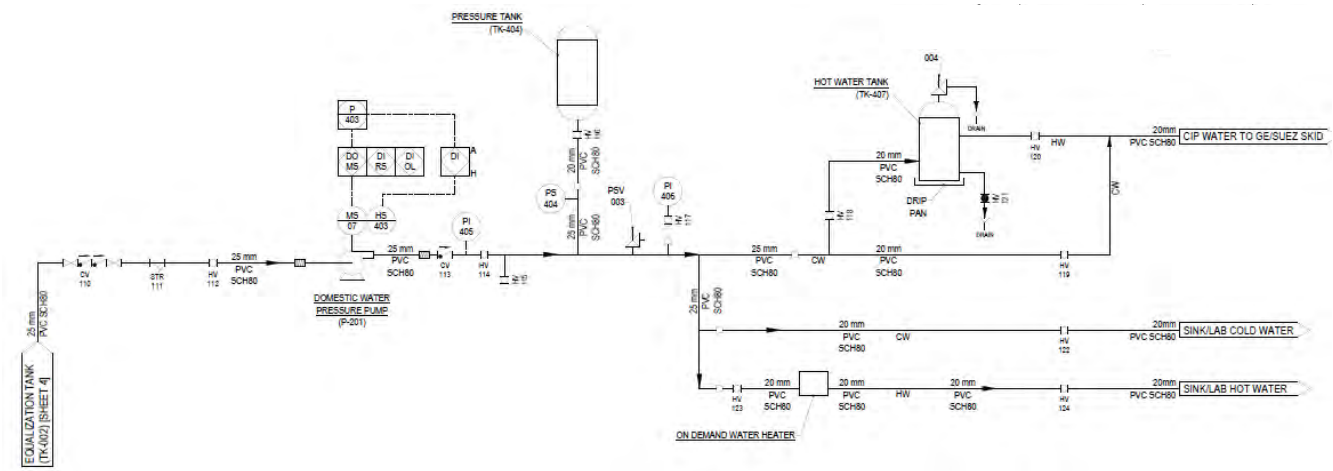


Figure 5: 1: Potable Water System

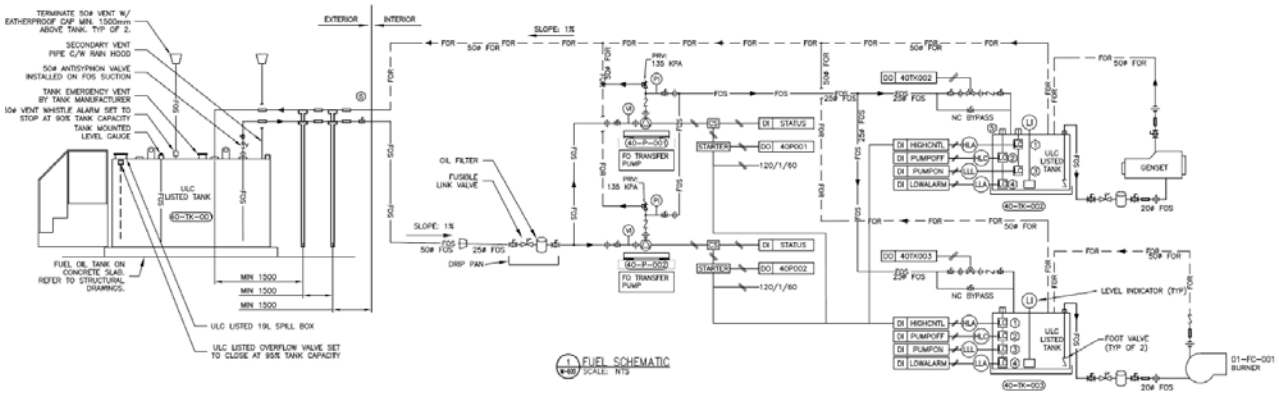


Figure 5: 2: Fuel System for the WTP

5.2 Operations Mode

During normal operation, the WTP is run automatically by the PLC program, but manual operation is also an option available to the Operator. To switch from automatic to manual, the Operator must adjust the HAND/OFF/AUTO (HOA) switches on the PLC cabinet door. The definition of HOA stages is:

- **HAND** means the device can be operated manually and energize the device (valves open and pumps turn on)
- **OFF** means the device is disabled and its power is disconnected (valves close and pumps turn off)
- **AUTO** means the device is controlled by the PLC program

There are indicator lights mounted on the cabinet door that illuminate to show the Operator the current mode of operation for each component. There are HOA switches for the following devices and/or systems (refer to Figure 5.3):

- Process Water Demand
- Raw Water Pump 1 (P-001)
- EQ Analyzer Pump (20-P-360)
- Coagulant Pump (MP-200)
- CT Disinfection Pump (MP-500)
- Fire Flow Disinfection Pump (MP-501)
- Top Up Disinfection Pump (MP-402)
- Fire Bypass Line ZV (ZV-003)
- Truck Fill Pump (P-004)

Figure 5: 3: HOA Switches

The main purpose for operating a device manually is to isolate it from the process train for control, servicing or testing. In the case of a valve, the Operator can control the open/close status or also how much a valve is throttled in order to control the flow through the system. In the case of a pump, the Operator may want to start and stop the pump in order to control flow through the system or the water level in a tank. For example, if there is an issue with the push buttons outside of the Plant, the Truck Fill Pump can be turned on manually by turning the HOA switch to the Hand position. Once the water truck is full, the Operator can return the HOA switch to AUTO and repeat this process while troubleshooting occurs.

5.3 Plant Control Set Points

5.3.1 Process Component Set Points

The following table displays the low-low, low, high, and high-high process set points for various process variables for the Plant. These values are based on indicators (as opposed to physical switches) and analog inputs.

Table 5. 1: Process System Setpoints.

Components	LL	L	H	HH
Fire Flow By Pass Line Flow (L/min)	750	800		
Raw Water Line Flow (L/min)			1150	1200
Raw Water Line pH	5	6	9	10
Raw Water Line Turbidity (NTU)			25	35
Flocculation Tank Level (mm)	800	900	1050	1150
Membrane Tank Level (mm)	1016	1016	1143	1200
Membrane Transmembrane Pressure (kPa)	-90			-20
Backpulse Flow (L/min)		78	96	
Backpulse Pressure (kPa)			62	
Backpulse Transmembrane Pressure (kPa)				90
Treated Water Turbidity (NTU)			0.1	0.3
Treated Water Flow (L/min)	78			110
Treated Water Temperature (°C)	0	5	35	40
CT Tank Chlorine Residue (mg/L)	0	0	4	5
CT Tank pH	5	6	9	10
EQ Tank Chlorine Residue (mg/L)	0	0	4	5
EQ Tank pH	5	6	9	10
EQ Tank Turbidity (NTU)			0.8	0.9
EQ Tank Level (mm)	50	350	2250	2300
Truck Fill Flow (L/min)				

5.4 Common Operating and Control Issues/Problems

Include a discussion of common operating problems which may be encountered in each unit process. Identify the probable cause and discuss possible corrective actions. Where appropriate, describe means by which the Operator may visually identify certain problems. Provide a tabulation of all control and alarm set-points. Alarm presentation, procedures for recovery and restart for all possible alarms.

5.4.1 Generator Still Running

After a power outage, the generator will turn on and when the utility power comes back on the

generator should cool down and stop after 2 minutes of stable power, however sometimes it continues to run. In these instances, turning the main breaker OFF and ON again will reset the system and the generator should shut down after the cool down period.

5.4.2 Chemical Pumps Not Pumping

Switching the HOA from OFF to AUTO, it is important to remember to change the controls of the chemical pumps on the HMI. Go to Raw Water Intake, Disinfection and Treated Water Storage, and Truck Fill screens, select the pumps and select AUTO on the HMI. The pumps will run as expected after completing this task. Also, selecting Reset Plant on the Plant Overview screen will ensure the statuses of the HOA switches on the PLC door matches the HMI HOA statuses.

5.4.3 High Pressure in Raw Water Line (PI-002)

If high pressure is observed in the raw water line, more specifically the pressure gauge PI-002, one possibility is that the basket strainers are clogged. To verify this, check the differential pressure gauge under the Flocculation Tank and in front of the basket strainers. The strainers may be clogged if the pressure gauge displays a pressure of 2 psi or higher. If this is the case, remove the filters, flush them and place them back into the strainers. Tighten the bolts and open the valves to return to normal operation.

5.4.4 SUEZ Skid Standby Unexpectedly

If the SUEZ Skid is in STANDBY and there is demand for water (EQ Tank is below the level set point and the YY-402 box is green on the ZW-1 HMI screen, select Alarm Reset. Sometimes the SUEZ Skid is waiting for the alarms to be cleared and reset before going into PRODUCTION. If this does not work, ensure the

HOA switches are in AUTO and view each HMI screen to verify each item is in AUTO. If the problem persists, call AWC.

5.4.5 Flocculation Tank Low and Raw Water Pump Not Running

If the Operator observes that the Flocculation Tank level is low and remains low even though there is a call for water, check to see if the Raw Water Pump is running. If the icon is green, then the PLC is telling it to run, but the issue could be software or hardware. To check the software issue, select the Pump icon on the HMI screen and check if there is a VFD fault, as indicated by a yellow fault button in the middle of the faceplate. If it is active, select the button itself until it is grey. If there is no VFD fault, then the pump itself or the electrical supply is not working. In this case, check the twist-lock receptacle for a secure connection and that the disconnect switch is in the ON position.

If none of these options work, then contact AWC to discuss troubleshooting methods. An electrician might have to be called in to work on the electrical connection or a mechanical technician might need to work on the pump itself.

5.4.6 Uncharacteristically High Turbidity Readings

If the permeate/treated water turbidity analyzer on the SUEZ Skid (AIT-313) is reading consistently above 0.1 NTU, then a few options are available to the Operator.

One is to remove the sensor from the body and clean the photocell with a KimWipe task wipe from the laboratory supply. There should be neither scratches nor dirt on its surface. Replace the sensor to the body after it is cleaned.

Another option is to isolate the sensor body, remove it from its mounting and clean it and the removable bubble trap with distilled water. Return all parts to correct location and open valves on either side of the sensor body to allow flow through it.

Another option is to drain the bottom of the sensor body by opening the brass clasped plug located at the bottom. Once it has drain, any accumulated solids at the bottom would have been removed, so replace the plug and continue operation.

The final option is to adjust the inlet flow rate. If the flow rate is too high, it can stir up dirt, debris, and/or bubbles, all of which disturb the turbidity readings. On the inlet of the analyzer body, close the solenoid/needle valve completely (grey knob on the SUEZ Skid SOV-313, and silver knob on Analyzer Panel HV-207) and then open it slowly by two full turns. This is an approximate amount, so further tweaking may be required. The end goal is to ensure the flow rate is high enough that it enters the sensor body but does not overflow the two weir sections located inside the sensor body (to the front ride when looking over top).

During the winter months, the Operator might observe a spike in turbidity (>0.3 NTU) on the SUEZ Skid in the mornings and then will see it even out after 20 minutes to the usual 0.02 NTU – 0.03 NTU. This occurs because of cold and warm water blending inside the turbidity body. There are two options available: drain the turbidity sensor body in the mornings before the skid starts to ensure only the colder inlet water is being measured, or continue to restart the SUEZ Skid after each SHUTDOWN until the turbidity decreases to its normal level (can take five to 20 minutes). AWC can assist with this troubleshooting matter, if required.

5.4.7 SUEZ Pneumatic Valves Sticking Open/Closed

This is not a common occurrence and should not happen with other Plants, but it did happen at one Plant and has since been remedied. If the Operator observes that the FCV-3xx valves are sticking and there is no flow in the system (low-low permeate or backpulse flow situations), which eventually shuts down the skid, then the following steps can be performed:

1. Select Alarm Reset.
2. Whichever valve is sticking, select that valve and open and close it on the HMI screen. This will help rotate the valve blade and “loosen” it up. Return the valve to AUTO once several repetitions are performed.
3. Select Mode Control ON. Skid will go back into production.

If a low-low flow situation shuts down the skid again, repeat Steps 1 to 3. If the problem persists, call AWC or SUEZ and explain the situation. The valve may need to be replaced, the bolts on the flange may need to be loosened, the valve travel stops (brass Allen Key fittings) may need to be adjusted, or the air speed for the pneumatic controller may need be adjusted. AWC and/or SUEZ will walk the Operator through the necessary steps. If none of the solutions above work, then SUEZ will come to site and fix the issue.

6 Operational Procedures

Notices, Cautions, Warnings, and Dangers emphasize important and critical instructions with associated procedures. Notes, cautions and warnings are defined as follows:

Notices:

Highlights an essential operating or maintenance procedure, condition or statement.

Caution:

Highlights an operating or maintenance procedure, practice, or condition, statement, etc., that, if not strictly observed, could result in damage to or destruction of equipment, loss of effectiveness, or health hazards to personnel.

Warning:

Highlights an operating or maintenance procedure, practice, condition, or statement, etc., that, if not strictly observed, could result in injury to or death of personnel.

Danger:

Highlights an unsafe situation or practice that, if not avoided, will result in severe injury or death.

6.1 WTP Start-Up from Utility Power

If, for any reason, the power to the WTP has been shut off, follow this step:

Step 1: Turn the main disconnect ON. The power should be connected to the WTP. If there is still no power, call Northwest Territories Power Corp (refer to 7.4).

6.2 HMI Process Start-Up and Shutdown[1]

The HMI (Human Machine Interface) provides the operators monitoring, control and adjustment of the treatment process. The following pages included in the chapter HMI LEGEND describe the displays and control inputs common to many of the screens.

The first step for PROCESS start-up is for the user to log-in into the HMI screen (refer to Figure 6.1):

[1] Note: the images used in this manual to describe the HMI operation are not indicative of the normal operation of the plant. They have been created for demonstration purposes only.

Step 1: When the HMI first boots up, the title page will be displayed. Clicking the 

button will open the Main Menu of the system. An operator can Login and Logout by clicking the button.

Step 2: On pressing the Login button on the main screen, a **Security Login pop-up** screen will appear, the user enters a name and password. By pressing the browse button an entry keypad will appear and the user enters their login information.

Figure 6. 1: : Main screen and login.

The following pre start-up checks must be performed before running the plant (refer to Figure 6.2):

Step 1: Ensure all HOA switches are in AUTO position.
Step 2: On the HMI screen, select “Plant Overview”.

The Plant Overview screen shows the Membrane System Information, totalized plant production, system information that includes Mode, Step and Time left for a cycle.

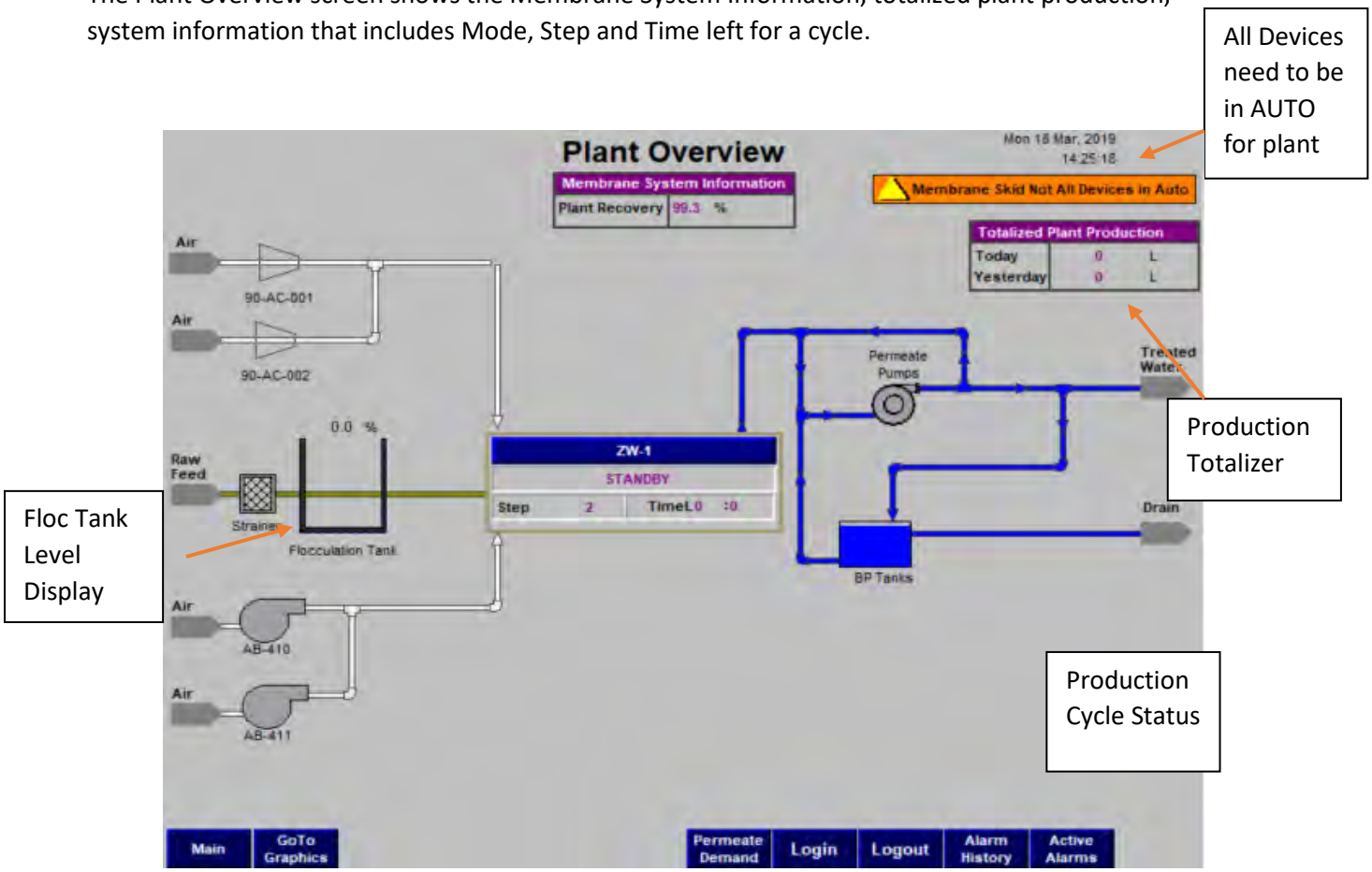


Figure 6. 2: Plant overview screen.

Next, each section of the process train must be in AUTO mode on the HMI screen. The Operator will either verify that it is already in AUTO mode or must select AUTO mode. The first section to check is the Raw Water Intake.

The main menu is the root screen that any screen may be accessed from. If, at any point, the operator becomes lost, he may press the “main” button from any screen to revert to this page.

Figure 6. 3: Main menu button from any screen reverts to this page.

6.2.1 Raw Water Intake Start-Up

Step 1: Select “Go To Graphics” at the bottom of the screen.
Step 2: Select “Raw Water Intake” and the status of each component is displayed beside its icon. If in “AUTO” or “HAND” operation, “AUTO” or “HAND” icons will be visible.
Step 3: Select “Raw Water Intake Pump” icon (refer to Figure 6.4).

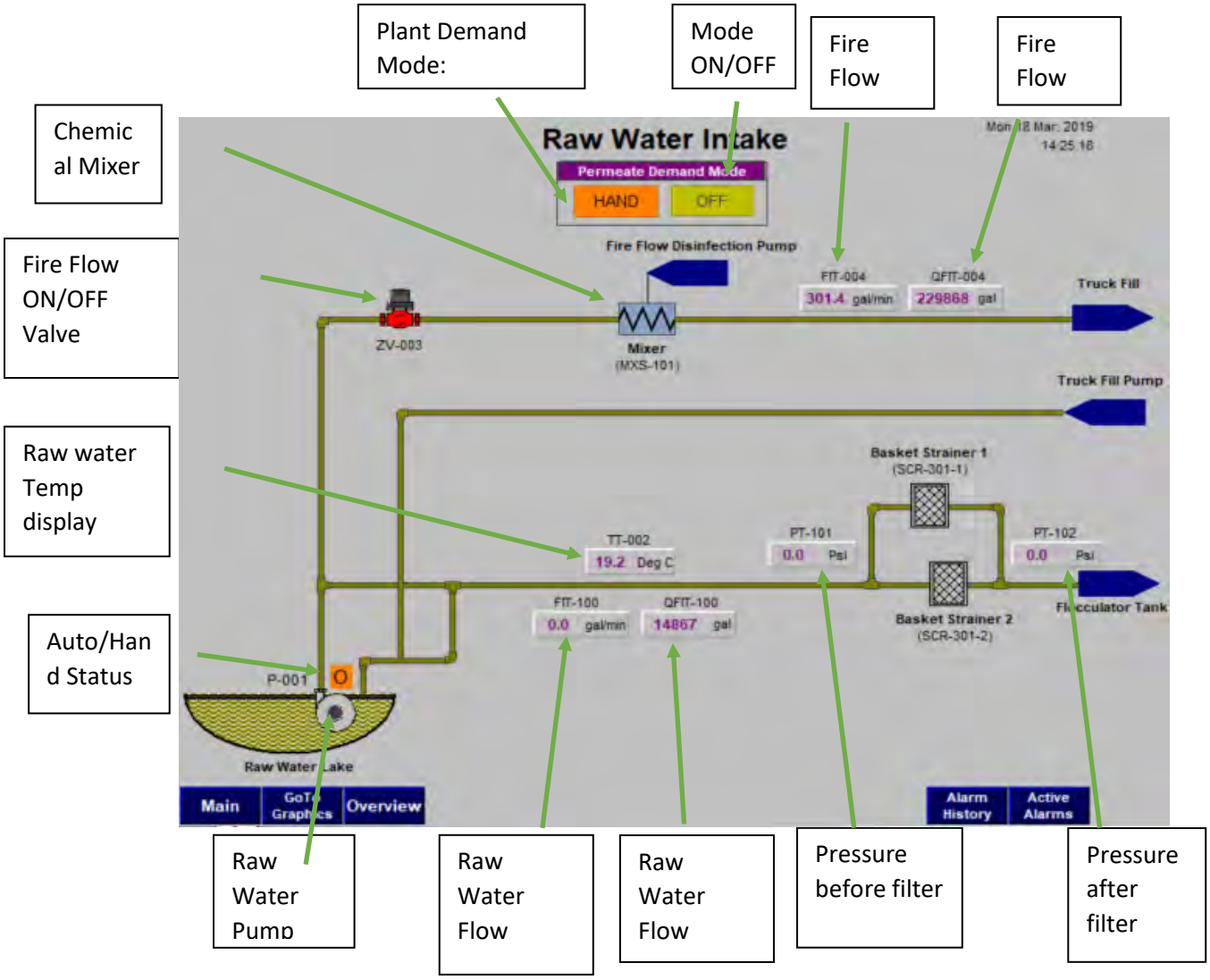
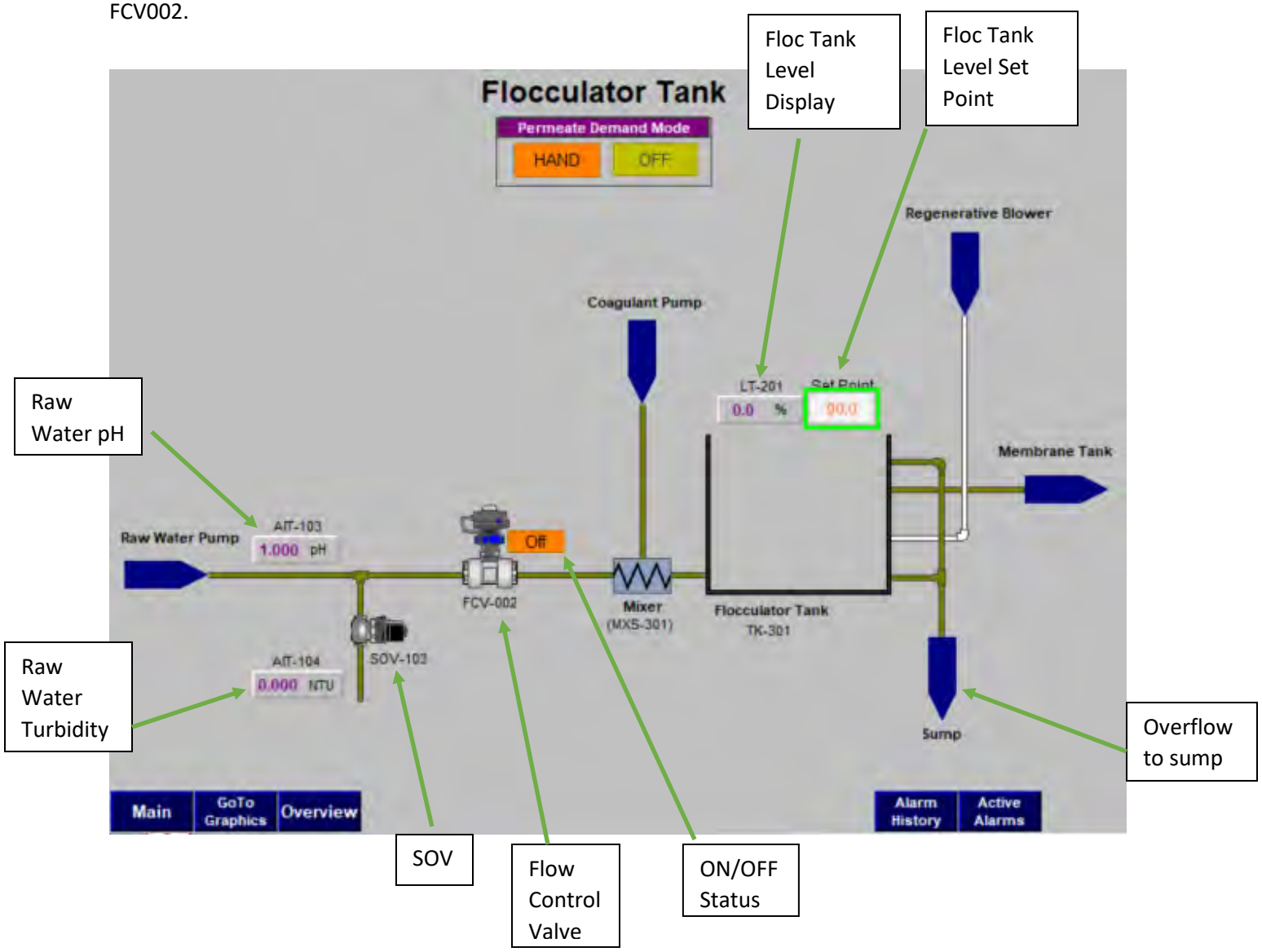


Figure 6. 4: Raw water intake screen.

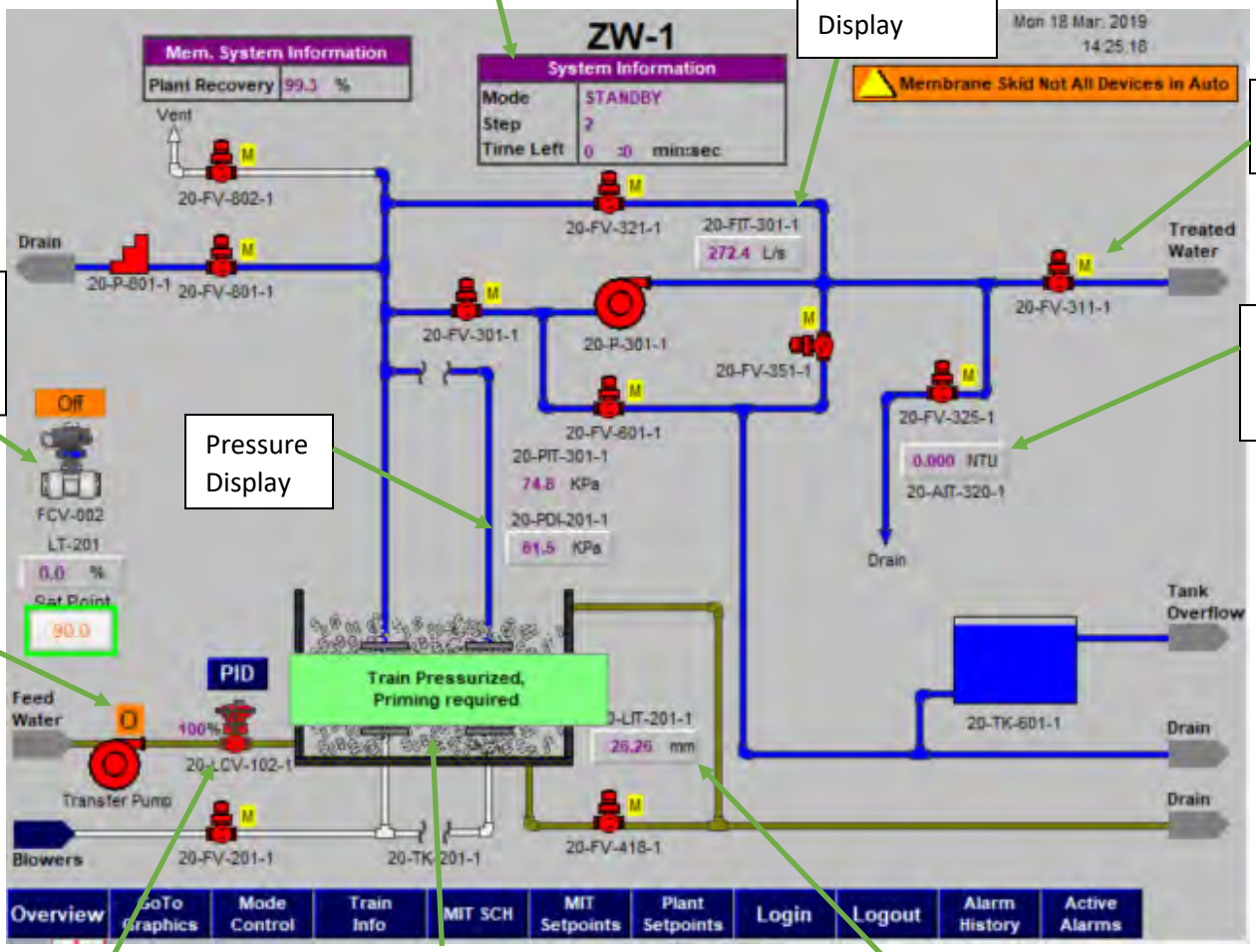
6.2.2 Pre-Treatment Start-Up

This screen enables the operator to control the flocculator tank level by operating the control valve FCV002.



6.2.3 ZW-1 (SUEZ Membrane Skid) Start-Up

This screen allows the operator to run the plant in different modes such as production, backwash, MIT and Prime.



Train Mode Information

Treated Water Flow Display

Auto/Hand Status

Raw Water Control Valve

Treated Water Turbidity

Pressure Display

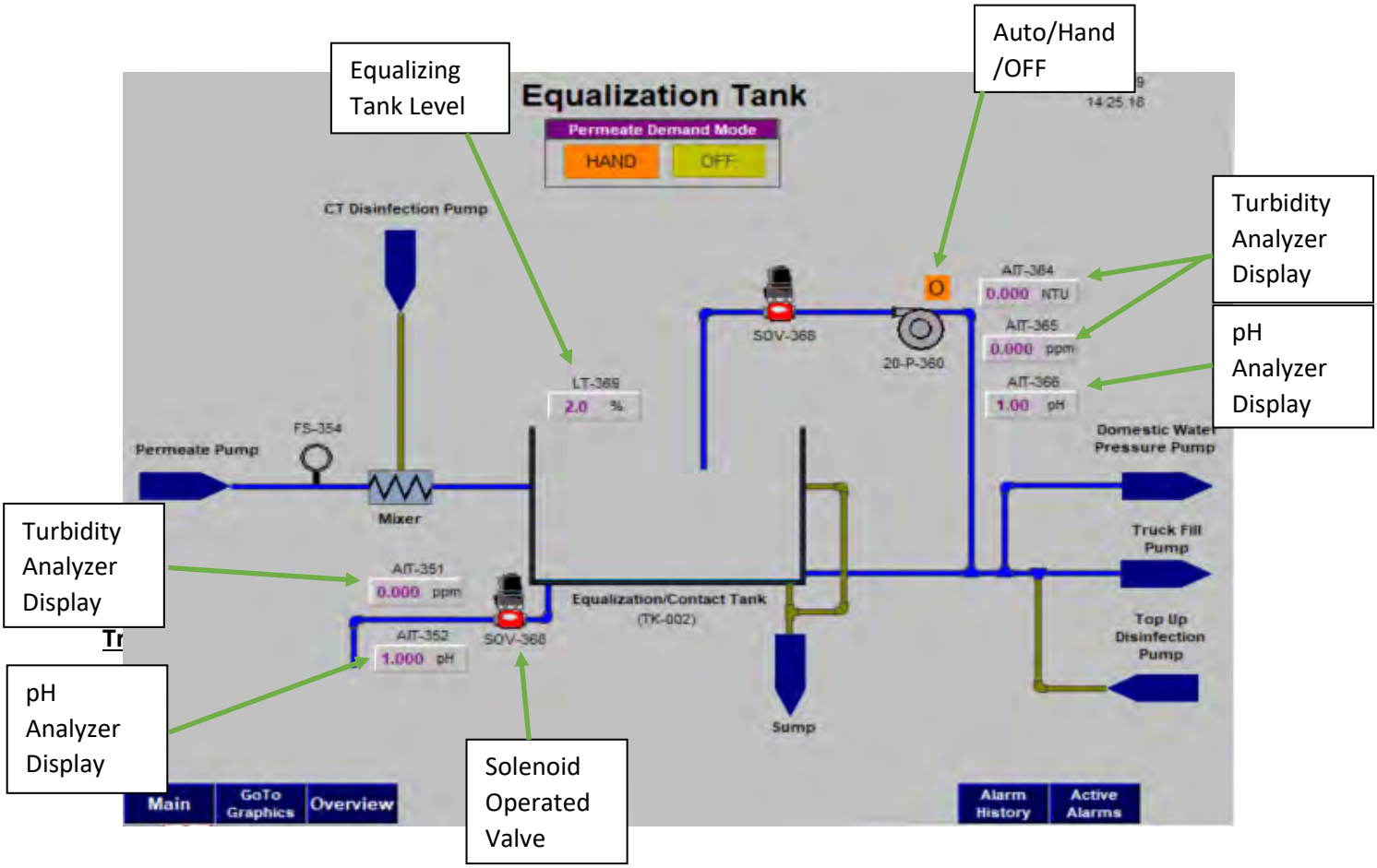
Pump ON/OFF Display

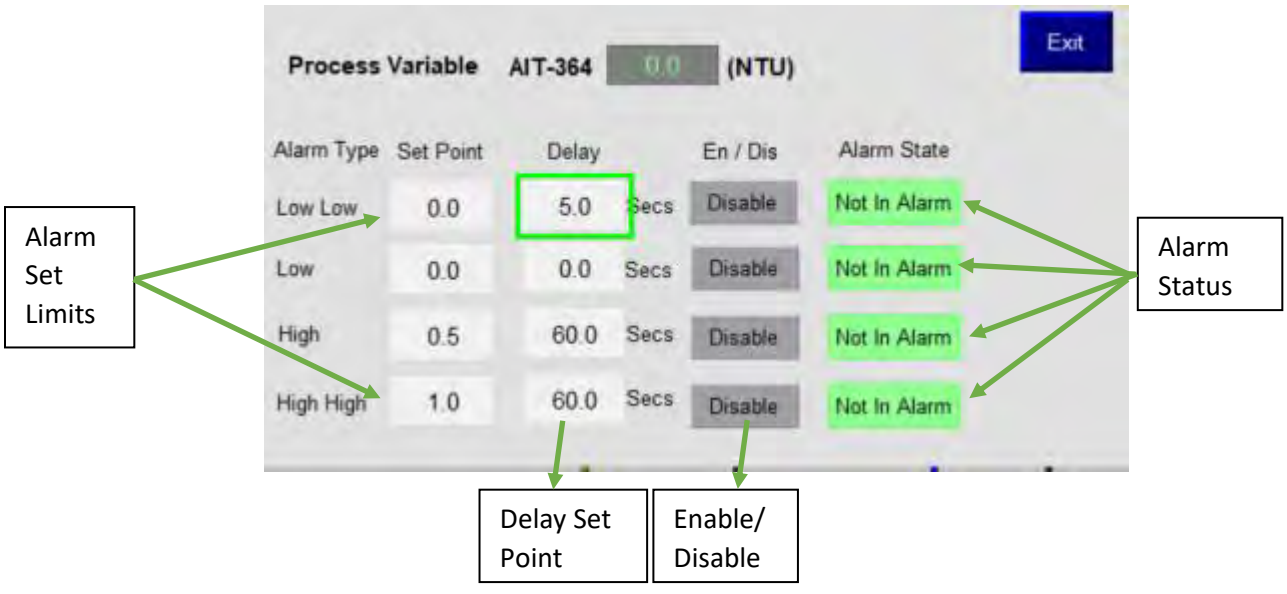
Permeate Tank Level Control Valve

Alarm Display

Permeate Tank Level Display

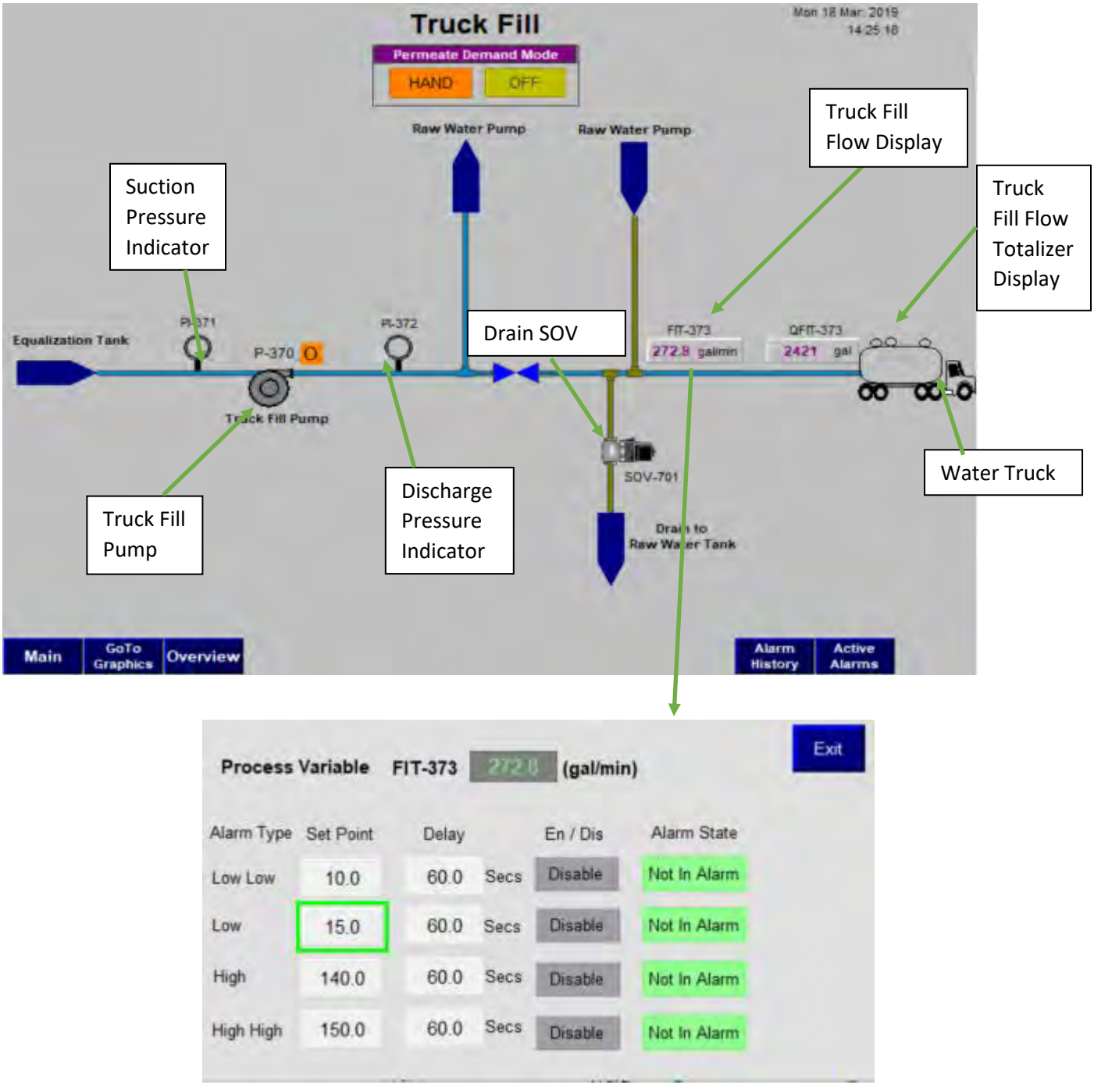
The Equalization tank screen is to monitor the tank level, treated water turbidity and pH. Operator Can also enable, disable the alarms, set the alarm limits and time delay for the process variables.





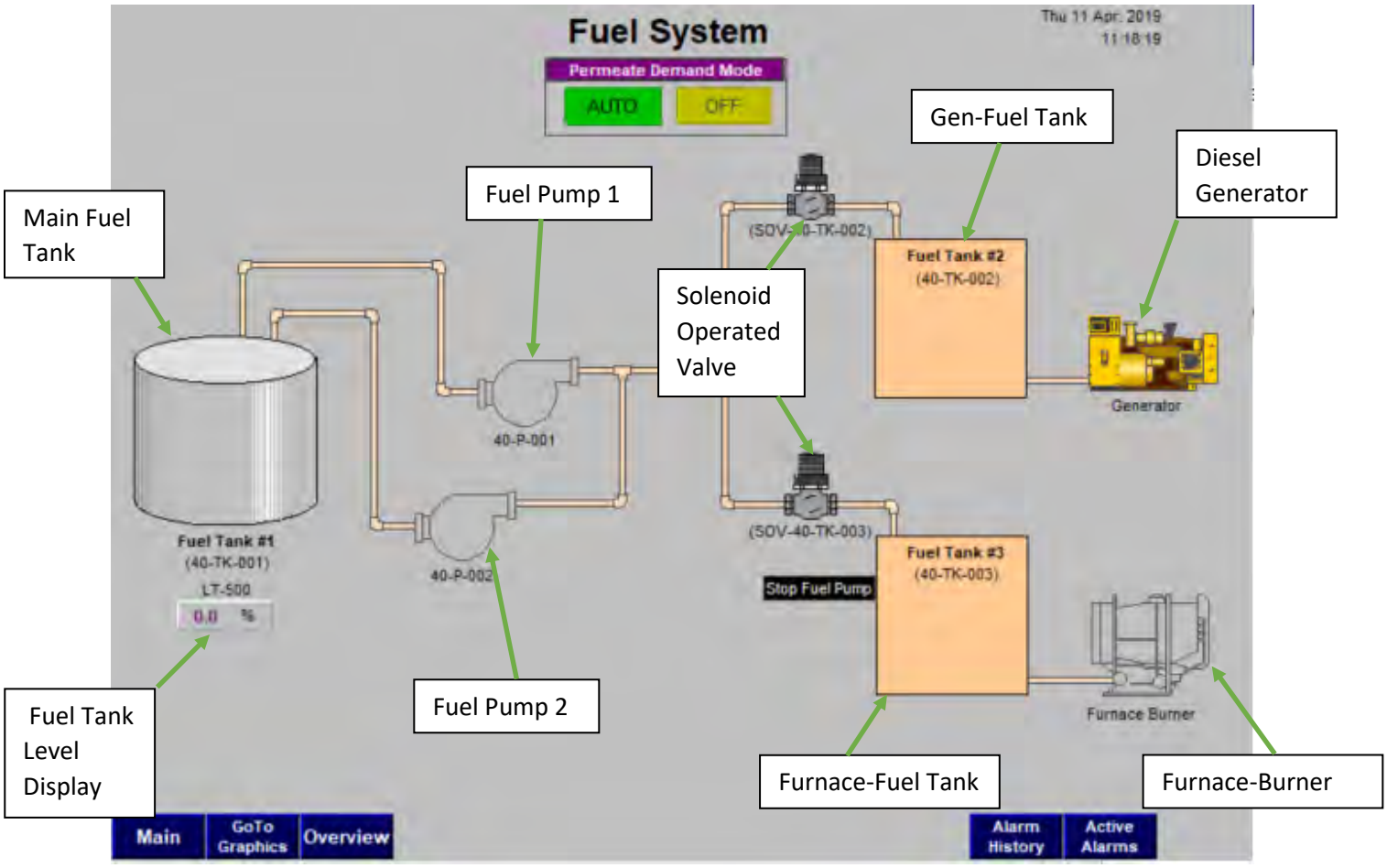
6.2.4 Truck Fill Start-Up

This screen shows the truck fill process. Operator can monitor the truck fill flow, flow totalizer value, and set the alarm limits for flow.



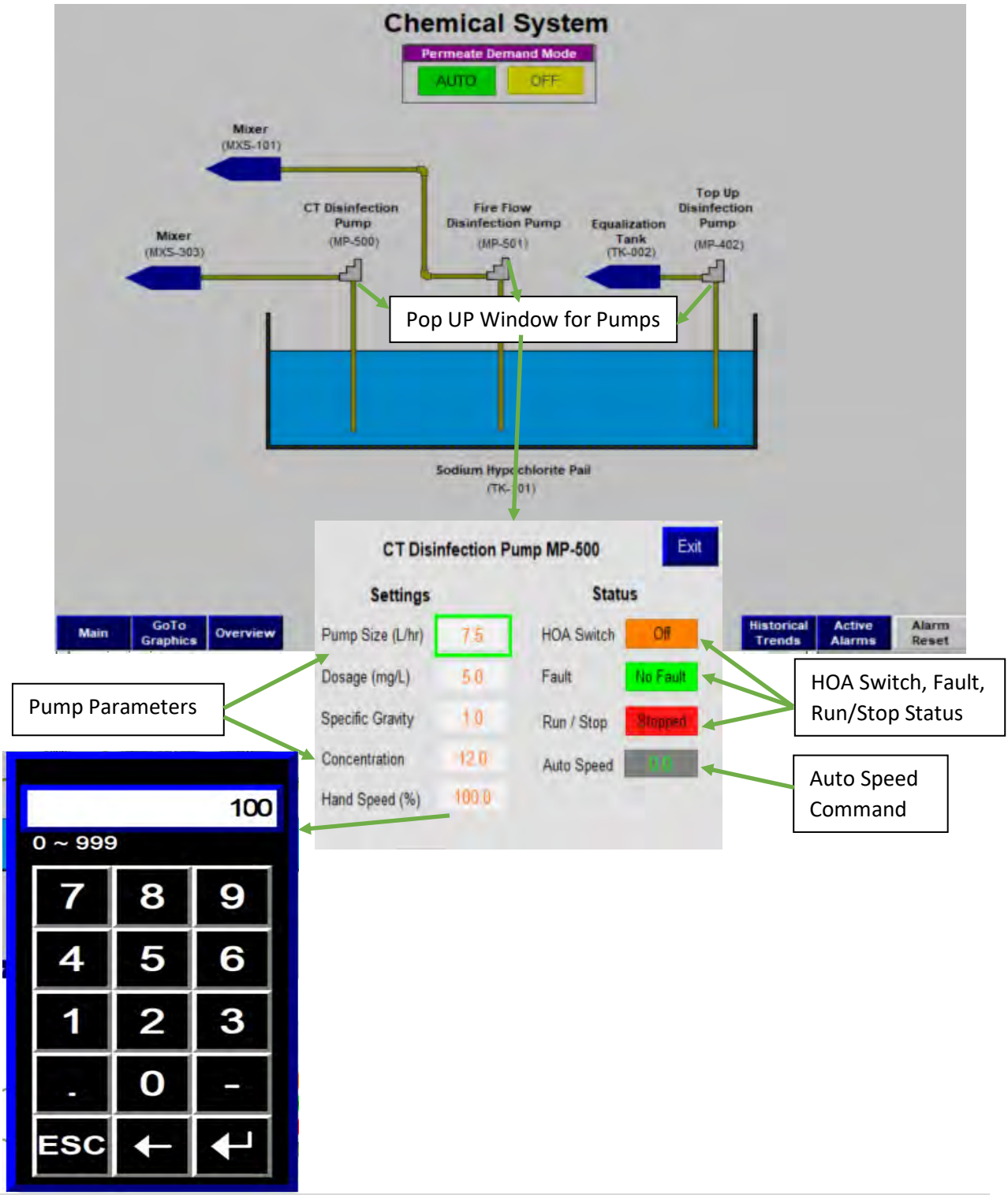
6.2.5 Fuel System Start-Up

This screen displays the fuel system for the diesel generator set and the furnace burner.



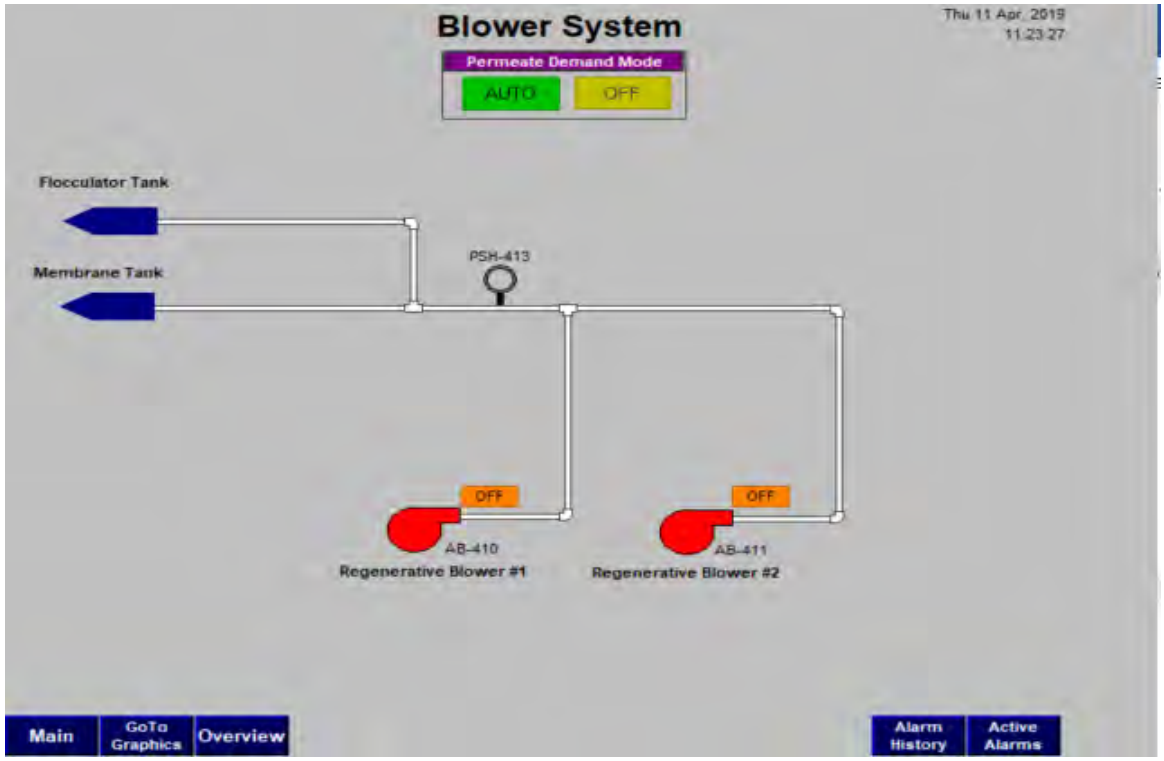
6.2.6 Chemical System Start-Up

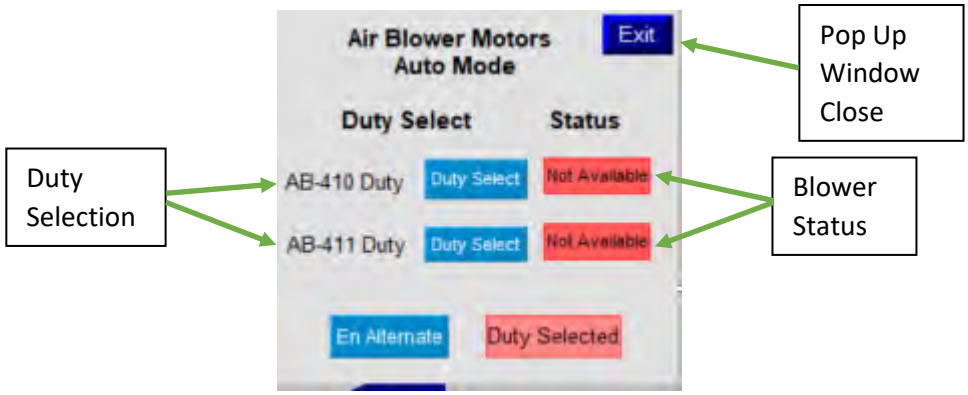
This Chemical Pump screens are for setting of coagulant and polymer feed system. Individual chemical feed control can be configured by selecting each chemical button.



6.2.7 Blower System Startup

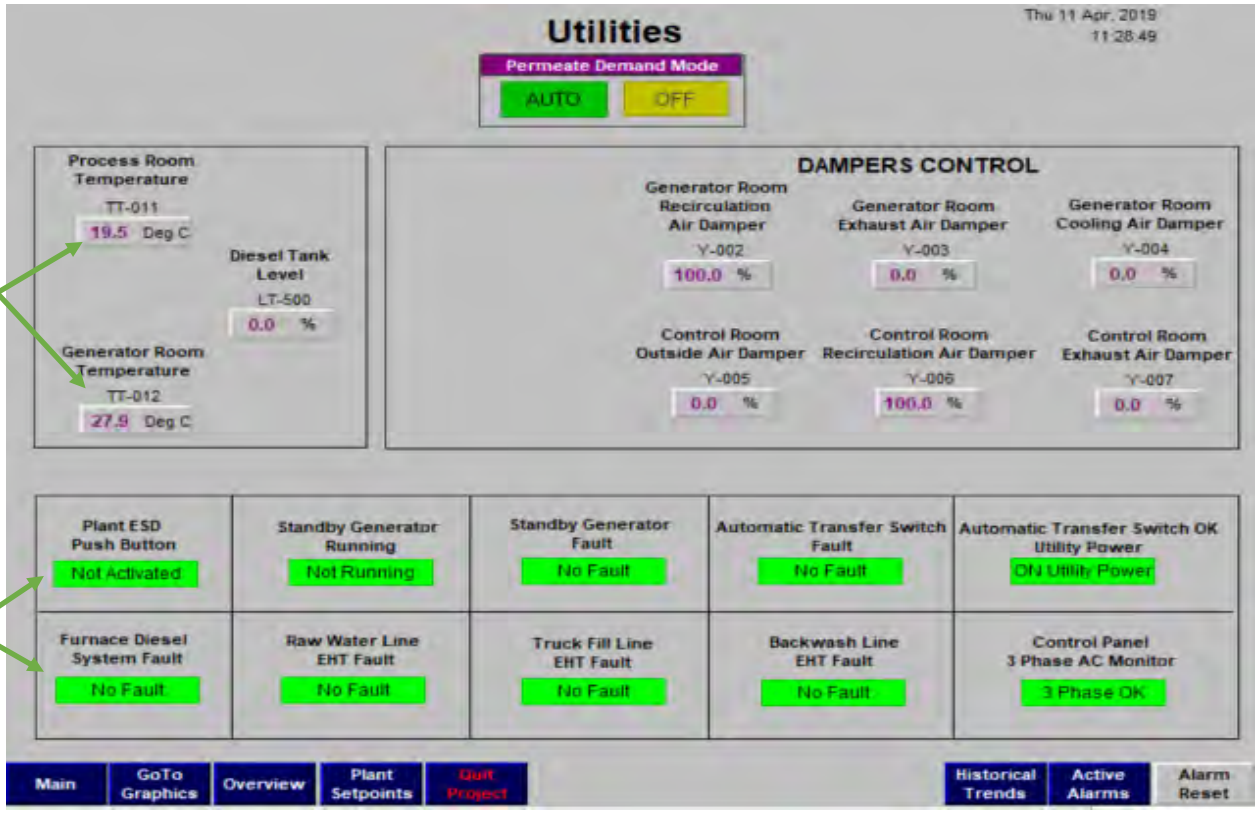
This screen displays the blower system for membrane tank and flocculator tank. Blowers can be turn on manually by using the selector switch on the control panel.





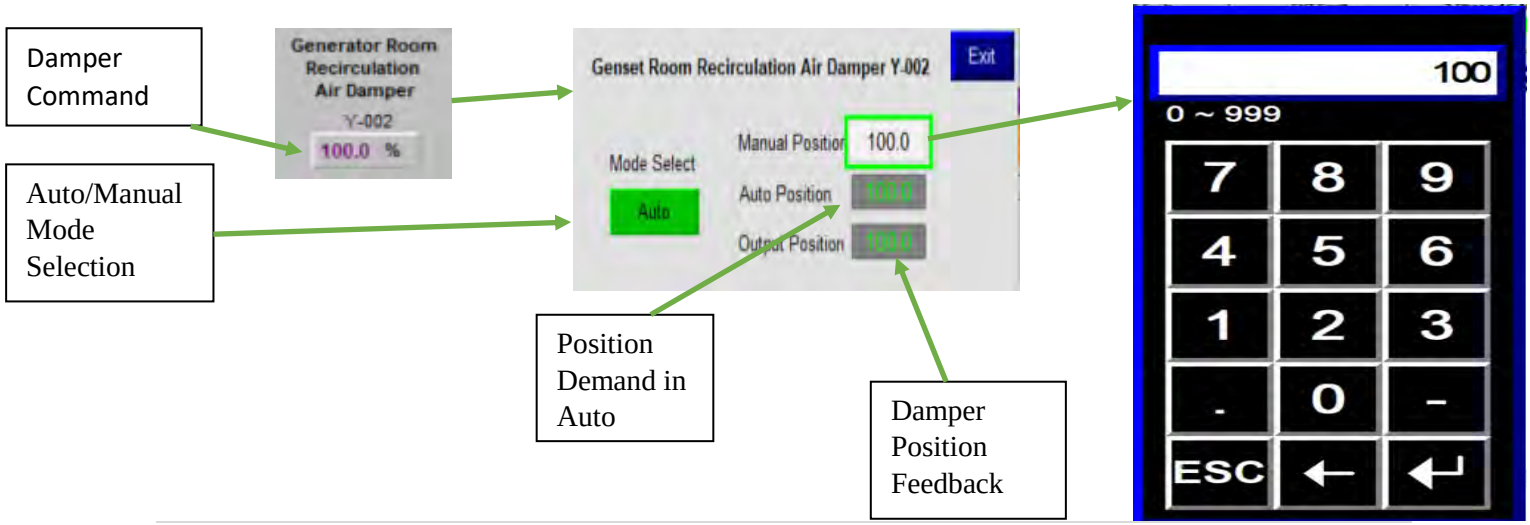
6.2.8 Utilities

The screen displays the utilities status of the plant. Damper can be controlled manually by clicking on the respective buttons.



Temperature Display

Status Indicator

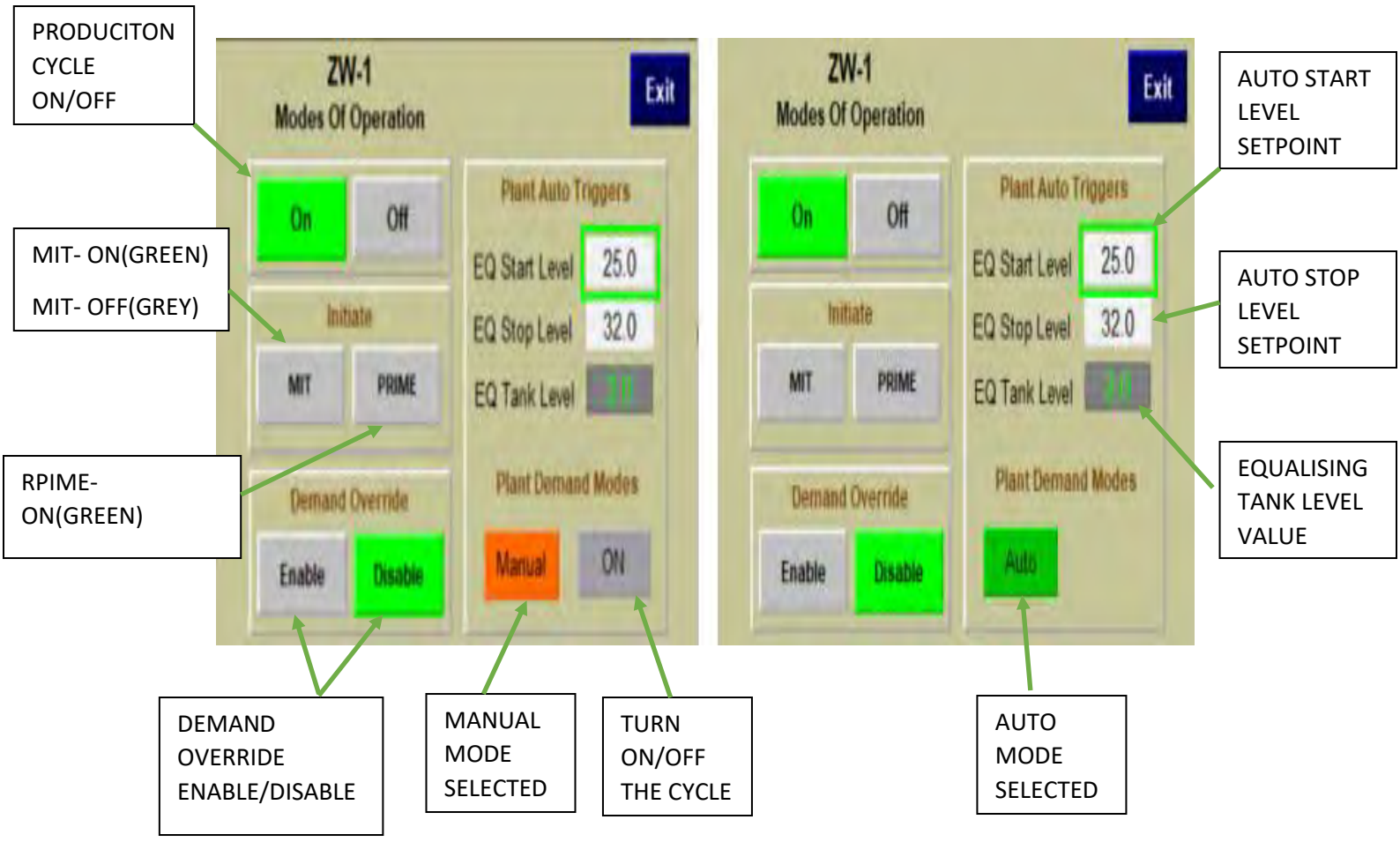


6.2.9 HMI Process Shutdown

CONTROL OVERVIEWS

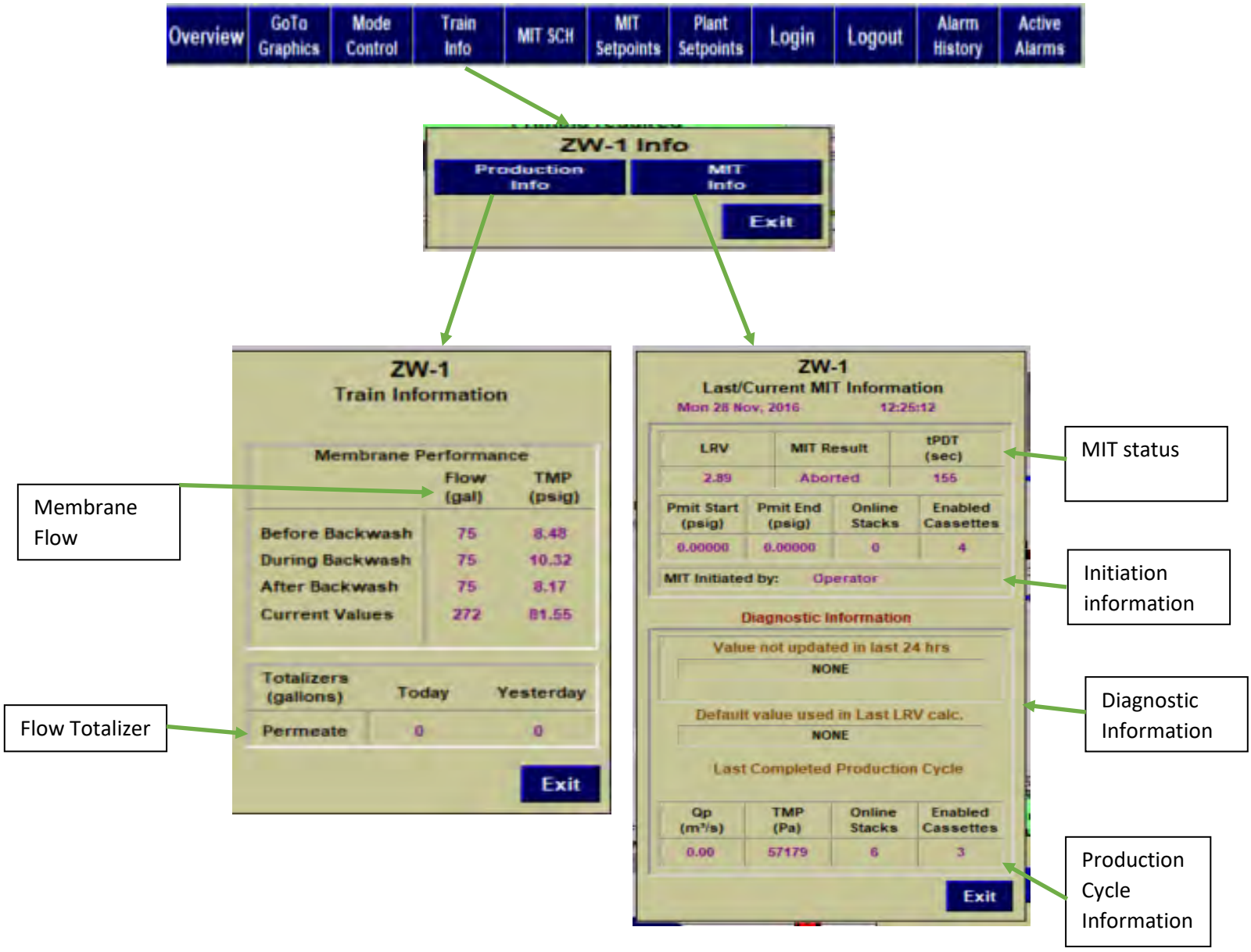
MODE CONTROL

Mode control window allows the operator to control the different modes of operation such as production, backwash, MIT and prime. To run the plant in auto, select the AUTO button and enter the start level and stop level setpoint..



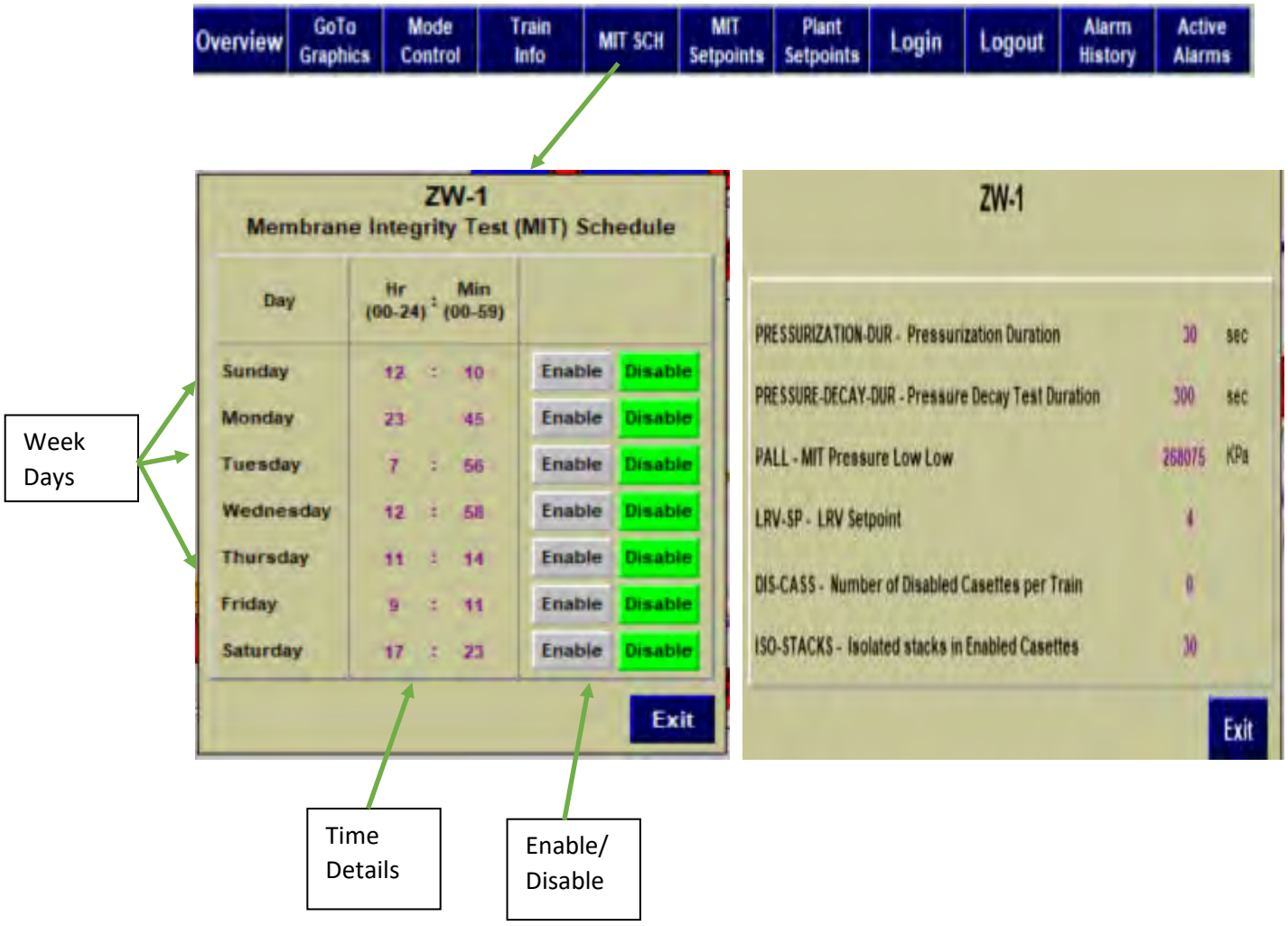
TRAIN INFO

Production information and MIT information can be check by clicking on the Train Info button on the bottom bar.



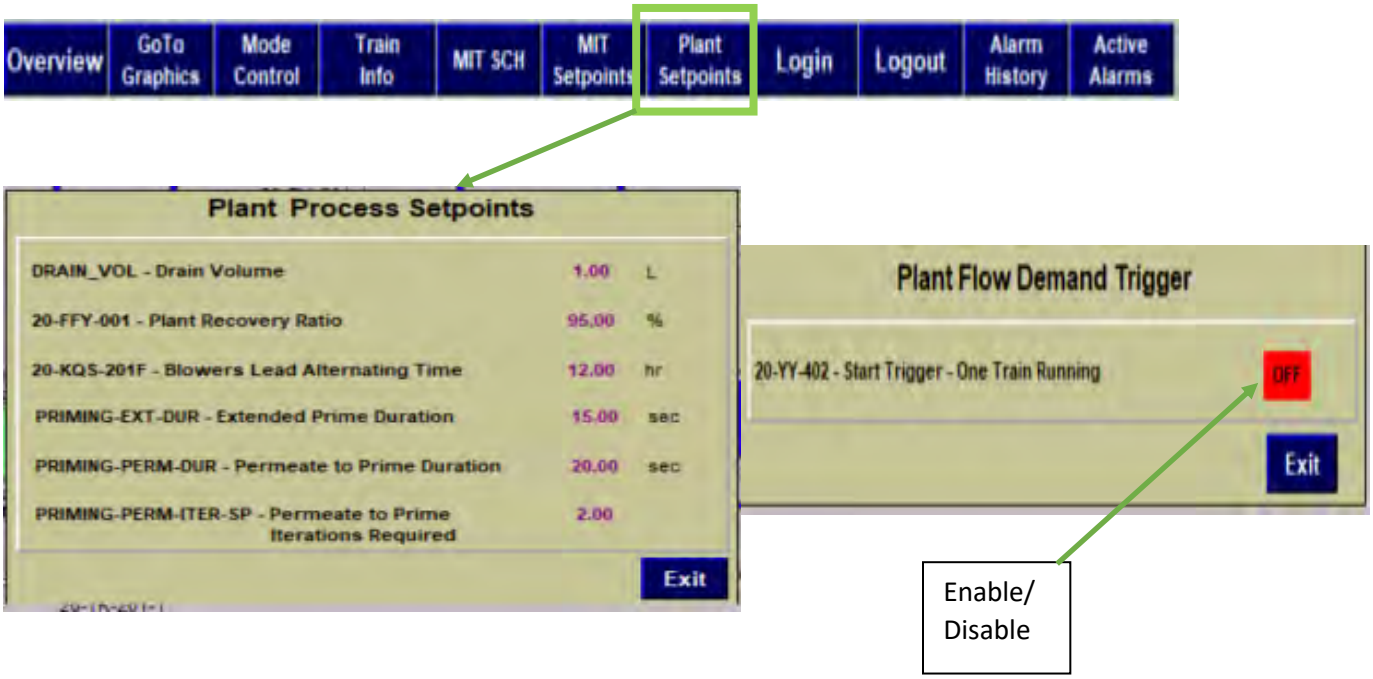
MIT SCHEDULING AND SETPOINTS

This control window let the operator to schedule the Membrane Integrity Test. Operator can enable and disable the schedule, also can define the start timing for the MIT.



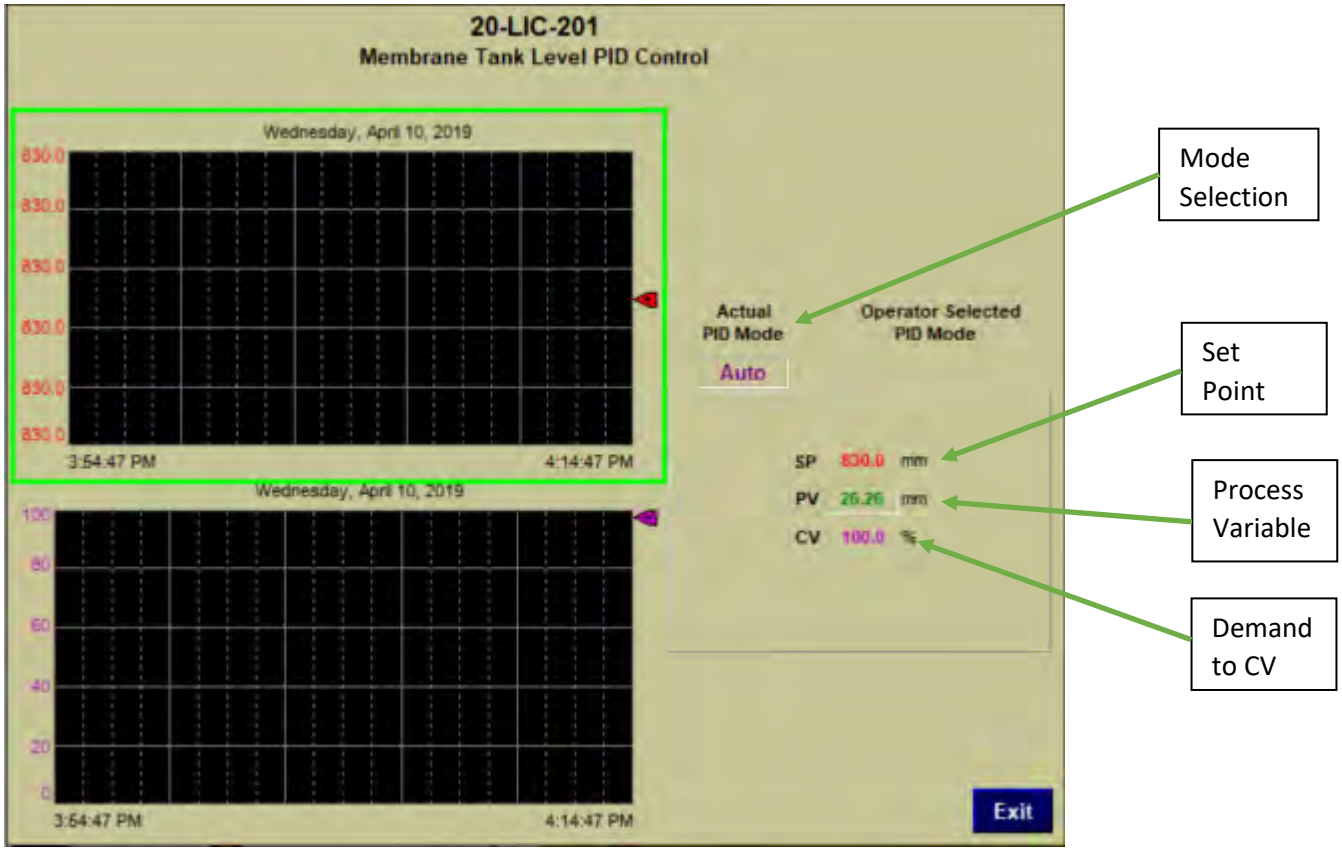
PLANT PROCESS SETPOINTS:

Operator can set the plant process parameters by selecting the Plant Setpoints from the bottom taskbar. Also, operator can enable the Plant flow demand trigger.



PID CONTROL

This control window let the operator to control the tank level by entering the level set point.

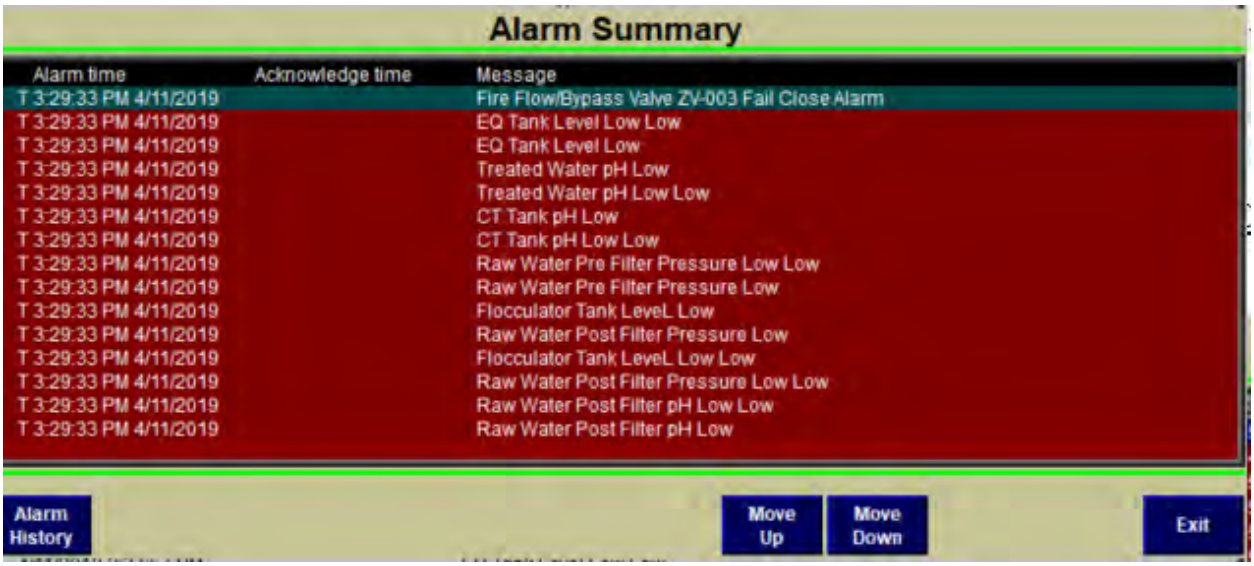


ACTIVE ALARMS

This window dispalys all the active alarms with their time stamping and description.

ALARM HISTORY

This window displays the alarm history along with the associated alarm time, acknowledge time and message. Alarm summary can be see under the alarm summary tab.



6.3 Auxiliary Start-Up and Shutdown

This section outlines the step-by-step start-up and shutdown procedures for various auxiliary equipment pieces located in the generator room. This section is for reference purposes only and the Operator must use the equipment-specific manufacturer's O&M Manual for detailed product and operational information and required safety precautions.

6.3.1 Generator Start-Up and Shutdown

The start up of the standby generator is AUTOMATIC and initiated by the Automatic Transfer Switch. This occurs when there is insufficient power supplied by the power utility service (e.g. power outage). The generator will provide electricity to the Plant until the power returns, at which point the Automatic Transfer Switch will switch back to normal operation, stop the standby generator and allow it to cool.

The AUTOMATIC start-up is as follows:

Step 1: Refer to Standby Generator O&M Manual in Appendix.

The Operator must follow the steps outlined in the Manufacturer's O&M Manual. The following summary steps are for reference purposes only.

Step 2: Perform Start-up check list.
Step 3: Press the master control Auto button to allow startup by the automatic transfer switch.

The controller provides up to 30 seconds of programmable cyclic cranking and up to 60 seconds rest with up to 6 cycles. The default setting is 15 seconds cranking and 15 seconds rest for 3 cycles.

However, if for any reason the Automatic Transfer Switch does not work, the standby generator can be run MANUALLY, as follows:

Step 1: Refer to Standby Generator O&M Manual in Appendix.

The Operator must follow the steps outlined in the Manufacturer's O&M Manual. The following summary steps are for reference purposes only.

Step 2: Perform Start-up check list.
Step 3: Ensure that all fuel supply valves are open and that the generator diesel day tanks and pumps are in AUTO mode.

Step 4: Press the master control RUN button to start the generator set at the controller.

NOTICE

The alarm horn sounds and the Not-In-Auto Warning display appears whenever the generator set is not in the AUTO mode.

Shutdown:

Step 1: Run the generator set without load for 5 minutes to ensure adequate engine cool down.
Step 2: The controller has a programmable cool down timer that functions only when the master control button is in the AUTO mode.
Step 3: To stop the generator set, press the generator set master control OFF/RESET button and wait until the generator set comes to a complete stop.

6.3.2 Furnace Start-Up and Shutdown

Step 1: Refer to Olsen O&M Manual in Appendix.

NOTICE **⚠WARNING**

The Operator must follow the steps outlined in the Manufacturer's O&M Manual. The following summary steps are for reference purposes only.

Start-Up:

Step 2: Open all supply and return air registers and grilles.
Step 3: Open all valves in oil pipes.
Step 4: Turn on electric power supply.
Step 5: Set the thermostat above room temperature to call for heat. The burner should start. NOTE: it may be necessary to press the RESET button on the primary combustion control relay.
Step 6: There will be a fan on time delay before the circulating fan is energized. The United Technologies 1158-120 has an adjustable fan on time that is set by selecting the dipswitch combination displayed in Chart 1. This fan on delay can be set at 1, 2, 4 or 6 minutes.
Step 7: Set the thermostat below room temperature. The oil burner should stop.
Step 8: The air circulation blower will continue to run until the time off setting selected on the electronic fan timer control times out. The United Technologies 1158- 120 has an adjustable fan off time of 30, 60, 90 or 120 seconds. The fan timer control adjustments may be altered if the air at the room registers is uncomfortably high upon blower start up or shutdown.
Step 9: The necessary adjustments to the fan control settings should be determined by measuring the temperature of the air in the supply air take-off, or within the first few

inches of the supply air trunk. The side mid point of the transition is usually ideal, providing that the thermometer probe is beyond the "line of sight" wherein false readings from radiant heat could be observed. System temperature rise is the difference in temperature between the supply air and return air.

Step 10: To check the operation of the limit switch, shut off power to the furnace. Temporarily remove the neutral wire from the direct drive blower motor. Restore the electrical power to the furnace and set the thermostat above room temperature.

Step 11: After three or four minutes of burner operation, the limit control should turn the burner off. When the limit function test is complete, shut off electrical power to the furnace, replace the neutral wire to the blower fan motor, and then restore power. The blower fan will start up immediately. Once the temperature has dropped and the limit control has reset, the fan will operate until the fan off time is achieved. The oil burner then resumes operation and continues until the thermostat is satisfied. Restore the thermostat setting to a comfortable temperature.

Shutdown:

Step 1: Set the thermostat to the lowest possible setting.

Step 2: Set the manual switch in the Electrical Power Supply Line to “OFF.”

6.3.3 Air Compressor Start-Up and Shutdown

Step 1: Refer to California Air Tools Air Compressor O&M Manual.

The Operator must follow the steps outlined in the Manufacturer’s O&M Manual. The following summary steps are for reference purposes only.

Start-Up:

Step 2: Turn the power switch to the OFF position.

Step 3: Attach the air hose to the 1/4” quick connect coupler.

Step 4: Close the drain valve.

Step 5: Have air filters attached.

Step 6: Plug the power supply cord into a power supply socket.

Step 7: Turn the power switch to the ON position.

Step 8: Let the motor run and tank fill until motor turns off.

Step 9: To regulate the air flow. While the air compressor is running, turn “On” your tool and turn the regulator knob to the right increasing the pressure. Turn the pressure up until the desired pressure is reached.

Step 10: Operate air tool normally.

Shutdown:

Step 1: Turn the power switch to the OFF position.

Step 2: Unplug the power supply cord.
Step 3: Reduce the pressure in the air tank through the air supply hose.

6.3.4 Air Dryer Start-Up and Shutdown

Step 1: Refer to Air Dryer O&M Manual in Appendix.

The Operator must follow the steps outlined in the Manufacturer's O&M Manual. The following summary steps are for reference purposes only.

Start-Up:

Step 2: If the suction pressure gauge reads zero, refrigerant loss has occurred. Call the factory or distributor for service.
Step 3: Air dryers with three-phase power supply are equipped with a compressor crankcase heater (except scroll compressors). This heater must be energized by closing the disconnect switch or circuit breaker a minimum of 6 to 10 hours before start-up. Power to the air dryer can be left on to energize the crankcase heater for the off-cycle, during evening or weekend shutdowns.
Step 4: Check the temperature on the crankcase of the compressor to make sure the crankcase heater is working before starting the dryer.
Step 5: For water-cooled Air Dryers make sure the water supply (minimum pressure 35 psig) is available at the condenser inlet. The Water regulating valve will modulate and control the water flow with respect to the dryer load conditions. The water-cooled condenser drain plug (located inside enclosure) must be installed.
Step 6: Turn the power ON/OFF switch to the ON position.
Step 7: The suction pressure will gradually come down to the blue or green range depending on the type of refrigerant used in the air dryer. Check the refrigerant suction pressure gauge reading. If the suction pressure is above or below the suggested color range, a hot gas bypass valve adjustment is required. (Refer to the Hot Gas Bypass Valve section of this manual.) For proper operating range and control settings see listing below.
Step 8: The Expansion valve is factory set for the correct superheat of 8-10ºF and should not be re-adjusted. If any malfunction is noticed on the expansion valve, contact the factory or your Air Dryer distributor.
Step 9: Allow 10 to 15 minutes of cool down time before adding the compressed air load.
Step 10: Keeping the dryer outlet isolation valve closed, pressurize the dryer to the line pressure.
Step 11: Check for any leaks in the system.
Step 12: Slowly open the dryer outlet isolation valve to pressurize the downstream system.

Shutdown:

Step 1: Open the bypass valve to allow process flow to continue downstream. Then close the outlet isolation valve on the dryer bypass piping.

Step 2: Close the inlet isolation valve on the dryer bypass piping. At this time the dryer is isolated and can be depressurized, ready for servicing.

Step 3: Turn the power switch to the OFF position.

6.3.5 Air Blower Start-Up and Shutdown

Step 1: Refer to Republic Air Blower O&M Manual.

NOTICE **⚠WARNING**

The Operator must follow the steps outlined in the Manufacturer's O&M Manual. The following summary steps are for reference purposes only.

Start-Up:

Step 2: Open shut-off device in intake/discharge pipe.

Step 3: Switch on power supply for drive motor.

Step 4: Operate blower for an hour, and then check:
Ambient temperature - increased room temperatures may require stronger ventilation especially for larger blowers. Room temperature should not exceed 104 (40°C).
Pressure and vacuum valves – adjust relief valve pressure or vacuum setting if needed.
Motor current – check that current supply matches recommended current rating on blower nameplate.
Electrical overload cutout – check that current matches rating on blower nameplate.

If motor fails to start or slows down significantly under load, shut off and disconnect from power supply. Check that the voltage is correct for the motor and that the motor is turning in the proper direction.

Shutdown:

Step 1: Switch off power supply for drive motor.

Step 2: Close shut-off device in intake/discharge pipe, if applicable.

6.3.6 Potable Water Pump Start-Up and Shutdown

Step 1: Refer to Air Dryer O&M Manual in Appendix.

NOTICE **⚠WARNING**

The Operator must follow the steps outlined in the Manufacturer's O&M Manual. The following summary steps are for reference purposes only.

Startup:

Step 2: Start the pump by continuously pressing until the desired set point is indicated.

Shutdown:

Step 1: Stop the pump by continuously pressing until none of the light fields are activated and the green indicator light flashes.

6.3.7 Chemical Metering Pump Start-Up and Shutdown

Step 1: Refer to the Grundfos Alldos DDA Chemical Metering Pump O&M Manual in Appendix.

NOTICE **WARNING**

The Operator must follow the steps outlined in the Manufacturer's O&M Manual. The following summary steps are for reference purposes only.

The DDA dosing pumps feature a user-friendly plain-text menu. The menu consists of 4 icon tabs:

Operation; Info; Alarm; Setup.

During initial start-up, all menu text appears in the English language. The menu can be set to display other languages.

The display is backlit with four different colors according to the "traffic light" concept. The meanings of these colors are as follows:

Display	Fault	Pump status
white	-	stop ■ standby ‖
green	-	running ▶
yellow	warning	stop ■ standby ‖ running ▶
red	alarm	stop ■ standby ‖

NOTICE

You are modifying the default settings of your electronics, so they will differ from the technical data.

Step 2: ACTIVATE AUTOMATIC DEAERATION
Press the black dial until the flow rate is not blinking. Spin the dial until the other four icons are blinking. Select the Setup icon (the Gear) by pressing the black dial when that

icon is blinking. Spin the dial to move along the menu options. Select Auto-Deaeration and change from OFF to ON. Confirm changes. Return to main display screen by selecting either the Back Arrow or Operation (the House).
On the main display, the deaeration icon will appear and look like:

Step 3: CHANGE EXTERNAL STOP

Press the black dial until the flow rate is not blinking. Spin the dial until the other four icons are blinking. Select the Setup icon (the Gear) by pressing the black dial when that icon is blinking. Spin the dial to move along the menu options. Select Input/Output, then External Stop and change the value from Normally Open (NO) to Normally Closed (NC). Return to main display screen by selecting either the Back Arrow or Operation (the House).

Start-Up:

Step 4: Press the black dial on the display. The flow rate will blink indicating that it can be changed. Adjust value to desired flow rate. Note the units (mL/h or L/h). Press the black dial again to accept the number. Confirm new flow rate.

Step 5: Select the START / STOP button  . Press this button until either a “play” or “pause” symbol appears on the left-hand side of the main display screen. This means that either the pump is RUNNING or in STAND BY and therefore ready for operation. Ensure there is no square symbol on the display unless the pump is being serviced or is stopped for emergency reasons.

Shutdown:

Step 6: Select the START / STOP button  . Press this button until a square symbol appears on the left-hand side of the main display screen. This means that either the pump is STOPPED and will not operate.

6.3.8 Turbidity Analyzer Calibration

Step 1: Refer to the HACH Turbidity Analyzer O&M Manual in Appendix.

Calibration:

NOTICE WARNING

The Operator must follow the steps outlined in the Manufacturer's O&M Manual. The following summary steps are for reference purposes only.

Step 2:	From the main Menu, select SENSOR SETUP and confirm.
Step 3:	Select the appropriate sensor if more than one is connected and confirm.
Step 4:	Select CALIBRATE and confirm.
Step 5:	Select STABLCAL CAL and confirm. Select the available Output Mode (Active, Hold, or Transfer) from the list and confirm.
Step 6:	Enter the standard turbidity value of the user prepared standard (in this case 20) and confirm.
Step 7:	Drain/clean/rinse the turbidimeter body or cal cylinder. Pour the 20 NTU standard into the cylinder body. Replace the head and confirm.
Step 8:	The measured reading (based on a gain of 1.0) is displayed. Confirm.
Step 9:	The display will read GOOD CAL! GAIN: X.XX ENTER TO CONT. Confirm. (If the calibration was unsuccessful, the display will read BAD CAL! Confirm to redo or exit.)
Step 10:	The display will read VERIFY CAL? Confirm to verify or exit without verification.
Step 11:	Select the VERIFICATION type (skip to step 13) or enter initials to complete calibration.
Step 12:	Return the sensor to measure mode and confirm.
Step 13:	Return to Main Menu when complete.

6.3.9 Chlorine Analyzer Calibration

Step 1: Refer to the Prominent Chlorine Analyzer O&M Manual in Appendix.

Calibration: slope (in the reduced and complete operating menu)

NOTICE WARNING

The Operator must follow the steps outlined in the Manufacturer's O&M Manual. The following summary steps are for reference purposes only.

The sensor is fitted, flushed with sample water and connected electrically to the DULCOMETER® D1Cb / D1Cc and run-in. There has to be adequate feed chemical in the sample water for calibration (> 2% of the measuring range of the sensor). Remove sample water directly at the measuring point and determine the content of metering medium in the sample water in "ppm" using an appropriate reference method (e.g. DPD, titration etc.). Enter this value as follows at the DULCOMETER® D1Cb / D1Cc:

Step 2:	Select the Calibration Menu. Then press . The current measured value will be frozen.
Step 3:	Take a sample of water and perform a reference measurement within 15 minutes.

Step 4: Select “DPD value” of unit to be calibrated using the key.

Step 5: Continue with .

Step 6: If necessary, match the flashing ppm value to the value determined with the measurement using the keys, , , and .
The mA value of the sensor shown in this display now corresponds to the measured value in “ppm”.

Step 7: Then press the following key twice . The display now shows the value determined for the zero point and slope. Refer to the Error Message table should an error be displayed (Table on page 73, Prominent O&M manual).

Calibration: Zero point (only in the complete operating menu)

NOTICE **WARNING**

The Operator must follow the steps outlined in the Manufacturer’s O&M Manual. The following summary steps are for reference purposes only.

A container with water, which is free of additives that could falsify the measured result, is needed for calibration. Immerse the dismounted, but still electrically connected to the DULCOMETER® D1Cb / D1Cc, sensor in this water. Use the sensor to stir the water for approx. 5 minutes until the measured value displayed at the DULCOMETER® D1Cb / D1Cc is steady and close to "0".

Step 1: Select the Calibration Menu. Then press .

Step 2: Select “Zero point” of unit to be calibrated using the key.

Step 3: Continue with . A prompt is shown in the display.

Step 4: Confirm prompt with the key .

Step 5: Continue with .

Step 6: Apply the “zero point” displayed during calibration using the key.

Step 7: Then press . Display shows the values determined.

Step 8: Then press . Refer to the Error Message table should an error be displayed (Table on page 73 of Prominent O&M manual).

NOTICE

Then definitively calibrate the slope with a suitable reference method (e.g., DPD. Titration, etc.)

6.3.10 pH Analyzer Calibration

Calibration of Prominent pH analyzer (AIT – 352 and AIT – 366):

NOTICE **⚠WARNING**

The Operator must follow the steps outlined in the Manufacturer's O&M Manual. The following summary steps are for reference purposes only.

Two test containers with a buffer solution are required for calibration. The pH value of the buffer solutions should be at least 2 ph values apart. The sensor should be rinsed thoroughly with water when changing the buffer solution.

Step 1:	Select the Calibration .
Step 2:	Immerse sensor in test container 1 with buffer solution (e.g., pH 7).
Step 3:	Move the sensor gently until the pH value displayed no longer changes.
Step 4:	Then press . Calibration is running; A buffer value is suggested once the waiting time has expired.
Step 5:	If necessary, adjust the pH value displayed using the keys and to the actual value of the buffer solution in test container 1.
Step 6:	Then press
Step 7:	Remove the sensor, rinse thoroughly in water and then dry with a cloth (pad dry, don't rub).
Step 8:	Immerse sensor in test container 2 with buffer solution (e.g. pH 4)
Step 9:	Move the sensor gently until the pH value displayed no longer changes.
Step 10:	Then press . Calibration is running; A buffer value is suggested once the waiting time has expired.
Step 11:	If necessary, adjust the pH value displayed using the keys and to the actual value of the buffer solution in test container 2.
Step 12:	Then press . The settings recorded will be displayed.
Step 13:	If the calibration result is correct, confirm with . The new calibration is now applied.

Calibration of HACH pH analyzer (AIT – 103):

Step 1:	Refer to the HACH O&M Manual in Appendix.

Calibration:

NOTICE **⚠WARNING**

The Operator must follow the steps outlined in the Manufacturer's O&M Manual. The following summary steps are for reference purposes only.

Step 2: From the main Menu, select SENSOR SETUP and confirm.
Step 3: Select the appropriate sensor if more than one is connected and confirm.
Step 4: Select CALIBRATE and confirm.
Step 5: Select 2 POINT AUTO. Select the available Output Mode (Active, Hold, or Transfer) from the list and confirm.
Step 6: Move the clean probe to Buffer 1 and confirm.
Step 7: Confirm when stable.
Step 8: Move the clean probe to Buffer 2 and confirm.
Step 9: Confirm when stable. A screen will display 2 Point Calibration Complete and the slope (XX.X mV/pH).
Step 10: Return the probe to process.

6.4 HMI PROCESS Operating Routines and Procedures

6.5 AUXILIARY Operating Routines and Procedures

The following consists of daily operating routines and procedures for all auxiliary items and activities. Refer to Appendix I for operating log sheets.

6.5.1 General

Step 1: Perform daily general safety checks and housekeeping activities such as:

- Visually inspect Plant for any missing items
- Check for leaks in tanks, pipes and fittings
- Check for damaged or worn equipment
- Ensure there are no physical obstructions around or near rotating parts (motors, pumps, etc.)
- Ensure there are no hanging items or "head knockers"
- Clean any spills and pooling of liquids
- Clean any debris on the floor
- Ensure walkways are kept clear to avoid slips, trips and falls
- Ensure the lab counter area is clean and tidy
- Ensure all chemicals are properly stored
- Check all spill and drip trays; empty as required

- Ensure the ladder is tied-off (if in use)

6.5.2 Air Compressor

Step 1: Refer to the California Air Tool O&M Manual in Appendix.

NOTICE **WARNING**

The Operator must follow the steps outlined in the Manufacturer's O&M Manual. The following summary steps are for reference purposes only.

Daily Starting Checklist:

Step 2: Make sure the air tank is not damaged, inspect all parts for damage, and check that all pipes are firmly connected.
Step 3: Drain liquid from the air receiver and moisture trap.
Step 4: Jog the starter button and check compressor rotation.
Step 5: Start compressor per factory instructions. Refer to Appendix (California Air Tool O&M Manual).
Step 6: Check system pressure.
Step 7: Check cooling fan.
Step 8: Check all pressure relief valves for proper operation.
Step 9: Check control system for proper operation.

6.5.3 Air Blower System

Step 1: Refer to the Republic O&M Manual in Appendix.

NOTICE **WARNING**

The Operator must follow the steps outlined in the Manufacturer's O&M Manual. The following summary steps are for reference purposes only.

Daily Starting Checklist:

Step 2: Open shut-off device intake/discharge pipe.
Step 3: Inspect all parts for damage, and check that all pipes are firmly connected.
Step 4: Pressure and vacuum valves - adjust relief valve pressure or vacuum setting if needed.
Step 5: Start blower as per factory instructions. Refer to Appendix (Republic O&M Manual).

Step 6: Check system pressure.

6.5.4 Air Dryer

Step 1: Refer to the SMC O&M Manual in Appendix.

NOTICE **WARNING**

The Operator must follow the steps outlined in the Manufacturer's O&M Manual. The following summary steps are for reference purposes only.

Operating Conditions:

Step 2: Check the entering air temperature. Units are design for entering air temperature of 100°F. If the temperature of entering air is to be greater than 100°F, the factory should be consulted to determine the maximum possible air flow through the unit.

Step 3: Check the operating pressure. Standard units are designed for operating air pressure 100 PSIG (150 PSIG MAX). Operating below 100 PSIG will reduce system capacity.

Step 4: Check the ambient air temperature. The allowable ambient temperature range is 40°F to 110°F. As temperatures approach freezing conditions, frost or icing may develop in the unit. At temperature above 110°F, refrigeration capacity will decrease, therefore affecting dew point.

6.6 Laboratory Operating Routines and Procedures

Step 1: Refer to the applicable Laboratory Testing Procedure in the manufacturer specific O&M Manual in Appendix.

NOTICE **WARNING**

The Operator must follow the steps outlined in the Manufacturer's O&M Manual. The following summary steps are for reference purposes only.

6.6.1 Turbidity (HACH 2100P Portable Turbidimeter)

Step 1: Perform all pre-installation and calibration steps, if it is the first time this meter is being used.

Step 2: Collect a representative sample in a clean container. Fill a sample cell to the line (about 15 mL), taking care to handle the sample cell by the top. Cap the cell.

NOTICE

The instrument automatically shuts off after 5.5 minutes if no keystrokes occur. To resume operation, press I/O.

Step 3: Wipe the cell with a soft, lint-free cloth to remove water spots and fingerprints.

Step 4: Apply a thin film of silicone oil. Wipe with a soft cloth to obtain an even film over the entire surface.

Step 5: Press: I/O. The instrument will turn on. Place the instrument on a flat, sturdy surface. Do not hold the instrument while making measurements.

Step 6: Insert the sample cell in the instrument cell compartment so the diamond or orientation mark aligns with the raised orientation mark in front of the cell compartment. Close the lid.

Step 7: Select manual or automatic range selection by pressing the RANGE key. The display will show AUTO RNG when the instrument is in automatic range selection.

Step 8: Select signal averaging mode by pressing the SIGNAL AVERAGE key. The display will show SIG AVG when the instrument is using signal averaging. Use signal average mode if the sample causes a noisy signal (display changes constantly).

Step 9: Press: READ. The display will show - - - - NTU, then the turbidity in NTU. Record the turbidity after the lamp symbol turns off.

Step 10: After recording the turbidity, discard the sample in the sink, wash the sample cell and then rinse with distilled water. Place sample cell upside down on rack, cloth or paper towel to dry.

Step 11: Once the sample cell is completely dry, use the oiling cloth to remove any water spot marks or fingerprints. Return sample cell to storage container.

NOTICE

The instrument defaults to the last operating mode selected. If automatic range mode and signal averaging were used on the previous measurements, these options will automatically be selected for subsequent samples.

Step 12: Read the “Measurement Notes” and “Measurement Techniques” sections for tips on how to ensure accuracy and learn about the best practices for calibration and handling equipment and chemicals.

6.6.2 Free Chlorine Residual (HACH Pocket Colorimeter II)

Step 1: Perform all pre-installation and calibration steps, if it is the first time this meter is being used.

Step 2: Fill a 10-mL cell with sample (the blank). Cap.

NOTICE

Samples must be analyzed immediately and cannot be preserved for later analysis.

Step 3: Press the POWER key to turn the meter on. The arrow should indicate the low range channel (LR). Note: See page 2—4 for information on selecting the correct range channel.

Step 4: Remove the meter cap. Place the blank in the cell holder with the diamond mark facing the keypad. Fit the meter cap over the cell compartment to cover the cell. Note: Wipe excess liquid and fingerprints off sample cells.

Step 5: Press ZERO/SCROLL. The display will show "- - - -" then "0.00". Remove the blank from the cell holder.

Step 6: Fill a second 10-mL cell to the 10-mL line with sample. Note: Do not use the same sample cells for free and total chlorine analysis without thoroughly rinsing the cells with sample between free and total tests.

Step 7: Add the contents of one DPD Free Chlorine Powder Pillow or one DPD Total Chlorine Powder Pillow to the sample cell (the prepared sample). Note: Use LOW RANGE (LR) POWDER PACKS ONLY.

Step 8: Cap and shake gently for 20 seconds. Note: Shaking dissipates bubbles that may form in samples with dissolved gases. Note: A pink color will develop if chlorine is present.

Step 9: For free chlorine, place the prepared sample cell in the cell holder. Cover with the instrument cap and proceed to the next step within one minute after adding the DPD Free Pillow. Note: Accuracy is not affected by undissolved powder. Note: Wipe off sample cells.

Step 10: Press READ/ENTER. The instrument will show "- - - -" followed by the results in mg/L chlorine.

Step 11: After recording the free chlorine residual, discard the sample in the sink, wash the sample cell and then rinse with distilled water. Place sample cell upside down on rack, cloth or paper towel to dry.

Step 12: Once the sample cell is completely dry, use the KimWipes (lint-free wipes) to remove any water spot marks or fingerprints. Return sample cell to storage container.

NOTICE

The instrument defaults to the last operating mode selected. If automatic range mode and signal averaging were used on the previous measurements, these options will automatically be selected for subsequent samples.

Step 13: Read the “Accuracy Check” and “Measuring Hints” sections for tips on how to ensure accuracy and learn about the best practices for calibration and handling equipment and chemicals.

6.6.3 pH (HACH HQ11d pH Meter)

Step 1: Perform “Start Up,” “Connect a Probe” and “Calibration” steps, if it is the first time this meter is being used

Step 2: Rinse the electrode with distilled water. Shake off any excess water and blot the electrode dry with lint-free tissue.

Step 3: Place the electrode into the sample and wait until reading stabilizes. Record the reading.

Step 4: Remove the electrode from the sample, rinse it with distilled or deionized water, blot it dry, place it in the next sample and repeat step 3.

Step 5: Once all the samples have been measured, rinse the electrode with distilled or deionized water and blot it dry. Consult the electrode user guide for proper storage techniques.

6.7 Special Procedures

The following section outlines the step-by-step instructions for performing the special procedures for the WTP. These procedures are: fire flow bypass and intake casing flush.

6.7.1 Fire Flow Bypass

The Fire Flow Bypass is initiated by the pressing the START button on the red Fire Flow Bypass box within the control panels located outside of the plant (one on the building exterior and one on the Truck Fill Arm).

When this START button is selected, the following steps occur as controlled by the PLC:

- Process motor-operated valve FCV-002 closes and fire flow motor control valve ZV-003 opens
- Raw water pumped into WTP by submersible Raw Water Pump P-001 at 1,000 L/min.
- Chlorine is injected by the Fire Flow Disinfection Pump through an injection quill IQ- 001 into the line with static mixer MXS-101.
- Chlorinated fire flow water passes through check valve CV-069, into the main process line before the magnetic flow meter FIT-373 and flows into the fire water truck through the Truck Fill Arm.

When the Fire Water Truck is full, the Operator selects the STOP button on the red Fire Flow Bypass box within the control panel and the Raw Water Pump will stop. All valves and equipment will return to its original operational state.

However, if for any reason the automatic Fire Flow Bypass does not work, the following MANUAL steps can be performed on the PLC Cabinet (HOA switches) or the HMI screen:

PLC CABINET (HOA)

Step 1: On the PLC Cabinet, turn the “Permeate (Treated Water) Demand” HOA switch into the OFF position**.**

Step 2: Next, turn the “Raw Water Flow Valve FCV-002” switch into the OFF position and turn the “Fire Flow Bypass Valve ZV-003” into the HAND position.

Step 3: Finally, turn the “Raw Water Pump” and the “Fire Bypass Metering Pump” switches into the HAND position. For this step, ensure that the truck is underneath the Truck Fill Arm and ready for water.

Step 4: When the Fire Water Truck is full, turn the “Raw Water Pump” switch OFF and return all HOA switches to their original operating positions (AUTO) by reversing Steps 1, 2 and 3.

Or HMI Screen

Step 1: On the HMI screen, select “Go To Graphics” and choose “ZW-1.”
Step 2: On the “ZW-1” screen, select “Mode Control.”
Step 3: On the “Mode Control” screen, select OFF for the “Main Control” and then “Exit” the screen.
Step 4: Select “Go To Graphics” located at the bottom of the “ZW-1” screen and choose “Raw Water Intake.”
Step 5: On the “Raw Water Intake” screen, select the “Raw Water Flow Valve FCV-002” icon and change the valve position to MANUAL and CLOSE on the faceplate screen. Select “Exit” when finished.
Step 6: On the “Raw Water Intake” screen, select the “Fire Flow Bypass Valve ZV-003” icon and change the valve position to MANUAL and OPEN on the faceplate screen. Select “Exit” when finished.
Step 7: After the valve positions have been changed, select the “Raw Water Intake Pump” icon and select MANUAL and START. Select “Exit” when finished.
Step 8: Once the Raw Water Pump is ON, select the “Fire Bypass Metering Pump” icon and select MANUAL and START. Select “Exit” when finished.
Step 9: Fire flow water will now fill the Fire Water Truck and once the Truck is full, STOP the Raw Water Intake Pump by reversing Step 7.
Step 10: Now, return all pumps, valves and mode of control to its original operational position by reversing Steps 2 through 8, starting at Step 8 by STOPPING the “Fire Bypass Metering Pump” and finishing at Step 2 by selecting ON for the “Mode Control” screen.

6.7.2 Intake Casing Flush

The Intake Casing Flush procedure is performed MANUALLY.

Step 1: Verify that chlorine residual is 0.0 mg/L in the EQ Tank by looking at the EQ Tank pH/chlorine analyzer.
Step 2: Re-verify that the free chlorine residual is 0.0 mg/L with a manual test (sample water from SV-368 and test with HACH Pocket Colorimeter).
Step 3: If free chlorine residual is NOT 0.0 mg/L, then casing flush cannot occur.
Step 4: If free chlorine residual is 0.0 mg/L, then proceed with steps.
Step 5: Close hand valves on either side of the backflow preventer CV-062.
Step 6: Open hand valve HV-065.
Step 7: Manually turn ON the Truck Fill Pump P-370 by switching HOA to HAND.
Step 8: After 5 minutes, turn the Truck Fill Pump HOA to OFF.
Step 9: Close hand valve HV-065
Step 10: Open hand valves on either side of the backflow preventer CV-062.
Step 11: Return Plant to normal operation.

6.8 Alarms and Troubleshooting

The WTP has two levels of alarms: major and minor.

Major alarms will trigger:

- A red alarm light and alarm to activate in the local display/alarm panel.
- An autodialer to dial out to a specified number(s)
- An exterior strobe light to activate on the side of the water treatment building.

Figure 6. 5: Autodialer.

Minor alarms will:

Step 1: Activate an alarm light within the alarm panel of the HMI display.

All alarms will initially be displayed on the “Active Alarms” screen. The step by- step instruction on how to acknowledge and clear an alarm is as follows:

Step 1: On “Active Alarms”, highlight the alarm of interest and select “Ack Alarm” to acknowledge the alarm. The buzzer will turn OFF once an alarm is acknowledged by the Operator. The PLC cabinet door light and exterior strobe (where applicable) will remain ON until each alarm is cleared.

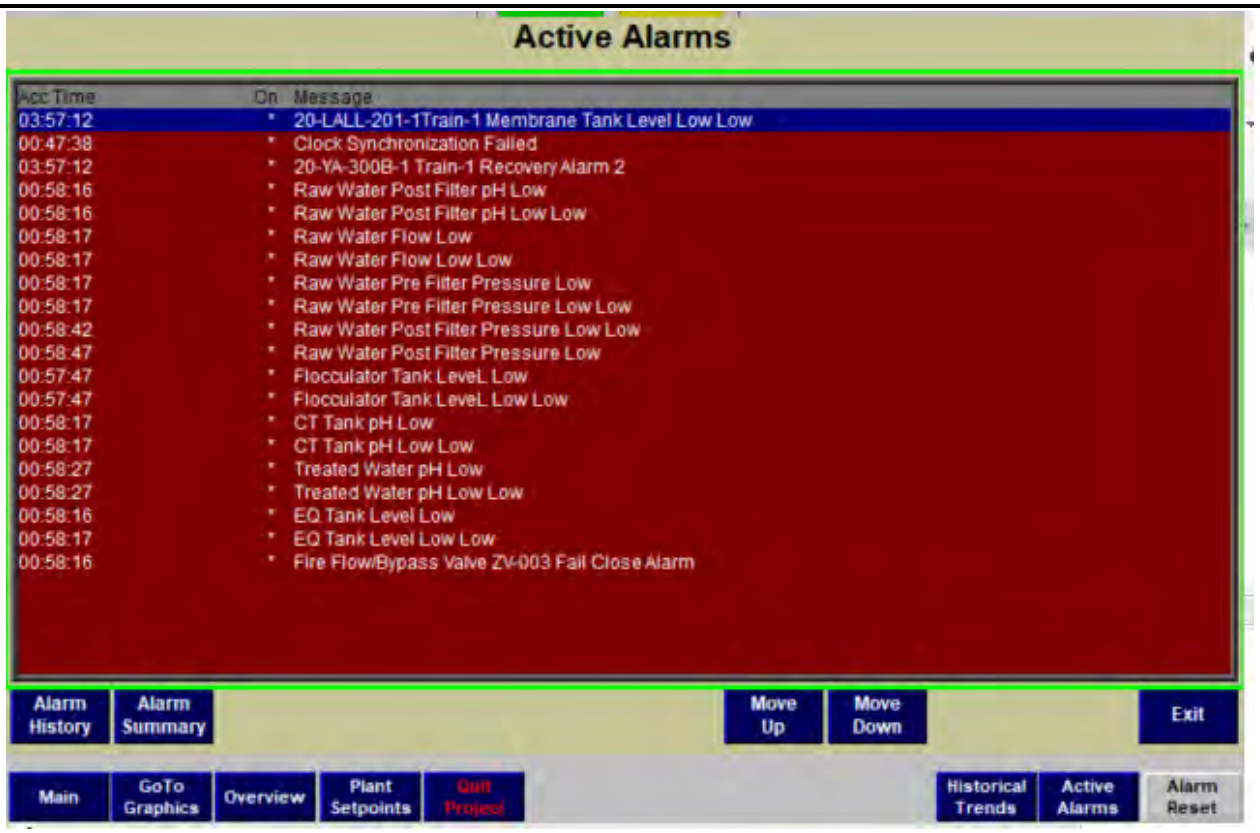


Figure 6. 6: Active Alarm Screen.

Step 2: Repeat Step 1 for each alarm or select “Ack All Alarm” to acknowledge all the alarms listed at the same time.

Step 3: All alarms will be transferred to the “Alarm Summary” screen.

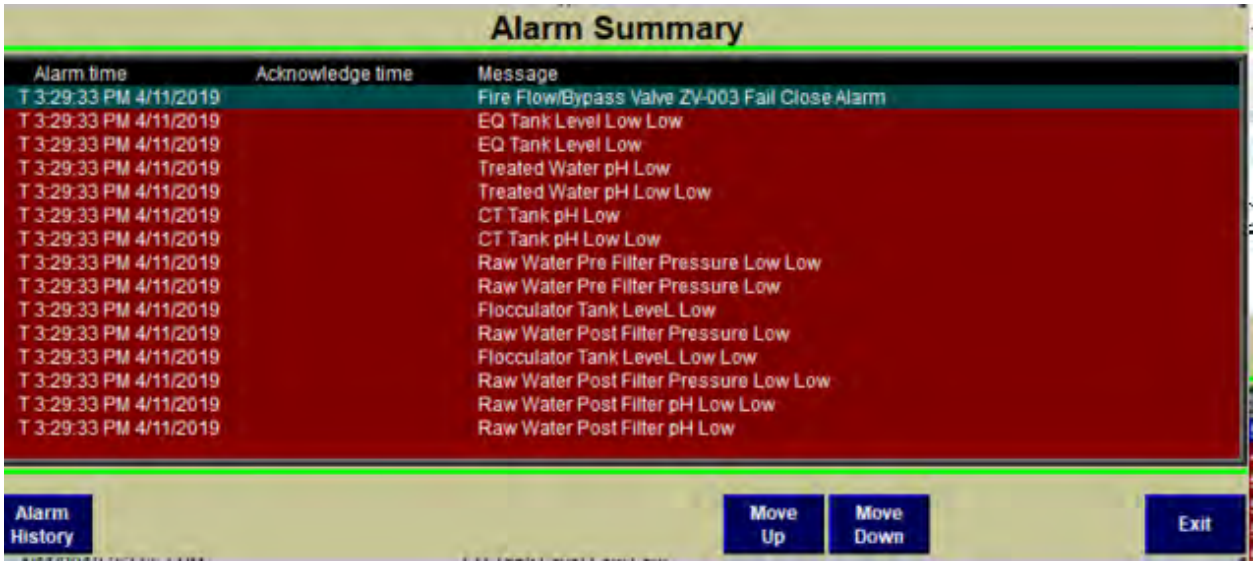


Figure 6. 7: Alarm Summary Screen.

Step 4: Read the message for each alarm to know what fault is active.

Step 5: Fix the fault locally. For assistance in troubleshooting the fault/alarm.

Step 6: Exit the “Alarm Summary” screen.

Step 7: Select “Alarm Reset” at the bottom of the current screen (or select Exit again until “Alarm Reset” is visible on the screen).

Step 8: Return to “Alarm Summary.” All outstanding or unaddressed alarms will be listed and the PLC cabinet door light will remain ON.

Step 9: Repeat Steps 5, 6, 7 & 8 until all alarms are addressed and cleared from the “Alarm Summary” list.

Step 10: Select “Alarm History” to view the past alarms for reference and record-keeping purposes (see Figure 6.25).

Figure 6. 8: Alarm History Screen.

6.8.1 Alarm Scenarios and Troubleshooting

For each alarm scenario, use the associated reference number in the following table for the step-by-step instructions on how to troubleshoot, address and resolve the issue.

It is important for the Operator to maintain a record of repairs and adjustments performed on the equipment. If the troubleshooting procedures do not explain how to correct the issue or does not fix the issue, contact the manufacturer, a local technician and/or AWC (if it is within the warranty period).

NOTICE **⚠WARNING**

The Operator must follow the complete troubleshooting instructions outlined in the applicable equipment-specific Manufacturer's O&M Manual in Appendix. The following summary steps are for reference purposes only.

Table 6. 1: List of Major and Minor Alarms. Major Alarm - plant will shut down. Minor Alarm - plant will not shut down.

SL #	Alarm	Alarm Trigger Description	Troubleshooting Section #	Plant Shut down
	Power Phase Monitor	This alarm occurs when the power supply to the control panel is unavailable.	6.8.1.1	Y
	Emergency stop has been activated	This alarm occurs when the emergency stop in the plant has been pressed by someone inside the plant.	6.8.1.2	N/A
	Furnace Diesel System Fault	This alarm occurs if there is any fault in the system, based on logic.	6.8.1.3	N
	Generator Diesel System Fault	This alarm occurs if there is any fault in the system, based on logic.	6.8.1.4	N
	Automatic Transfer Switch Fault	This alarm occurs when there is power outage and the automatic transfer switch fails to switch from main to standby generator power. This indicate that there is no power to the building.	6.8.1.5	N/A

	Elect. Heat Tracing Raw Water Fault	This alarm occurs if there is any fault in the system, based on logic.	6.8.1.6	Y
	Elect. Heat Tracing Truck Fill Fault	This alarm occurs if there is any fault in the system, based on logic.	6.8.1.7	Y
	Elect. Heat Tracing Backwash Line Fault	This alarm occurs if there is any fault in the system, based on logic.	6.8.1.8	Y
	Process Room Temperature	This alarm occurs when the process room temperature gets/falls above/below the set range.	6.8.1.9	Y
	Generator Room Temperature	This alarm occurs when the generator room temperature gets/falls above/below the set range.	6.8.1.10	Y
Pre-process: alarm				
	Raw Water Temperature High High	This alarm occurs when the raw water temperature gets above the maximum threshold value.	6.8.1.11	Y
	Raw Water Temperature High	This alarm occurs when the raw water temperature reaches the maximum threshold value.	6.8.1.12	N
	Raw Water Temperature Low	This alarm occurs when the raw water temperature reaches the minimum threshold value.	6.8.1.13	N
	Raw Water Temperature Low Low	This alarm occurs when the raw water temperature gets below the minimum threshold value.	6.8.1.14	Y
	Raw Water Flow High High	This alarm occurs when the flowmeter reads a flow higher than the maximum set value.	6.8.1.15	Y

	Raw Water Flow High	This alarm occurs when the flowmeter reads a flow equal to the maximum set value.	6.8.1.16	N
	Raw Water Flow Low Low	This alarm occurs when the flowmeter reads a flow lower than the minimum set value.	6.8.1.17	Y
	Raw Water Flow Low	This alarm occurs when the flowmeter reads a flow equal to the minimum set value.	6.8.1.18	N
	Fire Flow/Bypass Flow High High	This alarm occurs when the flowmeter reads a flow higher than the maximum set value.	6.8.1.19	Y
	Fire Flow/Bypass Flow High	This alarm occurs when the flowmeter reads a flow equal to the maximum set value.	6.8.1.20	N
	Fire Flow/Bypass Flow Low Low	This alarm occurs when the flowmeter reads a flow lower than the minimum set value.	6.8.1.21	Y
	Fire Flow/Bypass Flow Low	This alarm occurs when the flowmeter reads a flow equal to the minimum set value.	6.8.1.22	N
	Raw Water Pre-filter Pressure High High	This alarm occurs when the raw water pressure prior to basket filtration is higher than the maximum set value.	6.8.1.23	Y
	Raw Water Pre-filter Pressure High	This alarm occurs when the raw water pressure prior to basket filtration reaches the maximum set value.	6.8.1.24	N
	Raw Water Pre-filter Pressure Low Low	This alarm occurs when the raw water pressure prior to basket filtration is lower than the minimum set value.	6.8.1.25	Y
	Raw Water Pre-filter Pressure Low	This alarm occurs when the raw water pressure prior to basket filtration reaches the minimum set value.	6.8.1.26	N

	Raw Water Post-filter Pressure High High	This alarm occurs when the raw water pressure post basket filtration is higher than the maximum set value.	6.8.1.27	Y
	Raw Water Post-filter Pressure High	This alarm occurs when the raw water pressure post basket filtration reaches the maximum set value.	6.8.1.28	N
	Raw Water Post-filter Pressure Low Low	This alarm occurs when the raw water pressure post basket filtration is lower than the minimum set value.	6.8.1.29	Y
	Raw Water Post-filter Pressure Low	This alarm occurs when the raw water pressure post basket filtration reaches the minimum set value.	6.8.1.30	N
	Raw Water Post-filter Turbidity High High	This alarm occurs when the raw water turbidity post basket filtration is higher than threshold value.	6.8.1.31	Y
	Raw Water Post-filter Turbidity High	This alarm occurs when the raw water turbidity post basket filtration reaches the maximum threshold value.	6.8.1.32	N
	Raw Water Post-filter pH High High	This alarm occurs when the raw water pH post basket filtration is higher than the maximum set value.	6.8.1.33	Y
	Raw Water Post-filter pH High	This alarm occurs when the raw water pH post basket filtration reaches the maximum set value.	6.8.1.34	N
	Raw Water Post-filter pH Low Low	This alarm occurs when the raw water pH post basket filtration is lower than the minimum set value.	6.8.1.35	Y
	Raw Water Post-filter pH Low	This alarm occurs when the raw water pH post basket	6.8.1.36	N

		filtration reaches the minimum set value.		
	Raw Water Pump Fault	This alarm occurs when pump relay activates on any fault.	6.8.1.37	Y
	Raw Water Pump Fail to Start	This alarm occurs when the raw water pump fails to start.	6.8.1.38	Y
	Fire Flow/Bypass Valve Fail to Close	This alarm occurs when the fire flow bypass valve fails to close.	6.8.1.39	TBD
	Fire Flow/Bypass Valve Fail to Open	This alarm occurs when the fire flow bypass valve fails to open.	6.8.1.40	TBD
	Raw Water Flow Control Valve Fail	This alarm occurs when the raw water flow control valve fails.	6.8.1.41	TBD
	Flocculator Tank Level High High	This alarm occurs when the water level in flocculator tank is higher than the maximum threshold.	6.8.1.42	Y
	Flocculator Tank Level High	This alarm occurs when the water level in the flocculator tank reaches the maximum threshold.	6.8.1.43	N
	Flocculator Tank Level Low	This alarm occurs when the water level in the flocculator tank reaches the minimum set value.	6.8.1.44	N
	Flocculator Tank Level Low Low	This alarm occurs when the water level in the flocculator tank is lower than the minimum set value.	6.8.1.45	Y
	Flocculator Float Level Switch	This alarm occurs when level switch activates.		TBD
	Permeate Flow Switch	This alarm occurs when flow switch activates.	6.8.1.46	TBD
	Permeate Temperature High High	This alarm occurs when the permeate temperature gets	6.8.1.47	Y

		above the maximum threshold value.		
	Permeate Temperature High	This alarm occurs when the permeate temperature reaches the maximum threshold value.	6.8.1.48	N
	Permeate Temperature Low	This alarm occurs when the permeate temperature gets below the minimum threshold value.	6.8.1.49	N
	Permeate Temperature Low Low	This alarm occurs when the permeate temperature reaches the minimum threshold value.	6.8.1.50	Y
	CT Tank Chlorine High High	This alarm occurs when the chlorine concentration in the contact tank is higher than the maximum set value.	6.8.1.51	Y
	CT Tank Chlorine High	This alarm occurs when the chlorine concentration in the contact tank has reached the maximum set value.	6.8.1.52	N
	CT Tank Chlorine Low	This alarm occurs when the chlorine concentration in the contact tank has reached the minimum set value.	6.8.1.54	Y
	CT Tank Chlorine Low Low	This alarm occurs when the chlorine concentration in the contact tank is lower than the minimum set value.	6.8.1.53	N
	CT Tank pH High High	This alarm occurs when the water in the contact tank has pH higher than the maximum set value.	6.8.1.55	Y
	CT Tank pH High	This alarm occurs when the pH of water in the contact tank has reached the maximum set value.	6.8.1.56	N
	CT Tank pH Low	This alarm occurs when the pH of the water in the contact	6.8.1.58	N

		tank has reached the minimum set value.		
	CT Tank pH Low Low	This alarm occurs when the pH of the water in the contact tank is lower than the minimum set value.	6.8.1.57	Y
	Treated Water Chlorine High High	This alarm occurs when the chlorine concentration in the treated water is higher than the maximum set value.	6.8.1.59	Y
	Treated Water Chlorine High	This alarm occurs when the chlorine concentration in the treated water has reached the maximum set value.	6.8.1.60	N
	Treated Water Chlorine Low	This alarm occurs when the chlorine concentration in the treated water has reached the minimum set value.	6.8.1.61	N
	Treated Water Chlorine Low Low	This alarm occurs when the chlorine concentration in the treated water is lower than the minimum set value.	6.8.1.62	Y
	Treated Water pH High High	This alarm occurs when the pH of the treated water is higher than the maximum set value.	6.8.1.63	Y
	Treated Water pH High	This alarm occurs when the pH of the treated water has reached the maximum set value.	6.8.1.64	N
	Treated Water pH Low	This alarm occurs when the pH of the treated water has reached the minimum set value.	6.8.1.65	N
	Treated Water pH Low Low	This alarm occurs when the pH of the treated water is lower than the minimum set value.	6.8.1.66	Y

	Treated Water Turbidity High High	This alarm occurs when the turbidity of the treated water is higher than the maximum set value.	6.8.1.67	Y
	Treated Water Turbidity High	This alarm occurs when the turbidity of the treated water has reached the maximum set value.	6.8.1.68	N
	EQ Tank Level High High	This alarm occurs when the water level in the equalization tank is higher than the maximum threshold.	6.8.1.69	Y
	EQ Tank Level High	This alarm occurs when the water level in the equalization tank reaches the maximum threshold.	6.8.1.70	N
	EQ Tank Level Low	This alarm occurs when the water level in the equalization tank reaches the minimum set value.	6.8.1.71	N
	EQ Tank Level Low Low	This alarm occurs when the water level in the equalization tank is lower than the minimum set value.	6.8.1.72	Y
	EQ Tank Level Float Switch High High	This alarm occurs when tank level switch activates.	6.8.1.73	TBD
	EQ Tank Level Float Switch Low Low	This alarm occurs when tank level switch activates.	6.8.1.74	TBD
	Analyzer Recirculation Pump Fail to Start	This alarm occurs when pump fails to start.	6.8.1.75	TBD
	Analyzer Recirculation Pump Overload	This alarm occurs when pump relay is activated on overload.	6.8.1.76	TBD
	Truck Fill Pump Fail to start	This alarm occurs when pump fails to start.	6.8.1.77	TBD
	Truck Fill Pump Fault	This alarm occurs if there is any kind of fault.	6.8.1.78	TBD

	Truck Fill Flow High	This alarm occurs when the flowmeter reads the truck fill flow equal to the maximum set value.	6.8.1.79	TBD
	Truck Fill Flow Low	This alarm occurs when the flowmeter reads the truck fill flow equal to the minimum set value.	6.8.1.80	TBD
	Air compressor A fail to start	This alarm occurs when the air compressor A fail to start.	6.8.1.81	N
	Air compressor A overload	This alarm occurs when the air compressor A is overload.	6.8.1.82	N
	Air compressor B fail to start	This alarm occurs when the air compressor B fail to start.	6.8.1.83	N
	Air compressor B overload	This alarm occurs when the air compressor B is overload.	6.8.1.84	N
	Air Blower A fail to start	This alarm occurs when the air blower A fail to start.	6.8.1.85	N
	Air Blower A overload	This alarm occurs when the air blower A is overload.	6.8.1.86	N
	Air Blower B fail to start	This alarm occurs when the air blower B fail to start.	6.8.1.87	N
	Air Blower B overload	This alarm occurs when the air blower B is overload.	6.8.1.88	N
	Flocculation tank high Pressure switch	This alarm occurs when pressure switch activates.	6.8.1.89	N
	Sump Pump Fail to Start	This alarm occurs when pump fail to start.	6.8.1.90	TBD
	Sump Pump Overload	This alarm occurs when pump overload relay activates.	6.8.1.91	TBD
	Sump Level Float Switch High High	This alarm occurs when the sump level float is higher than the maximum limit.	6.8.1.92	TBD

	Sump Level Float Switch High	This alarm occurs when the sump level float reaches the maximum limit.	6.8.1.93	TBD
	Wastewater Tank Level Float Switch High High	This alarm occurs when the water level in the waste tank is higher than the maximum threshold.	6.8.1.94	TBD
	Wastewater Tank Level Float Switch High	This alarm occurs when the water level in the waste tank reaches the maximum set value.	6.8.1.95	TBD
	Diesel Tank Level Low	This alarm occurs when the fuel level in the diesel generator has reached the minimum threshold.	6.8.1.96	TBD
	Diesel Tank Level Low Low	This alarm occurs when the fuel level in the diesel generator is lower than the minimum threshold.	6.8.1.97	TBD
	Diesel Tank Level High High	This alarm occurs when the fuel level in the diesel generator is higher than the maximum threshold.	6.8.1.98	TBD
	CT Disinfection Pump Fault	This alarm occurs when pump relay activates on any fault.	6.8.1.99	TBD
	Fire Flow Disinfection Pump Fault	This alarm occurs when pump relay activates on any fault.	6.8.1.100	TBD
	Top Up Disinfection Pump Fault	This alarm occurs when pump relay activates on any fault.	6.8.1.101	TBD

6.8.1.1 Power Phase Monitor

Out of Phase Power alarm occur due to one of a few reasons, for example: the utility power is not working (power outage), the utility power cannot supply the necessary voltage for the phase converter, or the phase converter is not working.

Under normal circumstances, this alarm duration is very brief since the switch from low to no power to the generator is quick. However, if there is an issue, see the troubleshooting options below.

If the utility power is the issue, contact NTPC: 1-800-661-0855.

If the Automatic Transfer Switch is the issue, refer to its troubleshooting section 6.8.1.3. If the Generator is the issue, refer to its troubleshooting section 6.8.1.4.

6.8.1.2 Emergency Stop has been Activated

Emergency Shutdown Activated alarm occur when the Emergency Shutdown mushroom button on the PLC cabinet is pressed. The alarm light, buzzer and exterior strobe will be activated and the alarm will be listed on the “Active Alarms” HMI screen.

Step 1:	To silence the alarm, highlight the alarm using the UP and DOWN arrows and select “Ack Alarm” located at the bottom of the screen.
Step 2:	To deactivate and clear the alarm, pull the Emergency Shutdown button out on the PLC cabinet and select “Alarm Reset” on the “Plant Overview” screen.
Step 3:	Once the alarm is cleared, restart the WTP from the HMI.

6.8.1.3 Furnace Diesel System Fault

Furnace Diesel System Fault alarm occur when the PLC notices an issue with the feeding system of the diesel day tank and/or pump.

To troubleshoot this issue, complete the following steps:

Step 1:	Refer to the controller box on the Westeel Diesel Day Tank system for the nature of the fault (fuel level, pump control, fuel rupture in basin, etc.).
Step 2:	Check the feed system and ensure there are no blockages. Repair or clean as required.
Step 3:	If “high fuel” alarm, check the pump functionality and ensure the valves on the discharge line are open. Check integrity of pipe from the day tank to the furnace. Ensure there are no blockages. Check the furnace functionality and troubleshoot, if required.

Step 4: Step 4: If “low fuel” alarm, check the pump functionality and ensure the valves on the suction line are open. Check outdoor fuel tank level from the HMI and visually inspect the tank level, if necessary. Check integrity of pipe from the outdoor fuel tank to the day tank. Ensure there are no leaks.

Step 5: If “low fuel shutdown” alarm, manually shut down the furnace and repeat Step 4.

Step 6: If “fuel in rupture basin” alarm, the level switch in the rupture basin has been activated and the fuel supply pump shuts down. Check the integrity of the system and locate the leak. Repair and replace as required.

Step 7: If “ECM functional” alarm, there is a fault in the system. Check the level sensor and its wiring for loose connections and damage. Verify the level sensor signal is operational. Check the float switch. Verify that is not defective. Check the pump and its wiring for loose connections and damage. Ensure the pump is supplied with power. Repair and replace as required.

6.8.1.4 Generator Diesel System Fault

Generator Diesel System Fault alarms occur when the PLC notices an issue with the feeding system of the diesel day tank and/or pump.

To troubleshoot this issue, complete the following steps:

Step 1: Refer to the controller box on the Kohler Co. Diesel Day Tank system for the nature of the fault (fuel level, pump control, fuel rupture in basin, etc.).

Step 2: Check the feed system and ensure there are no blockages. Clean or repair as required.

Step 3: If “high fuel” alarm, check the pumps functionality and ensure the valves on the discharge lines are open. Check integrity of pipe from the day tank to the generator. Ensure there are no blockages. Check the generator functionality and troubleshoot, if required.

Step 4: If “low fuel” alarm, check the pump functionality and ensure the valves on the suction line are open. Check outdoor fuel tank level from the HMI and visually inspect the tank level, if necessary. Check integrity of pipe from the outdoor fuel tank to the day tank. Ensure there are no leaks.

Step 5: If “low fuel shutdown” alarm, manually shut down the generator to protect the motor and repeat Step 4.

Step 6: If “fuel in rupture basin” alarm, the level switch in the rupture basin has been activated and the fuel supply pumps shutdown. Check the integrity of the system and locate the leak. Repair and replace as required.

Step 7: If “ECM functional” alarm, there is a fault in the system. Check the level sensor and its wiring for loose connections and damage. Verify the level sensor signal is operational. Check the float switch. Verify that its not defective. Check the pumps and its wiring for loose connections and damage. Ensure the pumps are supplied with power. Repair and replace as required.

6.8.1.5 Automatic Transfer Switch Fault

NOTICE

<u>If the Operator cannot fix the problem</u> with the troubleshooting instructions provided, call a <u>local technician IMMEDIATELY</u> to fix the automatic transfer switch. The Plant will not be able to produce water and if the fuel oil system is not functioning, there will be no heat in the building. Keeping the building at low temperatures can potentially freeze the water in the Plant and the EQ Tank in a short time period. This can lead to a major emergency since the Plant may fail and be unable to produce water for an extended period. If the problem cannot be fixed in a short time, use another power source (e.g. minigenerator) to provide temporary power and heat in the building until the power is restored at the Plant.

Automatic Transfer Switch (ATS) Fault alarms occur when the PLC notices an issue with the normal operation of the ATS.

If the ATS will not transfer to standby generator upon failure of utility power, contact a local electrician. The following steps should be performed by a qualified electrician:

Step 1: Ensure the control circuit isolation plug is in place.
Step 2: Ensure generator set is producing enough voltage/frequency.
Step 3: Ensure output circuit breaker is closed.
Step 4: Verify ATS-FLT has correct voltage setting as set via software programming.
Step 5: Verify ATS-FLT timer setting; warm-up time delay function may not be timed out yet.
Step 6: Check for any loose control connections. Fix as required.
Step 7: Check motor limit switch; may be faulty. Fix as required.
Step 8: Check motor; may be defective. Fix as required.
Step 9: Verify output signals with circuit board mounted diagnostic LED’s. Controller may be defective. Fix as required.
Step 10: “Transfer Fail” alarm may have been activated locally (as indicated by flashing Load on Utility LED). Determine cause of alarm and rectify before ATS-FLT is reset.
Step 11: Reset ATS-FLT and return all functions to normal operating position.

If the ATS will not re-transfer to utility power upon restoration, complete the following steps:

Step 1: Ensure control circuit isolation plug is in place.

Step 2: Ensure utility disconnect switch is in the “energized” position.
Step 3: Check status LED. A test mode may have been activated. Correct the issue.
Step 4: Check utility source for adequate voltage.
Step 5: Check for any loose control connections. Fix as required.
Step 6: Check motor limit switch; may be faulty. Fix as required.
Step 7: Check motor; may be defective. Fix as required.
Step 8: Verify ATS-FLT has correct voltage setting as set via software programming.
Step 9: Verify output signals with circuit board mounted diagnostic LED’s. Controller may be defective. Fix as required.
Step 10: “Transfer Fail” alarm may have been activated locally (as indicated by flashing Load on Utility LED). Determine cause of alarm and rectify before ATS-FLT is reset.
Step 11: Reset ATS-FLT and return all functions to normal operating position.

For other symptoms and issues, refer to the Troubleshooting instructions and possible causes in the Thomson Technology ATS O&M Manual in Appendix.

6.8.1.6 Electrical Heat Tracing Raw Water Fault

Electrical Heat Trace (EHT) System (Raw Water Intake) Fault alarms occur when the PLC notices an issue with the normal operation of the EHT system.

An example of this fault is if there is no heat or current to the EHT system. If this is the case, contact a qualified electrician to complete the following steps:

Step 1: Check circuit breaker and electrical connections. Restore power to tracing circuit if applicable.
Step 2: Check the controller setpoint; it may be too low. Adjust setpoint if required.
Step 3: Check if the high temperature limit switch is activated. May require manual reset to re-enable heat tracing circuit.
Step 4: Check for an “open” series heating circuit. Repair or replace if required.
Step 5: Check the controller for failure. Repair sensor or controller if required.
Step 6: After rectifying the issue, reset the alarm.

6.8.1.7 Elect. Heat Tracing Truck Fill Fault

Electrical Heat Trace (EHT) System (Truck Fill) Fault alarms occur when the PLC notices an issue with the normal operation of the EHT system.
An example of this fault is if there is no heat or current to the EHT system. If this is the case, contact a qualified electrician to complete the following steps:

Step 1: Check circuit breaker and electrical connections. Restore power to tracing circuit if applicable.
Step 2: Check the controller setpoint; it may be too low. Adjust setpoint if required.
Step 3: Check if the high temperature limit switch is activated. May require manual reset to re-enable heat tracing circuit.
Step 4: Check for an “open” series heating circuit. Repair or replace if required.
Step 5: Check the controller for failure. Repair sensor or controller if required.
Step 6: After rectifying the issue, reset the alarm.

6.8.1.8 Elect. Heat Tracing Backwash Line Fault

Electrical Heat Trace (EHT) System (Backwash Line) Fault alarms occur when the PLC notices an issue with the normal operation of the EHT system.
An example of this fault is if there is no heat or current to the EHT system. If this is the case, contact a qualified electrician to complete the following steps:

Step 1: Check circuit breaker and electrical connections. Restore power to tracing circuit if applicable.
Step 2: Check the controller setpoint; it may be too low. Adjust setpoint if required.
Step 3: Check if the high temperature limit switch is activated. May require manual reset to re-enable heat tracing circuit.
Step 4: Check for an “open” series heating circuit. Repair or replace if required.
Step 5: Check the controller for failure. Repair sensor or controller if required.
Step 6: After rectifying the issue, reset the alarm.

6.8.1.9 Process Room Temperature

Process Room Temperature alarm occurs when the main process room temperature gets above (45^{o}C) or falls (5^{o}C) below the set range.

To trouble shoot the issue, complete the following steps.

For high temperature alarm (process room temperature higher than 45^{o}C),

Step 1: Verify the temperature reading on the “Utilities” screen on the HMI. If it does not display a reading higher than the setpoint, reset the alarm. If the alarm persists, check the temperature sensor. Check for damage or loose connections (repair and replace as required) and then reset the alarm by selecting “Alarm Reset” on the “Plant Overview Screen”.
Step 2: If the alarm persists, check the furnace and the thermostat set points to ensure they are accurate. See Section 6.8.1.3 for trouble shooting the furnace.

Step 3: If the alarm persists, visually insect the Plant for the cause of the heat. Rectify the issue. A solution may be to open the main process door to allow cooler air to circulate the room and check the furnace for excessive output or overheating.

Step 4: After rectifying the issue, reset the alarm.

For low temperature alarm (process room temperature lower than 5°C),

1. Verify the temperature reading on the "Utilities" screen on the HMI. If it does not display a reading lower than the setpoint, reset the alarm. If the alarm persists, check the temperature sensor. Check for damage or loose connections (repair and replace as required) and then reset the alarm by selecting "Alarm Reset" on the "Plant Overview Screen".
2. If the alarm persists, check the furnace and the thermostat set points to ensure they are accurate. See Section 6.8.1.3 for trouble shooting the furnace.
3. If the alarm persists, visually insect the Plant for the cause of the heat loss. Rectify the issue. Check the furnace for insufficient output or underheating.
4. After rectifying the issue, reset the alarm.

6.8.1.10 Generator Room Temperature

Generator Room Temperature alarm occurs when generator room temperature gets above (45°C) or falls below (5°C) the set range.

To trouble shoot the issue, complete the following steps.

For high temperature alarm (higher than 45°C),

Step 1: Verify the temperature reading on the "Utilities" screen on the HMI. If it does not display a reading higher than the setpoint, reset the alarm. If the alarm persists, check the temperature sensor. Check for damage or loose connections (repair and replace as required) and then reset the alarm by selecting "Alarm Reset" on the "Plant Overview Screen".

Step 2: If the alarm persists, check the furnace and the thermostat set points to ensure they are accurate. See Section 6.8.1.3 for trouble shooting the furnace.

Step 3: If the alarm persists, visually insect the Plant for the cause of the heat. Rectify the issue. A solution may be to open the main process door to allow cooler air to circulate the room and check the furnace for excessive output or overheating.

Step 4: After rectifying the issue, reset the alarm.

For low temperature alarm (lower than 5°C),

Step 1: Verify the temperature reading on the "Utilities" screen on the HMI. If it does not display a reading lower than the setpoint, reset the alarm. If the alarm persists, check the temperature sensor. Check for damage or loose connections (repair and replace as required) and then reset the alarm by selecting "Alarm Reset" on the "Plant Overview Screen".

Step 2: If the alarm persists, check the furnace and the thermostat set points to ensure they are accurate. See Section 6.8.1.3 for trouble shooting the furnace.

Step 3: If the alarm persists, visually insect the Plant for the cause of the heat loss. Rectify the issue. Check the furnace for insufficient output or underheating.

Step 4: After rectifying the issue, reset the alarm.

6.8.1.11 Raw Water Temperature High High

Action:

Step 1: Check if the raw water temperature is higher than the 40°C on the HMI screen and compare the temperature on the Wika temperature transmitter (TT-002) to ensure the alarm is legitimate. If the display appears to have a "normal" reading, then either the transmitter, wiring to the control cabinet, wiring within the control cabinet or PLC module may be faulty. An electrician will be required to resolve the problem.

Step 2: Reset the alarm once the problem has been resolved.

6.8.1.12 Raw Water Temperature High

Action:

Step 1: Check if the raw water temperature is higher than the 35°C on the HMI screen and compare the temperature on the Wika temperature transmitter (TT-002) to ensure the alarm is legitimate. If the display appears to have a "normal" reading, then either the transmitter, wiring to the control cabinet, wiring within the control cabinet or PLC module may be faulty. An electrician will be required to resolve the problem.

Step 2: Reset the alarm once the problem has been resolved.

6.8.1.13 Raw Water Temperature Low

Action:

Step 1: Check if the raw water temperature is below 5°C on the HMI screen and compare the temperature on the Wika temperature transmitter (TT-002) to ensure the alarm is legitimate. If the display appears to have a "normal" reading, then either the transmitter, wiring to the control cabinet, wiring within the control cabinet or PLC module may be faulty. An electrician will be required to resolve the problem.

Step 2: Reset the alarm once the problem has been resolved.

6.8.1.14 Raw Water Temperature Low Low

Action:

Step 1: Check if the raw water temperature is higher than the 0°C on the HMI screen and compare the temperature on the Wika temperature transmitter (TT-002) to ensure the alarm is legitimate. If the display appears to have a "normal" reading, then either the transmitter, wiring to the control cabinet, wiring within the control cabinet or PLC module may be faulty. An electrician will be required to resolve the problem.

Step 2: Reset the alarm once the problem has been resolved.

6.8.1.15 Raw Water Flow High High

Raw Water High-High Flow alarm occur when the pump is running and the magmeter (FIT-100) reads/displays a flow rate that is much higher than the design flow rate (> 1200 L/min).

To troubleshoot the issue, complete the following steps:

Step 1: Ensure the accuracy of the alarm reading by checking the flow displayed on the Alarm Set Points screen. Compare this value to the reading of the flowmeter (FIT – 100). If the flowmeter display appears to have the "normal" value but the HMI display a different value, then either the flowmeter or the wiring to/within the control cabinet or the PLC module may be faulty. Calls a qualified electrician to resolve the problem.

Step 2: If the reading on the flowmeter display is the same as what is seen on the HMI display, then the alarm is legitimate. It indicates that the flow is substantially more than what it should be. One possible cause for this could be that the plant is in fire-flow bypass mode, while the water is flowing through the main (treatment) line. Check if raw water flow valve (FCV-002) is open and fireflow bypass ZV-003 valve is close. On the control panel make sure the flow control and fire flow bypass valves are in "Auto" setting. If the alarm persists, call a technician to repair immediately.

6.8.1.16 Raw Water Flow High

Raw Water High-High Flow alarm occur when the pump is running and the magmeter (FIT-100) reads/displays a flow rate that is higher than the design flow rate (> 1150 L/min).

To troubleshoot the issue, complete the following steps:

Step 1: Ensure the accuracy of the alarm reading by checking the flow displayed on the Alarm Set Points screen. Compare this value to the reading of the flowmeter (FIT – 100). If the flowmeter display appears to have the “normal” value but the HMI display a different value, then either the flowmeter or the wiring to/within the control cabinet or the PLC module may be faulty. Calls a qualified electrician to resolve the problem.

Step 2: If the reading on the flowmeter display is the same as what is seen on the HMI display, then the alarm is legitimate. It indicates that the flow is substantially more than what it should be. One possible cause for this could be that the plant is in fire-flow bypass mode, while the water is flowing through the main (treatment) line. Check if raw water flow valve (FCV-002) is open and fireflow bypass ZV-003 valve close. On the control panel make sure the flow control and fire flow bypass valves are in “Auto” setting. If the alarm persists, call a technician to repair immediately.

6.8.1.17 Raw Water Flow Low Low

Raw Water Low - Low Flow alarm occur when the pump is running and the magmeter (FIT-100) reads/displays a flow rate that is much lower than the design flow rate.

To troubleshoot the issue, complete the following steps:

Step 1: Ensure the accuracy of the alarm reading by checking the flow displayed on the Alarm Set Points screen. Compare this value to the reading of the flowmeter (FIT – 100). If the flowmeter display appears to have the “normal” value but the HMI display a different value, then either the flowmeter or the wiring to/within the control cabinet or the PLC module may be faulty. Calls a qualified electrician to resolve the problem.

Step 2: If the reading on the flowmeter display is the same as what is seen on the HMI display, then the alarm is legitimate. It indicates that the flow is substantially less than what it should be. One possible cause for this could be that the fire-flow bypass valve (ZV-003) is open. On the control panel make sure the fire flow bypass valve is in “Auto” setting. If the alarm persists, call a technician to repair immediately.

6.8.1.18 Raw Water Flow Low

Raw Water Low Flow alarm occur when the pump is running and the magmeter (FIT-100) reads/displays a flow rate that is lower than the design flow rate.

To troubleshoot the issue, complete the following steps:

Step 1: Ensure the accuracy of the alarm reading by checking the flow displayed on the Alarm Set Points screen. Compare this value to the reading of the flowmeter (FIT – 100). If the flowmeter display appears to have the “normal” value but the HMI display a different value, then either the flowmeter or the wiring to/within the control cabinet or the PLC module may be faulty. Calls a qualified electrician to resolve the problem.

Step 2: If the reading on the flowmeter display is the same as what is seen on the HMI display, then the alarm is legitimate. It indicates that the flow is substantially less than what it should be. One possible cause for this could be that the fire-flow bypass valve (ZV-003) is open. On the control panel make sure the fire flow bypass valve is in “Auto” setting.. If the alarm persists, call a technician to repair immediately.

6.8.1.19 Fire Flow/Bypass Flow High High

Fire Flow/Bypass High-High Flow alarm occur when the pump is running and the magmeter (FIT-004) reads/displays a flow rate that is much higher than the design flow rate (> 1200L/min).

To troubleshoot the issue, complete the following steps:

Step 1: Ensure the accuracy of the alarm reading by checking the flow displayed on the Alarm Set Points screen. Compare this value to the reading of the flowmeter (FIT – 004). If the flowmeter display appears to have the “normal” value but the HMI display a different value, then either the flowmeter or the wiring to/within the control cabinet or the PLC module may be faulty. Calls a qualified electrician to resolve the problem.

Step 2: If the reading on the flowmeter display is the same as what is seen on the HMI display, then the alarm is legitimate. It indicates that the flow is substantially more than what it should be. This is very unlikely as the control panel and pump is NOT setup to allow such high flow rate. Call a technician to repair immediately.

6.8.1.20 Fire Flow/Bypass Flow High

Fire Flow/Bypass High Flow alarm occur when the pump is running and the magmeter (FIT-004) reads/displays a flow rate that is much higher than the design flow rate (> 1150 L/min).

To troubleshoot the issue, complete the following steps:

To troubleshoot the issue, complete the following steps:

Step 1: Ensure the accuracy of the alarm reading by checking the flow displayed on the Alarm Set Points screen. Compare this value to the reading of the flowmeter (FIT – 004). If the flowmeter display appears to have the “normal” value but the HMI display a different value, then either the flowmeter or the wiring to/within the control cabinet or the PLC module may be faulty. Calls a qualified electrician to resolve the problem.

Step 2: If the reading on the flowmeter display is the same as what is seen on the HMI display, then the alarm is legitimate. It indicates that the flow is substantially more than what it should be. This is very unlikely as the control panel and pump is NOT setup to allow such high flow rate. Call a technician to repair immediately.

6.8.1.21 Fire-Flow/Bypass Flow Low Low

Fire Flow/Bypass Flow Low - Low Flow alarm occur when the pump is running and the magmeter (FIT-004) reads/displays a flow rate that is much lower than the design flow rate (< 750 L/min).

To troubleshoot the issue, complete the following steps:

Step 1: Ensure the accuracy of the alarm reading by checking the flow displayed on the Alarm Set Points screen. Compare this value to the reading of the flowmeter (FIT – 004). If the flowmeter display appears to have the “normal” value but the HMI display a different value, then either the flowmeter or the wiring to/within the control cabinet or the PLC module may be faulty. Calls a qualified electrician to resolve the problem.

Step 2: If the reading on the flowmeter display is the same as what is seen on the HMI display, then the alarm is legitimate. It indicates that the flow is substantially less than what it should be. One possible cause for this could be that the treatment plant main line flow valve (FCV-002) is open. On the control panel make sure the fire flow bypass valve is in “AUTO” setting. If the alarm persists, call a technician to repair immediately.

6.8.1.22 Raw Water Flow Low

Fire Flow/Bypass Flow Low Flow alarm occur when the pump is running and the magmeter (FIT-004) reads/displays a flow rate that is much lower than the design flow rate (< 800 L/min).

To troubleshoot the issue, complete the following steps:

Step 1: Ensure the accuracy of the alarm reading by checking the flow displayed on the Alarm Set Points screen. Compare this value to the reading of the flowmeter (FIT – 004). If the flowmeter display appears to have the “normal” value but the HMI display a different value, then either the flowmeter or the wiring to/within the control cabinet or the PLC module may be faulty. Calls a qualified electrician to resolve the problem.

Step 2: If the reading on the flowmeter display is the same as what is seen on the HMI display, then the alarm is legitimate. It indicates that the flow is substantially less than what it should be. One possible cause for this could be that the treatment plant main line flow valve (FCV-002) is open. On the control panel make sure the fire flow bypass valve is in "AUTO" setting. If the alarm persists, call a technician to repair immediately.

6.8.1.23 Raw Water Pre-filter Pressure High High

Raw Water Pre-filter Pressure High High Alarm occurs when the raw water pressure transmitter (PT – 101) reads/displays a pressure much higher than the design pressure.

To troubleshoot the issue:

Step 1: Ensure the accuracy of the alarm reading by checking the pressure displayed on the Alarm Set Points screen. Compare this value to the reading of the pressure transmitter (PT – 101). If the pressure transmitter display appears to have the "normal" value but the HMI display a different value, then either the pressure transmitter or the wiring to/within the control cabinet or the PLC module may be faulty. Calls a qualified electrician to resolve the problem.

Step 2: If the reading, on the pressure transmitter display is the same as what is seen on the HMI display, then the alarm is legitimate. It indicates that the pressure in the line is more than the set pressure in the PLC. A high inlet pressure on any one filter could be due to the filter plugging from a large material in the raw water. The filter needs to be cleaned. Disconnect the filters before maintenance or treatment.

6.8.1.24 Raw Water Pre-filter Pressure High

Raw Water Pre-filter Pressure High Alarm occurs when the raw water pressure transmitter (PT – 101) reads/displays a pressure higher than the design pressure.

To troubleshoot the issue:

Step 1: Ensure the accuracy of the alarm reading by checking the pressure displayed on the Alarm Set Points screen. Compare this value to the reading of the pressure transmitter (PT – 101). If the pressure transmitter display appears to have the "normal" value but the HMI display a different value, then either the pressure transmitter or the wiring to/within the control cabinet or the PLC module may be faulty. Calls a qualified electrician to resolve the problem.

Step 2: If the reading, on the pressure transmitter display is the same as what is seen on the HMI display, then the alarm is legitimate. It indicates that the pressure in the line is more than the set pressure in the PLC. A high inlet pressure on any one filter could be due to the filter plugging from a large material in the raw water. The filter needs to be cleaned. Disconnect the filters before maintenance or treatment.

6.8.1.25 Raw Water Pre-filter Pressure Low Low

Raw Water Pre-filter Pressure Low Low Alarm occurs when the raw water pressure transmitter (PT – 101) reads/displays a pressure much lower than the design pressure.

To troubleshoot the issue:

Step 1: Ensure the accuracy of the alarm reading by checking the pressure displayed on the Alarm Set Points screen. Compare this value to the reading of the pressure transmitter (PT – 101). If the pressure transmitter display appears to have the “normal” value but the HMI display a different value, then either the pressure transmitter or the wiring to/within the control cabinet or the PLC module may be faulty. Calls a qualified electrician to resolve the problem.

Step 2: If the reading, on the pressure transmitter display is the same as what is seen on the HMI display, then the alarm is legitimate. It indicates that the pressure in the line is less than the set pressure in the PLC. A low inlet pressure on the filter could be due to low flow/pressure from the raw water pump. Check the flow reading on the flow transmitter (FIT-100). If the flow is lower than the design flowrate, then the raw water pump is not functioning properly. Refer to section for trouble shooting the pump. Another possible reason could be, the fire flow bypass valve is not closed fully, allowing diversion of water. Check the valve making sure its in “Auto” position. If the alarm persists, contact a qualified technician.

6.8.1.26 Raw Water Pre-filter Pressure Low

Raw Water Pre-filter Pressure Low Alarm occurs when the raw water pressure transmitter (PT – 101) reads/displays a pressure lower than the design pressure.

To troubleshoot the issue:

Step 1: Ensure the accuracy of the alarm reading by checking the pressure displayed on the Alarm Set Points screen. Compare this value to the reading of the pressure transmitter (PT – 101). If the pressure transmitter display appears to have the “normal” value but the HMI display a different value, then either the pressure transmitter or the wiring to/within the control cabinet or the PLC module may be faulty. Call a qualified electrician to resolve the problem.

Step 2: If the reading, on the pressure transmitter display is the same as what is seen on the HMI display, then the alarm is legitimate. It indicates that the pressure in the line is less than the set pressure in the PLC. A low inlet pressure on the filter could be due to low flow/pressure from the raw water pump. Check the flow reading on the flow transmitter (FIT-100). If the flow is lower than the design flowrate, then the raw water pump is not functioning properly. Refer to section for trouble shooting the pump. Another possible reason could be, the fire flow bypass valve is not closed fully, allowing diversion of water. Check the valve making sure its in “Auto” position. If the alarm persists, contact a qualified technician.

6.8.1.27 Raw Water Post-filter Pressure High High

Raw Water Pre-filter Pressure High High Alarm occurs when the raw water pressure transmitter (PT – 102) reads/displays a pressure much higher than the design pressure.

To troubleshoot the issue:

Step 1: Ensure the accuracy of the alarm reading by checking the pressure displayed on the Alarm Set Points screen. Compare this value to the reading of the pressure transmitter (PT – 102). If the pressure transmitter display appears to have the “normal” value but the HMI display a different value, then either the pressure transmitter or the wiring to/within the control cabinet or the PLC module may be faulty. Call a qualified electrician to resolve the problem.

Step 2: If the reading, on the pressure transmitter display is the same as what is seen on the HMI display, then the alarm is legitimate. It indicates that the pressure in the line is more than the set pressure in the PLC. A high inlet pressure post filter could be due to the line or static mixer plugged with large material (fouling debris from basket filter).

6.8.1.28 Raw Water Post-filter Pressure High

Raw Water Pre-filter Pressure High Alarm occurs when the raw water pressure transmitter (PT – 102) reads/displays a pressure higher than the design pressure.

To troubleshoot the issue:

Step 1: Ensure the accuracy of the alarm reading by checking the pressure displayed on the Alarm Set Points screen. Compare this value to the reading of the pressure transmitter (PT – 102). If the pressure transmitter display appears to have the “normal” value but the HMI display a different value, then either the pressure transmitter or the wiring to/within the control cabinet or the PLC module may be faulty. Call a qualified electrician to resolve the problem.

Step 2: If the reading, on the pressure transmitter display is the same as what is seen on the HMI display, then the alarm is legitimate. It indicates that the pressure in the line is more than the set pressure in the PLC. A high inlet pressure post filter could be due to the line or static mixer plugged with large material (fouling debris from basket filter).

6.8.1.29 Raw Water Pre-filter Pressure Low Low

Raw Water Pre-filter Pressure Low Low Alarm occurs when the raw water pressure transmitter (PT – 102) reads/displays a pressure much lower than the design pressure.

To troubleshoot the issue:

Step 1: Ensure the accuracy of the alarm reading by checking the pressure displayed on the Alarm Set Points screen. Compare this value to the reading of the pressure transmitter (PT – 102). If the pressure transmitter display appears to have the "normal" value but the HMI display a different value, then either the pressure transmitter or the wiring to/within the control cabinet or the PLC module may be faulty. Call a qualified electrician to resolve the problem.

Step 2: If the reading, on the pressure transmitter display is the same as what is seen on the HMI display, then the alarm is legitimate. It indicates that the pressure in the line is less than the set pressure in the PLC. A low inlet pressure post filter could be due to the fouling/clogging of filter. Check the flow reading on the flow transmitter (FIT-100). If the flow is lower than the design flowrate, then the filters are clogged. Disconnect the filters and change/clean the fouling. If the alarm persists, contact a qualified technician.

6.8.1.30 Raw Water Post-filter Pressure Low

Raw Water Pre-filter Pressure Low Alarm occurs when the raw water pressure transmitter (PT – 102) reads/displays a pressure lower than the design pressure.

To troubleshoot the issue:

Step 1: Ensure the accuracy of the alarm reading by checking the pressure displayed on the Alarm Set Points screen. Compare this value to the reading of the pressure transmitter (PT – 102). If the pressure transmitter display appears to have the "normal" value but the HMI display a different value, then either the pressure transmitter or the wiring to/within the control cabinet or the PLC module may be faulty. Call a qualified electrician to resolve the problem.

Step 2: If the reading, on the pressure transmitter display is the same as what is seen on the HMI display, then the alarm is legitimate. It indicates that the pressure in the line is less than the set pressure in the PLC. A low inlet pressure post filter could be due to the fouling/clogging of filters. Check the flow reading on the flow transmitter (FIT-100). If the flow is lower than the design flowrate, then the filters are clogged. Disconnect the filters and change/clean the fouling. If the alarm persists, contact a qualified technician.

6.8.1.31 Raw Water Post Filter Turbidity High High

Raw Water Post Filter Turbidity High High Alarm occurs when the raw water turbidity analyzer (AIT-104) reads/displays a turbidity of 35 NTU or greater.

To troubleshoot the issue, complete the following steps:

Step 1: Check that the alarm is real by verifying the accuracy of the analyzer.
Step 2: Compare the reading from the turbidity analyzer with the reading from the portable turbidity meter. Take a raw water sample and analyze it using the portable turbidity meter in the laboratory. These values should be the same (or fairly close due to experimental error). Recalibrate the turbidity analyzer as required. Follow the instructions in the HACH O&M Manual in Appendix or contact the manufacturer for technical support at 1-800-665-7635.

6.8.1.32 Raw Water Post Filter Turbidity High

Raw Water Post Filter Turbidity High Alarm occurs when the raw water turbidity analyzer (AIT-104) reads/displays a turbidity of 25 NTU or greater (but less than 35 NTU).

To troubleshoot the issue, complete the following steps:

Step 1: Check that the alarm is real by verifying the accuracy of the analyzer.
Step 2: Compare the reading from the turbidity analyzer with the reading from the portable turbidity meter. Take a raw water sample and analyze it using the portable turbidity meter in the laboratory. These values should be the same (or fairly close due to experimental error). Recalibrate the turbidity analyzer as required. Follow the instructions in the HACH O&M Manual in Appendix or contact the manufacturer for technical support at 1-800-665-7635.

A high turbidity alarm for the raw water is not a major concern because the membrane filtration system will remove the suspended solids and lower the turbidity in the treated water to acceptable levels.

6.8.1.33 Raw Water Post Filter pH High High

Raw Water High pH alarms occur when the pH analyzer (AIT-103) on raw water line reads a pH of 10 or more.

To troubleshoot this issue, complete the following steps:

Step 1: Check that the alarm is real by verifying and comparing the alarm set point valve with the reading from the pH analyzer. These values should match.
Step 2: Check the pH using the portable pH meter in the laboratory with the reading from the pH analyzer to ensure it is correct. If it is incorrect, recalibrate the pH analyzer as per instructions in the Hach O&M Manual in Appendix or contact the manufacturer for technical support at 1-888-385-1221.
Step 3: After rectifying the issue, reset the alarm.

6.8.1.34 Raw Water Post Filter pH High

Raw Water High pH alarms occur when the pH analyzer (AIT-103) on raw water line reads a pH of 5 or lower.

To troubleshoot this issue, complete the following steps:

Step 1: Check that the alarm is real by verifying and comparing the alarm set point valve with the reading from the pH analyzer. These values should match.

Step 2: Check the pH using the portable pH meter in the laboratory with the reading from the pH analyzer to ensure it is correct. If it is incorrect, recalibrate the pH analyzer as per instructions in the Hach O&M Manual in Appendix or contact the manufacturer for technical support at 1-888-385-1221.

Step 3: After rectifying the issue, reset the alarm.

6.8.1.35 Raw Water Post Filter pH low low

Raw Water High pH alarms occur when the pH analyzer (AIT-103) on raw water line reads a pH of 5 or lower.

To troubleshoot this issue, complete the following steps:

Step 1: Check that the alarm is real by verifying and comparing the alarm set point valve with the reading from the pH analyzer. These values should match.

Step 2: Check the pH using the portable pH meter in the laboratory with the reading from the pH analyzer to ensure it is correct. If it is incorrect, recalibrate the pH analyzer as per instructions in the Hach O&M Manual in Appendix or contact the manufacturer for technical support at 1-888-385-1221.

Step 3: After rectifying the issue, reset the alarm.

6.8.1.36 Raw Water Post Filter pH low

Raw Water High pH alarms occur when the pH analyzer (AIT-103) on raw water line reads a pH between 5 and 6.

To troubleshoot this issue, complete the following steps:

Step 1: Check that the alarm is real by verifying and comparing the alarm set point valve with the reading from the pH analyzer. These values should match.

Step 2: Check the pH using the portable pH meter in the laboratory with the reading from the pH analyzer to ensure it is correct. If it is incorrect, recalibrate the pH analyzer as per

instructions in the Hach O&M Manual in Appendix or contact the manufacturer for technical support at 1-888-385-1221.

Step 3: After rectifying the issue, reset the alarm.

6.8.1.37 Raw Water Pump Fault

Raw Water Pump Fault alarms occur when the PLC receives a signal (or lack thereof) that indicates there is an issue with the Raw Water Pump. There are various scenarios that could trigger this fault alarm and therefore many solutions as well. It is recommended that the Operator review the Grundfos O&M Manual in Appendix K for a full list of instructions on how to troubleshoot a Raw Water Pump fault.

When working with electrical circuits, use caution to avoid electrical shock. It is recommended that rubber gloves and boots be worn and that care is taken to have metal control boxes and motors grounded to power supply ground or steel drop pipe or casing extending into the well.

For example, if the “pump does not run,” then contact a qualified electrician to complete the following steps:

Step 1: If no power at pump panel, check the voltage at the panel. If no voltage is present, check feeder panel for tripped circuits.

Step 2: If fuses are blown or circuit breakers are tripped, remove fuses and check for continuity with ohmmeter. Replace blown fuses or reset circuit breaker. If new fuses blow or circuit breaker trips, check the electrical installation and motor.

Step 3: If motor starter overloads are burnt or have tripped out, check for voltage on line or load side of starter. Replace burnt heaters or reset. Inspect starter for other damage. If heater trips again, check the supply voltage and starter holding coil.

Step 4: If starter does not energize, energize control circuit and check voltage at the holding coil. If no voltage, check control circuit. If voltage, check holding coils for shorts. Replace bad coil.

Step 5: If defective controls, check all safety and pressure switches for operation. Inspect contacts in control devices. Replace worn or defective parts.

Step 6: If motor and/or cable are defective, turn off power. Disconnect motor leads from control box. Measure the lead-to-lead resistances with the ohmmeter (Rx1). Measure lead-to-ground values with ohmmeter (Rx100K). Record measured values. If open motor winding or grounding is found, remove pump and recheck values at the surface. Repair or replace motor or cable.

Step 7: After rectifying the issue, reset the alarm. If it is not cleared, contact the manufacturer for technical support at 1-905-491-6620 or 1-913-227-3500.

6.8.1.38 Raw Water Pump Fail to Start

Raw Water Pump Fail to Start alarms occur when the PLC receives a signal (or lack thereof) that indicates there is an issue with the Raw Water Pump. There are various scenarios that could trigger this fault alarm and therefore many solutions as well. It is recommended that the Operator review the Grundfos O&M Manual in Appendix K for a full list of instructions on how to troubleshoot a Raw Water Pump fault.

When working with electrical circuits, use caution to avoid electrical shock. It is recommended that rubber gloves and boots be worn and care must be taken to have metal control boxes and motors grounded to power supply ground or steel drop pipe or casing extending into the well.

For example, if the “pump does not run,” then contact a qualified electrician to complete the following steps:

Step 1: If no power at pump panel, check the voltage at the panel. If no voltage is present, check feeder panel for tripped circuits.

Step 2: If fuses are blown or circuit breakers are tripped, remove fuses and check for continuity with ohmmeter. Replace blown fuses or reset circuit breaker. If new fuses blow or circuit breaker trips, check the electrical installation and motor.

Step 3: If motor starter overloads are burnt or have tripped out, check for voltage on line or load side of starter. Replace burnt heaters or reset. Inspect starter for other damage. If heater trips again, check the supply voltage and starter holding coil.

Step 4: If starter does not energize, energize control circuit and check voltage at the holding coil. If no voltage, check control circuit. If voltage, check holding coils for shorts. Replace bad coil.

Step 5: If defective controls, check all safety and pressure switches for operation. Inspect contacts in control devices. Replace worn or defective parts.

Step 6: If motor and/or cable are defective, turn off power. Disconnect motor leads from control box. Measure the lead-to-lead resistances with the ohmmeter (Rx1). Measure lead-to-ground values with ohmmeter (Rx100K). Record measured values. If open motor winding or grounding is found, remove pump and recheck values at the surface. Repair or replace motor or cable.

Step 7: After rectifying the issue, reset the alarm. If it is not cleared, contact the manufacturer for technical support at 1-905-491-6620 or 1-913-227-3500.

6.8.1.39 Fire Flow/Bypass Valve Fail to Close

In normal operations of the WTP, the fireflow/bypass valve remains closed. Fireflow Valve Fail to Close alarm should occur when the plant is switched back to normal mode after the truck fills, during an event of fire, and the bypass flow valve (ZV-003) fail to close.

To troubleshoot the issue, complete the following steps:

Step 1: Ensure the accuracy of the alarm reading by checking the flow transmitter (FIT-004) on the fire-flow bypass line registering/displaying any value. If the flowmeter display appears to have the “normal” value (i.e., zero or no value and raw water pumping) but the HMI display an active alarm, then either the the wiring to/within the control cabinet or the PLC module may be faulty. Call a qualified electrician to resolve the problem.

Step 2: If the reading on the flow transmitter (FIT-004) displays a value, is the same as what is seen on the HMI display, then the alarm is legitimate. It indicates that the water is getting bypassed through the ZV-003 valve failure. Turn the valve HOA switch to “Hand” and manually turn off (close) the valve. The plant should be able to produce water, in an event of fire, remember to manually open the valve. Call a certified technician to replace the valve immediately.

6.8.1.40 Fire Flow/Bypass Valve Fail to Open

In normal operations of the WTP, the fireflow/bypass valve remains closed. Fireflow Valve Fail to Open alarm should occur when the plant is switched to fireflow/bypass mode for truck-fill during an event of fire, and the bypass flow valve (ZV-003) fail to open.

To troubleshoot the issue, complete the following steps:

Step 1: Ensure the accuracy of the alarm reading by checking the flow transmitter (FIT-004) on the fire-flow bypass line registering/displaying any value. If the flowmeter display appears to have the “normal” value (i.e., 1000L/min and raw water pumping) but the HMI display an active alarm, then either the wiring to/within the control cabinet or the PLC module may be faulty. Call a qualified electrician to resolve the problem.

Step 2: If the reading on the flow transmitter (FIT-004) displays no value (i.e., zero), is the same as what is seen on the HMI display, then the alarm is legitimate. It indicates that the water is not getting bypassed through the ZV-003 valve, due to failure. Turn the valve HOA switch to “Hand” and manually turn on (open) the valve. The plant should be able to provide water for the fire-flow. Remember to manually close the valve to resume normal operation of the plant after the fireflow. Call a certified technician to replace the valve immediately.

6.8.1.41 Raw Water Flow Control Valve Fail

In normal operations of the WTP, the Raw Water Flow (FCV-002) Control valve remains open. It closes during the fire-flow bypass. Raw Water Flow Control Valve Fail alarm occurs when it fails to open during normal operation or fails to close during an event of fireflow.

To troubleshoot the issue, complete the following steps:

Step 1: Ensure the accuracy of the alarm reading by checking the flow transmitter (FIT-100) on the WTP main line registering/displaying any value:

I. If the flowmeter display appears to have the "normal" value (i.e., design flowrate of 114L/min during normal operation) and raw water pumping.
II. Or, "zero" in the event of fireflow bypass; and raw water pumping.

But the HMI display an active alarm, then either the wiring to/within the control cabinet or the PLC module may be faulty. Call a qualified electrician to resolve the problem.

Step 2: If the reading on the flow transmitter (FIT-100) displays abnormal:

I. "Zero" in normal mode and raw water pumping.
II. Or, some value (greater than "zero" in fireflow/bypass) and raw water pumping.

The flow value is the same as what is seen on the HMI display, then the alarm is legitimate. It indicates that the raw water flow control valve has failed. Turn the valve HOA switch to "Hand" and manually turn on (open) the valve in case of normal operation or turn off (close) in event of fireflow bypass. The plant should be able to provide both drinking and fire-flow water needs. In the mean time call a certified technician to replace the valve immediately.

6.8.1.42 Flocculator Tank Level High High

Flocculation Tank High-High Level alarms occur when the level transmitter on Flocculation Tank (LIT-201) reads a water level of 1150 mm or more.

To troubleshoot this issue, complete the following steps:

Step 1: Visually inspect Flocculation Tank and check if the alarm is real.
Step 2: If the alarm is real, stop production by switching the Permeate (Treated Water) Demand HOA switch to OFF. Then turn the Transfer Pump HOA switch to OFF. Allow the Flocculation Tank to drain through the overflow, which directs water to the wastewater sump. Reset the alarm and return all components to its normal operating position. If the alarm persists, check the level transmitter (see below).

Step 3: If the alarm is not real, reset the alarm by selecting “Alarm Reset” on the “Plant Overview” screen. If the alarm is still active, check the level transmitter for damage or defectiveness. Repair or replace as required. If it appears to be O.K., recalibrate the level transmitter as per instructions in the Wika O&M Manual and reset the alarm. If the alarm persists, contact the manufacturer for technical support at 1-888-945-2872.

6.8.1.43 Flocculator Tank Level High

Flocculation Tank High Level alarms occur when the level transmitter on Flocculation Tank (LIT-201) reads a water level between 1050 mm or 1150 mm.

To troubleshoot this issue, complete the following steps:

Step 1: Visually inspect Flocculation Tank and check if the alarm is real.
Step 2: If the alarm is real, stop production by switching the Permeate (Treated Water) Demand HOA switch to OFF. Then turn the Transfer Pump HOA switch to OFF. Allow the Flocculation Tank to drain through the overflow, which directs water to the wastewater sump. Reset the alarm and return all components to its normal operating position. If the alarm persists, check the level transmitter (see below).
Step 3: If the alarm is not real, reset the alarm by selecting “Alarm Reset” on the “Plant Overview” screen. If the alarm is still active, check the level transmitter for damage or defectiveness. Repair or replace as required. If it appears to be O.K., recalibrate the level transmitter as per instructions in the Wika O&M Manual and reset the alarm. If the alarm persists, contact the manufacturer for technical support at 1-888-945-2872.

6.8.1.44 Flocculator Tank Level Low

Flocculation Tank Low Level alarms occur when the level transmitter on Flocculation Tank (LIT-201) reads a water level between 800 and 900 mm.

To troubleshoot this issue, complete the following steps:

Step 1: Visually inspect Flocculation Tank and check if the alarm is real. Check for any leak.
Step 2: If the alarm is real, stop production by switching the Permeate (Treated Water) Demand HOA switch to OFF. Make sure the Raw Water Pump HOA switch is in Auto. Allow the Flocculation Tank to fill up. Reset the alarm and return all components to its normal operating position. If the alarm persists, check the level transmitter (see below).
Step 3: If the alarm is not real, reset the alarm by selecting “Alarm Reset” on the “Plant Overview” screen. If the alarm is still active, check the level transmitter for damage or defectiveness. Repair or replace as required. If it appears to be O.K., recalibrate the level transmitter as per instructions in the Wika O&M Manual and reset the alarm. If the alarm persists, contact the manufacturer for technical support at 1-888-945-2872.

6.8.1.45 Flocculator Tank Level Low Low

Flocculation Tank High-High Level alarms occur when the level transmitter on Flocculation Tank (LIT-201) reads a water level below 800 mm.

To troubleshoot this issue, complete the following steps:

Step 1: Visually inspect Flocculation Tank and check if the alarm is real. Check for any leak. If there is a leak, immediately press the emergency shut off (and call the manufacturer).

Step 2: If the alarm is real, stop production by switching the Permeate (Treated Water) Demand HOA switch to OFF. Make sure the Raw Water Pump HOA switch is in Auto. Allow the Flocculation Tank to fill up. Reset the alarm and return all components to its normal operating position. If the alarm persists, check the level transmitter (see below).

Step 3: If the alarm is not real, reset the alarm by selecting “Alarm Reset” on the “Plant Overview” screen. If the alarm is still active, check the level transmitter for damage or defectiveness. Repair or replace as required. If it appears to be O.K., recalibrate the level transmitter as per instructions in the Wika O&M Manual and reset the alarm. If the alarm persists, contact the manufacturer for technical support at 1-888-945-2872.

6.8.1.46 Permeate Flow Switch

The permeate flow switch (ZV-310) allows the permeate to flow through the permeate pump. The Permeate Flow Switch alarm occurs when the valve fails.

To troubleshoot the issue, complete the following steps:

Step 1: Ensure the accuracy of the alarm reading by checking the flow transmitter (FIT-310) is registering/displaying any value; when water is drawn into the contact tank through the permeate pump. If the flowmeter display appears to have the “normal” value (i.e., 114L/min) but the HMI display an active alarm, then either the wiring to/within the control cabinet or the PLC module may be faulty. Call a qualified electrician to resolve the problem.

Step 2: If the reading on the flow transmitter (FIT-310) displays no value (i.e., zero), is the same as what is seen on the HMI display, then the alarm is legitimate. It indicates that the permeate is not able to flow through the valve, due to switch failure. Turn the valve HOA switch to “Hand” and manually turn on (open) the valve. The plant should be able to provide water for the normal operation. Call a certified technician to replace the flow switch immediately.

6.8.1.47 Permeate Temperature High High

Action:

Step 1: Check if the permeate temperature is higher than the 40°C on the HMI screen and compare the temperature on the Wika temperature transmitter (TT-315) to ensure the alarm is legitimate. If the display appears to have a "normal" reading, then either the transmitter, wiring to the control cabinet, wiring within the control cabinet or PLC module may be faulty. An electrician will be required to resolve the problem.

Step 2: Reset the alarm once the problem has been resolved.

6.8.1.48 Permeate Water Temperature High

Action:

Step 1: Check if the permeate temperature is higher than the 35°C on the HMI screen and compare the temperature on the Wika temperature transmitter (TT-315) to ensure the alarm is legitimate. If the display appears to have a "normal" reading, then either the transmitter, wiring to the control cabinet, wiring within the control cabinet or PLC module may be faulty. An electrician will be required to resolve the problem.

Step 2: Reset the alarm once the problem has been resolved.

6.8.1.49 Permeate Temperature Low Low

Action:

Step 1: Check if the permeate temperature is higher than the 0°C on the HMI screen and compare the temperature on the Wika temperature transmitter (TT-315) to ensure the alarm is legitimate. If the display appears to have a "normal" reading, then either the transmitter, wiring to the control cabinet, wiring within the control cabinet or PLC module may be faulty. An electrician will be required to resolve the problem.

Step 2: Reset the alarm once the problem has been resolved.

6.8.1.50 Permeate Temperature Low

Action:

Step 1: Check if the permeate temperature is below 5°C on the HMI screen and compare the temperature on the Wika temperature transmitter (TT-315) to ensure the alarm is

legitimate. If the display appears to have a “normal” reading, then either the transmitter, wiring to the control cabinet, wiring within the control cabinet or PLC module may be faulty. An electrician will be required to resolve the problem.

Step 2: Reset the alarm once the problem has been resolved.

6.8.1.51 CT Tank Chlorine High High

CT Tank High High Chlorine Residual alarms occur when the chlorine analyzer (AIT-351) reads a free chlorine residual of 5 mg/L or greater.

To troubleshoot this issue, complete the following steps:

Step 1: Check the chlorine residual displayed on the HMI screen and comparing it to the reading of the analyzer display. If the analyzer appears to have the “normal” value but the HMI displays a different value, then the analyzer wiring or the wiring to/within the PLC cabinet may be faulty. Call a qualified electrician to resolve the problem.

Step 2: If the readings are the same, then the alarm is legitimate. Check the dosing set point on the Disinfection Metering Pump. Adjust the dosing level slightly lower to bring down the chlorine residual in the CT Tank. Also check the analyzer for a defective probe. Repair and replace as required.

Step 3: After rectifying the issue, reset the alarm. If the alarm persists, recalibrate the chlorine analyzer.

Step 4: Any additional issues, contact the manufacturer for technical support at 1-412-787-2484.

6.8.1.52 CT Tank Chlorine High

CT Tank High Chlorine Residual alarms occur when the chlorine analyzer (AIT-351) reads a free chlorine residual between 4 and 5 mg/L.

To troubleshoot this issue, complete the following steps:

Step 1: Check the chlorine residual displayed on the HMI screen and comparing it to the reading of the analyzer display. If the analyzer appears to have the “normal” value but the HMI displays a different value, then the analyzer wiring or the wiring to/within the PLC cabinet may be faulty. Call a qualified electrician to resolve the problem.

Step 2: If the readings are the same, then the alarm is legitimate. Check the dosing set point on the Disinfection Metering Pump. Adjust the dosing level slightly lower to bring down the chlorine residual in the CT Tank. Also check the analyzer for a defective probe. Repair and replace as required.

Step 3: After rectifying the issue, reset the alarm. If the alarm persists, recalibrate the chlorine analyzer.

Step 4: Any additional issues, contact the manufacturer for technical support at 1-412-787-2484.

6.8.1.53 CT Tank Chlorine Low Low

CT Tank Low Low Chlorine Residual alarms occur when the chlorine analyzer (AIT-351) reads a free chlorine residual of 0 mg/L.

To troubleshoot this issue, complete the following steps:

Step 1: Check the chlorine residual displayed on the HMI screen and comparing it to the reading of the analyzer display. If the analyzer appears to have the “normal” value but the HMI displays a different value, then the analyzer wiring or the wiring to/within the PLC cabinet may be faulty. Call a qualified electrician to resolve the problem.

Step 2: If the readings are the same, then the alarm is legitimate. Check the dosing set point on the Disinfection Metering Pump. Adjust the dosing level slightly higher to bring up the chlorine residual in the CT Tank. Also check the analyzer for a defective probe. Repair and replace as required.

Step 3: After rectifying the issue, reset the alarm. If the alarm persists, recalibrate the chlorine analyzer.

Step 4: Any additional issues, contact the manufacturer for technical support at 1-412-787-2484.

6.8.1.54 CT Tank Chlorine Low

CT Tank Low Chlorine Residual alarms occur when the chlorine analyzer (AIT-351) reads a free chlorine residual of 0 mg/L.

To troubleshoot this issue, complete the following steps:

Step 1: Check the chlorine residual displayed on the HMI screen and comparing it to the reading of the analyzer display. If the analyzer appears to have the “normal” value but the HMI displays a different value, then the analyzer wiring or the wiring to/within the PLC cabinet may be faulty. Call a qualified electrician to resolve the problem.

Step 2: If the readings are the same, then the alarm is legitimate. Check the dosing set point on the Disinfection Metering Pump. Adjust the dosing level slightly higher to bring up the chlorine residual in the CT Tank. Also check the analyzer for a defective probe. Repair and replace as required.

Step 3: After rectifying the issue, reset the alarm. If the alarm persists, recalibrate the chlorine analyzer.

Step 4: Any additional issues, contact the manufacturer for technical support at 1-412-787-2484.

6.8.1.55 CT Tank pH High High

CT Tank High High pH alarms occur when the pH analyzer (AIT-352) reads a pH of 10 or more.

To troubleshoot this issue, complete the following steps:

Step 1: Check that the alarm is real by verifying and comparing the alarm set point valve with the reading from the pH analyzer. These values should match.
Step 2: Check the pH using the portable pH meter in the laboratory with the reading from the pH analyzer to ensure it is correct. If it is incorrect, recalibrate the pH analyzer as per instructions in the Prominent O&M Manual in Appendix or contact the manufacturer for technical support at 1- 412-787-2484.
Step 3: After rectifying the issue, reset the alarm.

6.8.1.56 CT Tank pH High

CT Tank High pH alarms occur when the pH analyzer (AIT-352) reads between pH of 9 and 10.

To troubleshoot this issue, complete the following steps:

Step 1: Check that the alarm is real by verifying and comparing the alarm set point valve with the reading from the pH analyzer. These values should match.
Step 2: Check the pH using the portable pH meter in the laboratory with the reading from the pH analyzer to ensure it is correct. If it is incorrect, recalibrate the pH analyzer as per instructions in the Prominent O&M Manual in Appendix or contact the manufacturer for technical support at 1- 412-787-2484.
Step 3: After rectifying the issue, reset the alarm.

6.8.1.57 CT Tank pH Low Low

CT Tank pH Low Low alarms occur when the pH analyzer (AIT-352) reads a pH of 5 or lower.

To troubleshoot this issue, complete the following steps:

Step 1: Check that the alarm is real by verifying and comparing the alarm set point valve with the reading from the pH analyzer. These values should match.
Step 2: Check the pH using the portable pH meter in the laboratory with the reading from the pH analyzer to ensure it is correct. If it is incorrect, recalibrate the pH analyzer as per instructions in the Prominent O&M Manual in Appendix or contact the manufacturer for technical support at 1- 412-787-2484.
Step 3: After rectifying the issue, reset the alarm.

6.8.1.58 CT Tank pH Low

CT Tank pH Low alarms occur when the pH analyzer (AIT-352) reads between pH 5 and 6.

To troubleshoot this issue, complete the following steps:

Step 1: Check that the alarm is real by verifying and comparing the alarm set point valve with the reading from the pH analyzer. These values should match.

Step 2: Check the pH using the portable pH meter in the laboratory with the reading from the pH analyzer to ensure it is correct. If it is incorrect, recalibrate the pH analyzer as per instructions in the Prominent O&M Manual in Appendix or contact the manufacturer for technical support at 1- 412-787-2484.

Step 3: After rectifying the issue, reset the alarm.

6.8.1.59 Treated Water Chlorine High High

Treated Water High High Chlorine alarms occur when the chlorine analyzer (AIT-365) reads a free chlorine residual of 5 mg/L or greater.

To troubleshoot this issue, complete the following steps:

Step 1: Check the chlorine residual displayed on the HMI screen and comparing it to the reading of the analyzer display. If the analyzer appears to have the “normal” value but the HMI displays a different value, then the analyzer wiring or the wiring to/within the PLC cabinet may be faulty.

Step 2: If the readings are the same, then the alarm is legitimate. Check the dosing set point on the Disinfection Metering Pump. Adjust the dosing level slightly lower to bring down the chlorine residual in the CT Tank. Also check the analyzer for a defective probe. Repair and replace as required.

Step 3: After rectifying the issue, reset the alarm. If the alarm persists, recalibrate the chlorine analyzer.

Step 4: Any additional issues, contact the manufacturer for technical support at 1-412-787-2484.

6.8.1.60 Treated Water Chlorine High

Treated Water High Chlorine alarms occur when the chlorine analyzer (AIT-365) reads a free chlorine residual between 4 and 5 mg/L or greater.

To troubleshoot this issue, complete the following steps:

Step 1: Check the chlorine residual displayed on the HMI screen and comparing it to the reading of the analyzer display. If the analyzer appears to have the “normal” value but the HMI displays a different value, then the analyzer wiring or the wiring to/within the PLC cabinet may be faulty.

Step 2: If the readings are the same, then the alarm is legitimate. Check the dosing set point on the Disinfection Metering Pump. Adjust the dosing level slightly lower to bring down the chlorine residual in the CT Tank. Also check the analyzer for a defective probe. Repair and replace as required.

Step 3: After rectifying the issue, reset the alarm. If the alarm persists, recalibrate the chlorine analyzer.

Step 4: Any additional issues, contact the manufacturer for technical support at 1-412-787-2484.

6.8.1.61 Treated Water Chlorine Low

Treated Water Low Chlorine Residual alarms occur when the chlorine analyzer (AIT-365) reads a free chlorine residual of 0 mg/L.

To troubleshoot this issue, complete the following steps:

Step 1: Check the chlorine residual displayed on the HMI screen and comparing it to the reading of the analyzer display. If the analyzer appears to have the “normal” value but the HMI displays a different value, then the analyzer wiring or the wiring to/within the PLC cabinet may be faulty. Call a qualified electrician to resolve the problem.

Step 2: If the readings are the same, then the alarm is legitimate. Check the dosing set point on the Disinfection Metering Pump. Adjust the dosing level slightly higher to bring up the chlorine residual in the CT Tank. Also check the analyzer for a defective probe. Repair and replace as required.

Step 3: After rectifying the issue, reset the alarm. If the alarm persists, recalibrate the chlorine analyzer.

Step 4: Any additional issues, contact the manufacturer for technical support at 1-412-787-2484.

6.8.1.62 Treated Water Chlorine Low Low

Treated Water Low Low Chlorine alarms occur when the chlorine analyzer (AIT-365) reads a free chlorine residual of 0 mg/L.

To troubleshoot this issue, complete the following steps:

Step 1: Check the chlorine residual displayed on the HMI screen and comparing it to the reading of the analyzer display. If the analyzer appears to have the “normal” value but the HMI displays a different value, then the analyzer wiring or the wiring to/within the PLC cabinet may be faulty. Call a qualified electrician to resolve the problem.

Step 2: If the readings are the same, then the alarm is legitimate. Check the dosing set point on the Disinfection Metering Pump. Adjust the dosing level slightly higher to bring up the chlorine residual in the CT Tank. Also check the analyzer for a defective probe. Repair and replace as required.

Step 3: After rectifying the issue, reset the alarm. If the alarm persists, recalibrate the chlorine analyzer.

Step 4: Any additional issues, contact the manufacturer for technical support at 1-412-787-2484.

6.8.1.63 Treated Water pH High High

Treated Water High High pH alarms occur when the pH analyzer (AIT-366) reads a pH of 10 or more.

To troubleshoot this issue, complete the following steps:

Step 1: Check that the alarm is real by verifying and comparing the alarm set point valve with the reading from the pH analyzer. These values should match.
Step 2: Check the pH using the portable pH meter in the laboratory with the reading from the pH analyzer to ensure it is correct. If it is incorrect, recalibrate the pH analyzer as per instructions in the Prominent O&M Manual in Appendix or contact the manufacturer for technical support at 1- 412-787-2484.
Step 3: After rectifying the issue, reset the alarm.

6.8.1.64 Treated Water pH High

Treated Water High pH alarms occur when the pH analyzer (AIT-366) reads between pH of 9 and 10.

To troubleshoot this issue, complete the following steps:

Step 1: Check that the alarm is real by verifying and comparing the alarm set point valve with the reading from the pH analyzer. These values should match.
Step 2: Check the pH using the portable pH meter in the laboratory with the reading from the pH analyzer to ensure it is correct. If it is incorrect, recalibrate the pH analyzer as per instructions in the Prominent O&M Manual in Appendix or contact the manufacturer for technical support at 1- 412-787-2484.
Step 3: After rectifying the issue, reset the alarm.

6.8.1.65 Treated Water pH Low

Treated Water pH alarms occur when the pH analyzer (AIT-366) reads between pH 5 and 6.

To troubleshoot this issue, complete the following steps:

Step 1: Check that the alarm is real by verifying and comparing the alarm set point valve with the reading from the pH analyzer. These values should match.
Step 2: Check the pH using the portable pH meter in the laboratory with the reading from the pH analyzer to ensure it is correct. If it is incorrect, recalibrate the pH analyzer as per

instructions in the Prominent O&M Manual in Appendix or contact the manufacturer for technical support at 1- 412-787-2484.

Step 3: After rectifying the issue, reset the alarm.

6.8.1.66 Treated Water pH Low Low

Treated Water pH Low Low alarms occur when the pH analyzer (AIT-366) reads a pH of 5 or lower.

To troubleshoot this issue, complete the following steps:

Step 1: Check that the alarm is real by verifying and comparing the alarm set point valve with the reading from the pH analyzer. These values should match.

Step 2: Check the pH using the portable pH meter in the laboratory with the reading from the pH analyzer to ensure it is correct. If it is incorrect, recalibrate the pH analyzer as per instructions in the Prominent O&M Manual in Appendix or contact the manufacturer for technical support at 1- 412-787-2484.

Step 3: After rectifying the issue, reset the alarm.

6.8.1.67 Treated Water Turbidity High High

Equalization Tank High Turbidity alarms occur when the turbidity analyzer (AIT-364) reads/displays a turbidity of 0.3 NTU or greater.

To troubleshoot this issue, complete the following steps:

Step 1: Check that the alarm is real by verifying the accuracy of the analyzer.

Step 2: Compare the reading from the turbidity analyzer with the turbidity of a treated sample taken from the EQ Tank using the portable turbidity meter in the laboratory. These values should be the same. Recalibrate the turbidity analyzer as required. Follow the instructions in the HACH O&M Manual in Appendix or contact the manufacturer for technical support at 1-800-665- 635.

Step 3: If the alarm is legitimate, then troubleshoot the GE Membrane Skid. There could be a major breach in the membrane modules which allows raw water to pass untreated. STOP production and refer to the GE Membrane O&M Manual in Appendix or contact GE for technical support at 1-866-271-5425.

Step 4: After rectifying the issue, reset the alarm.

6.8.1.68 Treated Water Turbidity High

Equalization Tank High Turbidity alarms occur when the turbidity analyzer (AIT-364) reads/displays a turbidity between 0.1 and 0.3 NTU.

To troubleshoot this issue, complete the following steps:

Step 1: Check that the alarm is real by verifying the accuracy of the analyzer.
Step 2: Compare the reading from the turbidity analyzer with the turbidity of a treated sample taken from the EQ Tank using the portable turbidity meter in the laboratory. These values should be the same. Recalibrate the turbidity analyzer as required. Follow the instructions in the HACH O&M Manual in Appendix or contact the manufacturer for technical support at 1-800-665- 635.
Step 3: If the alarm is legitimate, then troubleshoot the GE Membrane Skid. There could be a major breach in the membrane modules which allows raw water to pass untreated. STOP production and refer to the GE Membrane O&M Manual in Appendix or contact GE for technical support at 1-866-271-5425.
Step 4: After rectifying the issue, reset the alarm.

6.8.1.69 EQ Tank Level High High

EQ Tank High-High Level alarms occur when the level transmitter on EQ Tank (LT-369) reads a water level of 2300 mm or more.

To troubleshoot this issue, complete the following steps:

Step 1: Visually inspect EQ Tank and check if the alarm is real.
Step 2: If the alarm is real, stop production by switching the Permeate (Treated Water) Demand HOA switch to OFF. Allow the EQ Tank to drain through the overflow, which directs water to the wastewater sump. Reset the alarm and return all components to its normal operating position. If the alarm persists, check the level transmitter (see below).
Step 3: If the alarm is not real, reset the alarm by selecting “Alarm Reset” on the “Plant Overview” screen. If the alarm is still active, check the level transmitter for damage or defectiveness. Repair or replace as required. If it appears to be O.K., recalibrate the level transmitter as per instructions in the Wika O&M Manual and reset the alarm. If the alarm persists, contact the manufacturer for technical support at 1-888-945-2872.

6.8.1.70 EQ Tank Level High

EQ Tank High Level alarms occur when the level transmitter on EQ Tank (LT-369) reads a water level between 2250 and 2300 mm.

To troubleshoot this issue, complete the following steps:

Step 1: Visually inspect EQ Tank and check if the alarm is real.

Step 2: If the alarm is real, stop production by switching the Permeate (Treated Water) Demand HOA switch to OFF. Allow the EQ Tank to drain through the overflow, which directs water to the wastewater sump. Reset the alarm and return all components to its normal operating position. If the alarm persists, check the level transmitter (see below).

Step 3: If the alarm is not real, reset the alarm by selecting “Alarm Reset” on the “Plant Overview” screen. If the alarm is still active, check the level transmitter for damage or defectiveness. Repair or replace as required. If it appears to be O.K., recalibrate the level transmitter as per instructions in the Wika O&M Manual and reset the alarm. If the alarm persists, contact the manufacturer for technical support at 1-888-945-2872.

6.8.1.71 EQ Tank Level Low

EQ Tank Low Level alarms occur when the level transmitter on EQ Tank (LT-369) reads a water level between 50 and 350 mm.

To troubleshoot this issue, complete the following steps:

Step 1: Visually inspect EQ Tank and check if the alarm is real. Check for any leak from the tank.

Step 2: If the alarm is real, make sure the Permeate (Treated Water) Demand HOA switch is in Auto. Allow the EQ Tank to fill above the 350 mm mark. Reset the alarm and return all components to its normal operating position. If the alarm persists, check the level transmitter (see below).

Step 3: If the alarm is not real, reset the alarm by selecting “Alarm Reset” on the “Plant Overview” screen. If the alarm is still active, check the level transmitter for damage or defectiveness. Repair or replace as required. If it appears to be O.K., recalibrate the level transmitter as per instructions in the Wika O&M Manual and reset the alarm. If the alarm persists, contact the manufacturer for technical support at 1-888-945-2872.

6.8.1.72 EQ Tank Level Low Low

EQ Tank Low Low Level alarms occur when the level transmitter on EQ Tank (LT-369) reads a water level below 50 mm.

To troubleshoot this issue, complete the following steps:

Step 1: Visually inspect EQ Tank and check if the alarm is real. Check for any leak from the tank. If there is a leak, immediately press the emergency shut off (and call the manufacturer).

Step 2: If the alarm is real, make sure the Permeate (Treated Water) Demand HOA switch is in Auto. Allow the EQ Tank to fill above the 350 mm mark. Reset the alarm and return all components to its normal operating position. If the alarm persists, check the level transmitter (see below).

Step 3: If the alarm is not real, reset the alarm by selecting “Alarm Reset” on the “Plant Overview” screen. If the alarm is still active, check the level transmitter for damage or defectiveness. Repair or replace as required. If it appears to be O.K., recalibrate the level

transmitter as per instructions in the Wika O&M Manual and reset the alarm. If the alarm persists, contact the manufacturer for technical support at 1-888-945-2872.

6.8.1.73 EQ Tank Level Float Switch High High

Same as Section 6.8.1.69.

6.8.1.74 EQ Tank Level Float Switch Low Low

Same as Section 6.8.1.72.

6.8.1.75 Analyzer Recirculating Pump Fail to Start

Analyzer recirculating pump (20-P-360) fail to start alarms occur when the PLC receives a signal (or lack thereof) that indicates there is an issue with the analyzer recirculating pump. There are various scenarios that could trigger this fault alarm and therefore many solutions as well. It is recommended that the Operator review the Little Giant O&M Manual in Appendix for a full list of instructions on how to troubleshoot the Analyzer Recirculating Pump Fault.

For example, if the “pump does not run,” then contact a qualified electrician to complete the following steps:

- Step 1: If no power at pump panel, check the voltage at the panel. If no voltage is present, check feeder panel for tripped circuits.
- Step 2: If fuses are blown or circuit breakers are tripped, remove fuses and check for continuity with ohmmeter. Replace blown fuses or reset circuit breaker. If new fuses blow or circuit breaker trips, check the electrical installation and motor.
- Step 3: If motor starter overloads are burnt or have tripped out, check for voltage on line or load side of starter. Replace burnt heaters or reset. Inspect starter for other damages. If heater trips again, check the supply voltage and starter holding coil.
- Step 4: If starter does not energize, energize control circuit and check voltage at the holding coil. If no voltage, check control circuit. If voltage, check holding coils for shorts. Replace bad coil.
- Step 5: If defective controls, check all safety and pressure switches for operation. Inspect contacts in control devices. Replace worn or defective parts.
- Step 6: If motor and/or cable are defective, turn off power. Disconnect motor leads from control box. Measure the lead-to-lead resistances with the ohmmeter (Rx1). Measure lead-to-ground values with ohmmeter (Rx100K). Record measured values. If open motor winding or grounding is found, remove pump and recheck values at the surface. Repair or replace motor or cable.

Step 7: After rectifying the issue, reset the alarm. If it is not cleared, contact the manufacturer for technical support at 1-844-250-4982.

6.8.1.76 Analyzer Recirculation pump overload

Analyzer recirculating pump (20-P-360) overload alarms occur when the PLC receives a signal (or lack thereof) that indicates there is an issue with the analyzer recirculating pump. There are various scenarios that could trigger this fault alarm and therefore many solutions as well. It is recommended that the Operator review the Little Giant O&M Manual in Appendix for a full list of instructions on how to troubleshoot the Analyzer Recirculating Pump Fault.

For example, if the "pump does not run," then contact a qualified electrician to complete the following steps:

Step 1: If no power at pump panel, check the voltage at the panel. If no voltage is present, check feeder panel for tripped circuits.
Step 2: If fuses are blown or circuit breakers are tripped, remove fuses and check for continuity with ohmmeter. Replace blown fuses or reset circuit breaker. If new fuses blow or circuit breaker trips, check the electrical installation and motor.
Step 3: If motor starter overloads are burnt or have tripped out, check for voltage on line or load side of starter. Replace burnt heaters or reset. Inspect starter for other damages. If heater trips again, check the supply voltage and starter holding coil.
Step 4: If starter does not energize, energize control circuit and check voltage at the holding coil. If no voltage, check control circuit. If voltage, check holding coils for shorts. Replace bad coil.
Step 5: If defective controls, check all safety and pressure switches for operation. Inspect contacts in control devices. Replace worn or defective parts.
Step 6: If motor and/or cable are defective, turn off power. Disconnect motor leads from control box. Measure the lead-to-lead resistances with the ohmmeter (Rx1). Measure lead-to-ground values with ohmmeter (Rx100K). Record measured values. If open motor winding or grounding is found, remove pump and recheck values at the surface. Repair or replace motor or cable.
Step 7: After rectifying the issue, reset the alarm. If it is not cleared, contact the manufacturer for technical support at 1-844-250-4982.

6.8.1.77 Truck Fill Pump Fail to Start

Tuck Fill pump (P-370) fail to start alarms occur when the PLC receives a signal (or lack thereof) that indicates there is an issue with the truck fill pump. There are various scenarios that could trigger this fault alarm and therefore many solutions as well. It is recommended that the Operator review the Grundfos O&M Manual in Appendix for a full list of instructions on how to troubleshoot a Raw Water Pump fault.

For example, if the "pump does not run," then contact a qualified electrician to complete the following steps:

Step 1: If no power at pump panel, check the voltage at the panel. If no voltage is present, check feeder panel for tripped circuits.

Step 2: If fuses are blown or circuit breakers are tripped, remove fuses and check for continuity with ohmmeter. Replace blown fuses or reset circuit breaker. If new fuses blow or circuit breaker trips, check the electrical installation and motor.

Step 3: If motor starter overloads are burnt or have tripped out, check for voltage on line or load side of starter. Replace burnt heaters or reset. Inspect starter for other damages. If heater trips again, check the supply voltage and starter holding coil.

Step 4: If starter does not energize, energize control circuit and check voltage at the holding coil. If no voltage, check control circuit. If voltage, check holding coils for shorts. Replace bad coil.

Step 5: If defective controls, check all safety and pressure switches for operation. Inspect contacts in control devices. Replace worn or defective parts.

Step 6: If motor and/or cable are defective, turn off power. Disconnect motor leads from control box. Measure the lead-to-lead resistances with the ohmmeter (Rx1). Measure lead-to-ground values with ohmmeter (Rx100K). Record measured values. If open motor winding or grounding is found, remove pump and recheck values at the surface. Repair or replace motor or cable.

Step 7: After rectifying the issue, reset the alarm. If it is not cleared, contact the manufacturer for technical support at 1-905-491-6620 or 1-913-227-3500.

6.8.1.78 Truck Fill Pump Fault

Truck fill pump (P-370) fault alarms occur when the PLC receives a signal (or lack thereof) that indicates there is an issue with the truck fill pump. There are various scenarios that could trigger this fault alarm and therefore many solutions as well. It is recommended that the Operator review the Grundfos O&M Manual in Appendix for a full list of instructions on how to troubleshoot a Raw Water Pump fault.

For example, if the “pump does not deliver any liquid at start-up,” then complete the following steps:

Step 1: Ensure the suction valve is open.

Step 2: Ensure the pump has been bled of air.

Step 3: Ensure the suction line is completely primed.

Step 4: Ensure the fluid being pumped does not contain too much entrained air or gas.

Step 5: Ensure there are no air pockets in the suction line.

Step 6: Check for air entry past the shaft seal into the pump. Release the trapped air.

Step 7: Check the suction strainer. Clean or repair as required.

Step 8: Verify the pump drive rotational speed is correct.

Step 9: Check pump impeller for correct installation, damage and cleanliness. The rotation may be wrong, or the impeller may be installed backwards. Clean or repair as required.

Step 10: Check the backpressure. It may be too high. Clear any obstructions or thaw a frozen line (if applicable).

Step 11: After rectifying the issue, reset the alarm.

Step 12: If the alarm persists, contact the manufacturer for technical support at 1-913-227-3500.

6.8.1.79 Truck Fill Flow High

To troubleshoot this issue, complete the following steps:

Step 1: Silence the alarm. Ensure the accuracy of the alarm reading by checking the flow display on the Alarm Set Points screen. Compare this value to the reading of the flowmeter (FIT-373) display. If the flowmeter displays a different value, then either the flowmeter or the wiring to/within the control cabinet or the PLC module may be faulty. Call a qualified electrician to resolve the problem.

Step 2: If the reading on the flowmeter display is the same as what is seen on the HMI display, then the alarm is legitimate. It indicates that the flow is substantially more than what is required. One possible reason for this could be that both the fire-flow bypass and truck fill pumping are occurring simultaneously. Check to see whether the raw water pump (P-001) is running; fire flow bypass valve open (ZV-003); and the truck fill pump (P-370) is running simultaneously. This is very unlikely as the control panel is NOT setup to allow both fire flow and truck fill simultaneously. This indicates a possible mixing of raw and treated water. In such a situation, immediately press the emergency stop button on the control panel to shut down the plant including the raw water pump and the truckfill pump. If any water has been pumped to the trucks during this alarm, it should not be used for human consumption.

Step 3: If the alarm persists, contact the manufacturer for technical support.

6.8.1.80 Truck Fill Flow Low

To troubleshoot this issue, complete the following steps:

Step 1: Silence the alarm. Ensure the accuracy of the alarm reading by checking the flow display on the Alarm Set Points screen. Compare this value to the reading of the flowmeter (FIT-373) display. If the flowmeter displays a different value, then either the flowmeter or the wiring to/within the control cabinet or the PLC module may be faulty. Call a qualified electrician to resolve the problem.

Step 2: If the reading on the flowmeter display is the same as what is seen on the HMI display, then the alarm is legitimate. It indicates that the flow is substantially less than what is required. Check the truck fill valve both in the HMI and manually to ensure that they are working properly. If this happens during the fire flow, check the fire flow valve. Ensure the truck fill valve HOA switch or the fire flow by-pass valve HOA switch is in “AUTO” position. Attempt to manually operate these valves by moving the HOA to “HAND” position. If the valves do not open, then it indicates that there is a possible blown fuse within the control cabinet. Move the valve switch back to the “REMOTE” position after the testing. It may be necessary to have a technician to inspect the fuse and the breaker within the control cabinet. If the problem is resolved proceed to Step 4. If the valves are found to be working but the flowrates are still low on the truck fill line, proceed to Step 3.

Step 3: Check to see that the truckfill pump HOA on the control panel is in the “AUTO” position. If the HOA switch is not in the “AUTO”, switch it back to “AUTO” position. If it is in the “AUTO” position, then check that the local disconnect switch is in the “ON” position. If the handle is not in the “ON” position, switch back to the “ON” position and check the flow rate. If it is in the “ON” position already, then refer to the section and manual to trouble shoot the truck fill pump. If the problem persists, proceed to call an electrician to investigate the problem further.

Step 4: Once the problem is resolved, reset the alarm.

6.8.1.81 Air Compressor A Fail to Start

Air compressor A (AC-400) fail to start alarm occur when the PLC receives a signal (or lack thereof) that indicates there is an issue with the compressed air system. There are various scenarios that could trigger this fault alarm and therefore many solutions as well. It is recommended that the Operator review the California Air Tools O&M Manual in Appendix for a full list of instructions on how to troubleshoot an air compressor fault.

Step 1: Ensure the power is ON.

Step 2: Check for blown circuit fuses. Repair or replace as required.

Step 3: Check for thermal overload fuses that have tripped. Repair or replace as required.

Step 4: Check the voltage. Low voltage may cause this issue.

Step 5: Check for a faulty start switch.

Step 6: Check the pressure switch and ensure that is correctly adjusted and not faulty. Repair or replace as required.

Step 7: Check for any loose or broken wires.

Step 8: Check the motor. It may be defective. Repair or replace as required.

Step 9: After rectifying the issue, select “Alarm Reset” on the “Plant Overview” screen and the Compressed Air Fault alarm should be cleared. If it is not cleared, contact the manufacturer for technical support at 1-866-409-4581.

6.8.1.82 Air Compressor A Overload

Air compressor A (AC-400) overload alarm occur when the PLC receives a signal (or lack thereof) that indicates there is an issue with the compressed air system. There are various scenarios that could trigger this fault alarm and therefore many solutions as well. It is recommended that the Operator review the California Air Tools O&M Manual in Appendix for a full list of instructions on how to troubleshoot an air compressor fault.

Step 1: Check for blown circuit fuses. Repair or replace as required.

Step 2: Check for thermal overload fuses that have tripped. Repair or replace as required.

Step 3: Check the voltage. Low voltage may cause this issue.
Step 4: Check for a faulty start switch.
Step 5: Check the pressure switch and ensure that is correctly adjusted and not faulty. Repair or replace as required.
Step 6: Check for any loose or broken wires.
Step 7: Check the motor. It may be defective. Repair or replace as required.
Step 8: After rectifying the issue, select “Alarm Reset” on the “Plant Overview” screen and the Compressed Air Fault alarm should be cleared. If it is not cleared, contact the manufacturer for technical support at 1-866-409-4581.

6.8.1.83 Air Compressor B Fail to Start

Air compressor B (AC-401) fail to start alarm occur when the PLC receives a signal (or lack thereof) that indicates there is an issue with the compressed air system. There are various scenarios that could trigger this fault alarm and therefore many solutions as well. It is recommended that the Operator review the California Air Tools O&M Manual in Appendix for a full list of instructions on how to troubleshoot an air compressor fault.

Step 1: Ensure the power is ON.
Step 2: Check for blown circuit fuses. Repair or replace as required.
Step 3: Check for thermal overload fuses that have tripped. Repair or replace as required.
Step 4: Check the voltage. Low voltage may cause this issue.
Step 5: Check for a faulty start switch.
Step 6: Check the pressure switch and ensure that is correctly adjusted and not faulty. Repair or replace as required.
Step 7: Check for any loose or broken wires.
Step 8: Check the motor. It may be defective. Repair or replace as required.
Step 9: After rectifying the issue, select “Alarm Reset” on the “Plant Overview” screen and the Compressed Air Fault alarm should be cleared. If it is not cleared, contact the manufacturer for technical support at 1-866-409-4581.

6.8.1.84 Air Compressor B Overload

Air compressor B (AC-401) overload alarm occur when the PLC receives a signal (or lack thereof) that indicates there is an issue with the compressed air system. There are various scenarios that could trigger this fault alarm and therefore many solutions as well. It is recommended that the Operator review the California Air Tools O&M Manual in Appendix for a full list of instructions on how to troubleshoot an air compressor fault.

Step 1: Check for blown circuit fuses. Repair or replace as required.
Step 2: Check for thermal overload fuses that have tripped. Repair or replace as required.
Step 3: Check the voltage. Low voltage may cause this issue.

Step 4: Check for a faulty start switch.
Step 5: Check the pressure switch and ensure that is correctly adjusted and not faulty. Repair or replace as required.
Step 6: Check for any loose or broken wires.
Step 7: Check the motor. It may be defective. Repair or replace as required.
Step 8: After rectifying the issue, select “Alarm Reset” on the “Plant Overview” screen and the Compressed Air Fault alarm should be cleared. If it is not cleared, contact the manufacturer for technical support at 1-866-409-4581.

6.8.1.85 Air Blower A Fail to Start

Air Blower A fail to start alarm occur when the PLC receives a signal (or lack thereof) that indicates there is an issue with the blower air system. There are various scenarios that could trigger this fault alarm and therefore many solutions as well. It is recommended that the Operator review the Republic Manufacturing O&M Manual in Appendix for a full list of instructions on how to troubleshoot an air blower fault.

Step 1: Ensure the power is ON.
Step 2: Check for blown circuit fuses. Repair or replace as required.
Step 3: Check for thermal overload fuses that have tripped. Repair or replace as required.
Step 4: Check the voltage. Low voltage may cause this issue.
Step 5: Check for a faulty start switch.
Step 6: Check for any loose or broken wires.
Step 7: Check the impeller. It may be damaged. Repair or replace as required.
Step 8: After rectifying the issue, select “Alarm Reset” on the “Plant Overview” screen and the Compressed Air Fault alarm should be cleared. If it is not cleared, contact the manufacturer for technical support at 1- 800-847-0380.

6.8.1.86 Air Blower A Overload

Air blower A overload alarm occur when the PLC receives a signal (or lack thereof) that indicates there is an issue with the blower air system. There are various scenarios that could trigger this fault alarm and therefore many solutions as well. It is recommended that the Operator review the Republic Manufacturing O&M Manual in Appendix for a full list of instructions on how to troubleshoot an air blower fault.

Step 1: Check for blown circuit fuses. Repair or replace as required.
Step 2: Check for thermal overload fuses that have tripped. Repair or replace as required.
Step 3: Check the voltage. Low voltage may cause this issue.
Step 4: Check for a faulty start switch.
Step 5: Check the pressure switch, operating pressure or vacuum could be too high.
Step 6: Check for any loose or broken wires.

Step 7: Check the motor. It may be defective. Repair or replace as required. Check if the unit is very hot.
Step 8: After rectifying the issue, select “Alarm Reset” on the “Plant Overview” screen and the Compressed Air Fault alarm should be cleared. If it is not cleared, contact the manufacturer for technical support at 1-800-847-0380.

6.8.1.87 Air Blower B Fail to Start

Air Blower B fail to start alarm occur when the PLC receives a signal (or lack thereof) that indicates there is an issue with the blower air system. There are various scenarios that could trigger this fault alarm and therefore many solutions as well. It is recommended that the Operator review the Republic Manufacturing O&M Manual in Appendix for a full list of instructions on how to troubleshoot an air blower fault.

Step 1: Ensure the power is ON.
Step 2: Check for blown circuit fuses. Repair or replace as required.
Step 3: Check for thermal overload fuses that have tripped. Repair or replace as required.
Step 4: Check the voltage. Low voltage may cause this issue.
Step 5: Check for a faulty start switch.
Step 6: Check for any loose or broken wires.
Step 7: Check the impeller. It may be damaged. Repair or replace as required.
Step 8: After rectifying the issue, select “Alarm Reset” on the “Plant Overview” screen and the Compressed Air Fault alarm should be cleared. If it is not cleared, contact the manufacturer for technical support at 1- 800-847-0380.

6.8.1.88 Air Blower B Overload

Air blower B overload alarm occur when the PLC receives a signal (or lack thereof) that indicates there is an issue with the blower air system. There are various scenarios that could trigger this fault alarm and therefore many solutions as well. It is recommended that the Operator review the Republic Manufacturing O&M Manual in Appendix for a full list of instructions on how to troubleshoot an air blower fault.

Step 1: Check for blown circuit fuses. Repair or replace as required.
Step 2: Check for thermal overload fuses that have tripped. Repair or replace as required.
Step 3: Check the voltage. Low voltage may cause this issue.
Step 4: Check for a faulty start switch.
Step 5: Check the pressure switch, operating pressure or vacuum could be too high.
Step 6: Check for any loose or broken wires.
Step 7: Check the motor. It may be defective. Repair or replace as required. Check if the unit is very hot.

Step 8: After rectifying the issue, select “Alarm Reset” on the “Plant Overview” screen and the Compressed Air Fault alarm should be cleared. If it is not cleared, contact the manufacturer for technical support at 1-800-847-0380.

6.8.1.89 Flocculation Tank High Pressure Switch

Flocculation tank high pressure switch alarm occurs when the pressure inside the flocculation tank gets higher than the maximum value.

Step 1: Visually inspect the air line leading from the Air Blower to the Flocculation Tank and check for air blockage along the length and near fittings, connections, etc. Repair and replace as required.
Step 2: Ensure the outlet is not plugged.
Step 3: Check the pressure switch. It may be defective or set wrong. Repair or replace as required.
Step 4: Ensure the speed of blower is correct.
Step 5: Ensure the drain valve opens.
Step 6: Check the pressure relief valve. Repair or replace as required.
Step 7: After rectifying the issue, select “Alarm Reset” on the “Plant Overview” screen and the Flocculation Tank High Pressure Switch alarm should be cleared. If it is not cleared, contact the manufacturer for technical support.

6.8.1.90 Sump Pump Fail to Start

Sump pump fail to start alarm occurs when the PLC receives a signal/or a lack of it that there is an issue with the sump pump and it fails to start. It is recommended that the Operator review the Crane/Branes O&M Manual in Appendix for a full list of instructions on how to troubleshoot the sump pump.

Step 1: Check any damage to electrical connections, blown fuse, tripped breaker or other interruption to power or voltage supply.
Step 2: Motor or switch inoperative (to isolate cause, go to manual operation of pump).
Step 3: Check if float movement restricted or switch will not activate pump or is defective.
Step 4: Check if the motor is damaged or insufficient liquid level in sump.
Step 5: Once fixed, reset the alarm. If the alarm persists, contact the manufacturer for technical support 1-905- 457-6223.

6.8.1.91 Sump Pump Overload

Sump pump overload alarm occurs when the PLC receives a signal/or a lack of it that there is an issue with the sump pump and it fails to start. It is recommended that the Operator review the Crane/Branes O&M Manual in Appendix for a full list of instructions on how to troubleshoot the sump pump.

Step 1: Check any damage to electrical connections, blown fuse, tripped breaker or other interruption to power or voltage supply (usually, low voltage causes the issue).
Step 2: Check if the impeller is jammed, loose on shaft, worn or damaged, impeller cavity or inlet plugged.
Step 3: Once fixed, reset the alarm. If the alarm persists, contact the manufacturer for technical support 905- 457-6223.

6.8.1.92 Sump Pump Level Float Switch High High

Sump pump level float switch High-High Level alarms occurs when the high-high level switch is activated. This indicates an overflow situation.

To troubleshoot this issue, complete the following steps:

Step 1: Check that the alarm is real by visually inspecting the water level in the sump. If the water level is low and not overflowing, then there is an issue with the level switch or the wiring to/within the PLC cabinet. Contact an electrician to resolve the problem.
Step 2: If the sump water level is high and overflowing, IMMEDIATELY shut down the Plant manually to prevent additional wastewater entering the sump and possibly creating a flood event.
Step 3: Check the level in the Wastewater Tank. If the water level is above the inlet, coordinate a wastewater vacuum truck to the Plant to remove the wastes.
Step 4: Check the Sump Pump. Ensure that it is working properly by checking the electrical connections, fuses and motor. If it is defective, immediately remove the pump and replace it with the shelf spare. Install the shelf spare as per instructions in the Crane & Barnes O&M Manual in Appendix.
Step 5: After rectifying the issue, reset the alarm.

6.8.1.93 Sump Level Float Switch High

Sump pump level float switch High alarms occurs when the high-level switch is activated. This would lead to an overflow situation if not timely resolved.

To troubleshoot this issue, complete the following steps:

Step 1: Check that the alarm is real by visually inspecting the water level in the sump. If the water level is low and not overflowing, then there is an issue with the level switch or the wiring to/within the PLC cabinet. Contact an electrician to resolve the problem.
Step 2: If the sump water level is high and could lead to overflow, IMMEDIATELY shut down the Plant manually to prevent additional wastewater entering the sump and possibly creating a flood event.
Step 3: Check the level in the Wastewater Tank. If the water level is above the inlet, coordinate a wastewater vacuum truck to the Plant to remove the wastes.
Step 4: Check the Sump Pump. Ensure that it is working properly by checking the electrical connections, fuses and motor. If it is defective, immediately remove the pump and

replace it with the shelf spare. Install the shelf spare as per instructions in the Crane & Barnes O&M Manual in Appendix.

Step 5: After rectifying the issue, reset the alarm.

6.8.1.94 Wastewater Tank Level Float Switch High High

Wastewater Tank High-High Level alarms occurs when the water level in the tank reaches 1853 mm and the high-high level alarm is activated. This indicates an overflow situation. The overflow is directed outside of the building. Prevention of this action and minimizing the overflow volumes are a priority.

To troubleshoot this issue, complete the following steps:

Step 1: Check that the alarm is real by visually inspecting the water level in the Wastewater Tank. If the water level is low and not overflowing, then there is an issue with the level switch or the wiring to/within the PLC cabinet. Contact an electrician to resolve the problem.

Step 2: If the wastewater level is high and overflowing, IMMEDIATELY shut down the Plant manually to prevent additional wastewater entering the Wastewater Tank and allowing more overflow discharge to the surface outside.

6.8.1.95 Wastewater Tank Level Float Switch High

This could lead to an overflow situation. The overflow is directed outside of the building. Prevention of this action and minimizing the overflow volumes are a priority.

To troubleshoot this issue, complete the following steps:

Step 1: Check that the alarm is real by visually inspecting the water level in the Wastewater Tank. If the water level is low and not overflowing, then there is an issue with the level switch or the wiring to/within the PLC cabinet. Contact an electrician to resolve the problem.

Step 2: If the wastewater level is high and overflowing, IMMEDIATELY shut down the Plant manually to prevent additional wastewater entering the Wastewater Tank and allowing more overflow discharge to the surface outside.

6.8.1.96 Diesel Tank Level Low

Diesel Tank Low Level alarms occur when the diesel tank level transmitter/probe reads a level between 200 mm and 300 mm.

To troubleshoot this issue, complete the following steps:

Step 1: Visually inspect the diesel level inside the outdoor diesel tank and check if the alarm is real.

Step 2: If the alarm is real, immediately fill the tank with diesel and then reset the alarm. If the alarm is not real, check the level transmitter/probe for damage or defectiveness. Repair or replace as required. If it appears to be O.K., recalibrate the level transmitter/probe as per instructions in the Dwyer Flotech O&M Manual and reset the alarm. If the alarm persists, contact the manufacturer for technical support at 1- 800-872-9141.

6.8.1.97 Diesel Tank Level Low Low

Diesel Tank Low-Low Level alarms occur when the diesel tank level transmitter/probe reads a level of 200 mm or less.

To troubleshoot this issue, complete the following steps:

Step 1: Visually inspect the diesel level inside the outdoor diesel tank and check if the alarm is real.

Step 2: If the alarm is real, immediately fill the tank with diesel and then reset the alarm. If it is not real, recalibrate the level transmitter/probe as per instructions in the Dwyer Flotech O&M Manual and reset the alarm. If the alarm persists, contact the manufacturer for technical support at 1- 800-872-9141.

6.8.1.98 Diesel Tank Level High High

This scenario is a pre-overflow situation and must be addressed IMMEDIATELY or else a fuel spill is likely to occur.

NOTICE

Diesel Tank High-High Level alarms occur when the diesel tank level transmitter/probe reads a level of 1170 mm or greater.

To troubleshoot this issue, complete the following steps:

Step 1: Visually inspect the diesel level inside the outdoor diesel tank and check if the alarm is real.

Step 2: If the alarm is real and occurs during a diesel refill operation, immediately stop the diesel transfer into the diesel tank. Run the generator until the diesel level drops below the alarm set point. Refer to the Kohler O&M Manual for start-up and shutdown procedures.

Step 3: If the alarm is not real, check the level transmitter/probe for damage or defectiveness. Repair or replace as required. If it appears to be O.K., recalibrate the level transmitter/probe as per instructions in the Dwyer Flotech O&M Manual and reset the alarm. If the alarm persists, contact the manufacturer for technical support at 1- 800-872-9141.

Step 4: If a spill occurs, immediately use the absorbent spill kit located inside the WTP. Contain the spill to the best of your ability. Notify the Band Office of the spill as soon as possible and request direction on how to proceed. Seek approval for disposal of all diesel contaminated materials (soil, water, pads, etc.) and dispose the diesel contaminated materials at a pre-approved location only.

6.8.1.99 CT Disinfection Pump Fault

Disinfection Metering Pump Fault alarms occur when the PLC receives a signal (or lack thereof) that indicates there is an issue with the metering pump (MP-500). There are various scenarios that could trigger this fault alarm and therefore many solutions as well. The Operator must reference the Grundfos Alldos O&M Manual in Appendix for a full list of instructions for troubleshooting.

For example, if the “dosing pump does not run,” then complete the following steps:

Step 1: If there is no connection to the main, connect the power supply cable.
Step 2: If the mains voltage is incorrect, switch off the pump. Check voltage and motor. If the motor is faulty, return the pump for repair and replace with shelf-spare pump.
Step 3: If there is an electrical failure, return the pump for repair and replace with shelf spare pump. When installing the shelf spare, it must be re-programmed prior to use.
Step 4: If the alarm persists, contact the manufacturer for technical support at 1-905-829-9533.
Step 5: After rectifying the issue, reset the alarm.

6.8.1.100 Fire Flow Disinfection Pump Fault

Fire Flow Disinfection Pump fault alarms occur when the PLC receives a signal (or lack thereof) that indicates there is an issue with the metering pump (MP-501). There are various scenarios that could trigger this fault alarm and therefore many solutions as well. The Operator must reference the Grundfos Alldos O&M Manual in Appendix for a full list of instructions for troubleshooting.

For example, if the “dosing pump does not run,” then complete the following steps:

Step 1: If there is no connection to the main, connect the power supply cable.
Step 2: If the mains voltage is incorrect, switch off the pump. Check voltage and motor. If the motor is faulty, return the pump for repair and replace with shelf-spare pump.
Step 3: If there is an electrical failure, return the pump for repair and replace with shelf spare pump. When installing the shelf spare, it must be re-programmed prior to use.
Step 4: If the alarm persists, contact the manufacturer for technical support at 1-905-829-9533.
Step 5: After rectifying the issue, reset the alarm.

6.8.1.101 Top Up Disinfection Pump Fault

Top Up Disinfection Pump fault alarms occur when the PLC receives a signal (or lack thereof) that indicates there is an issue with the metering pump (MP-402). There are various scenarios that could trigger this fault alarm and therefore many solutions as well. The Operator must reference the Grundfos Alldos O&M Manual in Appendix for a full list of instructions for troubleshooting.

For example, if the “dosing pump does not run,” then complete the following steps:

Step 1: If there is no connection to the main, connect the power supply cable.
Step 2: If the mains voltage is incorrect, switch off the pump. Check voltage and motor. If the motor is faulty, return the pump for repair and replace with shelf-spare pump.
Step 3: If there is an electrical failure, return the pump for repair and replace with shelf spare pump. When installing the shelf spare, it must be re-programmed prior to use.
Step 4: If the alarm persists, contact the manufacturer for technical support at 1-905-829-9533.
Step 5: After rectifying the issue, reset the alarm.

7 Emergency Information

Notices, Cautions, Warnings, and Dangers emphasize important and critical instructions with associated procedures. Notes, cautions and warnings are defined as follows:

Notices:

Highlights an essential operating or maintenance procedure, condition or statement.

Caution:

Highlights an operating or maintenance procedure, practice, or condition, statement, etc., that, if not strictly observed, could result in damage to or destruction of equipment, loss of effectiveness, or health hazards to personnel.

Warning:

Highlights an operating or maintenance procedure, practice, condition, or statement, etc., that, if not strictly observed, could result in injury to or death of personnel.

Danger:

Highlights an unsafe situation or practice that, if not avoided, will result in severe injury or death.

7.1 WHMIS and MSDS

The following excerpts were taken from: https://www.canada.ca/en/health-canada/services/environmental-workplace-health/occupational-health-safety/workplace-hazardous-materials-information-system.html

The Workplace Hazardous Materials Information System (WHMIS) is Canada's hazard communication standard. The key elements of the system are cautionary labelling of containers of WHMIS "controlled products", the provision of material safety data sheets (MSDSs) and worker education programs.

WHMIS is implemented through coordinated federal, provincial and territorial legislation. Supplier labelling and MSDS requirements are set out under the Hazardous Products Act (HPA) and associated Controlled Products Regulations administered by Health Canada. Each of the thirteen provincial, territorial and federal agencies responsible for occupational safety and health have established employer WHMIS requirements within their respective jurisdiction. These requirements place an onus on employers to ensure that controlled products used, stored, handled or disposed of in the workplace are properly labelled, MSDSs are made available to workers, and workers receive education and training to ensure the safe storage, handling and use of controlled products in the workplace.

To promote national consistency in the application of WHMIS in Canada's workplaces, the government of each province and territory, as well as [the Labour Program at] Human Resources and Social Development Canada, which is responsible for workplaces under federal jurisdiction, established their respective employer requirements based on "Model [WHMIS] OSH Regulations". This model was prepared by the Occupational Health and Safety Committee of the Canadian Association of Administrators of Labour Legislation.

At the outset of the program (which came into effect on October 31, 1988), all governments agreed to undertake consultations on any proposed changes to their respective WHMIS legislation and regulations with the objective of maintaining consistency with developments in the national consensus on WHMIS. The Intergovernmental WHMIS Coordinating Committee serves as the forum for this consultation.

Please see MSDS folder (located on the wall in the process room) for more information on the lubricants, oils and chemicals within the plant.

7.2 Emergency Procedures

For chemical related emergencies, refer to the MSDS folder (located on the wall in the process room) for more information on chemical properties, exposure controls, first aid measures, handling and storage, accidental release measures and spill containment.

If a person has accidental contact with a chemical in the WTP, follow the procedure as outlined in the MSDS. There are flushing apparatus available at the WTP in case of exposure by means of:

1. Skin Contact/Absorption: Remove contaminated clothing and immediately rinse with water (via hose or faucet). Seek medical attention if irritation occurs or persists.
2. Eye Contact: Flush immediately with solution from eye wash station (located on the wall by the laboratory) for at least 20 minutes. Forcibly hold eyelids apart to ensure complete rinsing/flushing of eye tissue. Seek immediate medical attention.

The first aid kit is located in the process room of the WTP. For personal protection during chemical handling, aprons, gloves (neoprene or disposable latex) and safety glasses must be worn at all times. Extra care and time must be taken while handling chemicals.

7.2.1 Materials Handling

Use proper equipment for lifting and transporting all containers. Use sensible industrial hygiene and housekeeping practices. Wash thoroughly after handling. Avoid all situations that could lead to harmful exposure.

For the monthly CIP, it is advisable that the Operator strictly follow the instructions as outlined in the SUEZ O&M Manual.

The mixture of sodium hypochlorite (chlorine) and citric acid may create a hazardous chlorine gas, posing a severe safety hazard to all personnel within the plant. Under no circumstances should these solutions be permitted to come into contact with one another.

In summary, carefully transfer the required volume of either sodium hypochlorite or citric acid to the one liter pitcher. Remove the 2" NPT cap on the top of the membrane tank. Ensure no debris falls into membrane tank or possible damage to the membranes may occur. Set up step or ladder beside the tank. Set funnel spout inside connection. Walk back and carefully transport the pitcher to the membrane tank. Carefully pour contents in one liter pitcher into the funnel. Repeat if manual dose is more than one liter. After use, clean all lab equipment and return supplies to storage spot to reduce clutter and potential tripping hazards.

For daily laboratory testing, the same materials handling precautions apply. While handling the reagent powder pillows, single-use pH buffer rinse packages and other testing chemicals, the Operator must wear the appropriate PPE: apron, safety glasses and gloves. Do not directly inhale any of the chemicals and do not touch any unprotected skin or eyes with contaminated hands. All lab equipment must be cleaned after every use and storage in its proper place inside the available drawers or upboards/cabinets (dry and clean). Spent test solutions must be disposed off properly by means of emptying into the sink and waste (used wrappers) must be placed into the garbage can. A clean workstation ensures a more hygienic and safer environment for all personnel.

7.2.2 Spillage

In the case of accidental spills, consult the MSDS for the particular chemical prior to clean-up. Follow the step-by-step instructions and use the suggest materials, where available.

There is a wall-mounted absorbent kit in the WTP for containing and cleaning up various spills (refer to Figure 7.1). There are absorbent pads, spill containment devices, a dedicated Hazardous Waste bag and PPE (goggles, face shield, apron, and gloves) available for use.

Figure 7. 1: MSDS and Eye Wash Station

There is also a mop and a mop sink for cleaning spills, along with a phosphate-free detergent to assist with cleaning a spill. There are paper towels and a lab sink, as well. Use good judgment when deciding upon which supplies to be used to clean a spill and properly dispose off any items used to clean the spill. If further assistance is required, refer to the emergency contact list in section 7.4.

7.2.3 Containment

There are various types of containment at the WTP. The WTP itself has a 100 mm (4”) curb around the perimeter of the building to contain a potential flood of the system. There are also spill/drip trays under various equipment pieces, such as the air dryer, furnace, and chemical staging areas. They have been specified to contain 150% of its volume and/or the drain volume during operation.

7.3 Emergency Shutdown of Equipment

There are many options for a quick and safe shutdown of the plant. There is an EMERGENCY STOP button located on the PLC cabinet door that will enable the Operator to stop the Plant in the event of an emergency (refer to Figure 7.2).

Figure 7. 2: Emergency Shutdown Button

When the EMERGENCY STOP button is pressed, the WTP will shutdown safely and an emergency stop alarm will be generated. This is a major alarm and needs to be acknowledged and reset before returning the Plant to operation.

NOTICE **⚠CAUTION**

The EMERGENCY STOP button should be used for emergencies only. Under normal circumstances the plant should be stopped using the controls on the HMI and PLC.

Other means of shutdown are:

- Selecting OFF on the HOA switches on the PLC cabinet door
- Shutdown/OFF switches on individual components/motors
- Main disconnect located in the generator room

Activating the main disconnect will cut off all power to the WTP and should only be used as a last resort for emergency shutdown. The start-up procedure is extensive and with such an abrupt cut off from the main power source, some components may be damaged as a result.

The locations of the shutdown button or device on the various equipment pieces are:

- Main Service Breaker -- located on the wall beside the Generator Exhaust (refer to Figure 7.3)

Figure 7. 3: Main Service Breaker

- Raw Water Pump -- located on the wall above the intake casing (refer to Figure 7.4)

Figure 7. 4: Raw Water Pump Disconnect

- Truck Fill Pump – located on the cable tray beside the Pump (refer to Figure 7.5)

Figure 7. 5: Raw Water Pump Disconnect

- SUEZ Membrane Unit -- emergency stop mushroom button on junction box door (refer to Figure 7.6)

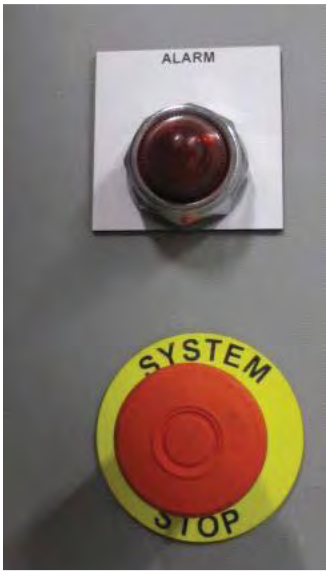


Figure 7. 6: SUEZ Membrane Skid Emergency Stop Button

- Chemical Dosing Pump -- Start/Stop Button locally on its control panel (refer to Figure 7.7)

Figure 7. 7: Chemical Dosing Pump Start/Stop Button

- Air Dryer -- locally on its control panel (refer to Figure 7.8)

Figure 7. 8: Air Dryer Stop Button

- Diesel Day Tank and Pumps -- locally on its control panel (refer to Figure 7.9)

Figure 7. 9: Diesel Day Tank Stop Button

- Furnace -- left-hand side of generator room door (when facing the exit) (refer to Figure 7.10)

Figure 7. 10: Furnace Disconnect

- Generator -- locally on its control panel (refer to Figure 7.11)

Figure 7. 11: Generator Emergency Shutdown Button

- Electrical Circuit Breaker -- inside the electrical panel with circuit breaker map/reference on inside of electrical panel door (refer to Figure 7.12)

Figure 7. 12: Circuit Breaker

- Wastewater Tank Pump Out -- on the exterior of the building and left-hand side of the wastewater Camlock connection (refer to Figure 7.13)

Figure 7. 13: Wastewater Tank Pump Out Emergency Stop Button

7.4 Emergency Personnel and Technical Contact Information

Table 7. 1: : Emergency Personnel and Technical Contact Information

Description	Contact Name	Contact Number
Emergency		
Band Office		
AWC Water Solutions Ltd.	Kaushik Biswas	604 638 0760 ext 529
SUEZ Water Technologies & Solutions	Customer Support	1-866-439-2837
Northwest Territories Power Corp.	Customer Support	1-800-661-0855
NWT Electrical Inspector		
NorthwesTel	Customer Care	1-888-423-2333
Technical Support and Sales		
Northwest Territories Power Corp.		
NorthwesTel Sales	Business Rep	1 888 423-2333
SUEZ Water Technologies & Solutions	Customer Support	1-866-439-2837
Westeel (Diesel Day Tanks)	Customer Support	1-800-665-2099
California Air Tools (Air Compressors)	Customer Support	1-866-409-4581
Air Blower System	Customer Support	1.866.544.1935
Grundfos (Raw Water Pump/Truckfill PumP))	Technical Support	1-(905) 829-9533
Goulds (Permeate Pump)	Customer Support	1-(315) 568-2811
Prominent (ph Analyzer)	Technical Support	1-888-709-9933
HACH (Turbidity Analyzer and Lab Reagents)	Technical Support	1-800-665-7635
Sureflow (Basket Strainers)	Technical Support	1-800-263-8251
Grundfos Alldos (Chemical Metering Pumps and pH/Chlorine Analyzers)	Technical Support	(905) 829-9533
ClearTech Chemical (Coagulant, Sodium Hypochlorite, Citric Acid, Sodium Hydroxide and VITA-DChlor Neutral) and Lab Equipment Sales	Customer Support and Sales	1-800-387-7503

7.5 Safety Program

A safety program is an important aspect of any business or operation and safety is the number one priority at the WTP. A safety program is used to prevent workplace injuries and occupational diseases and to deal effectively and efficiently with accidents or incidents that occur. An effective program will

identify the potential hazards, eliminate or minimize the potential for accidents/incidents and financial loss due to an accident or incident and to monitor the results for all employees to realize the progress.

7.5.1 Importance of Safety

Safety is a priority. No worker should go to work expecting to be severely or even slightly injured. Accidents, injuries and diseases that occur at work negatively affect the worker, her/her family, co-workers, and the company and place a burden on the Health Care System and applicable insurance policies. It is in everyone's best interest that accidents and injuries do not occur. There must be assurance that all safety precautions are followed and that all workers are fully trained in every safety procedure, accident response measure and overall monitoring/awareness of potential hazards and incidents at the workplace.

7.5.2 How to Implement Safety Program

There are various steps that lead to the implementation of a safety program. Examples are:

- Issuing a policy statement of the aims of the program and the responsibility for health and safety
- Regular inspections of premises, machinery, tools, equipment and work practices
- Appropriate written instructions for workers
- Periodic management meetings to discuss health and safety
- Investigation of accidents and other incidents in order to take action to prevent similar incidents
- Records and statistics
- Instruction and supervision of workers

For this WTP, regular inspections are expected and proper record keeping is a requirement.

7.6 Common Safety Hazards and Precautions

The following safety precautions must be adhered to at all times.

The following is a list of common safety hazards and precautions that must be monitored and/or performed by the Operator in order to prevent injury to self and others:

- Proper handling and storage of chemicals
- Proper use and storage of lab equipment
- Awareness and avoidance of rotating motors
- Awareness and avoidance of slips, trips and falls
- Proper use of ladder and support structures
- Awareness and avoidance of overhead objects
- Awareness of opening doors
- Awareness and safe operation of high pressure vessels
- Awareness and proper hearing protection for loud equipment
- Awareness and safe operation of electrical devices (can result in shocks, electrocution, etc.)
- Awareness and avoidance of confined space entry
- Awareness of spills and use of proper housekeeping to remove debris and potentials for slips, trips and falls.
- Awareness of hot and cold surfaces
- Awareness and safe operations regarding heavy objects
- Awareness and prevention of repetitive stress syndrome
- Awareness and use of adequate hygienic practices

8 Preventive Maintenance

Notices, Cautions, Warnings, and Dangers emphasize important and critical instructions with associated procedures. Notes, cautions and warnings are defined as follows:

Notices:

Highlights an essential operating or maintenance procedure, condition or statement.

Caution:

Highlights an operating or maintenance procedure, practice, or condition, statement, etc., that, if not strictly observed, could result in damage to or destruction of equipment, loss of effectiveness, or health hazards to personnel.

Warning:

Highlights an operating or maintenance procedure, practice, condition, or statement, etc., that, if not strictly observed, could result in injury to or death of personnel.

Danger:

Highlights an unsafe situation or practice that, if not avoided, will result in severe injury or death.

8.1 Importance of Maintenance and Accurate Records

Regular maintenance of equipment and motors minimizes the risk of replacement frequencies and premature and sudden dangerous failure. By consistently monitoring each item and applying minor adjustments on a periodic basis, the operational life cycle of the item lengthens. Not only does this save money, but it aids in general safety of operations since pieces of equipment will be less likely to suddenly and catastrophically breakdown. An additional benefit is that of improving the Operator's familiarity with the equipment, which makes daily operational tasks easier and also aids in developing an overall sense of ownership for each item.

8.2 Periodic Maintenance

The following table (Table 8.1) outlines the suggested periodic maintenance tasks to be performed in the WTP. The table is organized by schedule (daily, weekly, bi-weekly, monthly, etc.) with references to equipment-specific O&M Manuals for further information when clarification is required. This table is for **reference purposes only**.

NOTICE

Please note the Operator must reference to the manufacturers' O&M Manuals when maintaining and servicing any equipment. The schedule list below is a summary of the tasks required only and further detail is provided in the manufacturers' O&M Manuals.

8.2.1 Schedule of Maintenance Requirements

Table 8. 1: Schedule of Maintenance Requirement.

Component	Maintenance Requirements
Daily	
ALL	Fill out Daily Operating Log Sheet.
ALL	Fill out Government Weekly Log Sheet.
Membrane Skid	Cleanliness (wipe up any spills or debris). Remove any corrosion from piping or instruments.
Membrane Skid	Security of components.
Membrane Skid	Check for leaks anywhere in the system.
Chemical Pumps	Check for leaks in the chemical lines.
Air Compressor	Give compressor an overall visual inspection and be sure safety guards are in place.
Air Compressor	Check for any unusual noise or vibration.
Air Dryer	Check the suction pressure gauge. Reading should be within the specified range (BLUE RANGE) after a few minutes of start-up.
ALL	Sweep and clean floors inside the Plant.
Component	**Maintenance Requirements**
Weekly	
Data Logger	Download Data Log Files from USB key in PLC Cabinet. Click to transfer data, remove from port, insert into computer, open USB folder, transfer files to Gameti Water Treatment Plant folder, eject USB from computer, insert into port on PLC Cabinet, select AWC Banner, and then click to activate data logger.
Spill Containment	Check all spill containment pads and drip trays. Clean as required.
Outdoor Fuel Tank	Check for corrosion and leaks.
Outdoor Fuel Tank Level Indicator	Check HMI for level and refill tank if less than 20% full.
Outdoor Fuel Tank Fill and Vent Caps	Check and lock
Outdoor Fuel Tank Spill Containment	Inspect for any fuel spills.
Generator	Visually inspect and check day tank level.

Generator	Visually inspect flexible lines and connections on fuel and cooling system (and replace as needed).
Generator	Visually inspect fuel level switch.
Generator	Check main tank supply level.
Generator	Visually inspect and test solenoid valve operation as per O&M instructions
Generator	Visually inspect and test transfer pump operation as per O&M instructions.
Generator	Check and clean to remove any water in the system.
Generator	Check air cleaner to room/enclosure.
Generator	Check the block heater operation.
Generator	Visually inspect water pumps from the cooling system.
Generator	Check drain condensate trap.
Generator	Visually inspect and check leakage in exhaust system.
Generator	Visually inspect controller lamp test for AC electrical system.
Generator	Visually inspect AC electrical system.
Generator	Visually inspect alternator.
Generator	Visually inspect and check any condition of vibration, leakage, noise, temperature, or deterioration and clean as required.
Generator	Visually inspect and ensure that system is set for automatic operation.
Generator	Visually inspect interior of equipment room and clean as required.
Generator Engine	Check fuel filter.
Generator Engine	Check engine oil and coolant level.
Generator Engine	Check air cleaner dust valve and restriction indicator.
Generator Engine	Visual walk around inspection (check for fuel, oil, or coolant leaks, any signs of engine component damage or deterioration).
Furnace	Check for leaks
Air Compressors	Manually operate the pressure relief valves to be certain they are working.
Air Compressors	Clean the cooling surfaces of the intercooler and compressor.
Air Compressors	Check the compressor for air leaks.
Air Compressors	Check the compressed air distribution system for leaks.
Air Compressors	Clean or replace the air intake filter. Check more often under humid or dirty conditions.
Air Dryer	Check the fan motor for proper operation to maintain the cooling air to be drawn through the condenser and blown over the refrigerant compressor.

Component	Maintenance Requirements
Bi-Weekly	
Generator Engine & Automatic Transfer Switch	Operate engine at rated speed and 50-70% load for a minimum of 30 minutes every 2 weeks.
Exhaust Piping	Remove any ice formation (winter months only).
Component	**Maintenance Requirements**
Monthly	
Basket Strainer	Visually inspect basket strainers and clean as required.
Membrane Skid	Check water piping and air piping for leaks and cracks.
Membrane Skid	Check the Camlocks for worn or missing parts.
Membrane Skid	Check the aeration is functioning correctly by opening aeration valve SOV-202 and observing the membrane tank for bubbles.
Membrane Skid	Clean membranes with sodium hypochlorite and/or citric acid (or every three months if fouling is minimal). Never mix sodium hypochlorite and citric acid together.
Membrane Skid	Inspect the permeate pump and motor for noisy operation.
Membrane Skid: FIT-311	Clean the exterior of the meter using agents that do not attack the surface of the housing and seals
Raw Water Pump	Check water quantity, pressure, drawdown, periods of cycling and operation of controls.
Air Compressors	Check belt tension
Air Dryer	Clean the condenser to maintain the proper heat transfer on the condenser coil. See Air Dryer O&M for detailed procedure.
Generator	Visually inspect and fan and alternator belts. Replace as required.
Generator	Visually inspect battery charger operation, charge rate.
Generator	Check battery electrolyte level.
Generator	Test battery specific gravity, charge state.
Generator	Check recharge after engine start.
Generator	Visually inspect and remove corrosion, clean and dry battery and rack.
Generator	Visually inspect, check and test circuit breakers, fuses on AC electrical system. Clean and/or change as required.
Generator Engine	Service battery
Generator Engine	Visually inspect and check governor operation. Lubricate moving parts.
Furnace	Inspect, clean or replace filters as required.
Furnace	Inspect general condition of unit and look for any signs of oil leaks near the oil burner, soot forming on any external part of the furnace, soot forming around the joints in the vent pipe, etc.

Furnace	Inspect heat exchanger and clean if required. If cleaning is necessary, shut off power to the furnace.
Furnace	Inspect blower fan and clean as needed.
Emergency Lights	Test battery.
Fire Extinguishers	Check pressure gauge.
Hot Water Heater	Run hot water for five minutes and ensure it works. Check temperature as well.
Eyewash Station	Ensure flush station is equipped with enough solution.
Component	**Maintenance Requirements**
Every 3 Months	
Membrane Skid FIT - 310	Periodically clean the unit. The tapering tube may be cleaned with a soft bottle brush. Use a mild soap and water solution for cleaning purposes. Hard water can be removed with a 5% acetic acid solution (vinegar).
Membrane Skid	Where possible, remove fan cover and clean off dust from fan and airway on all motors. Use low-pressure compressed air and/or dry cloth.
Membrane Skid: PIT-303	Check for unattached or bent pointers due to extreme pressure pulsation, leakage of gauge fill, cracks or dents to case, any signs of service media leakage through the gauge or its connections, and any discoloration of the gauge that impedes readability. Fix or replace as required.
Membrane Skid: PIT-303	Broken windows should be replaced in order to keep dirt out of internal mechanisms.
Membrane Skid: PIT-303	Check diaphragm seal for failure. Replace as necessary.
Level Transmitters	Clean dust and debris from the exterior of the units.
pH Analyzer	Rinse off excess matter and wipe the sensor with a soft cloth or tissue before calibrating.
Air Compressors	Change lubricant.
Air Compressors	Torque pulley clamp screws or jamnut.
Generator	Change filters.
Generator	Visually inspect insulation, fire hazards on exhaust system.
Generator	Visually inspect, clean and tighten battery terminals.
Generator	Visually inspect and check for wire abrasions where subject to motion on AC electrical system.
Furnace	Test safety controls such as the high limit controls for functionality.
Furnace	Check fan control and ensure that the fan on and off delay function continues to start and stop the blower fan at the optimal settings.

Dampers	Check, clean and lubricate.
Damper Actuator	Check and lubricate.
Component	**Maintenance Requirements**
Every 6 Months	
Chemicals	Order more sodium hypochlorite, sodium hydroxide and citric acid, as required. Consult a ClearTech representative (1- 800-387-7503) for previous order, supply and delivery information. Make reference to the Gameti Water Treatment Plant and AWC.
Chemical Reagents and Consumables	Order more chemical reagents and consumables as required. Consult a ClearTech representative (1-800-387-7503) for previous order, supply and delivery information. Make reference to the Gameti Water Treatment Plant and AWC.
All Valves	Check and tighten union joints. Ensure no leaks.
Sump Pump	Inspect motor chamber for oil level and contamination (remove pipe plug and use flashlight). Ensure oil is clean and clear. Repair or replace as required.
Sump Pump	Inspect impeller and body for excessive build-up or clogging and repair as required. Refer to Sump Pump O&M Manual.
Sump Pump	Inspect seal for wear or leakage and repair as required. Refer to Sump Pump O&M Manual.
Analyzer Pumps	Lubricate the motor with two to three drops of S.A.E. 20 weight nondetergent oil. The oil holes are located on top at each end of the motor.
Analyzer Pumps	Check the power cord for wear and tear. Repair or replace as required.
Turbidity Analyzer (HACH)	Clean sensor as per HACH O&M Manual.
Air Compressors	Inspect compressor valves for leakage and/or carbon build-up. If excessive sludge build-up exists inside the crankcase, clean the inside of the crankcase as well as the screen. Never use a flammable or toxic solvent for cleaning. Always use a safety solvent and follow the directions provided.
Generator	Replace diesel supply as needed.
Generator	Test coolant temperature protection level.
Generator	Visually inspect flexible connectors on exhaust system.
Generator	Tighten DC electrical connections.
Generator	Check and test safety and alarm operation.

Generator Engine	Check air cleaner service and change as required.
Generator Engine	Check choke, carburetor adjustment.
Automatic Transfer Switch	Inspect unit for any signs of corrosion and clean as needed.
Potable Water Pump	Visually inspect unit and lines for any signs of wear or corrosion. Clean as needed.
Component	**Maintenance Requirements**
Annually	
Chemicals	Order more sodium hypochlorite, sodium hydroxide, VITA-DCHLOR Neutral, and/or citric acid, as required. Consult a ClearTech representative (1-800-387-7503) for previous order, supply and delivery information. Make reference to the Gameti Water Treatment Plant and AWC.
Membrane Skid	Remove membrane modules. Take pictures of the membrane modules, showing the fiber length wise. Take pictures of the end connections of the modules. Send the pictures to SUEZ Water and AWC.
Membrane Skid	Check all modules connections for wear.
Membrane Skid: LIT-302	Clean the device using a cleaning agent that will not corrode the seals and surfaces.
Membrane Skid: LIT-302	Check for mechanical damage to the diaphragm, the pipe, or the supporting cable. Repair or replace as required.
Membrane Skid: LIT-302	Verify the calibration.
Membrane Skid: PIT-303	Verify the calibration.
Membrane Skid: FIT-310	Verify the calibration.
Membrane Skid: PI-311	Verify the calibration.
Sump Pump	Inspect bearing and replace as required. Clean impeller. Refer to F-3 in Sump Pump O&M Manual.
Analyzer Pumps	Lightly clean any corrosion or debris which may clog the impeller.
Chemical Pumps	Clean the unit and hoses as per Grundfos O&M Manual. Warm water and vinegar is an effective cleaning solution.
pH and Chlorine Analyzers x 2 (Conex)	Clean the filter if high contamination is evident, or if the pressure drops considerably.

pH and Chlorine Analyzers x 2 (Conex)	Clean the whole flow armature if high (visible) contamination is evident, or is fault occurs, or before starting up again after a prolonged stoppage.
pH and Chlorine Analyzers x 2 (Conex)	Replace the pH and chlorine electrodes.
Turbidity Analyzers (AIT-104, AIT-364)	Calibrate the sensor as required. Clean the photocell window, light bulb and body, as needed.
pH Analyzer	Recalibrate as per the instrument's O&M Manual.
Lab Equipment	Inspect the pressure switch diaphragm and contacts. Inspect the contact points in the motor/starter.
Air Compressors	Inspect and clean compressor valve plates and reed valves. The reed valves are made of stainless steel and can be cleaned with a stiff bristle brush (not a wire brush). A clean safety solvent may also be used to loosen carbon deposits on the valve plates and reed valves. Handle all parts with care; do not bend, mar or scratch any sealing surfaces.
Generator	Visually inspect fuel piping.
Generator	Check tank vents and return lines for obstructions.
Generator	Check and clean air ducts, louvers on cooling system.
Generator	Clean heat exchanger.
Generator	Visually inspect, clean and test louver motors and controls.
Generator	Clean radiator exhaust.
Generator	Check water supply to heat exchanger.
Generator	Test excessive back pressure on exhaust system.
Generator	Visually inspect hangers and supports on exhaust system.
Generator	Tighten control and power wiring connections on AC electrical system.
Generator	Visually inspect and clean transfer switch main contacts.
Generator	Check and test voltage-sensing device/relay adjustment (do not break manufacturer's seals or internally inspect).
Generator	Visually inspect rotor and stator on alternator. Clean as required.
Generator	Visually inspect and check bearing condition on alternator. Replace as required.
Generator	Visually inspect and check exciter on alternator. Clean as required.

Generator	Visually inspect and check voltage regulator on alternator. Clean as required.
Generator	Measure and record resistance readings of windings with insulation tester.
Generator Engine	Change engine oil and replace filter after 100 hours maximum for first time and then every 250 hours or 12 months thereafter.
Generator Engine	Replace fuel filter element every 600 hours or 12 months.
Generator Engine	Check cooling system every 600 hours or 12 months
Generator Engine	Coolant solution analysis -- add SCA as needed every 600 hours or 12 months.
Generator Engine	Check air intake hoses, connections, and system every 600 hours or 12 months.
Generator Engine	Clean crankcase vent tube every 600 hours or 12 months.
Generator Engine	Check automatic belt tensioner and belt wear every 600 hours or 12 months.
Generator Engine	Visually inspect ignition components.
Generator Engine	Check and test injector pump and injector flow rate, pressure, spray pattern.
Unit Heater	Remove the dust accumulation inside the heater using a vacuum cleaner or compressed air. Clean slats with wet cloth. Cleaning should be done while the heater is disconnected.
Furnace	Professional servicing required. Changing the oil burner nozzle and oil filter is recommended.
Automatic Transfer Switch	Inspect all terminals (load, line and control) for tightness. Re-torque all bolts, nuts and other hardware. Clean or replace any contact surfaces that are dirty, corroded or pitted.
Automatic Transfer Switch	Check if control components are tight in sockets.
Automatic Transfer Switch	Test the transfer switch operation as per O&M Manual.
Automatic Transfer Switch	Ensure that the manual handle moves freely on the hub when the lock pin is disengaged.
Automatic Transfer Switch	Verify all program settings on the controller as per O&M Manual.

Automatic Transfer Switch	Lubricate drive hub/operator arm interface. Use high viscosity “moly” lubricant.
Hot Water Tank	Manually operate the temperature and pressure-relief valve. Lift and release the operating level on the valve to make it operate freely. If, after manually operating the valve, it fails to completely reset and continues to discharge water, replace it with a new one.
Component	**Maintenance Requirements**
2 Years or more	
Truck Fill Pump	Lubricate the motor and pump (once every three years or as required).
Raw Water Pump	Pull out of casing (when applicable), inspect and clean as required.
Generator	Visually inspect wire-cable insulation breakdown every 500 hours or 3 years. Clean as required.
Generator	Visually inspect and blow dust out of alternator every 300 hours or 2 years.
Generator Engine	Pressure test cooling system every 1200 hours or 24 months.
Generator Engine	Flushing cooling system every 1200 hours or 24 months.
Generator Engine	Check crankshaft vibration damper (6-cylinder) every 1200 hours or 24 months.
Generator Engine	Adjust droop on generator set engines every 1200 hours of 24 months.
Generator Engine	Check bolt torque every 500 hours or 3 years.
Generator Engine	Check and adjust engine valve clearance every 200 hours or 60 months (5 years).

8.2.2 Forms (Necessary for Items under Warranty)

Refer to Appendix for all applicable Warranty Disclaimers and Forms.

8.3 Equipment Suppliers and Technical Supporting Information

Refer to Appendix for Equipment Suppliers and Technical Supporting Information.

8.4 Forms and Instructions for Record Keeping of Preventive Maintenance

Refer to Appendix for all Maintenance Checklists. These include:

- Daily
- Weekly
- Bi-Weekly

- Monthly
- Quarterly
- Semi-Annually
- Annually
- Two Years (or more)