1 PROJECT TITLE

OPERATION AND MAINTENANCE MANUAL
VOLUME 1
FOR THE WATER TREATMENT PLANT
AT
TALOYOAK, NUNAVUT

Set No. _____ of _____

Year of Completion: 2011

Original Scope: Work of this Contract comprises general construction, located at Taloyoak, Nunavut; and further identified as:

- Supply of all materials and construction of the access road and truck turn around pad.
- Supply and installation of HDPE intake casing pipes.
- Supply and installation of bedding and riprap protection for the intake casing pipes.
- Supply and installation of intake screens.
- Supply and installation of HDPE intake line and pump system including heat trace system.
- Construction of earthworks and steel skid foundation for the water treatment plant.
- Supply and construction of building for the water treatment plant.
- Supply and installation of water treatment plant including cartridge filtration system, chlorination system, water storage, waste water storage and truck fill station.
- Supply and installation of mechanical, electrical and control and instrumentation systems.
- Supply and installation of HVAC system including but not limited to the furnace system and air handling systems.
- Coordinate and pay for the installation of the power supply from the existing grid to the water treatment facility.
- Coordinate and pay for the supply of telephone service to the facility.
- Supply and installation of alternative energy systems including but not limited to the solar voltaic collectors, wind generator, battery storage, and inverters.

Distribution:

Set 1: Department of Community and Government Services, Government of Nunavut, Cambridge Bay Regional Main Office
Set 2: Department of Community and Government Services, Government of Nunavut, Headquarters Main Office
Set 3: Hamlet Office, Taloyoak, NU
Set 4: Water Treatment Plant, Taloyoak, NU
Set 5: Dillon Consulting Limited, Yellowknife, NT

2 REVISION DATA

This manual has been updated to include:

Date	Description of Change
Sept. 17, 2012	Addition Madison Chlorine Tank Level Switch – Filters Section
December 10, 2020	updated contact informations

3 PROJECT REPRESENTATIVES

Owner

Hamlet of Taloyoak
General Delivery
Taloyoak, NU X0E 1B0
Contact: Janice Anderson, SAO
Phone: 867-561-2302
Fax: 867-561-5057

Owner	Government of Nunavut Department of Community and Government Services Cambridge Bay Regional Office Bag 200, Helen Maksagak Center Cambridge Bay, NU X0B 0C0 Contact: Shah Alam, P.Eng., E.P, MPE Shane Slifka, RPM Phone: 867-983-4156, 867-983-4141 Fax: 867-983-4123
General Contractor	Kitnuna, Cambridge Bay Office P.O. Box 92 Cambridge Bay, NU X0B 0C0
	Kitnuna, Edmonton Office Suite 203, 15023 123 Avenue, NW Edmonton, AB T5V 1J7 Phone: 780-447-1008 Fax: 780-447-3664
Process and Mechanical	BI Pure Water Inc. #2, 9790 190 Street Surrey BC V4N 3M9 Contact: John Kang Phone: 604-882-6650 Toll Free: 1-888-901-3111 Fax: 604-882-6659

Electrical	ADCO Power Ltd. 8750 58 Avenue Edmonton, AB T6E 6G6 Contact: Jeff Hohl Phone: 780-465-3265 Fax: 780-466-8086
Alternative Energy	EA Energy Alternatives Ltd. 5-4217 Glanford Ave Victoria, BC V8Z 4B9 Contact: Keven Pegg Phone: 250-727-0522; 1-800-265-8898 Fax: 250-727-2286
Consultant	Dillon Consulting Limited P.O. Box 1409 Suite 303, 4920 47th Street Yellowknife, NT X1A 2P1 Contact: Mr. Gary Strong, P. Eng., Project Manager Phone: 867-920-4555 Fax: 867-873-3328

APPENDIX A

SITE LOCATION

viii Greencheck BSQ70-4 Centrifugal in line Fan
ix Lennox HRV 3-150 Heat Recovery Ventilator
x Thernon 202 Heat Trace
xi Honeywell Electronic Oil Primary Control
xii Oliver MacLeod Chimney HT6000
xiii Tamco 9000 ECT Damper
xiv Totaline Easy 1H/1C and 2H/1C Thermostat

3. FILTERS
   i Harmsco Swing Bolt Water Filter
   ii Harmsco Hurricane Cartridges
   iii Hayward Simplex Basket Strainer
   iv Madison Chlorine Tank Level Switch
   v Petro Clear 40510W & 40530W Fuel Filter

4. PUMPS & TANKS
   i Dynamix Agitator IOM MMX
   ii Goulds 320L Installation Manual
   iii Grundfos Alldos DDI 209 Chemical Metering Pump
   iv Hydromatic SKV40 Waste Pump & Tank
   v Morrison Spill Container
   vi Norwesco Model 41862 378L Water Storage Tank VT0100-28
   vii Norwesco Model 40215 1136 Wastewater Storage Tank VT0300-35
   viii Plastic Mart Treated Water Storage VT0100-28
   ix Plastic Mart Waste Water Storage Tank VT0300-35
   x SHURflo 2088-492-144 Treated Water Pump
   xi Zeebest Calcium Hypochlorite Mixing and Solution Tank

5. MOTORS
   i Franklin Electric Submersible motors
   ii Hydromatic SKV 40 Sewage Ejector Pump
   iii Yaskawa AC Induction Motor Drive

6. VALVES & SWITCHES
   i Blocked Vent Shut Off Valve
   ii Bray R4 electric Actuator
   iii Bray Butterfly Valve Series 30/31
   iv Burkert Solenoid Valve
   v Crane Swing Check Valve
   vi Crane Gate Valve
   vii Crane Glove Valve
   viii Crane Ball Valve
   ix Grundfos Foot Valve with switch

ii Rheem SP2412 Hot water tank
iii Ritepro Couplings
iv Wolverine Tubing

Chapter 10 APPENDIX

1. Photo Album

3 DESIGN DATA

3.1 General

This section provides background information on Taloyoak. A description of the water treatment process, information on the water treatment process and building design as well as a description of the alarm systems in place within the water treatment plant.

3.2 Background Information

Taloyoak, the northernmost community on the Canadian mainland, is a traditional northern community. It is located 69°32´ north latitude and 93°3´ west longitude, approximately 460 km east of Cambridge Bay and 1224 km northeast of Yellowknife, sitting 26 m above sea level on the Boothia Peninsula on Stanners Harbour. The Hamlet is accessible all year round by aircraft and by barge during the summer.

Taloyoak is located within a continuous permafrost zone, which consists of bedrock terrain that is covered with a thin layer of tundra vegetation. Despite poor soil quality, various types of lichen, moss, willow, heather and wildflowers grow in the area. Wildlife in the area consists of ground squirrels, lemmings, weasels, arctic hares, arctic foxes, ringed seals and numerous species of birds and fish.

Climate for Taloyoak consists of reasonably cool summers and extremely cold winters, which is typical climate for the northern arctic. The average mean temperatures for January and July are about -30.6°C and 11.8°C, respectively. Taloyoak receives approximately on average 128.4 cm of rainfall and 141 cm of snowfall that accumulates to a mean precipitation of 223.4 mm per year.

3.3 System Description

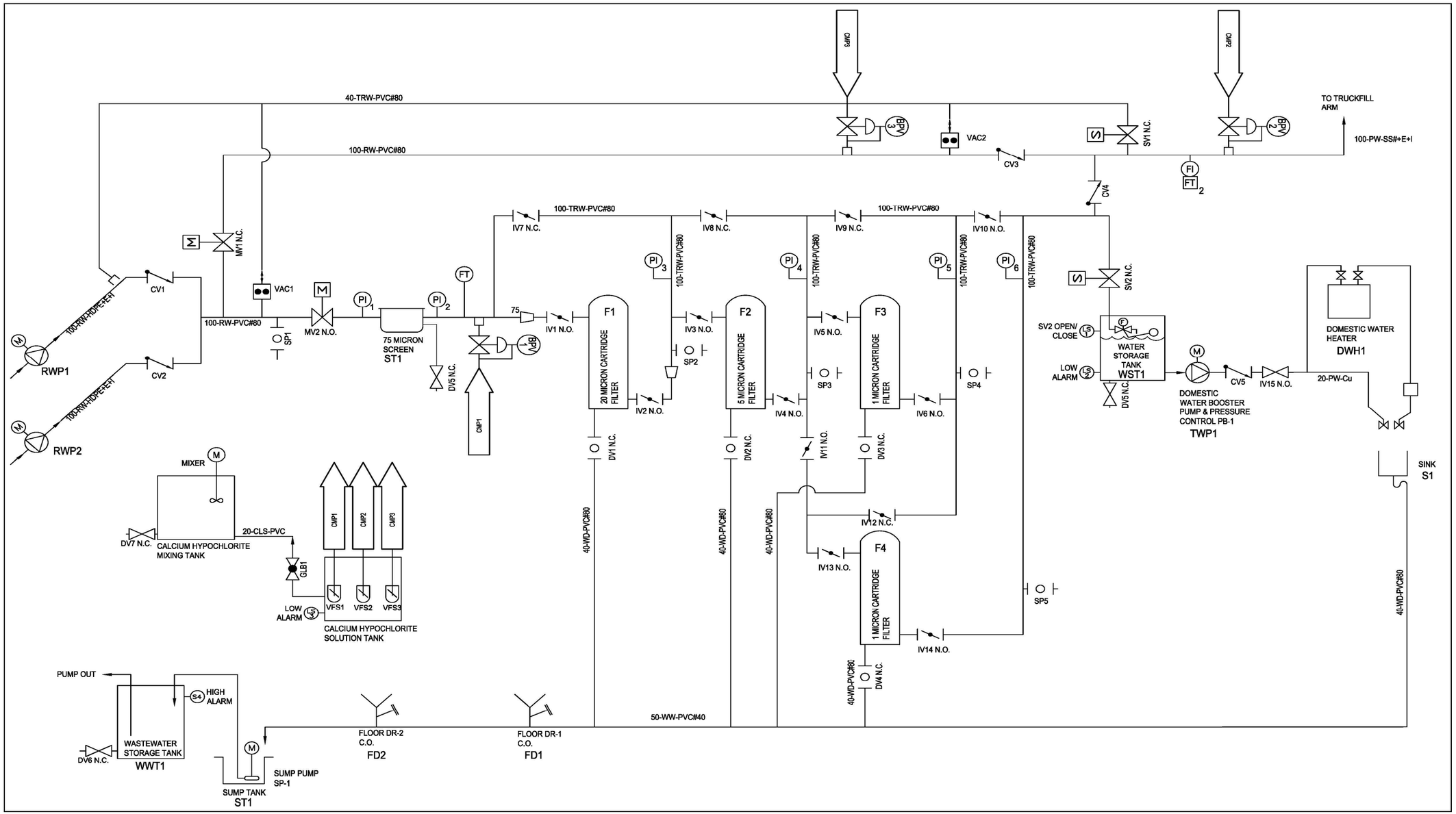

Figure 3-1: Process Schematic

3.3.1 Overview

Construction of the Water Treatment Plant (WTP) in Taloyoak, Nunavut began on 26 April, 2010.

Canso Lake was chosen as the raw water source for the community, a change from the previous source, Water Lake. This change was made due to the proximity of Water Lake to the community which presents a higher risk of contamination.

The cartridge filtration system consists of steel filter housings that contain different sizes of filter cartridges. Water disinfection is done through chlorination using powdered calcium hypochlorite.

There are two control panels: the Main Control Panel (MCP) is located in the building by the plant's operator station, the Truckfill Panel (TFP) is located outside on the truck fill arm. Treated water is transferred to the water truck following activation of a switch at the truckfill arm by the truck driver. Fire flow or bypass operation is initiated manually by the plant operator.

More detailed descriptions of all systems are shown below.

3.3.2 Raw Water Intake

Raw water is pumped from Canso Lake into the water treatment plant using a 20 hp submersible raw water pump (RWP1) rated at 28L/s (please refer to Appendix A at the end of this chapter for location). In the event that the main raw water pump fails, the system will automatically switch to the second intake pump (RWP2).

3.3.3 Filtration System

A 75 micron pre-filter screen is installed prior to raw water entering the filtration train. The screen is made up of stainless steel mesh strainer baskets, which remove dirt and debris so as to extend the operational life of filters.

The filtration stream consists of four swing bolt filter cartridge housings. The housings contain three 20 micron and five 5 micron cartridges in series, followed by two 1 micron absolute cartridges in parallel. The 1 micron absolute cartridges can be operated in series or in parallel. The 20 micron cartridge filter removes sand, silt, rust and loose scale. The 5 micron cartridge filter removes extra fine dirt, dust and particulates. Lastly, the 1 micron absolute filters provide three-log removal of Cryptosporidium and Giardia cysts and other cyst-sized particles from raw water.

Filtration System:

Nominal Flow Rate:	1,350 L/min
Operational Flow Rate:	1,000 L/min
Inflow Design Rate:	950 L/min
Filter Housing Material:	Stainless steel
Temperature Rating:	60°C (140°F)
Pressure Rating:	150 psi

All filter housings have drains that remove water from the filter; this is manual operation.

Pressure gauges are located between each filter to monitor pressure drops which will help determine if there are any upsets during any time of operation. As well, there are sampling ports along the system where samples can be taken which will assist with the monitoring of water quality during each stage of the process.

3.3.4 Treated Water Truckfill System

When there is a demand for water from the community, the solenoid valve (SV1) will open to initiate the flow of water stored in the water storage tank into the truck fill arm which fills the water distribution truck. This action is started when the water truck driver pushes the On/Off button located on the Truck Fill Panel.

During normal operation, the lead RWP will be energized on initiation. Motorized Valve 1 (MV1) is closed and Motorized Valve 2 (MV2) is open. Chlorine (as calcium hypochlorite solution) is also injected into the water entering the truck fill arm. After every truck filling, SV1 opens to allow excess water to flow back into the intake pipe casing. This removes water from the climate-exposed truck fill arm, thereby protecting the treated water from freezing in the arm.

3.3.5 Fire Flow/Bypass System

Under fire flow operation, or anytime that the plant operator wants to by-pass the filter train, the plant operator will select the “By-Pass” mode on the MCP. The by-pass mode will open MV1 and close MV2. Operation from the TFP will be the same as normal operation.

Drain water from the truckfill line and the by-pass line will be returned to the intake pipe casing by the overflow line. Solenoid Valve 1 (SV1) will open, allowing the water to drain back to the intake pipe casing after each fill cycle.

3.3.6 Disinfection System

Water disinfection is done through chlorination using powdered calcium hypochlorite. Pre-chlorination is done before and after water goes through the filtration train. Chlorine is also injected prior to the water entering the truck fill arm and storage tank. Treated water is stored in a water storage tank, goes through to the truck fill arm for the distribution of potable water using water trucks.
When the truckfill system is started, Flow Switch 1 (FS1) initiates Chemical Metering Pump 1 (CMP1) to inject chlorine into the water prior to the filtration train. When water passes through the filtration train and enters the truck fill arm, Flow Switch 2 (FS2) will initiate Chemical Metering Pump 2 (CMP2) to introduce chlorine into the water. The treated water leaves the filtration train and enters the water storage tank.

3.3.7 Power and Heating Systems

Power requirements for the Water Treatment Plant building and treatment processes will be supplied by the Alternative Energy System (AES). The AES consists of photovoltaic (PV) modules and a wind turbine, with batteries to store additional energy. Where power demands are greater than what can be produced by the AES, power provided by the Nunavut Power Corporation (NPC) via power transmission lines and/or the standby diesel generator will be used.

Heating in the WTP comes from an oil furnace and a Heat Recovery Ventilator (HRV). Heating in the AES building is supplied by oil-fired fan type heaters, heat generated from the photovoltaic system and the wind turbine generator.

3.3.8 System Backups and Redundancies

The Water Treatment Plant is designed with automatic backups for power and pumps. If one fails, the duplicate component is put into operation. The systems are designed to recover from freezing with no major damage and minimal interruptions to the operation of the Water Treatment Plant. The intake and truck fill lines are protected from freezing through the use of heat cables, which are controlled automatically.

Shelf spares are available in the Water Treatment Plant for all critical components of the treatment system in order to prevent extended plant shutdown due to component failure that requires a replacement part.

3.4 Design Data

3.4.1 Water Source

Raw water will be drawn from Canso Lake, situated northwest of the community. Refer to Appendix A for location of water source in comparison to community centre.

3.4.2 Chemical Analysis of Water Source

Water samples were taken in Canso Lake on August 8th, 2007 and October 8th, 2007. The water quality analysis revealed several exceedances to the Guidelines for Canadian Drinking Water Quality (GCDWQ), as shown below:

- Turbidity: 0.5 to 0.6 NTU;
- E.coli: < 1 MPN/100mL;
- Total Coliforms: 22 MPN/100mL

The GCDWQ limit for turbidity is 0.3 NTU for conventional treatment. The raw water is slightly exceeding the turbidity requirement for drinking water. The small presence of E.coli and total coliforms suggests an exceedance to the GCDWQ, where the limit for E.coli is 0 MPN/100mL. There is no limit presented for total coliforms. Based on this information, it was found that treatment will be required for turbidity and microbiological components. The treatment required will consist of filtration and disinfection.

The complete results of the raw water quality analysis are included in Appendix B.

3.4.3 Population Projections

The population of Taloyoak in 2007 was reported to be approximately 850 people (communicated by Stephen King, SAO Taloyoak). The average growth rate was estimated to be 2.4% over a 20-year period. This information was extrapolated to determine the population of the community in 2033 (25 year design horizon), where it is expected that the population of Taloyoak will be approximately 1761 people.

3.4.4 Water Consumption Data

It was calculated that 247.5 m^3/day of water will be required in 2033 to meet the community's needs, as per the water consumption equation provided by MACA. In addition to daily domestic demand, water will be required for emergency situations, such as a fire. The Fire Marshal of Nunavut recommended the design fire flow rate to be 1,000 L/min or 1440 m^3/day.

Table 1 shows the design flowrates for raw and treated water as well as the maximum supply pipeline pressure:

Table 1. Raw and Treated Water Design Parameters

Raw Water/Intake Pump Flow Rate	950 L/min
Fire Flow/By-Pass Flow Rate	1,000 L/min
Truckfill Arm Fill Rate	1,000 L/min
Process Flow Rate	1,000 L/min
100 mm HDPE Water Supply Pipe Line Max Pressure	100 psi

3.4.5 Climate

Climate conditions used in the design are as follows:

Table 2. Design Climate Parameters

Design Minimum Temperature		-45°C (-43°C)
Degree Days (below 18°C)		12037(11693)
Design Water Tank Storage Temperature		5.0°C
Design Operation Room Temperature		10.0°C
Design Incoming Water Temperature		0.5°C
Design Generator Room Temperature		10.0°C
Snow Load	S_S S_R	1.5 kPa(1.9 kPa) 0.1 kPa (0.1 kPa)
Wind Pressures		0.39 kPa (0.62 kPa)
Seismic	Za Zv	2 1

Source: Supplement to the National Building Code of Canada 2005, Third Edition. Cambridge Bay data used, Arctic Bay data is in brackets.

3.5 Site Development

3.5.1 Intake Line

The intake line specifications are:

- Submerged section of intake is approximately 5 m.
- The top of the intake screen is set at an elevation of approximately 17 m above sea level.
- Intake is installed within an insulated casing pipe.
- Intake pump is housed within a steel skid that allows for pump extraction.
- The skid has a steel cable attached, which leads to the off take pipe. The cable is used to extract the pump for maintenance and repairs.
- The off take pipe from the pump is 100 mm HDPE DR 17 pipe.
- The casing pipe is HDPE DR 17 300 mm diameter.
- The casing pipe consists of 63.5 mm of rigid polyurethane foam insulation and an outer jacket of 50 mm black (UV-inhibited) HDPE.
- Two heat traces are installed in the casing pipe, next to the 100 mm pipe in a copper tube.
- All heat traces are installed with controllers.

3.5.1.1 Heat Trace

A heat trace system is installed on the intake casings and pipes to prevent water from freezing. A total of four power-limiting cables will be installed, two per intake casing/pipeline. Only one heat trace cable on each intake will be operational during normal operation. The heat trace will be activated by Resistance Temperature Detectors (RTDs). A combined temperature sensor and thermostat will monitor and control the temperature of the heat trace cables. The following illustrates the heat trace set points:

Primary Cable:

Temperature low point:	5°C
Temperature high point:	8°C

Secondary Cable:

Temperature low point:	3°C
Temperature high point:	6°C

3.5.2 Turn Access and Building Pad

The truck turning access pad and building pad makes up the overall foundation for the building.

Building pad dimensions are 12.2 m X 4.5 m, grading is at a 2:1 slope throughout the perimeter.

The truck turn around pad has a radius of 15 m so that standard water distribution trucks can be used in the future. The side slopes of the building pad and turn around pad are be 3:1 (H:V). 150 mm of Type II granular material is placed on top of 500 mm Type I material. Granular materials are compacted to 95% standard proxy density.

3.5.3 Building Envelope

3.5.3.1 Water Treatment Plant

Pre-manufactured, skid-mounted building is constructed which is able to provide an insulation value of RSI 5.4 (nominal R-32).

3.5.3.2 Chlorine Room

Interior partition walls and an interior door separates the chlorine storage and mixing area from the rest of the Plant. The Chlorine Room is 1.2m by 1.6 m.

3.5.3.3 Furnace Room

The furnace is partitioned by walls to separate the furnace from the treatment system. The partitions measure approximately 2 meters.

3.5.3.4 Generator Room

The Generator Room is enclosed from the treatment section of the Water Treatment Plant by partition walls. Access for this room is from a separate entrance from the outside of the Plant.

3.5.4 Electrical and Power

Power sources for the water treatment plant come from the Alternative Energy System (which consists of a wind turbine, a photovoltaic (PV) system and batteries), the utility provider and the standby diesel generator. The wind turbine and PV system will be used as the major source of power. When power demand is low, energy is stored in batteries which will be used when power demands increase. In the event that power demands in the WTP cannot be met by the Alternative Energy System, grid power provided by the Nunavut Power Corp. will be used. If there is a grid power failure and the Alternative Energy System is insufficient to meet the power demand, the standby diesel generator will commence operation.

The Alternative Energy System (AES) consists of photovoltaic (PV) modules and a wind turbine. Under normal operation, majority of the power requirements can be supplied by either the PV modules and wind generator, or both. Any additional energy supplied by the system will be stored in batteries to be used at a later time. Therefore, during times when the power demand is greater than what can be supplied by the AES, the remaining power requirements will be supplied by energy stored in batteries, utility power and/or the backup diesel generator installed in the Water Treatment Plant. Daily energy consumption is calculated to be 60 kW-hr and system peak demand is expected to reach 20 kW.

The following depicts the specifications of different components of the Alternative Energy System:

Photovoltaic Modules:

Make & Model:	Sharp NT-175UC1
Material:	Crystal silicon
Max. Power:	175 W
Max. Power Voltage:	35.4 V
Output:	48V, 500 amp-hours
Type of Cell:	Monocrystalline silicon
Cell configuration:	72 in series

Wind Turbine Generator:

Make & Model:	Whisper 500
Rotor diameter:	4.5 m
Input:	48V DC
Rated Power:	3000 W @ 24 mph (10.5 m/s)
Frequency:	60Hz
Survival wind speed:	120 mph (55 m/s)
Blade specifications:	Carbon-reinforced fiberglass

Batteries:

Make & Model:	Unigy AVR95-27
Min no. of batteries:	48
Output:	48V, 6300 amp-hours
Autonomy days:	3.5 days @ 80% max. depth of discharge 3 days @ 68% max. depth of discharge 2.2 days @ 50% max. depth of discharge

Inverter:

Make & Model:	Xantrex XW Hybrid
Input:	48V DC
Output:	2 @ 3 x 3.6 kW ± 2%
Voltage:	120/240V
Configuration:	1-phase, 3-wire
Frequency:	60Hz

3.5.5 Fuel Source

Main fuel source for the furnace and standby generator will be arctic grade diesel. Fuel is stored in a fuel tank, and is transferred to a day tank for use in furnace/generator. The day tank pumps fuel at the required rate to run the furnace/generator.

Fuel Tank:

Make & Model:	Westeel Fuel-Vault HFV-C;conforms to ULC-S601-07
Capacity:	4540 litres
Material:	Mild Steel

Day Tank:

Make & Model:	Tramont TRS Series
Motor Specifications:	1/3 hp, 115 VAC, 60 Hz, thermally protected
Pump Specifications:	2 gpm, high lift gear pump
Capacity:	40 litres
Material:	Heavy gauge steel

3.5.6 Building Heat and Ventilation

The water treatment process building is heated by an oil furnace, oil-fired fan-type unit heaters, and a Heat Recovery Ventilator (HRV). The HRV provides fresh air into the building while exhausting an equal amount of stale air. During the cold seasons, incoming cold fresh air is warmed by using the heat recovered from the stale air before it is exhausted to the environment. Heating in the AES building is supplied from oil-fired fan type heaters, heat generated from the photovoltaic system and the wind turbine generator.

The following illustrates the heating and ventilation set points for the building:

Heat Recovery Ventilator:

Make & Model:	Lennox HRV 200-3
Max Efficiency:	69%
Voltage:	120V
Configuration:	1-phase
Frequency:	60Hz

Furnace:

Make & Model:	Beckett
Firing Rate Range:	0.40 - 3.00 GPH
Input:	56,000 – 420, 000 BTU/h
Voltage:	120V
Frequency:	60Hz
Configuration:	1-phase
Motor:	1/7 hp, 3450 rpm, NEMA 48M frame

3.6 Standby Power Generation

If there is a disruption in the power transmission lines, the automatic transfer switch initiates the standby generator and a relay switch activates the battery bank. The diesel generator and batteries in the AES are standby power sources.

Diesel Generator:

Make & Model:	John Deere PowerTech E4045
Number of Cylinders:	4
Bore:	106 mm
Stroke:	127 mm
Displacement:	4.5 L
Rated Speed:	2400 rpm
Power Rating @ Rated Speed:	45 kW
Voltage:	120V
Configuration:	1-phase
Frequency:	60Hz

3.7 Accepted Risks

Accepted risks can be described as risks that occur for which protection could not be provided.

The truck fill arms located on the exterior of the Water Treatment Plant are designed to drain any excess water from the pipe back into the wastewater collection system. The angle of the truck fill arm is

designed so that after the pumps are shut down, a solenoid valve will not sense flow and will open to release the remaining water back along the pipe into the septic tank. This prevents water from remaining in the pipe and being exposed to possible freeze-up. In the event that the pipe does freeze up, it can be thawed by the use of a Tiger Torch. To do this, apply the flame directly to the stainless steel pipe. This will thaw out the excess water and allow it to drain back into the wastewater tank where it can be properly disposed. To avoid overheating areas of unfrozen pipe, vise clamps can be used to isolate the frozen pipe sections.

3.8 Overload and Expansion Capability

The raw water pump is sized to accommodate the predicted population up to 2033. After that time, the pump will have to be changed to one of higher capacity to satisfy the community's further 25-year water requirements.

3.9 Emergency and Trouble Response

3.9.1 Alarm System

The Water Treatment Plant is also equipped with a monitoring alarm system that checks water levels, pumps, temperature and other features described in Chapter 6 – Monitoring Alarms. Alarms are categorized into major and minor alarms. The major alarms set off an auto-dialer that notifies maintenance staff with an emergency alert. Minor alarms set off a light and an alarm that rings throughout the building.

The alarm system enables the autodialer when a major trouble condition has occurred which requires the attention of the Operator. The precise trouble condition is indicated by a light on the control panel, with the exception of a complete loss of power. This condition will be apparent upon arrival at the water treatment plant.

Major alarms consist of:

- Intake pump RWP1 and RWP2 failure
- Low building temperature
- Power off – Standby Generator failure
- Very low fuel
- Heat Trace low temperature RWP1&2 and TWP1

Any alarm received should be treated as an emergency condition.

Minor trouble conditions do not enable the autodialer to transmit an alarm; they are only indicated by a light on the alarm panel and an audible alarm that can be heard within the building. The minor trouble conditions do not require the operator's immediate presence but should be taken as important.

Minor alarms consist of:

- High building temperature
- Power off – Standby Generator on
- Low fuel temperature
- High Wastewater Tank level
- Heat Trace general fault
- Generator general fault

Chapter 6 provides additional detail on all major and minor alarm conditions that could occur in the Water Treatment Plant and the procedures in mitigating and address these alarm conditions.

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4 SCHEMATIC AND FUNCTIONAL DATA

4.1 General

Chapter 4 contains tables that list all of the components in each system contained in the water treatment plant and a short description of their function.

For each system in the water treatment plant, there is a table listing each component, its function and cross reference to the attached Figure. The table will list references to the manufacturer's data that is located in Chapter 9: Manufacturer Data and Service Information.

A total of five (5) systems are shown in Chapter 4: Schematics and Functional Data.

SYSTEM	TABLE	FIGURE
Process Water Flow	Table 4.1	Figure 4.1
Plumbing System	Table 4.2	Figure 4.2
Fuel Oil System	Table 4.3	Figure 4.3
Heating and Ventilation System	Table 4.4	Figure 4.4
Single Line Diagram	Table 4.5	Figure 4.5

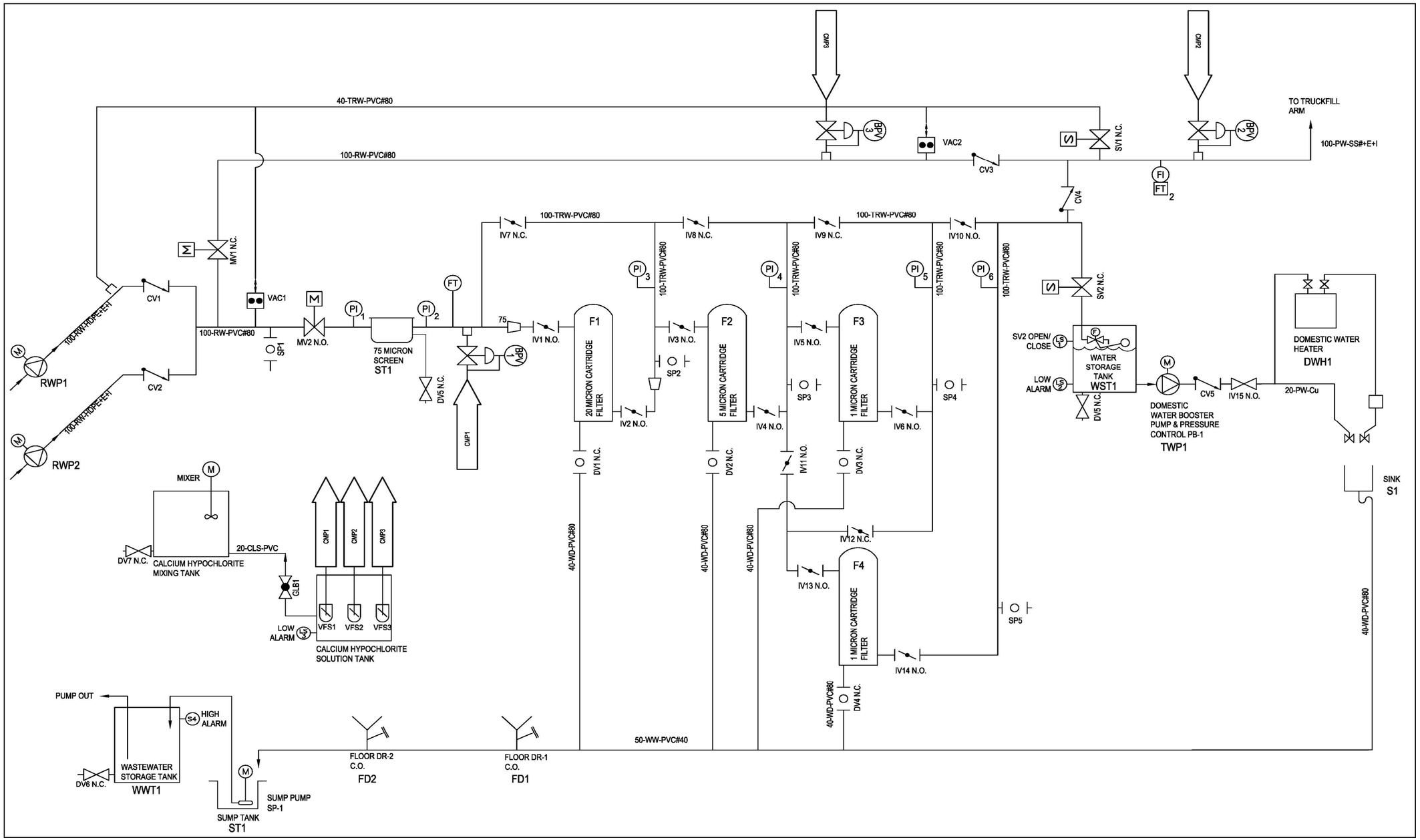


Figure 4-1: Process Water Flow

Table 4.1: Process Water Flow

Item No.	Item ID	Sec. 9 Tab	Location	Component Description	Make/Model	Function	Remarks/Notes
1	RWP1		Intake Casing 1	Raw water Pump	Goulds 320L20, 441 USgpm max flowrate, c/w Franklin Electric submersible motor model no. 236654, 6" motor dia., 200V, 3-phase, 60 Hz, 20 hp	Draws water from lake to WTP.	Normally open.
2	RWP2		Intake Casing 2	Raw water Pump	Same as Item No. 1	Draws water from lake to WTP.	Standby.
3	IV1		Upstream of Cartridge Filter #1	Isolation Valve	Bray 31/108, 75 mm butterfly valve	Isolates Cartridge Filter #1.	Normally open
4	IV2		Downstream of Cartridge Filter #1	Isolation Valve	Same as Item No. 3	Isolates Cartridge Filter #1.	Same as Item No. 3
5	IV3		Upstream of Cartridge Filter #2	Isolation Valve	Bray 31/108, 100 mm butterfly valve	Isolates Cartridge Filter #2.	Normally open
6	IV4		Downstream of Cartridge Filter #2	Isolation Valve	Same as Item No. 5	Isolates Cartridge Filter #2.	Same as Item No. 5
7	IV5		Upstream of Cartridge Filter #3	Isolation Valve	Same as Item No. 5	Isolates Cartridge Filter #3.	Same as Item No. 5
8	IV6		Downstream of Cartridge Filter #3	Isolation Valve	Same as Item No. 5	Isolates Cartridge Filter #3.	Same as Item No. 5
9	IV7		By-pass line for Cartridge Filter	Isolation Valve	Same as Item No. 5	Allows water to by-pass Cartridge Filter	Same as Item No. 5

			#1			#1.	
10	IV8		By-pass line for Cartridge Filter #2	Isolation Valve	Same as Item No. 5	Allows water to by-pass Cartridge Filter #2.	Same as Item No. 5
11	IV9		By-pass line for Cartridge Filter #3	Isolation Valve	Same as Item No. 5	Allows water to by-pass Cartridge Filter #3.	Same as Item No. 5
12	IV10		By-pass line for Cartridge Filter #4	Isolation Valve	Same as Item No. 5	Allows water to by-pass Cartridge Filter #4.	Same as Item No. 5
13	IV11		Downstream of By-pass line for Cartridge Filter #2	Isolation Valve	Same as Item No. 5	Allows water to by-pass Cartridge Filter #3.	Same as Item No. 5
14	IV12		Upstream of Cartridge Filter #4	Isolation Valve	Same as Item No. 5	Isolates Cartridge Filter #4.	Same as Item No. 5
15	IV13		Upstream of Cartridge Filter #4	Isolation Valve	Same as Item No. 5	Isolates Cartridge Filter #4.	Same as Item No. 5
16	IV14		Downstream of Cartridge Filter #4	Isolation Valve	Same as Item No. 5	Isolates Cartridge Filter #4.	Same as Item No. 5
17	IV15		Downstream of Treated Water Pump	Isolation Valve	Same as Item No. 5	Isolates Treated Water Pump.	Same as Item No. 5
18	DV1		Cartridge Filter #1	Drain Valve	Praher S6, 40 mm ball valve	Drains Cartridge Filter #1.	Normally closed
19	DV2		Cartridge Filter #2	Drain Valve	Same as Item No. 17	Drains Cartridge Filter #2.	Same as Item No. 17
20	DV3		Cartridge Filter #3	Drain Valve	Same as Item No. 17	Drains Cartridge Filter #3.	Same as Item No. 17
21	DV4		Cartridge Filter	Drain Valve	Same as Item No. 17	Drains Cartridge	Same as Item

			#4			Filter #4.	No. 17
22	DV5		Water Storage Tank	Drain Valve	Praher S6, 20 mm ball valve	Drains Water Storage Tank.	Normally closed
23	DV6		Wastewater Storage Tank	Drain Valve	Praher S6, 50 mm gate valve	Drains Wastewater Storage Tank.	Normally closed
24	DV7		Chlorine Mixing Tank	Drain Valve	Same as Item No. 21	Drains the Chlorine Mixing Tank.	Same as Item No. 21
25	CV1		Water Intake Line 1	Check Valve	Valmatic 504A, 100 mm swing check valve	Prevents backflow into Water Intake Line from RWP1.	Normally closed
26	CV2		Fireflow by-pass line	Check Valve	Same as Item No. 25	Prevents backflow from Truck fill line.	Same as Item No. 25
27	CV3		Between Fireflow and Treated Water Line	Check Valve	Same as Item No. 25	Prevents backflow of Raw Water into Treated Water.	Same as Item No. 25
28	CV4		Feed line to the Water Storage Tank	Check Valve	Crane Class 125, 20 mm swing check valve	Prevents backflow into the Blower.	Normally closed
29	CV5		Downstream of Treated Water Pump	Check Valve	Same as item no. 29	Prevents backflow into the Water Storage Tank.	
30	GLB1		Downstream of the Chlorine Mixing Tank	Globe Valve	Crane Class 150, 20 mm globe valve	Isolates the Chlorine Mixing Tank.	Normally closed
31	SV1		Truck Fill Line	Solenoid Valve at the Truck Fill Line	Burkert 5281A, 40 mm solenoid valve, 0.2 – 16 bar pressure range,	Controls Drain Valve on Truck fill Arm.	Normally closed
32	SV2		Upstream of	Solenoid	Burkert 5281A, 20 mm	Controls the fill rate	Normally closed

			line to Water Storage Tank	Valve	solenoid valve, 0.2 – 16 bar pressure range	of Water Storage Tank.	
33	MV1		Intake	Motorized Valve	Bray 70-0051-113AO, 100 mm motorized valve	Three-way control valve at Intake.	Normally closed
34	MV2		Intake	Motorized Valve	Same as Item No. 33	Three-way control valve at Intake.	Normally open
35	SP1		Raw Water Line	Sampling Port	Crane 9200 Series, 20 mm ball valve	Samples raw water entering the filter screen.	Normally closed.
36	SP2		Downstream of Cartridge Filter #1	Sampling Port	Same as Item No. 35	Samples water leaving Cartridge Filter #1.	Same as Item No. 35
37	SP3		Downstream of Cartridge Filter #2	Sampling Port	Same as Item No. 35	Samples water leaving Cartridge Filter #2.	Same as Item No. 35
38	SP4		Downstream of Cartridge Filter #3	Sampling Port	Same as Item No. 35	Samples water leaving Cartridge Filter #3.	Same as Item No. 35
39	SP5		Downstream of Cartridge Filter #4	Sampling Port	Same as Item No. 35	Samples water leaving Cartridge Filter #4.	Same as Item No. 35
40	VAC1		Upstream of the pre-filter screen	Air Vacuum Valve	Valmatic 101S	Vents gases in raw water prior to water entering pre-filter screen.	
41	VAC2		Upstream of the Truck Fill Arm	Air Vacuum Valve	Valmatic 101S	Vents gases in treated water prior to water entering the Truck Fill Arm.	
42	PI1		Upstream of the pre-filter screen	Pressure Indicator	WIKA 233.34	Measures pressure in line after raw water intake pump.	

43	PI2		Downstream of the pre-filter screen	Pressure Indicator located at the outflow of the pre-filter screen	WIKA 233.34	Measures pressure in line after pre-screen filter.	
44	PI3		Downstream of Cartridge Filter #1	Pressure Indicator	WIKA 233.34	Measures pressure in line after Cartridge Filter #1.	
45	PI4		Downstream of Cartridge Filter #2	Pressure Indicator	WIKA 233.34	Measures pressure in line after Cartridge Filter #2.	
46	PI5		Downstream of Cartridge Filter #3	Pressure Indicator	WIKA 233.34	Measures pressure in line after Cartridge Filter #3.	
47	PI6		Downstream of Cartridge Filter #4	Pressure Indicator	WIKA 233.34	Measures pressure in line after Cartridge Filter #4.	
48	VFS1		Chlorine Solution Tank	Foot Valve/Strainer	Grundfos (Kit) 91835825	Directs flow of liquid chlorine into CMP1 and prevents debris entrainment.	
49	VFS2		Chlorine Solution Tank	Foot Valve/Strainer	Same as Item No. 48	Directs flow of liquid chlorine into CMP2 and prevents debris entrainment.	
50	VFS3		Chlorine Solution Tank	Foot Valve/Strainer	Same as Item No. 48	Directs flow of liquid chlorine into CMP3 and prevents debris entrainment.	
51	CMP1		Upstream of the filter train	Chlorine Metering Pump 1	Grundfos DDI209 20-3	Adds chlorine to raw water entering filter train.	

52	CMP2		Upstream of the Truck Fill Arm	Chlorine Metering Pump 2	Grundfos DDI209 20-3	Adds chlorine to treated water entering Truck Fill Arm.	
53	CMP3		Upstream of the by-pass line	Chlorine Metering Pump 3	Grundfos DDI209 20-3	Adds chlorine to raw water entering pre-filter screen and the Water Storage Tank.	
54	BPV1		Chemical Metering Pump #1	Back Pressure Valve	Meridian Ball Valve, 3-Way L Port, Model # M21SRL	Prevents backflow of calcium hypochlorite solution.	
55	BPV2		Chemical Metering Pump #2	Back Pressure Valve	Same as Item no. 55	Same as Item no. 55.	
56	BPV3		Chemical Metering Pump #3	Back Pressure Valve	Same as Item no. 55	Same as Item no. 55.	
57	FT1		Upstream of filter train	Flow Transmitter	Endress & Hauser Proline ProMag 50W, max. pressure 40 bar, max. flow measurement 110000 m^3/h	Measures flow of raw water entering filter train.	
58	FT2		Upstream of Truck Fill Arm	Flow Transmitter	Same as Item No. 54	Measures flow of treated water entering truck fill arm.	
59	F1		Treatment Room	Cartridge Filter #1	Harmsco Hurricane filters HUR 3X170 HP, 20 micron	Removes sand, silt, rust and loose scale.	
60	F2		Treatment Room	Cartridge Filter #2	Harmsco Hurricane filters HUR 5X170 HP,	Removes extra fine dirt, dust and	

					5 micron	particulates.	
61	F3		Treatment Room	Cartridge Filter #3	Harmsco Hurricane filters HUR 5X170 HP, 1 micron absolute	Provide 3-log removal of Cryptosporidium, Giardia cysts and other cyst-sized particles from raw water.	
62	F4		Treatment Room	Cartridge Filter #4	Same as Item no. 61	Same as Item no.58.	
63			Chlorine Room	Calcium Hypochlorite Mixing Tank	Mixer: Dynamix MMX-2103D-9C7C, Tank: Zeebest Plastics OTCO 12, 45 Litres (12 US gallons), 12” (0.3m) dia. X 26” (0.66m) H, polyethylene w/ UV inhibitor	Mixes calcium hypochlorite solution.	
64			Chlorine Room	Calcium Hypochlorite Solution Tank	Zeebest Plastics OTCO 12, 45 L (12 US gallons), 12” (0.3m) dia. X 26” (0.66m) H, polyethylene w/ UV inhibitor	Stores liquid calcium hypochlorite.	
65	WST1		End of Filtration Train	Water Storage Tank	Norwesco 41862, 28” D X 81” H, 379 Litres (100 US Gallons)	Stores treated water.	
66	WWT1		Treatment Room	Wastewater Storage Tank	Norwesco 40215, 35” D X 81” H, 1136 Litres (300 US Gallons)	Stores wastewater from Sump Tank	Mounted on sleeper 50 mm above facility floor
67	DWH1		Treatment	Domestic	Rheem RE6, 6 Gallons	Heats and stores	Mounted under

			Room	Water Heater		treated water prior to supply for domestic use.	counter
68	LS1		Water Storage Tank	Level Switch		Opens and closes SV2 to initiate/end filling of water storage tank.	
69	LS2		Water Storage Tank	Level Switch		Initiates low level alarm when water level is water storage tank is below the setpoint.	
70	LS3		Calcium Hypochlorite Solution Tank	Level Switch		Initiates low level alarm when the level of calcium hypochlorite solution is below the setpoint.	
71	LS4		Wastewater Storage Tank	Level Switch		Initiates high level alarm when the level of wastewater in the tank is above the setpoint.	
72	FV		Water Storage Tank	Float Valve		Opens and closes depending on the actual treated water level in the tank.	
73	TWP1		Treatment Room	Treated Water Pump	Shurflo Park Model 2088-492-444, 0.5 hp	Boosts pressure in water supply lines to distribute domestic water throughout the WTP.	Consists of a booster pump with integrated pressure control
74	S1		Treatment Room	Sink	Kindred QSL 2020/8	Used for washing	

						and cleaning in the Water Treatment Plant.	
75	FD1		Floor of the water treatment plant	Floor Drain	Watts FD-200	Collects runoff water and waste from the floor of the plant.	Floor of the water treatment plant
76	FD2		Floor of the water treatment plant	Floor Drain	Watts FD-200	Collects runoff water and waste from the floor of the plant.	Floor of the water treatment plant
77	ST1		Treatment Room	Sump Tank	Hydromatic Series 218 Basin, 23" X 31", 50 mm PVC piping between sump pit and wastewater tank	Collects wastewater from floor drains.	Polyethylene sump tank recessed into floor, c/w pump
78	SP		Between Sump Tank and Wastewater Storage Tank	Sump Pump	Hydromatic SKV40AW110	Pumps water from Sump Tank into the Wastewater Storage Tank.	

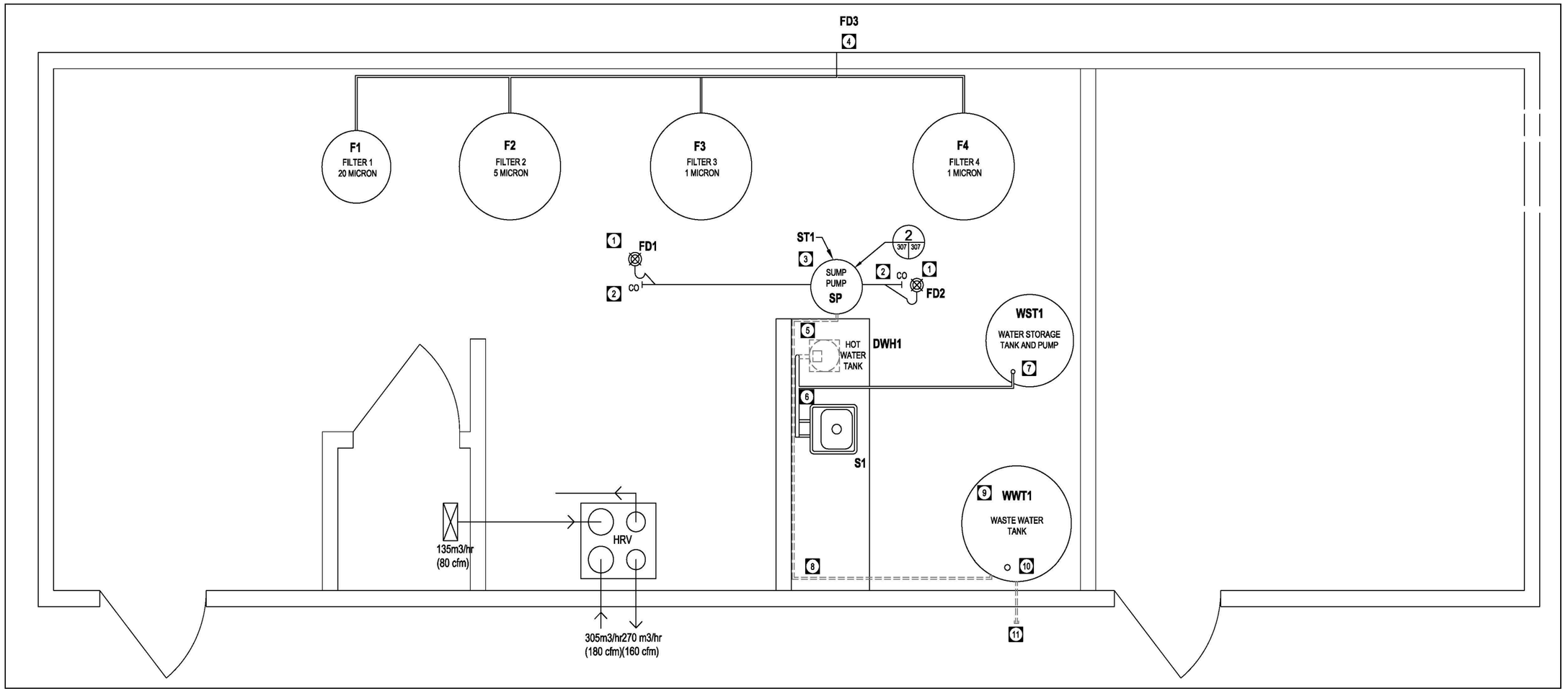
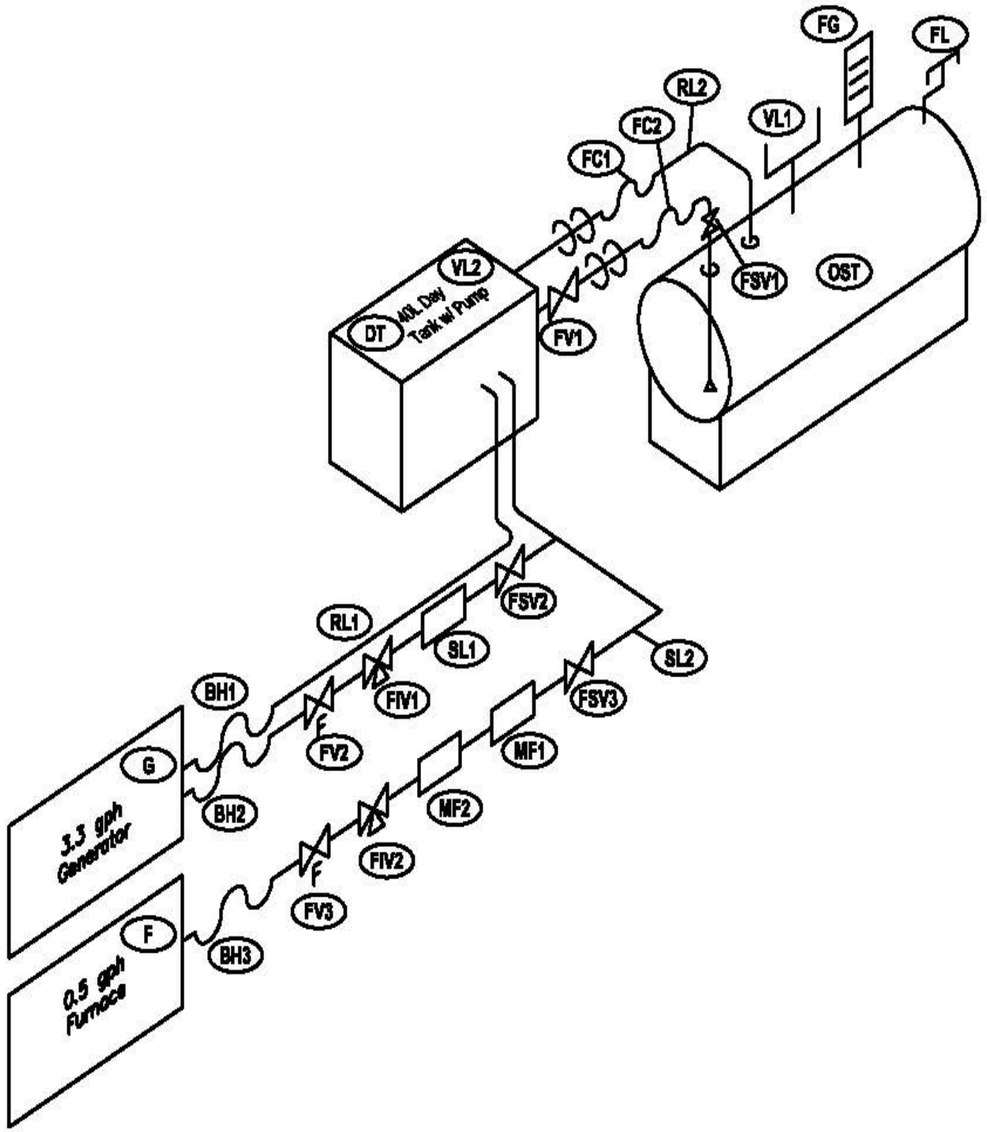


Figure 4-2: Plumbing System

Table 4.2: Plumbing System

Item No.	Item ID	Sec. 9 Tab	Location	Component Description	Make/Model	Function	Remarks/Notes
1	WST1		End of Filtration Train	Water Storage Tank	Norwesco 41862, 28" D X 81" H, 379 Litres (100 US Gallons)	Stores treated water.	
2	WWT1		Treatment Room	Wastewater Storage Tank	Norwesco 40215, 35" D X 81" H, 1136 Litres (300 US Gallons)	Stores wastewater from Sump Tank.	Mounted on sleeper 50 mm above facility floor
3	DWH1		Treatment Room	Domestic Water Heater/Tank	Rheem RE6, 6 Gallons	Heats and stores treated water prior to supply for domestic use.	Mounted under counter
4	TWP1		Treatment Room	Treated Water Pump	Shurflo Park Model 2088-492-444	Boosts pressure in water supply lines to distribute domestic water throughout the WTP.	
5	S1		Treatment Room	Sink	Kindred QSL 2020/8	Used for washing and cleaning in the Water Treatment Plant.	
6	FD1		Floor of the water treatment plant	Floor Drain	Watts FD-200	Collects runoff water and waste from the floor of the plant.	
7	FD2		Floor of the water	Floor Drain	Watts FD-200	Collects runoff water and waste	

			treatment plant			from the floor of the plant.	
8	ST1		Treatment Room	SumpTank	Hydromatic Series 218 Basin, 23" X 31", 50 mm PVC piping between sump pit and wastewater tank	Collects wastewater from floor drains.	Polyethylene sump tank recessed into floor, c/w pump
9	SP		Between Sump Tank and Wastewater Storage Tank	Sump Pump	Hydromatic SKV40AW110, 1/3 hp	Pumps water from Sump Tank into the Wastewater Storage Tank.	
10				Pumped Sanitary Discharge Line	75 mm dia.	Pumps wastewater out of WTP.	
11	CO			Cleanout		Allows access to drains for waste material cleanout purposes.	
12	CO			Cleanout		Allows access to drains for waste material cleanout purposes.	
13			Wastewater Storage Tank	Plumbing Vent		Vents gases from Wastewater Storage Tank.	Installed at high level and penetrate roof.
14			Downstream of filter train	Filter Drain	50 mm dia.	Drains water from filtration train to the outside of WTP.	



OST 4328L OIL STORAGE TANK TO BE INSTALLED ON NON COMBUSTIBLE STRUCTURE TO BUILDING FLOOR ELEVATION

FL 50mm (2") FILL W/ SECURED CAP.

FG FLOAT GAUGE

VL 31mm (1 1/4") VENT LINE W/ CAP

FC 500MM - 50MM DIA. FLEXIBLE COUPLING JUST PRIOR TO BUILDING PENATRATION

FV FUSIBLE VALVES FOR FIRE PROTECTION

DT INTEGRAL 40L DAY TANK & PUMP. TANK TO BE MOUNTED AT ELEVATION, SO THAT PUMP FEED IS ABOVE TOP OF TANK, TO AVOID SIPHONING.

SL SUPPLY LINE FROM DAY TANK TO GENERATOR AND FURNACE. 12mm Ø HEAVY WALLED COPPER TUBING FROM FUEL DAY TANK (TYPE K GREEN) REDUCED TO 9mm Ø AT FILTERS.

MF1 40 to 50 MICRON FILTER

MF2 ADDITIONAL 7 TO 10 MICRON FILTER

FIV 3-WAY BLEED & ISOLATION VALVES

BH 300mm FLEXIBLE COUPLING (ULC LISTED BRADED STAINLESS STEEL)

RL 25mm RETURN LINE

FSV FUEL SOLENOID VALVES TO CONTROL FUEL FLOW RATE.

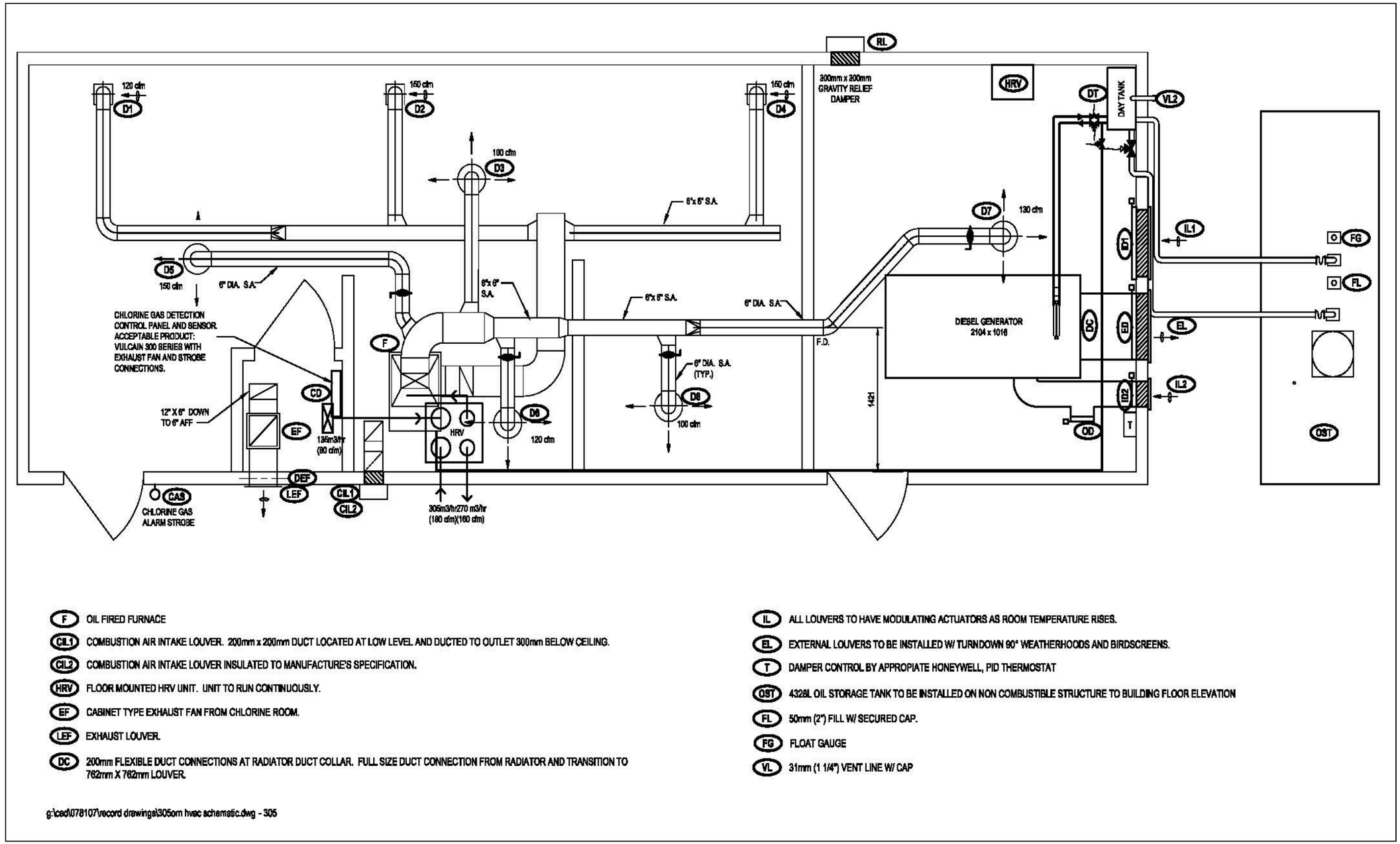
Figure 4-3: Fuel Oil System

Table 4.3 : Fuel Oil System

Item No.	Item ID	Sec. 9 Tab	Location	Component Description	Make/Model	Function	Remarks/Notes
1	G		Power Room	Generator	Stamford UC1224F, 3.3 gph, 40kW, 120/240V, 1-phase, 60 Hz, 50 kVA standby	Provides secondary power in case of primary power loss.	
2	OST		Outside of Water Treatment Plant	Oil Storage Tank	Westeel Fuel Vault, 4540 L	Stores fuel oil to supply generator and furnace.	To be installed on non-combustible structure
3	DT		Power Room	Day Tank	Tramont TRS Series, 40 Liters c/w 2 gpm pump	Provides fuel to generator and furnace.	Indoor fuel oil tank
4	F		Furnace Room	Furnace	Carrier 58CMA, oil-fired, 3450 rpm, 57 kBTUH heating capacity, 0.5 USgph firing rate	Provides heating for the WTP.	
5	FIV1		Upstream of the Generator	Fuel Isolation Valve		Isolates fuel going into the Generator.	
6	FIV2		Upstream of the Furnace	Fuel Isolation Valve		Isolates fuel going into the Furnace.	
7	BH1 & BH2		Generator	Braided Hose Connections	Silex, 300 mm dia.	Connection transfers pipe into braided hose to connect to component.	
8	BH3		Furnace	Braided Hose Connection	Same as Item No. 9	Connection transfers pipe into braided hose to connect to component.	
9	FC1		Prior to	Flexible	500 mm dia.	Connects Oil Storage	

	& FC2		building penetration	Coupling		Tank to Day Tank	
10	FSV1		Upstream of the Day Tank	Fuel Solenoid Valve		Control flow of fuel into the Day Tank.	
11	FSV2		Upstream of the Generator	Fuel Solenoid Valve		Controls flow of fuel into the Generator.	
12	FSV3		Upstream of the Furnace	Fuel Solenoid Valve		Controls flow of fuel into the Furnace.	
13	FV1		Downstream of the Oil Storage Tank	Fusible Valve		Fire protection.	
14	FV2		Upstream of Generator	Fusible Valve		Fire protection.	
15	FV3		Upstream of Generator	Fusible Valve		Fire protection.	
16	MF1		Upstream of the Furnace	Micron Filter	40 to 50 micron filter	To remove impurities from fuel oil prior to it entering the furnace.	
17	MF2		Upstream of the Furnace	Micron Filter	7 to 10 micron filter	To remove small particles from fuel oil prior to it entering the furnace.	
18	FG		Oil Storage Tank	Float Gauge		Measures fuel oil level in Oil Storage Tank.	
19	VL1		Oil Storage Tank	Vent Line	31 mm dia. c/w cap	Vents air from Oil Storage Tank.	
20	VL2		Day Tank	Vent Line	Same as Item No. 19	Vents air from Day Tank.	
21	FL		Upstream of the Oil Storage Tank	Fill Line	Schedule 40 steel pipe, 50 mm dia.	Access line to fill Oil Storage Tank.	

22	SL1		Upstream of the Generator	Fuel Oil Supply Line	12 mm dia. heavy walled copper tubing from fuel day tank. Reduces to 9 mm dia. at filters.	Supplies fuel to Generator.	
23	SL2		Upstream of the Furnace	Fuel Oil Supply Line	12 mm dia. heavy walled copper tubing from fuel day tank. Reduces to 9 mm dia. at filters.	Supplies fuel to Furnace.	
24	RL1		Between Day Tank and Generator	Fuel Oil Return Line	25 mm dia.	Returns oil back to Day Tank from Generator.	
25	RL2		Between Oil Storage Tank and Day Tank	Fuel Oil Return Line	25 mm dia.	Returns oil back to Oil Storage Tank from Day Tank.	



F OIL FIRED FURNACE

CIL1 COMBUSTION AIR INTAKE LOUVER. 200mm x 200mm DUCT LOCATED AT LOW LEVEL AND DUCTED TO OUTLET 300mm BELOW CEILING.

CIL2 COMBUSTION AIR INTAKE LOUVER INSULATED TO MANUFACTURE'S SPECIFICATION.

HRV FLOOR MOUNTED HRV UNIT. UNIT TO RUN CONTINUOUSLY.

EF CABINET TYPE EXHAUST FAN FROM CHLORINE ROOM.

LEF EXHAUST LOUVER.

DC 200mm FLEXIBLE DUCT CONNECTIONS AT RADIATOR DUCT COLLAR. FULL SIZE DUCT CONNECTION FROM RADIATOR AND TRANSITION TO 762mm X 762mm LOUVER.

IL ALL LOUVERS TO HAVE MODULATING ACTUATORS AS ROOM TEMPERATURE RISES.

EL EXTERNAL LOUVERS TO BE INSTALLED W/ TURNDOWN 90° WEATHERHOODS AND BIRDSCREENS.

T DAMPER CONTROL BY APPROPIATE HONEYWELL, PID THERMOSTAT

OST 4328L OIL STORAGE TANK TO BE INSTALLED ON NON COMBUSTIBLE STRUCTURE TO BUILDING FLOOR ELEVATION

FL 50mm (2") FILL W/ SECURED CAP.

FG FLOAT GAUGE

VL 31mm (1 1/4") VENT LINE W/ CAP

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Figure 4-4: Heating and Ventilation System

Table 4.4: Heating and Ventilation System

Item No.	Item ID	Sec. 9 Tab	Location	Component Description	Make/Model	Function	Remarks/Notes
1	G		Power Room	Generator	Stamford UC1224F, 3.3 gph, 40kW, 120/240V, 1-phase, 60 Hz, 50 kVA standby	Provides secondary power in case of primary power loss.	
2	OST		Outside Water Treatment Plant	Oil Storage Tank	Westeel Fuel Vault, 4540 L	Stores fuel oil to supply generator and furnace.	To be installed on non-combustible structure
3	DT		Power Room	Day Tank	Tramont TRS Series, 40 Liters c/w 2 gpm pump	Provides fuel to generator and furnace.	Indoor fuel oil tank
4	F		Furnace Room	Furnace	Carrier 58CMA, oil-fired, 3450 rpm, 57 kBTUH heating capacity, 0.5 USgph firing rate	Provides heating for the WTP.	
5	HRV		Generator Room	Heat Recovery Ventilator	Lennox HRV-150-3	Recovers heat from exiting (stale) air to and provides heat to incoming (fresh) air.	Floor mounted
6	T		Generator Room	Thermostat	Totaline Easy 1H1C/2H/1C	Senses and transmits temperature readings to heating system.	
7	CIL1 & CIL2		Furnace Room	Combustion Air Intake Louver	EH Price DE635	Provides entry of air into Furnace.	200 mm x 200 mm
8	IL1		Generator Room	Intake Air	EH Price DE635	Provides entry of	2’ x 4’

				Louver		outside air into the Generator room.	
9	IL2		Generator Room	Intake Air Louver	EH Price DE635	Provides entry of outside air into the Generator room.	1’ x 0.5’
10	EL		Generator Room	Exhaust Air Louver	EH Price DE635	Allows air to be exhausted from the Generator room.	2’ x 4’
11	ID1		Generator Room	Intake Damper	EH Price TAMCO 9000, 1000	Allows outside air to enter the building to cool the Generator radiator.	
12	ID2		Generator Room	Intake Damper	EH Price TAMCO 9000, 1000	Modulates air intake to maintain required minimum combustion air temperature of Generator.	
13	ED		Generator Room	Exhaust Damper	EH Price TAMCO 9000, 1000	Exhausts hot air out of the building to cool the Generator radiator.	
14	OD		Generator Room	Outside Damper	EH Price TAMCO 9000, 1000	Modulates air intake to maintain required minimum combustion air temperature of Generator.	
15	RL		Generator Room	Gravity Relief Damper	EH Price TAMCO 9000, 1000	Allows exhaust air to exit the Generator room.	Complete with cap.
16	EF		Chlorine Room	Chlorine Room Exhaust Fan	80 cfm, 0.25 hp, belt-driven centrifugal inline, Hi-Pro polyester coated,	Exhausts gases from the Chlorine Room.	

					explosion proof motor, corrosion resistant fasteners		
17	DEF		Chlorine Room	Chlorine Room Fan Exhaust Damper		Modulates airflow in the Chlorine Room.	
18	LEF		Chlorine Room	Chlorine Room Exhaust Louvre		Allows gases in the Chlorine Room to exit the building.	
19	DC		Between radiator and louver	Duct Collar		Flexible duct connection from radiator to Louver.	
20	D1		Water Treatment Plant	Diffuser	6”, 120 cfm	Distributes fresh air in the building.	
21	D2		Water Treatment Plant	Diffuser	6”, 150 cfm	Distributes fresh air in the building.	
22	D3		Water Treatment Plant	Diffuser	6”, 100 cfm	Distributes fresh air in the building.	
23	D4		Water Treatment Plant	Diffuser	6”, 150 cfm	Distributes fresh air in the building.	
24	D5		Water Treatment Plant	Diffuser	6”, 150 cfm	Distributes fresh air in the building.	
25	D6		Water Treatment Plant	Diffuser	6”, 120 cfm	Distributes fresh air in the building.	
26	D7		Water Treatment Plant	Diffuser	6”, 130 cfm	Distributes fresh air in the building.	
27	D8		Water Treatment Plant	Diffuser	6”, 100 cfm	Distributes fresh air in the building.	
28	CD		Water Treatment Plant	Chlorine Gas Detection Control Panel and Sensor		Detects and controls levels of chlorine gas in the building.	

29	CAS		Water Treatment Plant	Chlorine Gas Alarm Strobe		Lights up if chlorine gas levels in building are above safe limits.	

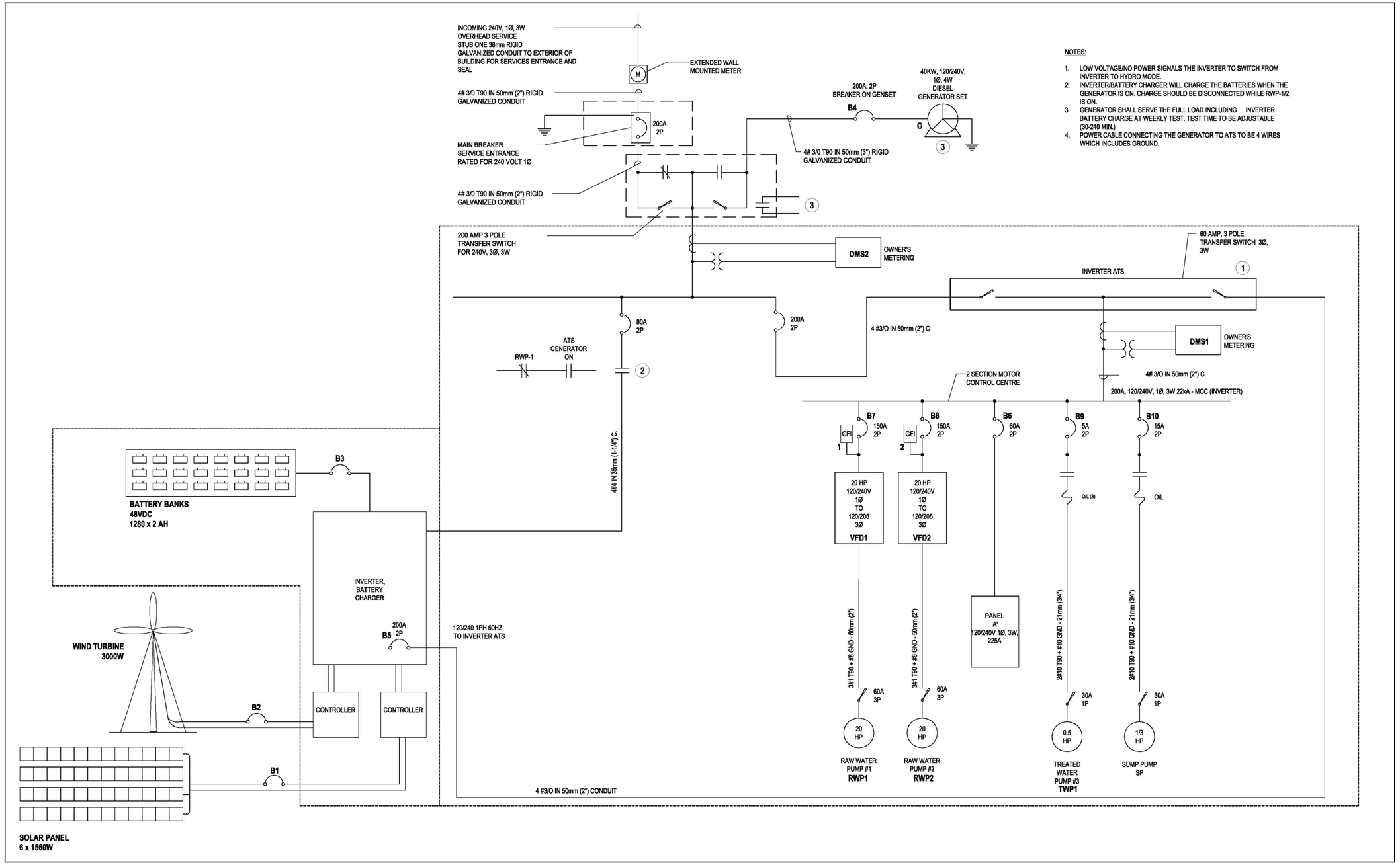

Figure 4-5: Single Line Diagram

Table 4.5: Single Line Diagram

Item No.	Item ID	Sec. 9 Tab	Location	Component Description	Make/Model	Function	Remarks/Notes
1			Overhead Service Pole	Overhead Grid Power	120/240VAC, 200A, 1-phase, 60Hz	Supplies additional primary power to building from the overhead transmission line and transformer.	Owned by Nunavut Power Corp. (NPC)
2	DMS1			Digital Metering Unit #1	200A, 2-phase, 240V	Measures overhead grid power consumed by the WTP.	
3	DMS2			Digital Metering Unit #2		Measures power consumption by the WTP.	
4	B			Main Breaker	240V, 200A	Breaks power entering WTP. Diverts power to Ground.	
5				Alternative Energy System (AES)		Provides primary power to WTP. Consists of Photovoltaic (PV) modules, wind turbine and battery bank.	
6	B1			Breaker	200A, 2-phase	Breaks power from Solar Panels to the Controller.	
7	B2			Breaker	200A, 2-phase	Breaks power from the Wind Turbine to the Controller.	
8	B3			Breaker	200A, 2-phase	Breaks power from the Battery Bank to the Inverter.	
9	C1			Controller		Controls power from the	

						Solar Panel to the Inverter.	
10	C2			Controller		Controls power from the Wind Turbine to the Inverter.	
11				Wind Turbine	Whisper 500, 3 kW, 48 VDC	Converts wind energy to electricity.	
12				Photovoltaic (PV) Panels	Sharp NT175UC1, 6 X 1560W	Converts solar energy to electricity.	
13				Battery Bank	Unigy II AVR95-27-SL, 2 X 1280Ah, 48 VDC	Stores unused electricity from AES for use in periods where more power is required or AES/Overhead Service Pole power loss.	
14	B4			Breaker	Square D Model JDS36175, 175A, 2P	Breaks power from the Generator.	
15	G			Generator	Stamford UC1224F, 3.3 gph, 40kW, 120/240V, 1-phase, 60 Hz, 50 kVA standby	Provides secondary power in case of primary power loss.	
16	ATS01			Automatic Transfer Switch	ASCO 7000 Series, 200A, 2-pole	Controlled by AES and ATS02. Transfers between primary power and secondary power supply.	
17	ATS02			Automatic Transfer Switch	ASCO 7000 Series, 200A, 2-pole	Controlled by utility power and generator. Transfers power usage from primary to secondary power supply.	

18				Inverter/Charger	Xantrex XW, 120/240VAC, 1-phase, 24kW	Converts Direct Current (DC) from AES to Alternating Current (AC).	
19	B5			Breaker	200A, 2-phase	Breaks power from the Inverter/Charger to ATS01.	
20	B6			Breaker	60A, 2P	Breaks power to Panel 'A'.	
21				Panel 'A'	120/240V, 1-phase, 2W, 225kA	Distributes power to equipment in the WTP.	
22	B7			Breaker	150A, 2P	Breaks power to RWP1.	
23	VFD1			Variable Frequency Drive	Yaskawa F7 Drive, 0.5 to 500 hp, 120/240V, 1-phase to 120/208V, 3-phase	Switches power for RWP1.	
24	GFI1			Ground Fault Interrupter		Grounds RWP1 to protect personnel from electrical shocking.	
25	RWP1			Raw Water Pump	Goulds 320L20, 20 hp	Pumps water out of Canso Lake to WTP.	
26	B8			Breaker	150A, 2P	Breaks power to RWP2.	
27	VFD2			Variable Frequency Drive	Yaskawa F7 Drive, 0.5 to 500 hp, 120/240V, 1-phase to 120/208V, 3-phase	Switches power for RWP2.	
28	GFI2			Ground Fault Interrupter		Grounds RWP2 to protect personnel from electrical shocking.	
29	RWP2			Raw Water Pump	Goulds 320L20, 20 hp	Pumps water out of Canso Lake to WTP.	

30	B9			Breaker	5A, 2P	Breaks power to TWP1.	
31	O/L			Overload Switch		Stops power to TWP1 when circuit overloads.	
32	TWP1		Truck Fill Line	Truck Fill Water Pump	Shurflo Park Model 2088-492-444, 0.5 hp	Boosts pressure in water supply lines to distribute domestic water throughout the WTP.	Consists of a booster pump with integrated pressure control
33	B10			Breaker	15A, 2P	Breaks power to SP.	
34	O/L			Overload Switch		Stops power to SP when circuit overloads.	
35	SP			Sump Pump	Hydromatic SKV40AW110, 1/3 hp	Pumps water from Sump Tank into the Wastewater Storage Tank.	
36	MCC			Motor Control Centre	Moeller MCC 3000, 600 VDC	Controls motor starters, houses relays and fuses.	
37				Generator Control Panel	Controls Inc. Genmaster Plus P/N GMPLUS-C40125	Controls Generator operation.	

APPENDIX B

CANSO LAKE WATER QUALITY ANALYSIS

Parameter	Units	GCDWQ		S2 T1 (Aug 8th)	S2 B1 (Aug 8th)	Site 2 (Oct 8th)
		MAC	AO			
Physicals						
Alkalinity	-	-	-	-	-	-
Total (as $CaCO_3$)	mg/L	-	-	83	83	97
PP (as $CaCO_3$)	mg/L	-	-	<1	<1	<1
Color, True	PtCo	-	≤15 TCU	5	5	2
Conductivity	uS/cm	-	-	221	221	252
Particle Size	-	-	-	-	-	-
pH	pH	-	6.5-8.5	8.1	8.2	8.1
Total Dissolved Solids	mg/L	-	≤500	110	109	127
Total Suspended Solids	mg/L	-	-	<2	<2	<2
Turbidity	NTU	0.3/1.0/0.1[a]	-	**0.5**	**0.5**	**0.6**
Major Ions (Dissolved)						
Calcium	mg/L	-	-	20.8	20.6	22.1
Chloride	mg/L	-	≤250	14	14	16
Fluoride	mg/L	1.5	-	-	-	-
Hardness (as $CaCO_3$)	mg/L	-	-	90	90	97
Magnesium	mg/L	-	-	9.3	9.3	10.1
Potassium	mg/L	-	-	0.9	0.9	1.2
Sodium	mg/L	-	≤200	9.9	9.9	12.2
Sulphate (as SO_4)	mg/L	-	≤500	5	4	7
Metals (Total)						
Arsenic	mg/L	0.01	-	<0.001	<0.001	<0.001
Aluminum	mg/L	-	0.1/0.2[b]	0.005	0.004	<0.04
Barium	mg/L	1	-	<0.01	<0.01	<0.01
Cadmium	µg/L	5	-	<0.01	<0.01	<0.0002
Chromium	mg/L	0.05	-	<0.001	0.001	<0.01
Copper	mg/L	-	≤1.0	<0.0002	<0.0002	0.0004
Iron	mg/L	-	≤0.3	<0.06	<0.06	<0.06
Lead	mg/L	0.01	-	<0.0002	<0.0002	<0.0002
Manganese	mg/L	-	≤0.05	<0.004	<0.004	<0.004
Mercury	mg/L	0.001	-	-	-	<0.0000
Selenium	mg/L	0.01	-	<0.001	<0.001	5 <0.001
Uranium	mg/L	0.02	-	0.0003	0.0003	0.0005
Zinc	mg/L	-	≤5.0	<0.0003	<0.0003	<0.0003
Organics						
Total Cyanide	mg/L	0.20	-	< 0.005	< 0.005	< 0.005
Total Trihalomethanes	mg/L	0.10	-	-	-	-
Tribromomethane	µg/L	-	-	<0.5	<0.5	<0.4
Trichloromethane	µg/L	-	-	<0.5	<0.5	<0.4
Bromodichloromethane	µg/L	16	-	<1	<1	<0.4
Chlorodibromomethane	µg/L	-	-	<0.5	<0.5	<0.4
Nutrients						
Total Dissolved Carbon	mg/L	-	-	-	-	3
Total Nitrate + Nitrite	mg/L	10	-	<0.2	<0.2	<0.2
Total Organic Carbon	mg/L	-	-	2.0	1.9	3.2
Total Phosphorous	mg/L	-	-	<0.003	<0.003	<0.1
Microbiological						
E. Coli	mpn/100	0	-	**<1**	**<1**	**<1**
Fecal Coliforms	mL	mg/L/100mL	-	-	-	-
Total Coliforms	mpn/100	-	-	**22**	**13**	**<1**
Standard Plate Count	mL	0	-	-	-	<1

a. Based on conventional treatment/slow sand or diatomaceous earth filtration/membrane filtration.

b. Operational guidance value, designed to apply only to drinking water treatment plants using aluminum-based coagulants. Based on conventional treatment/all other treatment systems.

Source: "Water System Upgrades, Taloyoak Pre-Design Report", Dillon Consulting Limited, 2007.

Taloyoak Water Analysis 2018-2020

Parameters			April 30 2018			September 12 2018			June 03 2019		
	Units	MAC	TAL-1 Raw Water	WTP	Truck Fill	TAL-1 Raw Water	WTP	Truck Hose	TAL-1 Raw Water	WTP	Truck Fill
Colour	TCU	<=15	8	5	5				<5	<5	<5
pH	pH Units	7.0 - 10.5	7.73	7.87	7.86	8.29	8.27	8.23	7.78	7.86	7.86
Turbidity	NTU	1	0.22	0.2	0.19	0.38	0.33	0.43	0.33	0.28	0.20
TDS	mg/L		76	86	92	122			182	176	190
TSS	mg/L		<3	<3	<3	<3	<3	<3	4	<3	6
Alkalinity	mg/L		131	130	131	94.8	94.1	94.7	131	131	131
Conductivity	mg/L		373	375	379	276	277	280	350	356	357
Dissolved C	mg/L	45	3.8	3.6	3.9	3.5	3.5	3.2	4.6	4.3	4.5
Total C	mg/L		4.0	3.9	4.0	3.4	3.6	3.3	4.3	4.5	4.3
Cyanide	mg/L	0.2	<0.0010	<0.0010	<0.0010	<0.0050	<0.0050	<0.0050	<0.0010	<0.0010	<0.0010
THMs	mg/L	0.1		0.048	0.032		<0.005			0.011	
Phenol, Total	mg/L		<0.0010	<0.0010	<0.0010	0.0013	0.0019	0.0016	<0.0010	<0.0010	<0.0010
Bromo-CH4	mg/L			0.016	0.008		<0.005			<0.005	
Nitrate N	mg/L		0.32	0.36	0.32	0.24	0.25	0.23	0.56	0.54	0.55
Hardness	mg/L		137	142	142	103	127	139	134	137	138
Chloride	mg/L	<=250	31.1	32.1	31.9	22.7	23.4	23.7	31.1	31.9	32.0
Fluoride	mg/L		0.1	0.1	0.1				<0.1	0.1	0.1
Sodium	mg/L	<=200	19.4	19.5	19.5	10.1	13.6	16.2	19.6	19.8	19.8
Sulphate	mg/L	<=500	16	16	16	12	12	12	14	14	14
Magnesium	mg/L		14.7	15.1	14.8	12.0	16.3	18.2	13.9	14.1	14.1
Calcium	mg/L		30.6	31.7	32.5	21.3	24.1	25.5	30.6	31.8	31.9
Potassium	mg/L		1.7	1.7	1.7	1.8	2.5	2.3	1.6	1.6	1.6
Total Coliform	CFU	none	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
E. Coli	CFU	none	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Aluminium	µg/L	<100	0.9	1.8	1.2	1.7	3.9	16.7	2.9	3.3	2.5
Arsenic	µg/L	100	0.3	0.3	0.3	0.2	0.3	0.2	0.3	0.4	0.4
Barium	µg/L	1	5.2	5.5	5.3	4.1	4.1	4.1	5.0	5.0	5.0
Cadmium	µg/L	5	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Chromium	µg/L	50	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	0.1
Copper	µg/L	<=1000	1.4	16.7	4.6	0.4	1.4	8.7	1.1	0.5	3.2
Iron	µg/L	<=300	7	6	6	<5	6	26	<5	<5	11
Lead	µg/L	10	0.1	0.7	0.2	<0.1	<0.1	0.2	0.1	<0.1	0.2
Manganese	µg/L	<=50	1.5	0.8	0.9	3.1	2.6	3.2	2.5	1.9	1.7
Selenium	µg/L	50	0.4	0.3	0.7	<0.3	<0.3	0.4	0.5	0.4	0.4
Uranium	µg/L	20	0.5	0.6	0.6	0.4	0.4	0.4	0.5	0.5	0.5
Zinc	µg/L	<=5000	5.5	37.9	4.3	1.1	4.1	7.8	6.1	1.3	3.1
Mercury	µg/L	1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	µg/L		0.1	0.4	0.2	0.1	0.2	0.2			

P&ID #	Description	Make	Model #	Size
RW1, RW2	Raw water pump	Goulds	320L20	
RW1, RW2	Pump motor	Franklin Electric	304SS	20 hp
CV1 to CV5	Swing Flex check valve	Valmatic	504A	
MV1, MV2	Electric actuator	Bray	70-0051-113AO	
(ST1)	Basket strainer	Hayward	Simplex	75 micron
IV1 to IV15	Butterfly valve	Bray	31/108	4”
PI1 to PI6	Pressure gauge	WIKA	233.34	0 - 150 psi
SV1, SV2	Solenoid valve	Burkert	5281A	Normally closed
CMPI to CMP3	Dosing pump	Grundfos	DDI209 20-3	20 L/h
VFS1 to VFS3	Foot valve with switch	Grundfos (Kit)	91835825	
(MX)	Mixer	Dynamic	MXX-2103D-9C7C	0.33. hp
(WH-1)	Hypochlorite mixing tank	Zeebest Plastics	OTCO12	45 L
GBL	Ball valve	Praher	S6	
(WH-2)	Hypochlorite solution tank	Zeebest Plastics	OTCO12	45 L
SP1 to SP5	Sampling taps			
FT1, FT2	Mag. flow meter	Endress & Hauser	ProMag 50	
VAC1, VAC2	Air and vacuum valve	Valmatic	101S	
(F1)	Swing bolt filter housing	Harmsco	HUR 3x170FL	(20 micron)
(F2)	Swing bolt filter housing	Harmsco	HUR 5x170FL	(5 micron)
(F3)	Swing bolt filter housing	Harmsco	HUR 5x170FL	(1 micron abs.)
(F4)	Swing bolt filter housing	Harmsco	HUR 5x170FL	(1 micron abs.)
(F1)	Cartridge	Harmsco	HC/170-20	20 micron
(F2)	Cartridge	Harmsco	HC/170-5	5 micron
(F3, F4)	Cartridge	Harmsco	PP/170-1	1 micron abs.
PB-1	Domestic booster pump	Shurflo Park Model	2088-492-444	115 V
WST-1	Treated water tank	Norwesco	41862	378 L
DWH-1	Hot water tank	Rheem	RE6	120 V
SP-1	Sump pump	Hydromatic	SKV40AW110	115 V
WWT-1	Wastewater sump tank	Hydromatic	Series 218 basin	23” x 31”
WWT-2	Waste water storage tank	Norwesco	40215	1,136 L
DV1 to DV7	Drainage valve	Praher	S6	
-	Ext. emergency valve	Morrison Bros.	346DI-0500 AV	
-	Ball valve	Crane	0202	
-	Blocked vent shut-off valve	Honeywell	BVSO-225-A	120 V
-	Floor drain	Mifab	F1000	
-	SCADA controller	Schneider Electric	ScadaPack 32	
-	HMI touch screen	Maple Systems	5070 TH	
-	Switching power supply	Carlo Gavazzi	SPD241001	
-	Autodialler	Barnett Eng.	B1290 ProTalk Plus	
-	Day tank control system	Tramont	2000 ECM	
-	Heat recovery ventilator	Lennox	HRV-150-3	150 cfm

-	Centrifugal in-line fan	Greenheck	BSQ-70-4	
-	Temperature controller	Johnson Controls	A350PS-1C	
-	Diesel generator	Stamford	AC	
-	Diesel engine	PowerTech	E4045	
-	Thermostat	Totaline Easy	1H1C/2H/1C	
-	Electronic oil primary control	Honeywell	R7184A	
-	Furnace	Carrier	58CMA	
-	Fuel tank	Weesteel	ULC-S601-07	4,546 L
-	Fuel filter	PetroClear	40510W, 40530W	10,30 micron
-	Foot valve	Morrison Bros.		
-	3-way ball valve	Meridian	M21SRL	
-	CL2/CO sensor	Honeywell Vulcain	VA301D2CL2-CO	
-	Motor control center	Moeller	MCC 3000	
-	AC motor drive	Yaskawa	F7	
-	Automatic transfer switch	ASCO	7000	
-	Damper lot	EH Price	TAMCO 9000,1000	
-	Louvers	EH Price	DE635	
-	Actuator	Belimo	NF24SR-US	
-	Chimney	Oliver MacLeod	HT6103+	
Lab eqt.	Portable colorimeter	Hach	DR890	
Lab eqt.	Portabel turbidimeter	Hach	2100P	
Safety eqt.	Fire extinguisher	Sentry	AA20	
-	Exit light	Ready-Lite	CX5100WHISP	
-	Battery light	Ready-Lite	LDX12722RQ12	
-	Flashing	AdaptaBeacon	104FLED-G1	
-	Outdoor lighting system	Sceptalight		
-	Wall mount	Lumark	Wal-Lite	70 W

6.0 OPERATION PROCEDURES

6.1 START/STOP TRUCKFILL – NORMAL OPERATION

Location: START / STOP Switch located on truckfill arm or on wall inside the treatment room.

6.1.1 Press the START button to start fill
6.1.2 Press the STOP button to stop fill
6.1.3 Check that water drains out of arm and into the intake casing

Troubleshooting

6.1.4 If the there is no flow
  6.1.4.1 Check that there is power to the plant
  6.1.4.2 Check that all controls are in the AUTO position
  6.1.4.3 Check that all manual valves are set in the correct positions
6.1.5 If there is no or insufficient chlorine
  6.1.5.1 See section on chlorine pumps
6.1.6 If the truckfill arm does not drain
  6.1.6.1 Check the operation of SV1, located on the wall by the water storage tanks

6.2 START/STOP TRUCKFILL – FIRE FILL

Location: START / STOP Switch located on truckfill arm or on wall inside the treatment room.

6.2.1 Press the START button to start fill
6.2.2 Press the STOP button to stop fill
6.2.3 Check that water drains out of arm and into the intake casing

Troubleshooting

6.2.4 If the there is no flow
  6.2.4.1 Check that there is power to the plant
  6.2.4.2 Check that all controls are in the AUTO position
  6.2.4.3 Check that all manual valves are set in the correct positions
6.2.5 If there is no or insufficient chlorine
  6.2.5.1 See section on chlorine pumps
6.2.6 If the truckfill arm does not drain
  6.2.6.1 Check the operation of SV1, located on the wall by the water storage tanks

6.3 RAW WATER PUMPS

Location: VFD's and Control Panel in generator room, START/STOP stations

6.3.1 The raw water pumps are started by the START/STOP stations

Troubleshooting

6.3.2 If the pumps do not start
  6.3.2.1 Check that there is power to the plant
  6.3.2.2 Check that all controls are in the AUTO position
  6.3.2.3 Check that the VFD's or Control Panel do not show any errors
  6.3.2.4 Check that all manual valves are set in the correct positions
  6.3.2.5 Switch to other pump

6.3.3 If flow is too low
6.3.3.1 Switch to other pump

6.4 BASKET STRAINER

Location: Treatment Room after raw water intakes

6.4.1 To change or empty the strainer
6.4.1.1 Turn off the raw pumps
6.4.1.2 Close valves immediately upstream of the strainer IV1.
6.4.1.3 Depressurize the system by opening sample tap, SP1
6.4.1.4 Close sample tap, SP1
6.4.1.5 Unscrew top of strainer
6.4.1.6 Clean strainer
6.4.1.7 Open valves that were closed, IV1.

6.5 CARTRIDGE FILTRATION

Location: Treatment room

Fig. 1 Swing bolt cartridge filter housings.

6.5.1 Filters should be changed when the pressure differential across them reaches 15-20 psi
6.5.2 To change the filters

Always Isolate And Remove Pressure From Housing Before Servicing.

6.5.2.1 Turn off the raw pumps
6.5.2.2 Close valves before and after the filter vessel
6.5.2.3 Open the drain valve
6.5.2.4 Undo the housings bolts
6.5.2.5 Rotate the cover off the vessel

6.5.2.6 Pull out filters by the stainless steel Cartridge Handle
6.5.2.7 Undo the Handle from the used filter and put it onto the new filter. Tighten securely to seal the handle to the filter
6.5.2.8 Install Cartridge/Handle assembly(s) onto Stand-pipe(s). Position Cartridge/Handle assembly downward until Cartridge's Bottom End Cap contacts the housing's Tube Sheet. The Cartridge's Bottom End Cap will seal with the Stand-pipe Coupling to prevent by-passing. A slight rotating action will assist in the positioning of the Cartridge while engaging the Stand-pipe Coupling. Confirm all Cartridge/Handle assemblies are properly positioned.
6.5.2.9 Inspect Housing O-ring and make sure that it is free from cracks and debris.
6.5.2.10 Clean Housing and Lid O-ring mating surfaces.
6.5.2.11 Place Housing O-ring into channel of Housing.
6.5.2.12 Return Lid to proper closure position and lower onto Housing O-ring. Make sure O-ring stays in the channel of the Housing.
6.5.2.13 Return all Swing Bolts, Eye Nuts, & Washers to their closure position.
6.5.2.14 Tighten all Eye Nuts by hand in a star pattern several times until all Eye Nuts are uniformly tight.
6.5.2.15 Start the flow of water by first opening the inlet valve and allow the housing to completely fill, then, open the outlet valve.

6.5.3 For PARALLEL operation of the 1 micron cartridge filters. (i.e. NORMAL operation)
6.5.3.1 Open valves IV10 and IV11
6.5.3.2 Close valve IV12
6.5.4 For SERIES operation of the 1 micron cartridge filters
6.5.4.1 Close valves IV10 and IV11
6.5.4.2 Open valve IV12
6.5.4.3 Remember to reset these valves to the parallel settings for normal operation.

6.6 CALCIUM HYPOCHLORITE MIXER

Location: Chlorine Room

Fig.2 Calcium hypochlorite mixing arrangement.

6.6.1 To make solution
- 6.6.1.1 Add 2 calcium hypochlorite tablets to the top tank
- 6.6.1.2 Use water fill line to fill top tank with 50L of water
- 6.6.1.3 Turn on mixer with the START/STOP switch on the wall
- 6.6.1.4 Leave mixer on until the tablets are dissolved and the solution is well mixed
- 6.6.1.5 Turn off the mixer
- 6.6.1.6 Open valve GBL1 to transfer the solution to the bottom tank
- 6.6.1.7 Close valve GBL1

Troubleshooting

6.6.2 No water to fill
- 6.6.2.1 Check there is water in the domestic water tank
- 6.6.2.2 Check the domestic water pump under the sink
- 6.6.2.3 Check that the valve is open

6.6.3 Mixer doesn't work
- 6.6.3.1 Check for power on the wall socket
- 6.6.3.2 Replace mixer if needed

6.7 CALCIUM HYPOCHLORITE DOSING PUMPS

Location: Chlorine Room, Control Panel in generator room

Fig.3 Calcium hypochlorite solution pumps.

Three dosing pumps deliver chlorine to the truck fill line, namely pump CMP1 before filtration, pump CMP3 after filtration, while pump CMP2 operates only when the fire flow mode is activated.

Assuming that a solution of 1.2 % strength is prepared (two calcium hypochlorite tablets added to 50 L of mixing tank water), the chlorine feed tank will contain 0.012 x 0.68 (0.68 is solid calcium hypochlorite yield) = 0.00816 kg/L (8.16 g/L) of free chlorine. At a residual chlorine target of 1 mg/L (1 ppm) at the nominal flow of 1,350 L/min, total demand is theoretically 0.001 x 1,350 = 1.35 g/min. However, actual demand will be somewhat higher dependent of the amount of organics in the raw water. Set tentatively on the HMI screen CMP1 to 0.5 ppm and CMP3 to 1 ppm. Set CMP2 to 1 ppm.

Chlorine content should be verified regularly by sampling at the truckfill arm outlet (note that it will decay with time if staying in the solution tank for some extended time).

6.7.1 To dose chlorine
- 6.7.1.1 Chlorine is automatically dosed when the water pumps are started

6.7.2 To adjust chlorine dosing quantity
- 6.7.2.1 Change the chlorine output levels on the HMI on the Control Panel
- 6.7.2.2 The chlorine pumps do not need direct adjustment
- 6.7.2.3 Set CMP1 to 0.5 ppm
- 6.7.2.4 Set CMP3 to 1.0 ppm
- 6.7.2.5 Set CMP2 to 1.0 ppm, this does not need to be changed
- 6.7.2.6 Fill the truck and take a sample
- 6.7.2.7 Check the chlorine concentration in the sample
- 6.7.2.8 Adjust CMP3 as needed to achieve the desired chlorine concentration.
- 6.7.2.9 If CMP3 and CMP1 cannot be adjusted to achieve the desired chlorine levels, then the chlorine solution needs to be changed.

Troubleshooting

6.7.3 Chlorine too high/low
- 6.7.3.1 Adjust dosing levels on the Control Panel
- 6.7.3.2 Check the solution strength in the chlorine tank. The tank may need to be diluted or drained and a new batch of chlorine solution made.

6.7.4 No Chlorine
- 6.7.4.1 Check that there is power to the pumps
- 6.7.4.2 Check that all controls are in the AUTO position
- 6.7.4.3 Check that the valves are in the correct positions
- 6.7.4.4 Check that there are no leaks in the chemical feed lines

6.8 DOMESTIC WATER SUPPLY

Location: storage tank is across from sink, pump and hot water heater are under sink

6.8.1 Open the taps as needed for water

Troubleshooting

6.8.2 There is no water in the tank
- 6.8.2.1 Check the solenoid valve supplying the storage tank (SV2)
- 6.8.2.2 Water usage may be too high

6.8.3 The tank is overflowing
- 6.8.3.1 The solenoid valve supplying the storage tank (SV2) may be stuck open.
- 6.8.3.2 Manually override and close the solenoid
- 6.8.3.3 There may be debris in the solenoid and the solenoid needs to be disassembled and cleaned

6.8.4 There is no water pressure
- 6.8.4.1 Check the water booster pump operation. All controls for the pump are internal to the pump
- 6.8.4.2 Check for leaks in the system

6.8.5 There is no hot water
- 6.8.5.1 Check that there is power to the water heater
- 6.8.5.2 Check that the valves are in the correct positions

6.9 WASTE WATER SYSTEM

Location: Sump pump and tank is under the floor next Filter #4. The waste water Storage tank is on the wall across from the sink.

6.9.1 Sump pump operates automatically

6.9.2 The waste water tank needs to be emptied when 80% full

Troubleshooting

6.9.3 The sump pump is not emptying into the waste tank
- 6.9.3.1 Check that there is power to the sump pump
- 6.9.3.2 Check that the float switch on the sump pump is operational
- 6.9.3.3 Check that there are no obstructions in the sump pump outlet line

6.10 FURNACE

Location: In the space across from Filters 2 & 3

6.10.1 The furnace is controlled by the thermostat on the wall

Troubleshooting

6.10.2 There is no heat
- 6.10.2.1 Check that the thermostat is working properly
- 6.10.2.2 Check that there is sufficient fuel in the day tank and the day tank is operational
- 6.10.2.3 Check that the furnace is starting
- 6.10.2.4 Check the damper on the heat vents are open

6.11 BACKUP POWER GENERATOR SET

Location: Generator Room

Figure 4: Automatic Transfer Switches
ATS1 (“Load Switch”) on the right, ATS2 (“Power Switch”) on the left

Figure 5: ATS control switches

6.11.1 The generator operation is automatically controlled by the Automatic Transfer Switches
6.11.2 All switches should be in AUTO mode in regular operation

6.11.3 To manually test the Genset without switching power source to the building.
6.11.3.1 on BOTH Automatic Transfer Switch, turn the “Engine – Generator Control” switch to “Engine Start”

6.11.4 To manually switch to Hydro / Utility power
6.11.4.1 On ATS1 “Load Switch”

6.11.4.2 Change the "Transfer Mode" switch to MANUAL
6.11.4.3 Change the "Manual Control" switch to EMERGENCY

6.11.5 To manually switch to Generator Power
6.11.5.1 On ATS1 "Load Switch"
6.11.5.2 Change the "Transfer Mode" switch to MANUAL
6.11.5.3 Change the "Manual Control" switch to EMERGENCY
6.11.5.4 Change "Engine – Generator Control" switch to ENGINE START
6.11.5.5 On ATS2 "Power Switch"
6.11.5.6 Change the "Transfer Mode" switch to MANUAL
6.11.5.7 Change the "Manual Control" switch to EMERGENCY
6.11.5.8 Change "Engine – Generator Control" switch to ENGINE START

Troubleshooting

6.11.6 Generator doesn't start
6.11.6.1 Check that there is sufficient fuel
6.11.6.2 Check the battery is charged, the battery charger is on the wall

6.12 GENSET VENTILATION

Location: Generator Room

6.12.1 The ventilation dampers are automatically controlled by the thermostat on the wall
6.12.2 The temperature that they open at can be adjusted using the dial on the thermostat

Troubleshooting

6.12.3 The dampers do not open or close as expected
6.12.3.1 Check that there is power to the damper control panel
6.12.3.2 Check that the damper actuators are moving

6.13 DAYTANK AND DIESEL FUEL SUPPLY

Location: Daytank is in generator room, main diesel storage is outside

6.13.1 No adjustments to the day tank are needed
6.13.2 To fill the diesel tank outside
6.13.2.1 Open the lid on the Spill container
6.13.2.2 Fill tank
6.13.2.3 Pull drain on the spill container to empty any spilled diesel fuel into the tank
6.13.2.4 Close lid on Spill container

Troubleshooting

6.13.3 There is no fuel in the day tank
6.13.3.1 Check the fuel lines for leaks
6.13.3.2 Check for power to the day tank

Maintenance Procedures

RAW WATER PUMPS

Location: In Reservoir

No regular maintenance is required

BASKET STRAINER

Location: Treatment Room after raw water intakes

Strainer should be emptied when:
Pressure differential exceeds 5 psi
Every 2 weeks

CARTRIDGE FILTRATION

Location: Treatment room

Filters should be changed when
The pressure differential across them reaches 15-20 psi
See Chapter 6 for filter change out procedure
O-rings and seals should be checked for damage or excessive wear when filters are changed.

CALCIUM HYPOCHLORITE MIXER

Location: Chlorine Room

Tanks should be cleaned when there is excessive build up of debris
The mixer impeller should be checked for damage and signs of rust. Replace if necessary.

CALCIUM HYPOCHLORITE DOSING PUMPS

Location: Chlorine Room, Control Panel in generator room

Daily checks for leaks
Check fittings
Check for cracks in tubing

Once a year or every 4000 hrs of operation
Follow cleaning procedure in pump manufacturer's manual

DOMESTIC WATER SUPPLY

Location: storage tank is across from sink, pump and hot water heater are under sink

Hot water tank
At least once a year, lift and release the lever handle on the temperature pressure relief valve, located near the top of the water heater, to make certain the valve operates freely. Allow several gallons to flush through the discharge line to an open drain.
Rapid closing of faucets or solenoid valves in automatic water using appliances can cause a banging noise

heard in a water pipe. Strategically located risers in the water pipe system or water hammer arresting devices can be used to minimize the problem.

The anode rod should be removed from the water heater's tank annually for inspection and replaced when more than 6″ of core wire is exposed at either end of the rod. Make sure the cold water supply is turned off before removing anode rod.

NOTICE: Do not remove the anode rod from the water heater's tank, except for inspection and/or replacement, as operation with the anode rod removed will shorten the life of the glass lined tank and will exclude warranty coverage.

WASTE WATER SYSTEM

Location: Sump pump and tank is under the floor next Filter #4. The waste water Storage tank is on the wall across from the sink.

The waste water tank needs to be emptied when 80% full

FURNACE

Location: In the space across from Filters 2 & 3

Check the furnace air filter every 3-4 weeks and replace as necessary

Check the fuel filters every week.

Once a year, have a professional inspect and service the furnace

BACKUP POWER GENERATOR SET

Location: Generator Room

To assure that your engine will deliver efficient standby operation when needed, start engine and run at rated speed (with 50%-70% load) for 30 minutes every 2 weeks. DO NOT allow engine to run extended period of time with no load.

Follow maintenance schedule and procedures from John Deere engine manual.

	Lubrication and Maintenance Service Intervals				
Item	**Daily**	**250 Hour/ 6 Month**	**500 Hour/ 12 Month**	**2000 Hour/ 24 Month**	**As Required**
Check the battery charge level	*				
Check Engine Oil and Coolant Level	*				
Check Fuel Filter(s)/Water Separator Bowl	*				
Check Air Cleaner Dust Unloader Valve & Indicator[a]	*				
Perform Visual Walkaround Inspection		*			
Change Engine Oil And Replace Oil Filter[b]		*			
Check Engine Mounts		*			
Service Battery		*			

Check Manual Belt Tensioner and Belt Wear		*			
Clean Crankcase Vent Tube			*		
Check Air Intake Hoses, Connections, & System			*		
Replace Single or Dual Fuel Filter Elements			*		
Check Automatic Belt Tensioner and Belt Wear			*		
Check Engine Speeds			*		
Check Engine Electrical Ground Connection			*		
Check Cooling System			*		
Coolant Solution Analysis-Add SCAs as required			*		
Pressure Test Cooling System			*		
Check Crankshaft Vibration Damper ***(6.8 L Engines)***[c]				*	
Flush Cooling System[d]				*	
Test Thermostats				*	
Check and Adjust Engine Valve Clearance				*	
Add Coolant					*
Replace Air Cleaner Elements					*
Replace Poly-Vee Belt					*
Check Fuses					*

[a] Replace primary air cleaner element when restriction indicator shows a vacuum of 625 mm (25 in.) H2O.

[b] Change the oil for the first time after 100 hours maximum of break-in operation. For subsequent oil and filter intervals, see recommendations in section 10.

[c] Replace crankshaft damper every 4500 hours or 60 months, whichever occurs first.

GENSET VENTILATION

Location: Generator Room

No regular maintenance is required

DAYTANK AND DIESEL FUEL SUPPLY

Location: Day tank is in generator room, main diesel storage is outside

Check fuel levels every 2-3 days

No other regular maintenance is required.