



Sewer Protection Upgrades

Preliminary Design Report – **Final**

January 27, 2021

Prepared for:

City of Iqaluit

Prepared by:

Stantec



Revision	Description	Author		Quality Check		Independent Review	
0	DRAFT	AR		GP		LR	
1	FINAL	AR		GP		LR	



SEWER PROTECTION UPGRADES

This document entitled Sewer Protection Upgrades was prepared by Stantec Architecture Ltd. ("Stantec") for the account of City of Iqaluit (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by _____
(signature)

Alejandro Rojas, P.Eng.

Reviewed by _____
(signature)

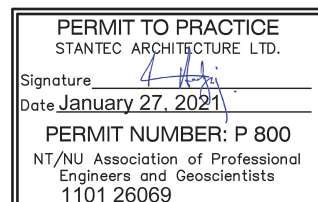
Libin Ren, P.Eng. (Alberta)

Approved by _____
(signature)

Glenn Prosko, P.Eng.



Engineers Seal



Corporate Permit Stamp



Table of Contents

1.0	INTRODUCTION.....	1.1
1.1	BACKGROUND.....	1.1
1.2	OBJECTIVE	1.2
2.0	DESIGN BASIS.....	2.1
2.1	PROCESS DESIGN CRITERIA.....	2.1
2.1.1	Lift Station No. 01.....	2.1
2.1.2	Septage Receiving Station	2.4
2.1.3	Coarse Solids, Grit and Grease Removal.....	2.6
2.2	CIVIL DESIGN.....	2.9
2.2.1	Site Work	2.9
2.3	ARCHITECTURAL DESIGN.....	2.10
2.3.1	Design Process	2.10
2.3.2	Exterior Systems Description	2.11
2.3.3	Stairs.....	2.13
2.3.4	Interior Systems Description.....	2.14
2.3.5	Interior Doors	2.14
2.3.6	Interior Finishes.....	2.14
2.4	STRUCTURAL DESIGN.....	2.15
2.4.1	Vertical & Lateral Loading	2.15
2.4.2	Specified Vertical Loading.....	2.15
2.4.3	Wind, Snow & Rain Loading.....	2.15
2.4.4	Seismic Loading.....	2.16
2.4.5	Building Importance Category	2.16
2.4.6	Building Systems WWTP Addition.....	2.17
2.4.7	Building Systems LS No.1	2.17
2.4.8	Building Systems Septage Station	2.18
2.4.9	Codes, Standards & Acceptable Products.....	2.18
2.5	BUILDING MECHANICAL DESIGN.....	2.18
2.5.1	Introduction	2.18
2.5.2	HVAC Design Considerations	2.19
2.5.3	Heating Systems.....	2.20
2.5.4	Ventilation Systems.....	2.24
2.5.5	Fuel System	2.26
2.5.6	Plumbing Systems	2.28
2.5.7	Fire Protection.....	2.30
2.5.8	HVAC Controls.....	2.30
2.5.9	Other.....	2.35
2.6	ELECTRICAL DESIGN.....	2.35
2.6.1	Introduction	2.35
2.6.2	Electrical Services and Distribution	2.36
2.6.3	Standby Power Supply	2.39
2.6.4	Grounding	2.39
2.6.5	Branch Circuit Wiring	2.40
2.6.6	Lighting	2.40



SEWER PROTECTION UPGRADES

2.6.7	Communication Systems.....	2.41
2.6.8	Access Control System	2.41
2.6.9	Intrusion Alarm System.....	2.42
2.6.10	Fire Alarm System.....	2.42
2.6.11	Motor Control	2.42
2.6.12	Commissioning and Testing	2.43
2.7	INSTRUMENTATION AND CONTROLS DESIGN.....	2.43
2.7.1	Introduction	2.43
2.7.2	PLC Control	2.44
2.7.3	Instruments & Systems Monitoring	2.45
2.7.4	Alarming.....	2.47
2.7.5	System Communications.....	2.48
2.7.6	Operation Sequence & Pump Control	2.48
2.7.7	Commissioning and Testing	2.49
3.0	PRELIMINARY EQUIPMENT LIST	3.1
3.1	EQUIPMENT LIST.....	3.1
3.2	LONG LEAD DELIVERY ITEMS.....	3.1
4.0	REGULATORY REQUIREMENTS.....	4.1
5.0	CONSTRUCTABILITY PLAN AND SCHEDULE	5.1
5.1	CONSTRUCTION STAGING, SEQUENCING AND OBSTACLES	5.1
5.1.1	Lift Station No. 01.....	5.1
5.1.2	Septage	5.1
5.2	CONSTRUCTION SCHEDULE	5.2
6.0	PRELIMINARY FUNCTIONAL SPECIFICATION.....	6.1
6.1	LIFT STATION NO. 1	6.1
6.2	SEPTAGE STATION	6.1
6.3	PRELIMINARY TREATMENT PLANT	6.2
7.0	PROJECT COSTS	7.1
7.1	PRELIMINARY COST ESTIMATE.....	7.1
7.2	SCHEMATIC TO PRELIMINARY COST INCREASE.....	7.2
7.3	PROJECT EXPENDITURES	7.2
7.4	COST SAVING POTENTIALS.....	7.2

LIST OF TABLES

Table 2.1. Design Flows Iqaluit Lift Station No. 1	2.1
Table 2.2. Design Criteria Pumping System in LS No. 1	2.2
Table 2.3. Design Criteria for Septage Receiving Station.....	2.5
Table 2.4. Design Criteria Wastewater Pre-treatment System.....	2.7
Table 2.5. Preliminary Design of Grease Storage & Pumping System	2.8
Table 2.6. Building Importance Factors.....	2.16
Table 2.7. HVAC Design Criteria.....	2.20
Table 2.8. Initial Heating Loads.....	2.21



SEWER PROTECTION UPGRADES

Table 2.9. Initial Airflows	2.25
Table 4.1. Proposed Regulatory Map for Sewer Protection Upgrades.....	4.3
Table 7.1. Preliminary Cost Estimate Summary	7.1
Table 7.2. Anticipated Expenditures	7.2
Table 7.3: Cost Savings Potential	7.3

LIST OF FIGURES

Figure 1.1. Lift Station No. 1.....	Error! Bookmark not defined.
Figure 1.2. Dump Station	1.1
Figure 1.3. City of Iqaluit WWTP	1.1
Figure 1.4. Location of Current Infrastructure	1.2
Figure 2.1. Configuration of Lift Station No. 1.....	2.4
Figure 2.2. Location for the New Septage Station at the WWTP	2.5
Figure 2.3. Preliminary Configuration of the Packaged Septage Station at the WWTP.....	2.6
Figure 2.4. Pre-treatment System Installation Concept	2.9
Figure 2.5. Configuration of Sewage Pre-Treatment Systems.....	2.9
Figure 4.1. Current Legal Land Boundary which Divides the Iqaluit WWTP	4.2

LIST OF APPENDICES

APPENDIX A	PRELIMINARY DESIGN DRAWINGS	A.1
APPENDIX B	PRELIMINARY EQUIPMENT LISTS	B.1
APPENDIX C	PRELIMINARY CONSTRUCTION SCHEDULE.....	C.1
APPENDIX D	PRELIMINARY COST ESTIMATE.....	D.1



SEWER PROTECTION UPGRADES

Introduction

1.0 INTRODUCTION

1.1 BACKGROUND

Lift Station No. 01 (LS No.1) at Iqaluit has experienced numerous challenges in maintaining operations. When the station was upgraded in 2007, the existing wetwell was re-utilized, with the addition of a macerator (Muffin Monster). The wetwell is undersized for the projected future flows and, due to the space restrictions, no redundancy in solids handling (macerator) was able to be provided. The current configuration is inefficient, since the macerator is difficult to service and, without the redundancy, cannot be removed without sacrificing solids handling capabilities.



Figure 1.1. Lift Station No. 1

The WWTP also experiences numerous operational difficulties due to deleterious solids being deposited in the sewer system. The main source of solids causing issues is the septage dump adjacent the plant,



Figure 1.2. Dump Station

although it is also suspected that waste from the jail (via the gravity sewer) also contributes to these problems. In general, items such as jeans, sheets, shoes, rags, and other non-typical sanitary sewer components create problems for both the distribution and treatment systems. Although improvements have been made to the existing WWTP wetwell in 2019 (benching, mixing and more robust solids handling pumps), items such as jeans and sheets are still able to wrap themselves around the pumps, causing them to fail or be damaged.

Another issue that may be contributing to the performance of the Iqaluit Wastewater Treatment Plant is the presence of grit and greases in the sewage generated. Grease is difficult to handle and may be causing issues to the health of the wastewater treatment biological reactors. Grit if not removed can contribute to early deterioration of the equipment installed at the wastewater treatment plant due to abrasive wear.

Previous design developed before the current upgrade of the City of Iqaluit WWTP contemplated the addition of a septage station with ability to macerate solids and a grit removal system, however the value engineering session developed at that time decided to remove this process from the WWTP upgrade due to budgetary issues. **Figure 1.4** presents the location of the current utilized



Figure 1.3. City of Iqaluit WWTP



SEWER PROTECTION UPGRADES

Introduction

infrastructure (LS No.1, sewage dump station and WWTP building) at the City of Iqaluit.



Figure 1.4. Location of Current Infrastructure

The purpose of this document is to provide a preliminary basis of design to upgrade the LS No. 1, install a modern septage station with capacity to macerate solids and measure flows of sewage disposed from trucks, and install a sewage pre-treatment system able to remove coarse solids, grit and greases present in the wastewater with the main objective to protect the current process developed at the City of Iqaluit WWTP. Both the septage station and sewage pre-treatment system are planned to be installed as additions to the WWTP.

1.2 OBJECTIVE

The specific objectives of this document are:

- Refine and update the basis of design, which was developed in the *Expanded Options Design Basis Report* in September 2020, for a 20-year design horizon for sewer protection, including LS No. 1 upgrade, coarse solids, grit, and grease removal.
- Present preliminary civil, architectural, structural, process, electrical, mechanical and instrumentation and controls design criteria related to the sewer protection system upgrades project.
- Present preliminary civil, structural, architectural, process, mechanical, electrical and instrumentation and controls design drawings of the project, including preliminary configuration and location of the main pieces of equipment.
- Develop preliminary process functional description.
- Develop preliminary process, mechanical, electrical and instrumentation and controls equipment and load lists.
- Present preliminary electrical single line diagrams.
- Highlight constructability challenges.
- Develop a preliminary cost estimate (+/- 30%) of the project.



SEWER PROTECTION UPGRADES

Design Basis

2.0 DESIGN BASIS

The following discipline sections outline the preliminary design basis for the Sewer Protection Upgrades, which include Lift Station No.1, a Septage Receiving Station at the WWTP, and a Pre-treatment addition to the WWTP. Preliminary design drawings, developed in conjunction with the design criteria, are presented in Appendix A (under separate cover).

2.1 PROCESS DESIGN CRITERIA

Nunami Stantec developed the document “Sewer Protection Study – Option Analysis Results” dated November 19, 2019 for the City of Iqaluit. The general design criteria established in that document is transcribed to this document with some variations considered for process improvement based on current operation of the wastewater treatment plant and conversations with city operations.

Current issues faced by the WWTP operation are related to big solids, grit and high content of greases arriving in the influent. It is therefore highly recommended to install robust systems able to handle and remove such contaminants before they arrive to the biological treatment stage of the WWTP to improve its performance, operability, and useful life.

As outlined in the “Sewer Protection Study”, upgrades will be focused at LS No. 1, and at installation of a septage receiving station that can handle these solids, and at installation of a sewage pre-treatment system at the WWTP that will provide better protection to the overall sewer system and treatment plant.

2.1.1 Lift Station No. 01

The Sewer Protection Study considered a design based on current average flow handled of 34.5 L/s and future year-2041 (typical 20-year design horizon) peak flows of 72 L/s, recommending a peak flow of 80 L/s for the LS No.1. Such information was obtained from the following documents:

- Civil Engineering Services for Sanitary Relocation, Iqaluit, NU. - Feasibility Memorandum Rev 01. (Nunami, April 2019),
- Draft Design Basis, Earth Tech May 2005, and
- Iqaluit WWTP Upgrade City of Iqaluit Design Development Report (Nunami, November 2017).

Based on this information, the upgraded LS No.1 will be able to handle current and future flows.

Table 2.1 presents the design flows established for the lift station.

Table 2.1. Design Flows Iqaluit Lift Station No. 1

Description	Flow
Current Average Flow (L/s)	34.5
Estimated 2041-Year Design Peak Flow (L/s)	72.0
Assumed Peak Design Flow for the Pumping System (L/s)	80.0



SEWER PROTECTION UPGRADES

Design Basis

Recommendation is to install three Vaughan submersible chopper pumps that can macerate solids at the time the sewage is pumped from the LS No. 1 to the WWTP building. The pumps will be installed in a new LS No.1 with a bigger wetwell made from concrete and a bigger building that allows better access and operational activities as discussed with City operations during the initial project workshop held on August 18, 2020.

One pump will be able to handle current low, average and maximum day flows, two pumps will handle current peak flows and future maximum and peak flows as indicated in **Table 2.2** below. A magmeter will be installed at the sewage discharge pipe to monitor pumped flows from LS No. 1. The wetwell will be provided with ultrasonic and float switches for level controls and the pumps will operate with Variable Frequency Drives (VFDs) to have control of the flows based on level within the wetwell. Power and controls will be located at a local control panel (LCP) for the operation of the pumps located within the LS No. 1 building.

An automated submersible three-way valve for mixing will be installed in the wetwell of the LS No.1 to keep solids and greases in suspension within the wetwell to avoid continuous cleaning by city operators. The three-way valve will be operated from the same LCP installed within the building. Submersible chopper pumps and three-way valve will be provided with railing system and one motorized lifting davit for extraction of the equipment from the well during maintenance operations.

LS No. 1 wetwell will be provided with installed flexible pipe and camlock for connection of a sewage extraction sucking system for the cases when the well needs to be cleaned so that there is no need for operators to enter to the well. This was specifically requested by city operations during the initial workshop. However, the wetwell will be provided with a ladder embedded on one of the walls for access to the bottom.

The influent sewage pipe to the new LS No.1 will be modified. A new manhole will be installed to receive the influent. Two pipelines with isolation valves will be installed in the manhole; one pipeline will be running to the existing LS No.1 wetwell and the other pipeline to the new LS No.1 wetwell. The purpose is to provide a bypass with isolation valves with the objective to divert the wastewater to the existing LS No.1 wetwell during maintenance periods so that existing station can still be used for sewage pumping purposes during the time the new LS No.1 is off if required.

Table 2.2. Design Criteria Pumping System in LS No. 1

Parameter	Description
Location of Building at LS No. 1	Parallel to the Existing One
Area within Building	Classified, Explosion Proof
Wetwell at LS No. 1	1 Concrete
Wetwell Dimensions	3.0 m x 3.0 m x 5.5 m depth
Wetwell Total/Effective Volume	49 / 29 m ³
Number of Pumps	2 duty / 1 Stand by
Flow per Pump	40 L/s



SEWER PROTECTION UPGRADES

Design Basis

Parameter	Description
Flow for Two Pumps	80 L/s
Pump type	Vaughan Submersible Chopper Pump
Pump Operation	VDF
Three-Way Valve	1 For Solids & Grease Mixing
Equipment Operation	Local Control Panel Located within New LS No. 1 Building
Level Control in Wetwell	1 Radar Level Sensor and Four Level Switches
Sewage Flow Monitoring from LS No.1	Magmeter
Equipment Lifting	Rails System and Electrical Lifting Davit
Cleaning Pipe	Flexible Pipe Provided with Camlock for Connection to Sucking Pumping System
Bypass at New Manhole	Installed bypass with Isolation Valves to existing and new LS No.1 wetwells

Appendix A presents a preliminary design 3D model of the configuration and location of LS No. 1.



SEWER PROTECTION UPGRADES

Design Basis

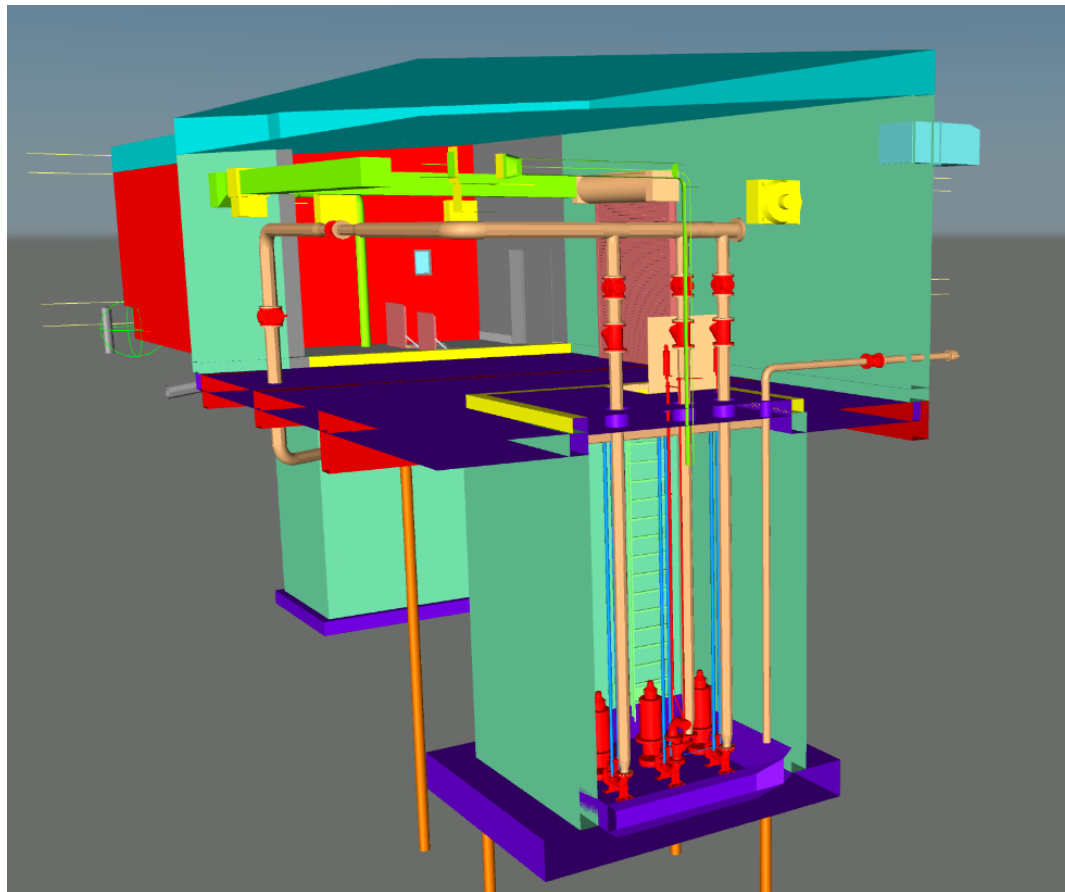


Figure 2.1. Configuration of Lift Station No. 1

2.1.2 Septage Receiving Station

Information confirmed by the City of Iqaluit operations indicate that trucks with 13,250 litres (3,500 gallons) in volume capacity are used to discharge sewage at the dump station. Each truck discharge last approximately five (5) minutes. Therefore, each port of the septage receiving station should be able to receive approximately 44 L/s of septage. Based on this information, each port of the septage receiving station will be designed with minimum capacity of 50 L/s. **Table 2.3** below presents the design criteria followed for the septage receiving station.



SEWER PROTECTION UPGRADES

Design Basis

Table 2.3. Design Criteria for Septage Receiving Station

Parameter	Description
Number of Packaged Stations	1
Location of Packaged Station	North Side of WWTP Building
Area within Packaged Station	Classified, Explosion Proof
Number of Ports/Lines	2 (duty/standby)
Equipment per Port/Line	One Electrical Actuated Plug Valve, One Rock Trap, One Grinder, One Flowmeter
Maximum Design Flow per Port (L/s)	50
Truck Dumping Time (minutes)	5
Equipment Operation	Local Control Panel

A dual port packaged septage receiving station offering duty/standby services will be located at the north side of the WWTP headworks building. This place is very close to the WWTP access road offering good access to trucks for septage unloading. Septage haulers will connect their transfer hoses to the discharge ports located on the packaged station for sewage discharge. The dual port septage receiving station will be provided with rock traps, grinders and flow measurement connected to the plant control system to measure septage flows discharged through each port. Macerated septage from the receiving station will enter the wet well to be processed through the main WWTP processes.

Figure 2.2 presents the preliminary design 3D model with the location of the septage station at the WWTP.

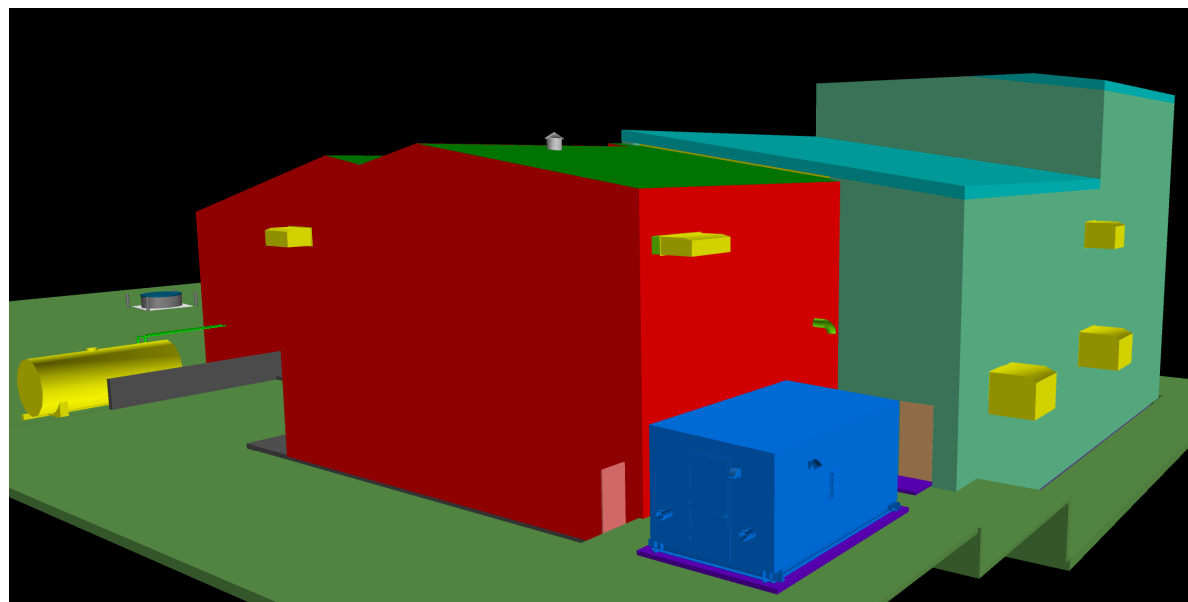


Figure 2.2. Location for the New Septage Station at the WWTP



SEWER PROTECTION UPGRADES

Design Basis

The packaged septage receiving station will be provided with local control panel for local operation of the valves and motors. As recommended for the LS No. 1, it is also recommended to improve the pumping system at the influent wet well in the WWTP by replacing the current installed Flygt pumps with Vaughan chopper pumps able to macerate and pump sewage with solids to the WWTP process without clogging issues.

Figure 2.3 presents the preliminary design 3D model configuration of the packaged septage receiving station to be located at the north side of the WWTP building.

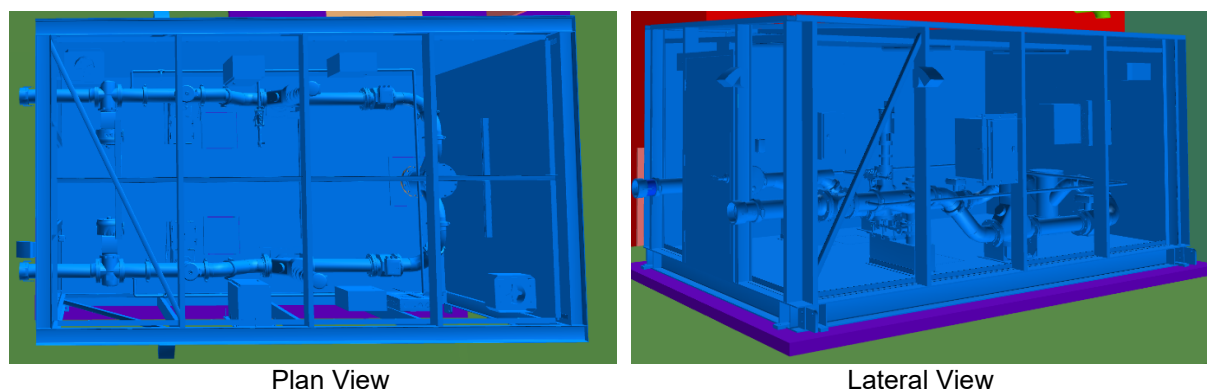


Figure 2.3. Preliminary Configuration of the Packaged Septage Station at the WWTP

2.1.3 Coarse Solids, Grit and Grease Removal

After being aware of all the problems the City of Iqaluit is facing, the recommendation is to install not only a system that can remove grit from the sewage but an integrated pretreatment system for removal of coarse solids, grit, and grease. The system will be installed at the northwestern side of the WWTP building. The building will be expanded at that location as recommended in the “Sewer Protection Study”, but not for installation of a grit removal system only but a complete wastewater pretreatment system.

The wastewater pre-treatment system will be designed with capacity to remove big solids (larger than 10 mm), grit, and greases arriving in the influent to the WWTP. Removal of coarse solids and grit as a preliminary treatment insertion to the plant will contribute to protecting the installed equipment and pipelines downstream at the WWTP. This protection will extend the equipment’s useful life, while removal of greases will improve the exiting biological treatment process in the MBBR trains and the sludge dewatering process downstream.

Based on the current and future flows to be handled by the WWTP presented in

Table 2.4 below, the coarse solids, grit and grease removal system will be designed with capacity to handle current sewage flows of 38.5 L/s or less and future expected peak flows of 151 L/s.

During the workshop held on August 18, 2020 Colliers requested to consider a duty/standby configuration for the wastewater pre-treatment system, which is being contemplated in this document.



SEWER PROTECTION UPGRADES

Design Basis

Table 2.4. Design Criteria Wastewater Pre-treatment System

Parameter	Description
Number of Trains	2 (Duty/Standby)
Location of Pre-Treatment Trains	Second Floor at Northwest Side of Expanded WWTP Building
Location of Removal Trailers	First Floor at Northwest Side of Expanded WWTP Building
Area of Installation of Pre-Treatment System Trains	Classified, Explosion Proof
Current Average Flow (L/s)	38.5
Current Maximum Month Flow (L/s)	46.2
Current Maximum Day Flow (L/s)	77.0
Current Peak Flow (L/s)	115.5
2041-Year Average Flow (L/s)	50.3
2041-Year Maximum Month Flow (L/s)	60.4
2041-Year Maximum Day Flow (L/s)	100.6
2041-Year Peak Flow (L/s)	151
Solids Separation Screen (mm)	10
Grit Separation Degree at Max Flow	90% Grit Particles $\geq 200 \mu\text{m}$
Unit Type, Each	Aerated
Approx. Retention Time Each (sec)	140
Approx. Retention Time Each (sec)	140
Equipment Operation, Each Train	Local Control Panel

There are systems in the market that offer the capability of coarse solids, grit, and grease removal within integrated compacted systems that can be installed at the Iqaluit WWTP. Companies like Huber Technology and Enviro-Care offer such integrated pretreatment systems. Refer to the links below presenting integrated wastewater pretreatment systems.

Huber Technology: <https://www.youtube.com/watch?v=BKPMhiNjmRI>

Enviro-Care: <https://www.youtube.com/watch?v=mA7SEnIWzBE>

Each train of the packaged pretreatment system will come with the following elements:

- 304L stainless steel tank construction
- Grit Removal system with grit transfer screw, grit removal screw and grit discharge chute
- Regenerative blowers for the aeration system
- Coarse solids screen, integrated shafted spiral conveyor, solids washing, and bagger system for solids discharge
- Grease removal system including travelling paddle for grease transport and pump for grease removal
- NEMA 4X local control panel in 304 stainless steel



SEWER PROTECTION UPGRADES

Design Basis

Influent wastewater collected in the wet well will be pumped by Vaughan chopper pumps to the packaged pretreatment systems to be installed at the second level of the expanded WWTP building for coarse solids, grit, and grease removal. Under normal conditions only one train will be operating while the second one will be on standby. Solids and grit transported by different screws will be deposited in a trailer to be located at the first floor of the expanded WWTP building for disposal to the landfill.

Greases will be collected in a separate tank located on the first floor of the expanded building for off-site disposal. Two grease pumps (duty/standby) will be utilized to recirculate the grease continuously from/to the grease storage tank to avoid settling/plugging. The same pumps will be used to pump the grease to a truck for final disposal. **Table 2.1** presents preliminary information on the grease storage and pumping system.

Table 2.5. Preliminary Design of Grease Storage & Pumping System

Parameter	Description
Grease Storage Tank Effective Capacity	5.9 m ³
Grease Storage Tank Material	HDPE
Grease Pumps Quantity	2 (duty/standby)
Grease Pumps Type	Rotary Lobe
Grease Pumps flow @ TDH	6.5 L/s @ 207 kPa

Operation of each pre-treatment system train will be automated controlled from the plant SCADA system. The wastewater will flow through one of the packaged pretreatment trains by gravity to the existing fine screens and primary filters to follow the current installed process at the WWTP. A bypass line from the influent wet well to the fine screens will be kept as part of the existing process for the cases when the packaged pretreatment trains may not be operational.

A preliminary design 3D model of the pre-treatment systems installation for coarse solids, grit and greases removal within an expanded WWTP building is presented **Figure 2.4**.



SEWER PROTECTION UPGRADES

Design Basis

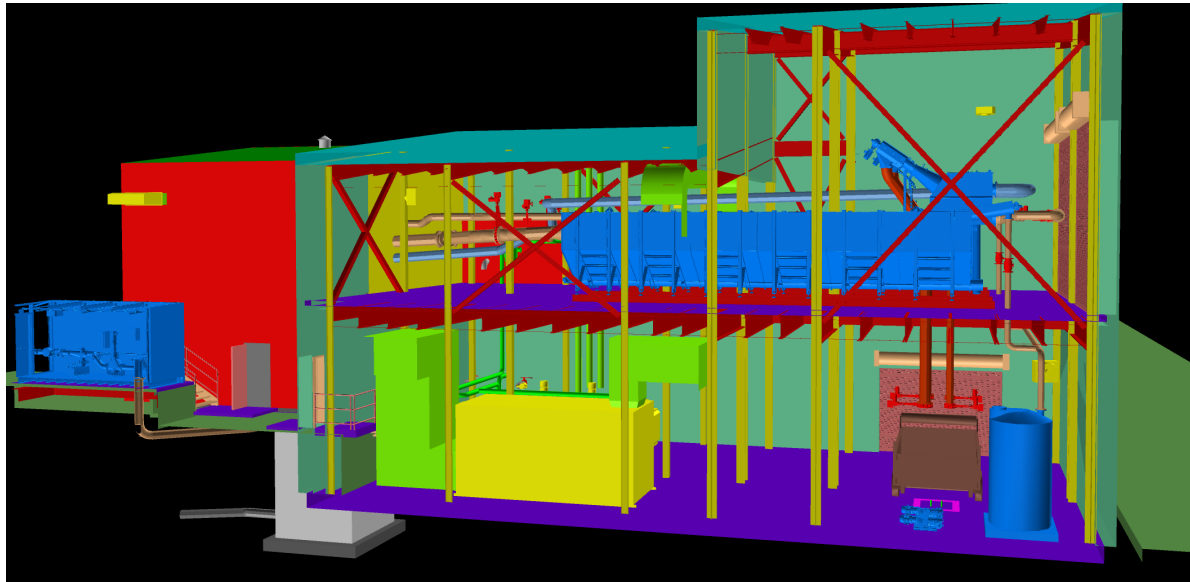


Figure 2.4. Pre-treatment System Installation Concept

Figure 2.5 Presents configuration of sample pre-treatment systems existing in the market for coarse solids, grit and grease removal.



Figure 2.5. Configuration of Sewage Pre-Treatment Systems

2.2 CIVIL DESIGN

2.2.1 Site Work

The sites included within this scope of work are shown in **Figure 4**. The civil scope was limited to desktop review of topography and each of the site features, including legal lot lines. Three drawings have been prepared and consist of an overall site plan (C100), as well as site plans showing Lift Station No. 1 (C101) and the WWTP septage station (C102). These are preliminary drawings meant to outline the general works within this study and not for construction purposes.



SEWER PROTECTION UPGRADES

Design Basis

The Lift Station No. 1 (LS1) site is located near the beach just south of Iglulik Street, south of Queen Elizabeth Way. It is in close proximity to a residential area but generally situated in an area with good access. Future civil work for this site may involve slight regrading such that a minimum slope of 2% is achieved, directed toward the Frobisher Bay. Any external equipment will be situated on a pad, Type I gravel compacted to a minimum of 98% proctor density. The grading plan for LS1 will identify major features in the area, including power lines and nearby properties. Also, consideration will be given for the connecting line leading from MH2. The new lift station is to be located east of the existing lift station. The existing MH to the east of the new lift station should be removed and replaced. This could be replaced with a new concrete MH, however, it is recommended that a new, insulated steel access vault (AV) be considered for these works. From the replaced MH, a split will occur with a large portion of the existing 200mm DI pipe remaining to the old wetwell and a new 250mm HDPE overflow running south of the building to the overflow. The existing 200mm HDPE overflow will be abandoned and replaced with a new 200mm HDPE overflow. As shown in C101, the new overflow will tie-in to the existing portion of the existing overflow to the south of the building at the discharge point.

The new dump station is located in West 40 near the new Iqaluit Wastewater Treatment Plant. For this work, access around the septage station will be important. The design will consider the pumper truck size and model for easy turning radius preparation. As such, the new septage station, located at the north east corner of the WWTP, will require a widening of the existing roadway for adequate truck turning and or bypass. In addition to this, further roadway work will be completed on the south west corner of the building to provide vehicle access around the building and a turn-around area for the solids trailer. All grading will be at a minimum of 2% and follow a southern direction. Granular materials will be compacted in 50mm lifts, with a minimum of 150mm of Type I gravels on the surface. Compaction expectations are for 98-99% proctor density. The grading plan for the septage station (C102) shows above and below ground infrastructure, including fuel lines, power lines, and buried water and wastewater infrastructure.

2.3 ARCHITECTURAL DESIGN

2.3.1 Design Process

The Wastewater Treatment Plant and Lift Station will require new additions to house the new systems and upgrades that will help them to function effectively going forward. These expansions will need to be well coordinated with existing site conditions and existing building systems to ensure that the buildings remain true to previous planning intention while integrating increased systems performance requirements with those that are already in place.

For the WWTP it is crucial to work around the process requirements for Pre-treatment to gravity feed to second floor equipment will push the datum for the systems upward to a second story level and create space below for building services. Providing an economical mass that has similar foundation, wall and roof systems to the existing WWTP while managing any additional requirements on the existing roof that may come as a result of the addition will be the main challenges.

Any addition to the Lift Station will need to carefully consider impact on site for the adjacent access road while also considering how to best tie in the existing wood and metal clad construction to one that meets



SEWER PROTECTION UPGRADES

Design Basis

current performance requirements. Important in this scenario is the consideration of maintaining continuous service of the existing lift station throughout construction; the new construction will be developed separately and will effectively provide redundancy in the building overall to minimize issues.

2.3.2 Exterior Systems Description

The building envelope will be designed to meet the RFP Project Brief requirements, Government of Nunavut's 'Good Building Practices Guidelines – Third Edition 2020' and the National Building Code of Canada 2015's (NBCC 2015) performance criteria as best as practically feasible. Should the City of Iqaluit have additional recommendations we would be open to reviewing and implementing those recommendations for this project.

In terms of thermal resistance for the construction assemblies the RSI values (nominal) noted assume consistent thickness and/or application but are not dependent on placement or method of installation.

We are recommending the proposed construction assemblies for the building upgrades follow the general descriptions below and are established on northern best building practices for this type of facility. Proven, easily constructed, and durable assemblies will provide a cost-effective means of addressing space constraints and efficient energy use for the facilities.

2.3.2.1 Wastewater Treatment Plant Addition Assemblies

Roof Assembly RSI 8.75:

- Metal Roofing to Match Existing
- High Temperature Underlayment
- Semi-rigid mineral wool insulation (multiple layers) with z-bars @ 600mm o.c. in outer layer
- Self-adhered Modified Bitumen Air/Vapour Barrier
- 16 mm exterior grade gypsum sheathing
- Metal decking per structural
- OWSJ or other structural steel
- Ceiling finish

Wall Assembly RSI 5.6

- Metal Cladding
- Metal Strapping Channel
- Spun Olefin Weather Barrier
- Semi-rigid mineral wool insulation
- Standoff fiberglass clips (Cascadia clips)
- Self-adhered Modified Bitumen Air / Vapour Barrier
- 16mm exterior grade gypsum sheathing



SEWER PROTECTION UPGRADES

Design Basis

- Wind load-bearing heavy gauge steel studs
- Structural steel columns and bracing
- Finish as specified (metal liner / gypsum / plywood - tbd)

Floor RSI 3.5

- Sealed Concrete
- Concrete Slab per Structural
- 10mil Poly Ground Sheet
- Rigid Insulation to meet RSI values
- Void Form per Structural
- Ground Preparation per Geotechnical Report
- Wind load-bearing light gauge metal framing

2.3.2.2 Lift Station Assemblies

Roof Assembly RSI 8.75:

- Metal Roofing
- Roofing Membrane
- Semi-rigid mineral wool insulation (multiple layers) with z-bars @ 600mm o.c. in 2 layers
- Self-adhered Modified Bitumen Air/Vapour Barrier
- 16mm exterior grade T&G plywood sheathing
- Pre-engineered wood joints and beams, painted

Wall Assembly RSI 5.6

- Metal Cladding
- 19x64 wood strapping
- Semi-rigid mineral wool insulation
- 152mm Standoff fiberglass clips (Cascadia clips)
- Self-adhered Air / Vapour Barrier
- 13mm exterior grade gypsum sheathing
- 38mm Wood Studs (framing per structural)
- 50mm rigid mineral wool in stud cavities
- Finish as specified (metal liner / gypsum / plywood - tbd)

Floor RSI 7.0

- Sealed Concrete
- Concrete Slab per Structural



SEWER PROTECTION UPGRADES

Design Basis

- 38mm Wood framing to support suspended panels
- Insulated metal panels to meet RSI requirements
- Steel pipe piles
- * for slab on grade applications refer to system used for WWTP addition

2.3.2.3 Common Exterior Systems

Exterior Doors

- Entry Systems
 - Insulated 1.9mm (14 gauge) pressed steel doors in thermally broken 1.9mm (14 gauge) hollow metal frames, utilizing institutional hardware and continuous hinges.
- Overhead Doors
 - Thickness = 50mm, high performance insulated sectional steel overhead doors to RSI 3.08 (R17.5) with PVC thermal break. Low air infiltration rating for high wind load conditions. Galvanized, painted finish. (Thermacore Sectional Steel Doors)

Roof Coverings

- 'Enerstar' rated metal roofing, standing seam profile, zinc / pre-finished, 24 gauge.
- Alternative roofing product
 - Two ply MBM (modified bitumen membrane) system can be used employing minimum 250 gram granular cap-sheet with 180 gram sanded base sheet on exterior grade gypsum sheathing / protection board.

Exterior Cladding

- Exterior cladding to be 22mm corrugated metal siding in 'Galvalume Plus' or pre-painted finish, 22 gauge thickness.
- Exterior cladding is chosen on its merits of exceptional integrity, cost, longevity and ability to sustain its finish with little to no maintenance. Overall, this is a system which will hold up well to abuse during inclement weather and seasonal maintenance such as snow removal.

2.3.3 Stairs

Any new exterior stairs, ramps and landings will be galvanized steel founded on steel pipe piles. New interior stairs for the WWTP will be constructed with steel pan and concrete and finished with rubber tile treads and risers employing non-slip finishes with edge warning strips and nosings. For all exterior stairs, landings and ramps, as well as interior stairs and landings that will have slip concerns, provide galvanized steel no-slip serrated type bar grating.



SEWER PROTECTION UPGRADES

Design Basis

2.3.4 Interior Systems Description

Interior wall framing will be 22-gauge 92 mm, 152 mm or 203 mm galvanized metal stud with scheduled finishes as required. Interior rated partitions to terminate at the underside of metal deck and finished with appropriate fire stopping systems. For the Lift Station, wood framing to be substituted for metal.

General Interior Wall Assembly 0hr & 1hr FRR:

- Metal liner or painted wall finish
- 16mm Type 'X' Impact resistant gypsum board
- 152mm light gauge metal framing
- 16mm Type 'X' Impact resistant gypsum board
- Metal liner or painted wall finish

Interior Wall Assembly 2hr FRR:

- Metal liner wall finish
- 2 Layers 16mm Type 'X' Impact resistant gypsum board
- 152mm light gauge metal framing
- 2 Layers 16mm Type 'X' Impact resistant gypsum board
- Metal liner wall finish

2.3.5 Interior Doors

All interior doors, including any fire rated doors, will be 16-gauge hollow metal in fully welded 16-gauge pressed steel frames.

2.3.6 Interior Finishes

Interior finishes are to be easily maintained and durable for use in an industrial application. Care will be taken to specify the appropriate paint product for areas with humid conditions.

Walls: In light use applications such as Mechanical and Electrical rooms: Painted 16mm abuse resistant gypsum board on light metal framing. Backboards for mounting electrical and mechanical to be 19mm plywood treated with fire resistant paint coating on all sides. For exterior walls the use of prefinished preformed metal liner panels will be recommended.

Ceilings: Exposed, painted structural steel. Where required spray applied cementitious fire proofing over any exposed structure requiring a fire resistance rating.

Floor: Sealed exposed concrete with non-slip surface additive.



SEWER PROTECTION UPGRADES

Design Basis

2.4 STRUCTURAL DESIGN

2.4.1 Vertical & Lateral Loading

The structural design of this wastewater treatment facility and lift station #1 will conform to the latest edition of the National Building Code of Canada (NBCC). The following loads will be applied to the structure in accordance with the Codes and Standards referenced above.

2.4.2 Specified Vertical Loading

In addition to structures self-weight, loads to be used in the design will be as follows:

Roofs

- Snow (SL): see 3.4.3
- Superimposed Dead (SDL): 1.50 kPa

Main Floor – addition to WWTP

- Live (LL): 12.0 kPa*
- Superimposed Dead (SDL): 1.00 kPa
- Partition Load: 1.00 kPa

Main Floor – LS No.1 addition

- Live (LL): 6.00 kPa*
- Superimposed Dead (SDL): 1.00 kPa
- Partition Load: 1.00 kPa

Second Floor - addition to WWTP

- Live (LL): 6.00 kPa*
- Superimposed Dead (SDL): 1.00 kPa
- Partition Load: 1.00 kPa

*or actual equipment weight, which ever is greater.

2.4.3 Wind, Snow & Rain Loading

Wind and snow loads to be used in the design will be as follows:

Ground snow load:

- S_s (snow) = 2.90 kPa
- S_r (rain) = 0.20 kPa

Drift loading, snow sliding, and unbalanced loading will be considered with respect to the shape and slope of the roof structure.



SEWER PROTECTION UPGRADES

Design Basis

Hourly wind pressure:

- (1/50 years) = 0.58 kPa
- (1/10 years) = 0.45 kPa

24 Hour Rain (1/50 years)

- 58mm

2.4.4 Seismic Loading

One of the key components in determining the seismic requirements is the site/soil classification, which requires the involvement of a qualified geotechnical engineer. A geotechnical evaluation including site seismic classification must be done prior the design phase.

Sa (T) = 5% damped spectral response acceleration value for given building structure period:

- Sa (0.2) = 0.087
- Sa (0.5) = 0.065
- Sa (1.0) = 0.043
- Sa (2.0) = 0.023
- Sa (5.0) = 0.0058
- Sa (10.0) = 0.0025
- PGA (peak ground acceleration) = 0.051
- PGV (peak ground velocity) = 0.052

2.4.5 Building Importance Category

The NBCC 2015 sets importance categories for various building functions. A wastewater treatment plant must remain fully functional in the event of disaster. Therefore, Stantec has designated this building as “Post Disaster” as set out in the NBCC. This designation requires an increase in loading factors to be applied to environmental loading during design. **Table 2.6** gives the Importance Factors at the four different levels of importance for comparison.

Table 2.6. Building Importance Factors

Loading Type	Importance Factor, I			
	Low Importance	Normal Importance	High Importance	Past Disaster
Dead Load	1.00	1.00	1.00	1.00
Live Load	1.00	1.00	1.00	1.00
Snow / Rain Load	0.80	1.00	1.15	1.25
Wind Load	0.80	1.00	1.15	1.25
Seismic Load	0.80	1.00	1.30	1.50



SEWER PROTECTION UPGRADES

Design Basis

2.4.6 Building Systems WWTP Addition

2.4.6.1 Foundation & Main Floor

- Rock-socketed steel piles to bedrock.
- Concrete grade beams.
- Concrete suspended slab with void form insulation to minimize frost heave.

2.4.6.2 Second Floor

- Steel HSS columns
- Steel W-Section beams and Open Web Steel Joists (OWSJ)/ W-Section.
- Composite steel deck with concrete topping

2.4.6.3 Roofs

- Steel HSS columns
- Steel W-Section beams and OWSJs.
- Corrugated steel deck roof fastened to the supporting structure.
- Lateral Resistance

2.4.6.4 Lateral Resistance System

- The foundation will resist lateral forces using a combination of the pile bending resistance, and steel bracing
- The lateral resistance system of the superstructure will be HSS bracing

2.4.7 Building Systems LS No.1

2.4.7.1 Foundation & Main Floor

- To be determined based on geotechnical report.

2.4.7.2 Superstructure & Roof

- Structural plywood wall sheathing for all perimeter walls and shear walls.
- Dimensional and/or engineered light wood frame construction.
- Built-up columns under the point loads
- Structural plywood roof sheathing.
- Pre-engineered wooden roof trusses.



SEWER PROTECTION UPGRADES

Design Basis

2.4.7.3 Lateral Resistance System

- Wood panel shear wall and diaphragm structural elements are used to resist lateral load such as wind or seismic forces.

2.4.8 Building Systems Septage Station

2.4.8.1 Foundation & Main Floor

- Rock-socketed steel piles to bedrock.
- Steel W-Section floor frame for prefabricated station.

2.4.8.2 Super Structure

- Prefabricated & pre-engineered station.

2.4.8.3 Lateral Resistance System

- The foundation will resist lateral forces using a combination of the pile bending resistance, and steel bracing

2.4.9 Codes, Standards & Acceptable Products

- Design Criteria, Loading and Methodology - Limit Stated Design (LSD) / NBCC 2015
- Design of Structural Concrete – Latest Edition of CSA A23.3.
- Design of Structural Steel – Latest Edition of CSA S16.
- Reinforcing Steel Quality - Latest Edition of CAN/CSA G30.18
- Structural Steel Quality – Latest Edition of CSA G40.21
- Design of Wooden Structures – Latest Edition of CSA O86
- Anchorage / Fastening – Simpson Strong-Tie and/or Hilti Systems.
- OWSJs & Steel Deck – Canam Canada Standards / Design Literature

2.5 BUILDING MECHANICAL DESIGN

2.5.1 Introduction

The mechanical systems for the WWTP building shall meet or exceed requirements of the Government of Nunavut “Good Building Practice Guidelines”, 3rd edition, January 2020, (referred herein as “Good Building Practice (GBP)”), all applicable ASHRAE standards and guidelines, normal industry practice for similar facilities, and all other applicable codes and standards. These include, but are not necessarily limited to:

- National Building Code of Canada – latest edition;
- National Fire Code of Canada – latest edition;



SEWER PROTECTION UPGRADES

Design Basis

- National Plumbing Code of Canada – latest edition;
- CSA B139 Series 19, Installation Code for Oil-Burning Equipment;
- Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products;
- Applicable ASPE Standards;
- NFPA 10 (2018) – Standard for Portable Fire Extinguishers;
- NFPA 90A (2018) – Standard for the Installation of Air-Conditioning and Ventilating Systems;
- NFPA 91 (2015) – Standard for Exhaust Systems for Air Conveying of vapors, Gases, Mists and Particulate Solids.
- NFPA 101 – Life Safety Code.
- NFPA 820 (2016) – Standard for Fire Protection in Wastewater Treatment and Collection Facilities.
- ACGIH Industrial Ventilation Manual
- Canadian Occupational Health and Safety (CCOHS) Act
- SMACNA Duct Construction Methods
- Applicable SMACNA Design and Construction Guidelines;
- ASHRAE Handbooks;
- ASHRAE Guideline 0-05 The Commissioning Process;
- ASHRAE Guideline 4 for O&M Manuals;
- ASHRAE 62.1-2019, Ventilation for Acceptable Air Quality;
- ASHRAE 90.1-2019, Energy Standard for Buildings except Low-Rise Residential Buildings; and
- Other applicable codes and standards.

2.5.2 HVAC Design Considerations

2.5.2.1 Outdoor Design Conditions

Design conditions for the WWTP will be based on the National Building Code of Canada statistical 1% January and 2.5% July norms as follows:

- Winter design Temperature: -41°C
- Summer: 17°C dry bulb / 12°C wet bulb

2.5.2.2 Indoor Design Requirements

The design criteria for the HVAC systems serving the Lift station and WWTP Additions systems will be as indicated in **Table 2.7**. The existing WWTP rooms will remain as classified in the previous design for the WWTP upgrades.



SEWER PROTECTION UPGRADES

Design Basis

Table 2.7. HVAC Design Criteria

Building Room	Design Indoor Temp. (°C)		Vent Rate (min ACH)	Hazard Classification (NFPA Group D)	Room Pressure
	Max.	Min.			
Lift Station No. 1					
New Wet Well	24	10	6*	Class 1, Div 1	Negative
New Room above wet well	24	10	6*	Class 1, Div 1	Negative
Existing Wet Well	24	10	6*	Class 1, Div 1	Negative
Existing Room above wet well	24	10	6*	Class 1, Div 1	Negative
Existing Mechanical Room	24	18	N/A	1 hr rated	Neutral
Existing Clean Room (Electrical/Generator)	30	18	N/A	2 hr rated	Neutral
*To minimize energy use caused by heating of ventilation air to maintain a lower Hazard Classification, this space will not be continuously ventilated. As such its Hazard Classification will not be reduced. The ventilation rate being provided will be for gas and odour control only.					
WWTP – Septage Receiving Station					
Septage receiving room*	24	10	N/A	N/A	Neutral
*All sewage in room is enclosed within piping or equipment, no sewage exposure to room. Ventilation is required for moisture and humidity control					
WWTP – New Additions Lower Level					
Electrical Room #3 (Addition 115)	30	18	N/A	1 hr rated	Neutral
Mechanical Room (Addition 114)	24	18	N/A	1 hr rated	Neutral
Coarse Solids, Grit, and Grease Removal Trailer Room (Addition 116)	24	10	6	Class 1, Div 2	Negative
WWTP – New Addition Upper Level					
Coarse Solids, Grit, and Grease Removal Process Room (Addition 212)	24	10	12	Class 1, Div 2	Negative

2.5.3 Heating Systems

2.5.3.1 Calculations

Preliminary heating load calculations were prepared based on the 1% winter design temperature. These calculations have been used to size equipment and estimate peak heat loss, peak and normal building loads, heat gains, and ventilation outside air quantities and loads. The preliminary loads are shown in **Table 2.8**. Note that these loads are based on the preliminary floor plans, sections, and building construction. It is anticipated they may vary up to +/- 30% over the course of detailed design.



SEWER PROTECTION UPGRADES

Design Basis

Table 2.8. Initial Heating Loads

Building Room	Skin Loss (kW)	Infiltration Loss (kW)	Ventilation (kW)	Process & Other (kW)	Total (kW)
Lift Station No. 1					
New Wet Well	0	0	0*	0	0.0
New Room above wet well	4.35	7.52	43.3	0	55.2
Existing Wet Well	0	0	0*	0	0.0
Existing Room above wet well	1.29	2.19	16.4	0	19.9
Existing Mechanical Room	0.79	0.62	0	0	1.4
Existing Clean Room (Electrical/Generator)	2.30	1.96	0	0	4.3
Total					80.7
<i>*Wet well ventilation load is included in the load for the room above.</i>					
WWTP					
Septage receiving room (standalone)	2.13	1.31	3.1	0	6.6
Electrical Room #3 (Addition 115)	1.93	1.92	0	0	3.9
Mechanical Room (Addition 114)	2.86	2.30	0	0	5.2
Coarse Solids, Grit, and Grease Removal Trailer Room (Addition 116)	3.42	5.43	79.2	0	88.1
Coarse Solids, Grit, and Grease Removal Process Room (Addition 212)	4.96	21.10	295.1	0	321.2
Existing WWTP building (per previous project)	33.3	12.6	309.1	51.6	406.6
Total					831.6

2.5.3.2 Heating Plant – Lift Station No. 1

The existing heating plant at Lift Station No. 1 will be upgraded to support the additional heating loads as it does not have enough capacity for the anticipated load and there is not sufficient space within the boiler room to add a 3rd boiler. The existing boilers in the lift station mechanical room will be removed and replaced with new boilers sized for the new anticipated load. The new boilers will be high efficiency cast iron sectional fuel oil fired boilers. As the ventilation load for the wet well composes a significant portion of the building heating load, careful consideration has to be given to boiler selections to prevent grossly oversized boilers which will likely result in short boiler run times / high cycling. The capacity of the boiler system shall be such that with one boiler out of service the heating plant will:

- Maintain the normal building minimum room temperatures when the wet well ventilation systems are not operating; and
- Maintain the building room temperatures at 1°C when the wet well ventilation systems are operating.

A two (2) boiler system is proposed for this plant with each boiler sized at approximately 66% of the peak heating load. A primary (boiler) pump will be provided for each boiler.



SEWER PROTECTION UPGRADES

Design Basis

Portions of the existing heating water piping will be removed as required to allow the new boilers to be installed in a primary/secondary configuration with the secondary side serving the existing building as one loop and the new addition as a second loop. New heating water piping will be a two-pipe reverse/return distribution system to serve the buildings terminal units.

A duplex set of secondary heating water pumps will be provided. These pumps will be equipped with integral variable speed drives (VSD's) controlled off differential pressure as measured by integral pressure sensors to reduce energy consumption.

Boilers, primary pumps, and secondary pumps will be controlled by a new standalone Tekmar controller. The alarm contact on the controller will be connected to the existing building system utilized for remote alarm callouts.

Heating media shall be a factory premixed 50%-50% water/glycol Dowfrost HD, with high-temperature inhibited propylene glycol (no substitutes will be allowed). A small packaged automatic heating media makeup system with pump, tank and pressure reducing valve shall be provided. In addition, a chemical pot feeder and glycol side stream filters shall be provided.

All HW equipment in the mechanical room including pipe, valves, fittings and heating equipment, e.g. air separator and heat exchanger) will be insulated. Where the existing HW piping is visible and the insulation is observed to be in poor condition it will be replaced with new.

A separate chimney shall be provided for each oil-burning appliance. The length of exposed chimney lengths outdoors shall be minimized to reduce the risk of condensation. A barometric draft regulator shall be installed on each oil-burning appliance if natural draft. A cleanout shall be provided at all vent piping changes of direction.

2.5.3.3 Heating Plant – WWTP

The current boiler plant installed with the recent WWTP upgrades has very little extra available capacity without having to utilize the standby boiler's capacity. Based on the preliminary heating loads in **Table 2.8**, an additional boiler or new boiler plant to support the new additions will be required. The additional load required by the addition is approximately equal to the output of one of the current boilers. The current boiler room does not have sufficient space to allow the installation of a 3rd boiler. Discussions took place with the client as to the preference to have an additional boiler place just for the new addition or to relocate the current heating plant to the new addition where sufficient space will be available to allow a 3rd boiler. Considering the additional maintenance that would be required by a second boiler plant and the desire to have some storage space and maintenance area within the WWTP, it was decided to relocate the existing heating plant to the new addition and convert the existing mechanical room into storage and maintenance space.

The current two boilers installed in the WWTP are high efficiency cast iron sectional Bosch Buderus G515/11 boilers. Each boiler has a Riello RL50/M modulating oil-fired burner and a net IBR output of 403 kW. As previously mentioned, the required additional load for the new additions is approximately equal to the net IBR output of one of the boilers.



SEWER PROTECTION UPGRADES

Design Basis

The two existing boilers, associated primary heating water pumps, heating water expansion tanks, glycol fill tank and chimneys will be relocated from the existing mechanical room to the new mechanical room in the Coarse Solids, Grit, and Grease Removal addition.

A new Buderus G515/11 boiler with a Riello RL50/M burner and new chimney will be provided. This will result in each boiler being sized for approximately 50% of the peak heating load. As the capacity of the system is increasing significantly, an additional heating water expansion tank of the same size (based on preliminary calculations) will also be required.

The existing heating water controls and controllers would be relocated as well and supplemented with new control devices and sensors to support the addition of the 3rd boiler. The heating plant and distribution system controls would remain under the existing WWTP HVAC control system.

Select modifications to the heating water distribution mains will be required to allow the heating water to be provided from a different location. These modifications are described on the preliminary drawings.

Due to the increase total capacity of the heating water system, the secondary pumps will be removed and replaced by new larger secondary pumps with variable frequency drives. Control of the secondary pumps will be changed to differential pressure rather than the current differential temperature.

The heating plant will remain as a two-pipe reverse/return primary/secondary distribution system. Two additional loops will be provided to serve the new additions. One will serve the Coarse Solids, Grit, and Grease Removal addition and the second will serve the Septage Receiving Station.

Additional heating media will be required to fill the expanded heating water system. New heating media shall be a factory premixed 50%-50% water/glycol Dowfrost HD, with high-temperature inhibited propylene glycol (no substitutes will be allowed). Care will be taken during the selective demolition and tie-in of new heating water piping to retain the existing heating water media.

All new HW equipment in the mechanical room including pipe, valves, fittings and heating equipment (e.g. air separator and heat exchanger) will be insulated. Where modifications to the existing heating water piping are completed, new insulation will be provided as well where the existing needs to be cut back to allow the modifications.

2.5.3.4 Terminal Heat

To aid in balancing and flow control throughout the existing heating water system, all existing unit heaters (15 total) will have a circuit balance valve installed. All existing unit heaters that are not located in a classified area (12 total) will also have an on/off control valve installed. The control valve would be cycled by the existing line-voltage thermostat that controls the unit heater fan.

Unclassified areas will be heated using commercial hydronic unit heaters. In the classified areas, explosion proof hydronic unit heaters will be used for space heating. Each terminal heating unit will have thermostatic control to provide individual space temperature control.



SEWER PROTECTION UPGRADES

Design Basis

Heat piping shall be Schedule 40 black iron or Type L copper. Grooved mechanical joints will be permitted only where piping is readily accessible in case of leaks. A means of isolation, balancing and flow measurement at all pieces of major equipment and at major circuits shall be provided.

Isolation ball valves shall be provided on the supply and return of every heating unit. Isolation ball valves shall be provided on each side of all zone valves.

Circuit balancing valves with integral testing ports shall be used for all balancing valves; globe or butterfly valves are not acceptable. A balancing valve shall be provided at the return connection of each terminal unit. A drain valve with cap and chain shall be provided at all system low points, and manual vents at all system high points.

Appropriate maintenance access shall be provided for all valves, drains, system vents and equipment.

Adequately sized sleeves shall be provided for all heating piping passing through walls or floors.

Insulation on all HVAC piping will be provided to the requirements of National Energy Code for Buildings, in order to maintain water temperature, minimize heat loss and to prevent condensation.

Distribution to the ventilation coils for air handling equipment shall be direct return with circuit flow balancing valves, modulating 2- way control valves complete with a Coil Loop Pump for pre-heat coils and modulating 2-way control valves for re-heat coils. Distribution to the main building terminal heating units shall be a reverse return piping loop.

2.5.4 Ventilation Systems

All unclassified areas will need to be physically separated from classified areas in accordance with NFPA 820. No air will be allowed to transfer from classified space into an unclassified space or vice versa.

Preliminary required airflows are shown in **Table 2.9**. Note that these airflows are based on the preliminary floor plans and sections. It is anticipated they may vary up to +/- 30% over the course of detailed design.



SEWER PROTECTION UPGRADES

Design Basis

Table 2.9. Initial Airflows

Building Room	Classified Space Full Airflow (L/s)	Non-classified space airflow (L/s), use as noted
Lift Station No. 1		
New Wet Well	85	N/A
New Room above wet well	545	N/A
Existing Wet Well	60	N/A
Existing Room above wet well	175	N/A
WWTP		
Septage receiving room (standalone)	N/A	~50, for space ventilation (odor, humidity & cooling) only
Electrical Room #3 (Addition 115)	N/A	800, for space cooling
Mechanical Room (Addition 114)	N/A	40, for space cooling
Coarse Solids, Grit, and Grease Removal Trailer Room (Addition 116)	1,420	N/A
Coarse Solids, Grit, and Grease Removal Process Room (Addition 212)	5,430	N/A

2.5.4.1 Ventilation – Lift Station No. 1

The existing air handling unit serving the wet well will be removed along with most of its associated ductwork. The wall penetration left by the removed duct through the existing clean room / pumping room wall will be patched and sealed to ensure no leakage of gases into the clean room. Select portions of the AHU ductwork and fittings will be kept for re-use with the new ventilation systems.

As the existing pumping room / wet well and new pumping room / wet wells are being classified as Class 1, Division 1 spaces, continuous ventilation is not required. Three exhaust fans will be provided for odor control and removal of any gas build-up within the classified areas. This system will be referred to as Air System #1 (AS-1). One exhaust fan will be ducted to draw from the existing wet well and another will be ducted to draw from the new wet well. A dedicated vent through the roof with a gooseneck will provide unheated make-up air directly to the wet wells. As the airflows are relatively low and the wastewater level is constantly changing in the wet well freezing will not occur. A third exhaust fan will draw air from high and low level within the combined existing/new pump room. Make-up air for this exhaust fan will be provided by an outdoor air intake hood and will be heated by a unit heater situated immediately in front of the opening and such that the outside air opening is directed at its inlet.

Service cooling air for the mechanical room will be accomplished through an economizer and using a small single fan system. This system will be referred to as Air System #2 (AS-2). The mechanical room will also have a combustion air intake duct. The existing summer cooling fan system serving the clean room (electrical/generator room) will remain. The existing generator cooling system will remain.



SEWER PROTECTION UPGRADES

Design Basis

Air distribution will be low velocity galvanized sheet metal and the supply ductwork will be insulated. Ducting located within the wet well and connected to its vents will be stainless steel.

2.5.4.2 Ventilation – WWTP

Air system #4 (AS-4) will serve the classified areas of the WWTP Coarse Solids, Grit, and Grease Removal Addition that requires 6 and 12 air changes. The equipment will meet the electrical requirements for Class 1 Div. 2 operation and be located within the addition mechanical room on the lower level. The unit will provide 100% fresh air in order to remove explosive and corrosive sewer gases. The exhaust will include a 50mm MERV 8 filter to remove most particles, an aluminum flat plate heat exchanger to assist in the heating of the fresh air, and then the exhaust fan. The fresh air supply will include a summer position for a MERV 8 filter, a pre-heating coil, a winter position for a MERV 8 filter, the aluminum flat plate heat exchanger, a final heating coil, and the supply fan. The flat plate heat exchanger will recover about 65% of the heat down to 0°C. The exhaust air temperature will be limited to 0°C to avoid frosting of the heat exchanger core. There will be a face and bypass damper installed at the heat exchanger to provide free cooling during the summer. A flat plate heat exchanger is proposed, rather than a heat wheel heat exchanger because the flat plate heat exchanger is a more robust system and has a proven history of operation in this application. Fans will have VFD controllers to modulate the fan speeds to maintain constant air static pressure. The unit control panels will include an integral purge system fed by the supply air side of the unit to prevent hazardous atmospheres from entering the controls and electrical devices.

Air system #5 (AS-5) will provide service cooling air for the mechanical room and air system #6 (AS-6) will provide service cooling air for the electrical room. Service cooling will be accomplished through an outdoor air and return air economizer and single fan system. The electrical room will have an exhaust air damper interlocked with its economizer. The mechanical room will have a combination relief air and combustion air intake duct and will not have an exhaust air damper.

Air system #7 (AS-7) will serve the Septage Receiving Station. The Septage Receiving Station is being supplied as a packaged unit with all internal equipment and devices being provided by the manufacturer. The manufacturer will provide a ventilation system suitable for a mechanical space to control temperature, odors and humidity build up.

Air distribution will be low velocity galvanized sheet metal. All outdoor air and exhaust air ductwork will be insulated for its full length.

2.5.5 Fuel System

2.5.5.1 Fuel System – Lift Station No.1

The existing fuel oil system installed at Lift Station No. 1 will be re-used for the new boilers. Based on preliminary loads and sizing, the existing 2,400 L tank appears to have sufficient capacity to provide for 2 weeks of building heating and peak load and have sufficient remaining capacity to allow for approximately 1.5 days of generator run time at full load. The tank size will be confirmed suitable during detailed design.



SEWER PROTECTION UPGRADES

Design Basis

2.5.5.2 Fuel System – WWTP

Based on preliminary loads and anticipated ventilation system usages, the anticipated fuel oil consumption for the existing WWTP and new additions will be approximately 14,000 L per week at peak heating conditions. For reference, the previous WWTP upgrade was estimated to require approximately 7,200L per week at peak heating conditions. This increase is as expected due to the ventilation load required to support the new process areas in the Coarse Solid, Grit and Grease Removal Handling Addition being similar to the combined load for the existing headworks (AHU-3) and unclassified areas (AHU-2).

The exterior 24,000L fuel oil storage tank at the WWTP was originally sized to provide 2 weeks of heating operation at peak heating load and approximately 1 week of generator operation at full load. The existing tank will provide approximately 13.5 days at peak heating load with no allowance for generator operation. To allow for a week of generator operation at full load, the resulting fuel volume would allow for approximately 1 week of heating operation at peak heating conditions. Based on these estimates it is currently proposed that the existing exterior storage tank be kept as it is relatively new and it is not cost effective to upgrade now. Additionally, a minimum once per week filling schedule should be adopted to ensure sufficient fuel levels in the tank in case of extended power outages or missed deliveries due to weather. When the current exterior tank requires replacement a 35,000 L tank should be provided.

The anticipated fuel oil consumption will be reviewed again during detailed design to ensure the existing exterior storage tank provides sufficient capacity.

The existing level and leak monitoring devices in the exterior fuel oil storage tank will remain and continue to be monitored by the existing WWTP HVAC control system.

The existing fuel oil day tank and associated level controls for automatic filling will be relocated from the existing mechanical room to the new addition mechanical room. New control wiring between the relocated day tank and the fuel oil transfer pumps controller will be provided. New fuel oil supply piping will be run from the existing transfer pumps up to high level on the upper level and run across the unclassified area of the WWTP (adjacent to the existing heating water lines) to the new addition before dropping down to the lower level. A fuel oil return line will run in parallel with the supply line and will connect to the existing vent/overflow line to the exterior storage tank near the transfer pumps. The return line will only be used for the pressure relief valve discharge required by code upstream of the day tank fill solenoid valve. Due to vertical rise required to reach the upper level of the WWTP (such that the fuel piping can cross the building) from the transfer pumps on the lower level on the southeast side of the building exceeding the 7.0m allowed by code, the return line will not be used for overflow/venting of the day tank.

As the relocated day tank cannot be vented via an overflow/vent pipe back to the main exterior tank due to the rise of the return pipe exceeding the maximum allowed by code, it will be vented to the exterior. An additional level switch will be required by code as an additional means to prevent overfilling of the day tank. This level switch will be installed on the day tank vent line and will be hardwired to disconnect power to the day tank solenoid valve and fuel oil transfer pumps.



SEWER PROTECTION UPGRADES

Design Basis

The relocated day tank will provide fuel warming for the two relocated and one new oil-fired boilers that will be located in the mechanical room of the Coarse Solid, Grit and Grease Removal Handling Addition. Individual fuel supply to each boiler will be provided from a common supply header of the top of the day tank. Each supply line will have an anti-siphon valve at the header and a fuel-oil de-aerator at the burner.

A new 283 L auxiliary day tank will be provided in the existing mechanical room to serve the oil-fired domestic hot water heater that is not being relocated. The day tank will include the same level controls and solenoid valve for automatic filling as the existing auxiliary tank that is being relocated. Venting of the tank will be by a combined vent/overflow pipe to the exterior storage tank.

The existing fuel oil transfer pumps will remain. However, the existing control panel will be removed and replaced with a new panel as the current panel only provides the required functionality to fill two auxiliary tanks. A new control panel that has the same functionality but is capable of monitoring and filling three auxiliary day tanks will be provided.

2.5.6 Plumbing Systems

2.5.6.1 Sanitary – Lift Station No.1

The existing drainage systems will be left as is and any new drainage required (i.e. floor drains) will be piped to discharge into the new wet well. Trap guards will be provided to prevent odors and gases being released from the floor drains.

2.5.6.2 Sanitary – WWTP

No sanitary system will be provided for the new Septage Receiving Station.

New floor drains will be provided for both the upper and lower levels of the Coarse solids, Grit, and Grease Removal addition at the WWTP. Trap guards will be provided to prevent odors and gases being released from the floor drains.

Floor drains on the upper level will be piped to discharge into the existing wet well. If possible, the floor drain sanitary piping will connect into the existing sanitary piping discharging to the wet well rather than creating a new penetration through the wet well wall.

Floor and or trench drains on the lower level will drain to one of two sump pits. One sump pit and set of explosion proof duplex sanitary pumps and associated explosion proof control panel and level switches will be located in the new solids/grit trailer room. The other sump pit and set of sanitary pumps and associated control panel and level switches will be located in the new mechanical room towards the north end where the majority of the sanitary waste would be produced. Both sets of sump pumps will discharge to the sanitary line serving the upper level floor drains which will be installed at high level within the lower level.

Where equipment drains are required, they will be piped to either the sump pits or the upper level floor drain sanitary line.



SEWER PROTECTION UPGRADES

Design Basis

The above grade piping will be PVC DWV similar to IPEX System 15 which is suitable for most applications in non-combustible construction. Below grade the piping will be complete with 50mm of urethane insulation and an exterior polyethylene jacket.

2.5.6.3 Potable Water – Lift Station No.1

The existing potable water system at Lift station No.1 consisting of a water storage tank and packaged pressure pump and tank will remain. The water pressure pump and tank will be relocated closer to the water storage tank and the cold water supply line from the pressure pump will be relocated from mid-level to high level to free up more space for the new electrical devices required for the new wet well and pumps.

The existing hose bibb in the existing pumping room will remain. A new hose bibb will be provided in the new pumping room near the south east corner. Piping to the hose bibb will be PEX; copper piping will not be permitted in the pumping rooms. A new eyewash will be provided in the new pumping room located centrally between the existing and new pumping room exterior doors.

2.5.6.4 Potable Water – WWTP

No new potable water system will be provided to the WWTP Coarse solids, Grit, and Grease Removal addition and the Septage Receiving Station at the WWTP.

2.5.6.5 Non-Potable Water – Lift Station No.1

No non-potable water system will be provided at the Lift station.

2.5.6.6 Non-Potable Water – WWTP

The existing non-potable water system within the WWTP will be extended to serve process needs in the new Coarse solids, Grit, and Grease Removal addition and the Septage Receiving Station at the WWTP. A new reduced pressure backflow preventer will be installed in the WWTP water entrance room or on available wall space near the room. New piping will be run from the backflow preventer up to the WWTP upper level and across to the new addition.

Should the proposed process equipment require hot water for cleaning, a non-potable hot water heater (heated by the boiler plant) will be provided in the mechanical room for new loads requiring hot water. The non-potable water heater will include a heating water injection pump and will be piped in parallel to the secondary heating water pumps. Subject to the piping distances and process usage times, a non-portable hot water recirculation pump will be provided to ensure hot water is available within the duration required.

A single insulated and hydronically heat traced non-potable water line will be provided for the new Septage Receiving Station for pipeline flushing. The line will run alongside the above ground heating water lines running to the Septage Receiving Station running from the new addition mechanical room to the Septage Receiving Station. The line will be heat traced as a portion of it runs exposed between the WWTP and the Septage Receiving Station.



SEWER PROTECTION UPGRADES

Design Basis

All pipe will be insulated and identified to differentiate it from the potable water systems.

2.5.7 Fire Protection

The Lift Station No. 1 and WWTP buildings are not sprinklered. In lieu, passive and active fire protection systems will be provided.

Passive mechanical protection systems will include rated fire stopping, fire dampers and the use of low flame and smoke spread rated material. To provide the highest level of passive protection the facility will be of non-combustible construction throughout.

Fire extinguishers will be installed to the requirements of NFPA 10 and the Authority having jurisdiction. For general service, multi-purpose use extinguishers will be Type ABC dry chemical. For electrical and equipment rooms clean extinguishing agent extinguishers will be provided. Fire extinguishers will be hanger mounted.

2.5.8 HVAC Controls

2.5.8.1 Controls – Lift Station No.1

New controls for the Lift Station No. 1 will be standalone electronic types. Where required, the new controls will be integrated with the existing building control systems and alarm outputs.

Controls – General

A new Tekmar controller will be provided for the boilers and heating water pumps. Heating plant control will include boiler staging and water temperature reset. Heating pump control will include automatic pump sequencing and pump speed control to provide improved energy efficiency and equipment life cycle.

Unit heater fans will be cycled on/off by line voltage thermostats.

The air system for the mechanical room will operate to maintain the room temperature set-points.

Critical alarms will be reported through the existing control panel for the Lift Station using digital pager or email connections. In addition, connection to auto dialers, where supplied by electrical, will also be included for critical alarms.

Draft control descriptor logic for the systems is described in the following sections.

Heating System Control Logic

- The building heating provides heat for space and air heating through the heating terminal units and ventilation air heating coils. The building heating system will run continuously.
- Two high efficiency fuel oil boilers will provide peak load heating. The fuel oil boilers will operate lead/lag. When any of the boilers is on, the associated primary circulation pump is to be on.



SEWER PROTECTION UPGRADES

Design Basis

- The fuel oil boilers are to be staged on and the burners are to operate to meet demand. The primary heating system glycol temperature will be reset based on outdoor air temperature.
- The secondary pumps are to operate lead/standby with auto transfer on failure and with lead rotating weekly. If both pumps fail a critical alarm will be generated. Pump speed is to be controlled based on the internal variable speed drive and internal pressure and/or temperature sensors.
- Zone heating for all radiators is to be 2 position solenoid type valves.
- Space heating thermostats are to start the unit heater fan as required to maintain the temperature.

Ventilation System Control Logic

AS-1 – Pumping Rooms and Wet Wells

- All three exhaust fans (existing wet well, new wet well, and new/existing pumping room) to be enabled should any of the following occur:
 - Manually enabled by wall switch corresponding to the fan.
 - Enabled by timer for a set duration
 - Gas detectors sense high H₂S and or other high gas levels.
- On enable, exhaust air damper to open and fan to start on damper end switch.
- On enable of pumping room exhaust fan, outside air damper to open. Unit heater located in front of outside air inlet to provide heating of outdoor air.
- A low space temperature alarm is to be triggered if the pumping room space temperatures is below 5°C; however, the pumping room exhaust fan is not to be disabled.

AS-2 – Mechanical Room

- Supply fan on/off by a cooling demand.
- Supply air temperature is to be reset based on space demand using proportional control to economizer to maintain temperature set point.
- When the cooling fans are on, any space heating equipment is to be locked out.

Fuel System Control Logic

The existing fuel oil system controls will remain. No modifications will be made.

Plumbing System Control Logic

The existing plumbing system controls will remain. No modifications will be made.



SEWER PROTECTION UPGRADES

Design Basis

2.5.8.2 Controls – WWTP

New controls for the WWTP additions will be integrated into the existing Johnson Control Metasys System installed with the recent WWTP upgrade. All controls for the WWTP are to be BACnet compliant and compatible with the existing control system, network, and devices.

The system will have a fail-safe design to ensure continued system operation regardless of the BMS status using manufacturer proprietary controllers wherever possible with the BMS used for initiating control and monitoring only.

Controllers on the BMS will be capable of standalone operation and will communicate over a peerless network. The existing web server PC located on the existing LAN will operate both as the system server and as a web based Internet server that will allow control functions, report functions, all data base generation and modification functions as described for typical BMS work-stations to be completed via the Internet from any remote site with Internet access.

Control for packaged equipment will be through the unit manufacturer supplied and programmed PCU's. For all equipment open protocol BACNet communications will be provided between the PCU's and the BMS.

For on-site diagnostics and control, the existing PC workstation located in the WWTP Office and connected to the BMS will be used. After hours monitoring and alarm system trouble will be reported through the existing means to allow after hours communications to maintenance personnel for critical system trouble, e.g. heating system failure. The existing BMS allows for remote monitoring and control of the building through Internet based communications. As a requirement of the project closeout, the BMS contractor will verify successful communications from the site using the Internet based communications. Output to the building process system PLC for critical alarms will be used.

Controls – General

The air systems for the mechanical room and for the electrical room will operate to maintain the room temperature set-points.

Heating plant control will include boiler staging and water temperature reset. Heating pump control will include automatic pump sequencing and pump speed control to provide improved energy efficiency and equipment life cycle.

Heating terminal unit control will be on/off by line voltage thermostats.

Critical alarms will be reported through the existing BMS for the WWTP using digital pager or email connections. In addition, connection to auto dialers, where supplied by electrical, will also be included for critical alarms.

Draft control descriptor logic for the systems is described in the following sections.



SEWER PROTECTION UPGRADES

Design Basis

Heating System Control Logic

- The building heating provides heat for space and air heating through the heating terminal units and ventilation air heating coils. The building heating system will run continuously.
- Three high efficiency fuel oil boilers will provide peak load heating. The boilers will operate as lead/lag/standby. When any of the boilers is on, the associated primary circulation pump is to be on.
- The boilers are to be staged on and the burners are to modulate to meet demand.
- The primary heating system glycol temperature will be reset based on outdoor air and DHW heating demands.
- The secondary pumps are to operate lead/standby with auto transfer and alarm signal on failure and with lead rotating weekly. If both pumps fail a critical alarm will be generated. Pump speed is to be controlled based on differential pressure.
- Zone heating for all radiators is to be 2 position solenoid type valves.
- Zone heating for all unit heaters in non-classified areas is to be by space heating thermostats that start the unit heater fans and open the 2-position solenoid valves as required to maintain the temperature.
- Zone heating for all unit heaters in classified areas is to be by space heating thermostats that start the unit heater fans as required to maintain the temperature.

Ventilation System Control Logic

AS-4 = Coarse Solid, Grit and Grease Removal Handling Addition

- The system will consist of AHU-4 associated ductwork, and heating equipment that serves the AHU. The air system that run continuously and will operate at 2 speeds at times as noted below.
- AHU-4 will operate at 50% capacity unless any of the three following conditions occurs. Whenever any of the following conditions apply, the air system will operate at 100% capacity.
 - The ambient air temperature is above 10°C;
 - Whenever the ventilated space is occupied; Or
 - Whenever activated by approved combustible gas detectors set to function at 10% of the lower flammable limit (LFL).
- AHU-4 supply speed to be modulated based on duct static pressure and required air changes per hour. AHU-1 exhaust fan speed to be adjusted to maintain building pressurization.
- Supply air temperature is to be reset based on outdoor air using proportional control to the reheat coil and “free” cooling economizer to maintain set point. The face and bypass damper at the heat exchanger will provide the economizer cooling.
- Fresh air will be conditioned by the preheat coil, heating the air to -8°C and then the flat plate heat exchanger. Preheating the fresh air will provide the frost control and permit continuous supply air.



SEWER PROTECTION UPGRADES

Design Basis

- The pre-heating coil pump is to operate whenever the outdoor air temperature is less than - 5°C and to never operate less than 1hr.
- A low temperature override and alarm will be provided for AHU-4. Alarms on high filter pressure drop and fan failure will be provided.

AS-5 – Mechanical Room & AS-6 – Electrical Room

- Supply fan on/off by a cooling demand.
- Supply air temperature is to be reset based on space demand using proportional control to economizer to maintain temperature set point.
- When the cooling fans are on, any space heating equipment is to be locked out.

AS-7 – Septage Receiving Station

- The Septage Receiving Station is being supplied as a packaged unit with all internal equipment and devices provided by the manufacturer. All mechanical controls for ventilation and heating will be by the Station manufacturer.

Fuel System Control Logic

The existing control sequence for the relocated boiler fuel oil day tank will remain the same as its currently is. Existing control logic is provided below in italics for reference. New additional control logic is not italicized.

- On low fuel oil at the main tank, a critical alarm will be generated.
- The fuel oil transfer pumps will cycle to maintain the auxiliary tank levels.
- The transfer pumps will operate as lead/standby with auto transfer after each duty cycle.
- On Lead pump failure, standby pump enabled and alarm sent to OWS (WWTP) or building alarm panel (Lift Station).
- Low level switch in auxiliary tank to cause tank solenoid valve to open and lead fuel oil transfer pump to start.
- High level switch in auxiliary tank to cause fuel oil transfer pumps to stop and tank solenoid valve to close.
- High level alarm level switch in auxiliary tank to generate an alarm, close the auxiliary tank solenoid valve and stop the fuel oil pumps. The pumps will not restart until manually reset.
- Low level alarm level switch in auxiliary tank to generate an alarm, open the auxiliary tank solenoid valve and start both the fuel oil pumps.
- Critical high-level alarm level switch to disable power to both auxiliary tank solenoid valve and both fuel oil transfer pumps. The pumps will not restart and the solenoid valve will not open until the fuel oil level is lower than the level switch.



SEWER PROTECTION UPGRADES

Design Basis

Plumbing System Control Logic

- The HWH injection pump for each non-potable water heater will cycle to maintain the HW heater temperatures. If HW exceeds or is below set points, alarms will be generated.
- The non-DHW recirculation pump will operate continuously. If the pump fails, a critical alarm will be generated.

2.5.9 Other

2.5.9.1 Testing, Adjusting and Balancing

Testing, Adjusting and Air Balancing of all air and water systems will be included.

2.5.9.2 Commissioning and Training

Construction commissioning services will be provided for the WWTP. Commissioning is necessary to ensure installation and operation of the mechanical equipment to the requirements of the contract documents, reducing start-up problems and failures common during the warranty period.

Training of maintenance staff as an element of the commissioning process is also included.

2.6 ELECTRICAL DESIGN

2.6.1 Introduction

2.6.1.1 General

The purpose of this section is to document the key aspects of the electrical systems proposed for the new Lift Station No. 1, Septage Receiving Station, and WWTP Coarse Solids, Grit and Grease Removal Expansion. This section outlines specific strategies for the electrical systems of the proposed facility and will form the basis for the development of further details during detailed design. The electrical requirements for the project are directly related to the process, instrumentation and mechanical sections of this report.

The design goals are to provide electrical systems that are operational, efficient and flexible.

The electrical systems will be designed so as to facilitate cable replacement, renewal and removal as the needs and activities of the facility change over the life of the building. The electrical systems will be designed to provide energy efficient solutions to achieve low operating and maintenance costs while supporting the facility functions. The design will accommodate all mechanical equipment electrical requirements.

Other factors in the overall design of the facility will include:

- Reliability including backup power providing continuity of the electrical systems.
- Flexibility as well as simplicity of operation and maintenance.



SEWER PROTECTION UPGRADES

Design Basis

- Consideration of maintenance of major system components with negligible down time.
- Life safety systems will meet all applicable code requirements.
- Post construction training will be addressed.
- Equipment selection will be based on production and serviceability at the proposed location.

2.6.1.2 Basis of Electrical Design

The electrical systems will be designed in accordance with the current edition of the following Codes and Standards:

- Canadian Electrical Code Part-1 2018 Edition
- Illumination Engineering Society (IES) Standards
- Telecommunication Industries Association (TIA)
- CAN-ULC-S524-14- Standard for Installation of Fire Alarm Systems
- CAN-ULC-S537-13- Verification of Fire Alarm Systems
- Local Ordinances and Authorities Having Jurisdiction

2.6.2 Electrical Services and Distribution

2.6.2.1 Lift Station No. 1

A new wet well and service room will be constructed adjacent to the existing wet well/service room. This new wet well is to completely replace the existing wet well. However, the existing wet well, pumps and equipment are to remain in place as a redundant backup for future.

It will not be possible for the new wet well and existing wet well to operate simultaneously. Therefore, for the purpose of electrical load calculations it is considered that the existing wet well pumps and process equipment feeder breakers will be tagged and locked in the off position once the new wet well is commissioned. The electrical demand of the existing pumps will be replaced with the demand of the new pumps. The changes in mechanical equipment for heating and ventilation have also been included in the demand calculation.

Based on the proposed process and mechanical equipment, it has been determined that the existing 200A 347/600V 3-phase service has enough available capacity to support the proposed upgrades.

An existing 100kW/125kVA standby generator is installed within the clean room/electrical room. The service calculations indicate that the existing generator has sufficient capacity for the new demand load and will therefore be retained.

2.6.2.2 Septage Receiving Station

A new packaged septage receiving station (SRS) offering duty/standby services is to be located at the north side of the WWTP headworks building. Power for the packaged septage receiving station and



SEWER PROTECTION UPGRADES

Design Basis

controls will be provided from the existing WWTP electrical distribution. However, based on the anticipated load requirements for the new SRS and Coarse Solids, Grit and Grease Removal expansion described below, an upgrade to the WWTP electrical service and backup generator system is required.

2.6.2.3 WWTP Expansion

An expansion to the WWTP building is proposed for the grit removal and wastewater pretreatment systems. Based on preliminary load information from process and mechanical, the existing electrical service to the building will not have sufficient capacity for the additional loads of the expansion and septage receiving station. The existing WWTP electrical room has no additional physical space for new service and distribution equipment. There is also limited space elsewhere in the existing building for new electrical equipment. Therefore, the WWTP expansion will include a new electrical room on the main floor level. The new electrical room addition will be constructed at the South-west corner of the building adjacent to the old generator room. The new electrical room is ideally located near the new proposed exterior generator location as well as the existing electrical room which houses the current main service and distribution equipment for the building.

The new electrical room will house a new main electrical service entrance and distribution panel for the building, sized to accommodate the entire building load plus an additional 15-20% for future expansion. The existing main distribution in the WWTP electrical room will be re-fed from the new service once the new service is energized and fully operational. This will allow the existing WWTP to continue to operate uninterrupted during construction of the addition with a relatively short shutdown duration to switch over to the new service once the addition is completed. This new up-sized utility feed will be coordinated with the requirements of the utility and will require upgrading of the existing utility transformer. The sizing of the electrical service will be re-calculated during detailed design as process and mechanical motor loads are further developed. The existing electrical service is 400A at 347/600V 3-phase, 4-wire. The new service is anticipated to be 600A at 347/600V 3-phase.

The existing generator system is also at maximum capacity with current loads. The generator is currently operating in a temporary configuration in a sea container outside the WWTP and has been scheduled for replacement with a new packaged enclosed generator. The new generator system and transfer equipment will be sized for the load of the entire building including the proposed septage receiving station and WWTP expansion. The generator will be specified as a packaged unit in a self-contained, walk-in arctic enclosure. The generator will be located as close as practicable to the new main electrical room that will be constructed for the WWTP expansion. Current load calculations indicate a recommended generator size of 500kW at 347/600V, 3-phase, 4-wire. Although the generator requirements are described within this report, the scope of generator replacement will be completed under a separate project as part of ongoing upgrades to the WWTP.

2.6.2.4 Electrical Distribution

The existing WWTP distribution system will remain in operation while the new main service entrance and distribution is constructed. Once the new service is completed, the existing distribution will be re-fed from the new main distribution located in the new electrical room of the WWTP expansion.



SEWER PROTECTION UPGRADES

Design Basis

Voltage considerations: Mechanical and process loads have been specified as either 120/208V or 600V to maintain common voltages and minimize the number of transformers and distribution equipment required. It is not expected that any 480V rated equipment will be provided.

Electrical distribution details: The main switchboard, rated for a minimum of 600A (to be confirmed during detailed design) 600V 3-phase 4-wire, shall consist of a main 600AT/800AF ground fault protected circuit breaker with solid state trip unit, a current transformer section for utility metering and a distribution section for the feeder circuit breakers. A digital power metering equipment (Amps, volts, KW, PF, THD) will be provided at the main service with provision for future tie-in into any building management system and energy management activities. This switchboard will sub feed Motor Control Centres (MCC) and Central Distribution Panels (CDP's) in other areas. The primary distribution voltage throughout the facility will be 600V with localized 208V as required. Interior dry type transformers will be used for any voltage transformation requirements and will be sprinkler proof enclosure and high efficiency type K-13 rated to handle non-linear loads.

Large mechanical motors and equipment with high electrical loads will be fed at 600 volts. Lighting will be predominantly fed from 208 volts supply as will small miscellaneous mechanical equipment. All communication systems and building receptacles will be fed from 120/208V, 3-phase 4-wire distribution systems.

The MCCs will, where practical, house all the necessary breakers, motor starters, soft starters etc., for the equipment installed, in addition to retaining the necessary spare capacity required for any additional loads to be installed under future developments.

120/208V distribution centers are to be 3-phase, 4-wire type having full capacity solid neutral complete with molded case circuit breakers and 25% spare capacity. 120/208V panel boards will be 3-phase, 4-wire, solid neutral design, complete with copper bussing, bolt-in place branch circuit breakers, hinged lockable enclosures. All panel boards will have a minimum spare breaker capacity of 25%.

Molded case circuit breakers equipped with electronic instantaneous and adjustable time relays will be used for the main feeders.

All distribution and branch circuit breakers will be automatic, molded-case type. Uniformity of manufacturer will be maintained for all panelboards and circuit breakers specified. Transient voltage surge suppression (TVSS) protection will be provided at the main 600V switchboard and selected distribution panels.

All floor-mounted electrical equipment including switchboards, transformers, motor control centers and distribution centers will be mounted on 100mm high concrete housekeeping pads.

Electrical room is to have a minimum 1-hour fire rating and will be coordinated with architectural.

Short circuit and protective coordination/Arc flash studies shall be included in the project by a professional employed by the contractor.



SEWER PROTECTION UPGRADES

Design Basis

The existing distribution for Lift Station No. 1 will generally remain intact as existing. New breakers will be added to existing empty spaces in the distribution panel to feed the new process and mechanical loads as well as lighting and general electrical loads for the new wet well room.

2.6.3 Standby Power Supply

A diesel driven electric generator unit will provide back-up power as a standby source to the normal utility power service through an automatic transfer switch. The standby generator system will be designed to automatically energize on utility failure with a delayed shutdown on return to normal power. The generator system will be sized to back up the entire building load including the new additions and SRS. No separate distribution will be required for normal and generator backup loads. The generator system will be housed in a separate packaged walk-in enclosure adjacent to the new electrical room. Based on current load calculations, the generator size is proposed as 500kW at 347/600V, 3-phase, 4-wire. As described earlier, the generator replacement will be carried out as a separate project as part of ongoing upgrades to the WWTP and will be initially connected to the existing automatic transfer equipment and distribution system. When proceeding with the sewer protection upgrades described in this report, the generator will then be disconnected from the existing distribution and re-connected to the new distribution as part of these upgrades.

For Lift Station No. 1, the existing 100kW/125kVA generator will remain and will continue to provide backup power to the full load of the lift station.

2.6.4 Grounding

A complete grounding and bonding system will be provided in accordance with the current Canadian Electrical Code and the electrical inspection authority.

The design will be an extension of the existing grounding and will provide a stable system voltage reference, ensure limitation of over-voltages, switching surges, ground faults and other conditions. This will enable proper operation of circuit protective devices by providing a low impedance path for any fault current. The grounding system will ensure personnel and equipment safety, as well as proper equipment operation.

The grounding system will have a buried grounding connected to grounding electrodes and main grounding bus located in the electrical room. Grounding systems for the MCCs, process equipment and piping, distribution panelboards, emergency generator, dry transformers, and communications bus will be connected to the main grounding bus.

Bonding conductors interconnecting the building structure will be specified for overall equipotential bonding of the metal building elements and equipment and will be bonded to the main grounding bus. All transformer neutrals will be connected to the grounding buss and a common cable connected back to the system ground. To ensure solid low resistance connection, Thermite welding (CADWELD) or permanent compression connections and approved ground lugs would be used to connect the ground conductor to the ground electrode. Number 6 AWG green insulated copper conductor would be used for bonding telecommunications system enclosures.



SEWER PROTECTION UPGRADES

Design Basis

2.6.5 Branch Circuit Wiring

All power wiring for the process areas in general will be installed in exposed rigid metallic conduit (RMC). Electrical metallic tubing (EMT) will be used only in non-hazardous areas where conduits are not subject to mechanical injuries. Wiring methods in hazardous areas will meet the requirements of Section 18 and 20 of the Canadian Electrical Code. Conduit size to be a minimum of 21mm. Any external underground ducts will be PVC schedule 40. Conduit runs in concrete slabs and floors shall be rigid PVC. Empty conduits will be complete with nylon pull wire. All flexible conduit connections to motors and motor controls will be flexible metallic type with liquid tight connectors. Raceways and cables passing through floors and fire-rated walls will have sleeves filled with fire-rated sealing compound. Metal clad cables or flexible metallic raceways may be used for connections to transformers and connection drops from ceiling junction boxes to luminaries.

All building wiring larger than #10AWG, unless otherwise noted will be stranded copper, 600V insulation. Insulation resistance and resistance to ground tests will be performed on all feeders prior to being energized. No conductors smaller than No.12 gauge to be used for branch circuit wiring. All wiring will be complete with permanent markers identified at each splice and pull box and will be color coded.

All feeders will consist of copper conductors pulled in conduits, with separate grounding conductors for interior distribution equipment and Teck 90 armored cable for all process and exterior feeders. All Teck cables will either be installed in the cable trays or in the underground duct banks.

Overhead wire mesh cable trays may be used on accessible ceiling areas to accommodate cabling for data, telephone, security and other low-tension systems.

2.6.6 Lighting

The following summarizes the lighting design and lighting systems to be implemented for the proposed upgrades:

- Lighting systems will be designed as energy efficient, quality artificial lighting low maintenance systems.
- Lighting design will be in accordance with IESNA lighting handbook.
- The design includes luminaires in all new addition service rooms and process areas. All luminaires will be LED.
- All luminaires will be suitable and rated for the environment where they are located. Explosion proof luminaires will be specified in hazardous areas. Industrial style luminaires will be located elsewhere.
- Lighting control systems for exterior fixtures will include a contactor from an "On Off Auto" switch with photocell and time clock control. Exterior luminaires for the WWTP expansion will be connected to the existing exterior lighting control circuits.



SEWER PROTECTION UPGRADES

Design Basis

Emergency lighting will be achieved via battery units and remote heads. Units will be sized for minimum 30-minute operation as per NBCC. Power will also be supplied via the standby generator. Unit equipment and remote heads (as required) will also be provided in the generator enclosure and new service spaces.

Exit signs will be LED type with green running man pictogram. The signs will have a minimum 25-year life expectancy. Exit lights will be connected to AC power with all breakers feeding these devices in the locked on position. Exit lighting will be on battery backup as well as on the standby generator. For the general use spaces, individual areas, which are generally separated from adjacent occupancies by walls, are individually illuminated to the recommended IES lighting levels. The design levels for lighting in Lux, maintained average, will be:

- | | |
|--|-------------|
| • Corridors and access routes | 250 Lux |
| • Equipment / maintenance rooms | 350-500 Lux |
| • Mechanical and Electrical rooms | 250 Lux |
| • Process areas will generally be illuminated at | 250 Lux |

2.6.7 Communication Systems

The existing service may require additional incoming phone lines. This will be determined as the design progresses. Data distribution throughout the WWTP building will originate at the current demarcation point in the existing electrical room. The final arrangement will be discussed with the owner and telecommunication utility provider and details will be incorporated in the subsequent construction documents.

The communication system modifications will meet all relevant TIA/EIA standards. All structured cabling will be rated Cat 6 and will utilize the existing structured cabling distribution system. Cabling will be FT4 or FT6 rated in accordance with NBC requirements. Typically, 2 data drops will be provided at each outlet.

There will be network points for PLC communication at every location identified by the instrumentation and controls division.

Only passive infrastructure such as cabling, conduit, outlets and termination patch panels will be provided. All active equipment such as data switches, servers, and wireless access points (if required) will be provided by the owner.

2.6.8 Access Control System

The existing access control system (ACS) will be modified as required due to the building additions at the WWTP. New equipment and wiring shall be compatible with the existing system.

Electronic access control has not been specified for the new Lift Station No. 1 or Septage Receiving Station but may be provided if required by the owner.



SEWER PROTECTION UPGRADES

Design Basis

2.6.9 Intrusion Alarm System.

The existing Intrusion Alarm System (IAS) will be modified as required to address the WWTP expansion and addition of the septage receiving station.

An IAS has not been specified for Lift Station No. 1 and will not be provided.

2.6.10 Fire Alarm System

The existing WWTP fire alarm system will be expanded to meet National Building Code and CAN/ULC S524 requirements. New initiating and signal devices will be provided as needed.

A fire alarm system is not required for Lift Station No. 1 and will not be provided.

2.6.11 Motor Control

In general, all motors 0.37 kW and smaller shall be single phase, 120V and motors larger than 0.37kW shall be 208V or 600V three phase. There may be occasional exceptions to this rule based on the availability of motors on selected pieces of mechanical equipment.

Motors will be specified as high efficiency type with high power factor. Should any variable frequency drives (VFD's) be required, motors that are to be supplied via VFD's will be specified compliant with NEMA 31, a standard specifically tailored to address the high transient voltage conditions associated with VFD's.

Single phase motors that are 1hp or less will be controlled using motor protection switches and contactors. Connections to mechanical systems will be supplied as required by the mechanical/process equipment installed.

All disconnects, motor protection switches, starters and load rated relays will be provided under the electrical division documentation.

For fixed speed motors, electronic soft starters will be used where there would be benefit to the distribution system by having reduced motor starting loads. All soft starters will include adjustable start/stop ramping times and will have automatic electronic bypass contactors to eliminate harmonics once the motors are at full operating speed.

A new Motor Control Centre (MCC) is proposed to be installed in the mechanical/electrical room addition at the North end of the building. The MCC will include motor starters and controls for the major mechanical and process equipment within the addition. Additional 120/208V branch circuit panelboards will feed smaller motors and general electrical loads for the area.

For Lift Station No. 1, new VFD's will be provided for the three raw waste-water pumps and these will be individual wall-mounted equipment provided within the existing clean room adjacent to the wet well room. Existing equipment within the room will be relocated as needed to provide wall space to mount the new VFDs.



SEWER PROTECTION UPGRADES

Design Basis

2.6.12 Commissioning and Testing

In a project of this nature it is imperative that the commissioning and testing of major electrical equipment and systems be undertaken by a commissioning and testing agency employed by the contractor. This work will include necessary verification and start-up procedures. Operation and maintenance manuals incorporating copies of shop drawings, complete schematic diagrams, recommended maintenance schedules and logs, system operation write-ups test results and safety procedures would also form part of the electrical contractor's scope of work.

2.7 INSTRUMENTATION AND CONTROLS DESIGN

2.7.1 Introduction

The purpose of this section is to identify the components of the new Instrumentation and Controls system for new Lift Station No. 1, Septage Receiving Station, and WWTP Coarse Solids, Grit and Grease Removal Expansion. This section outlines specific strategies for the I&C systems of the proposed facility and will form the basis for the development of further details during detailed design. The Instrumentation and Control requirements for the project are directly related to the process and electrical sections of this report.

The design goals are to provide a control system that follows and displays the process requirements, provides operators with full control of all components, that monitors setpoints and alarms when the process is outside of expected parameters.

2.7.1.1 Lift Station No. 1

There is an existing Local Control Panel at Lift Station 1 that will require an upgrade to support the expansion of the lift station. A new control panel will be designed and will meet all current code and industry standards. The PLC (Programmable Logic Controller) will be upgraded to be consistent with the newly upgraded systems throughout the City sites. During detailed design, a remote I/O panel will need to be added for the additional components of the station upgrade.

During the time that this changeover will take place, it will be a requirement that the successful proponent submit a detailed plan that will allow the basic functions of the station to remain functional. This may include a temporary control system, or even relay logic to run the pumps while the level of the wet well will be monitored by the auto dialer. This plan will be thoroughly reviewed to minimize risk of an environmental incident during the upgrade.

2.7.1.2 Septage Receiving Station

As mentioned above in the process section the septage receiving station will contain its own control Local Control Panel that will control all of the devices in its system. The system will be tied to the existing WWTP PLC through hard wired general alarms and an ethernet link for monitoring the system on the existing SCADA system. Based on need and assessment, points on the SRS will monitored and alarms generated through the existing SCADA system.



SEWER PROTECTION UPGRADES

Design Basis

2.7.1.3 Coarse Solids, Grit and Grease Removal

As mentioned above in the process section Coarse Solids, Grit and Grease removal system will contain its own control Local Control Panel that will control all of the devices in its system. The system will be tied to the existing WWTP PLC through hard wired general alarms and an ethernet link for monitoring the system on the existing SCADA system. Based on need and assessment, points on the SRS will be monitored and alarms generated through the existing SCADA system.

Any additional instruments required such as environmental monitoring will be tied into the existing control panel. The equipment selected will be consistent with that already contained in the WWTP.

2.7.2 PLC Control

2.7.2.1 Lift Station No. 1

A new PLC control panel shall be designed and installed within the new Lift Station No. 1 building. This control panel will be where all the instrumentation and devices, new and existing, will be connected and controlled from. The control panel will include the existing HMI which will not only monitor and provide control over the lift station, but also will send the information to the City-wide SCADA system and allow the operators to see the entire SCADA system from LS1. which all new instrumentation and control processes funnel through to the city-wide SCADA system.

Hardware

The new Lift Station No.1 will be equipped with an Allen Bradley CompactLogix Programmable Logic Controller (PLC) by Rockwell Automation. This will provide consistency with the type of PLCs that can be found through the City's water and wastewater sites and ease of integration into the SCADA system. with the existing WWTP. The recently upgraded, existing local Human-Machine-Interface (HMI) will be reused to provide operators a local SCADA interface to monitor and control the facility. The design intent is to create uniformity of technology manufacturer to provide advantages in that operations and maintenance personnel will need no additional training once familiar with existing hardware throughout the city's infrastructure.

The PLC control panel will also be equipped with an uninterruptible power supply (UPS), an automatic UPS bypass system, I/O terminals, relays, and redundant 24V power supplies to maintain control system power and monitoring. The PLC will be backed up by a smart relay system to automatically run the pumps if the event of a PLC failure.

Software

Similar to the new hardware, the software within the new PLC control panel shall be consistent with that which is installed within the WWTP (e.g. Rockwell Automation RSLogix 5000). The existing radio communications link that tie's the station into the SCADA Radio system will be utilized to tie into the City's city-wide SCADA system for monitoring, control, and alarming / notification of abnormal facility conditions requiring operator intervention.



SEWER PROTECTION UPGRADES

Design Basis

2.7.2.2 Septage Receiving Station/Coarse Solids, Grit and Grease Removal

Hardware

As these components are pre-packaged units, the hardware will be self-contained, though much like the Primary filters in the WWTP, we will require that they be controlled by an Allen Bradley PLC for consistency

Software

The manufacture will be required to provide any proprietary software as part of the contract, to be licensed in the City's name. They will also be required to supply a copy of the PLC code, which will be stored on the City's SCADA server.

Because all PLCs will be Allen Bradley, they will be able to be monitored or the operator able to go online with the processor from the engineering terminal using the programming software the City currently owns.

2.7.3 Instruments & Systems Monitoring

2.7.3.1 Lift Station No. 1

Process measurement and control devices will be specified to provide rugged, reliable, industrial quality components. These devices will be selected with the intent to ensure that they have local or reliable remote vendor service and support. Where possible, devices such as flow meters, pressure transmitters, temperature transmitters, and level instruments will be selected to correspond with the manufacturers/types that are currently installed in the WWTP. Where the owner has device preferences those instrument and control components will be specified.

Gas Detection

The hazardous areas within Lift Station No.1, such as the wet well, are to be installed with instruments and control devices which meet the appropriate code requirements for hazardous areas.

Lift Station No. shall be fitted with a gas detection system which will provide local visual and audible alarm signaling for hazardous gases. Gas detection instruments shall be rated accordingly with the hazardous area rating. All instruments will be monitored and connected both to the auto dialer and the SCADA alarms system.

Flow Monitoring

As mentioned in the above process section the lift station will contain a flow meter on the discharge line. It will be required that it come with field bus enabled so SCADA can read and record not only flowrate but also the totalizer value directly from the device rather than calculating it from the PLC, increasing the accuracy of the flow totals.



SEWER PROTECTION UPGRADES

Design Basis

Pressure Monitoring

Pressure monitoring of the discharge line to the existing WWTP from the new Lift Station No.1 is considered optional. Conditions for a pressure instrument to be considered in the detailed design but will not be indicated unless this option is deemed mandatory.

Level Monitoring

The new Lift Station No.1 will be equipped with two independent and diverse level monitoring systems to report the level within the wet well. These systems will provide redundancy and are required to be distinct monitoring technologies (e.g. ultrasonic + level bulbs or ultrasonic + radar). The level systems will not operate as a duty/standby. Either level system will trigger a run command to the pumps when a high level is detected.

Building Monitoring

New building controls for Lift Station No. 1 will be integrated into the existing building control system at the WWTP. This will include a door switch to monitor intrusion and occupancy which will be indicated through the local PLC. Power quality is to be monitored through PLC inputs from a power meter located within the MCC. A temperature instrument shall be installed to monitor the temperature in the new building. Further HVAC controls to be confirmed in the detailed design phase.

2.7.3.2 Septage Receiving Station

The septage receiving station will be classified as a hazardous area and as such all the instruments and control devices installed there are to meet the appropriate code requirements.

System Monitoring

The Septage Receiving Station is a pre-packaged design that has its own control panel, and as such will not require additional programming. It will be a requirement that the controller be Allen Bradley so as to be easily connected to and monitored by the SCADA and the PLCs from the WWTP.

Gas Detection

The septage receiving station shall be fitted with a gas detection system which will provide local visual and audible alarm signaling for hazardous gases. Gas detection instruments shall be rated accordingly with the hazardous area rating.

Flow Monitoring

Each septage line from the septage receiving station will be equipped with a flow meter for flow monitoring and volume totalization to be used for reporting. It will be required that the flow meters be equipped with fieldbus so all parameters can be monitored rather than calculated to ensure maximum accuracy.



SEWER PROTECTION UPGRADES

Design Basis

2.7.3.3 Coarse Solids, Grit and Grease Removal

Similar to the Septage Receiving Station, the Coarse Solids, Grit and Grease Removal system will be a packaged unit with its own Local Control Panel that will monitor and control the unit. The Local control panel will tie into the existing network at the WWTP, to be monitored by both PLC in Control Panel 900 (Existing in the WWTP) and the SCADA system. The manufacture will be required to use an Allen Bradley PLC so it can be polled via Ethernet/IP communication protocol from the WWTP PLC, as well as be remotely worked on by utilizing the City's version of Rockwell Automation RSLogix Studio. The manufacture will also be required to supply a list of alarms and statuses that can be monitored by SCADA. The statuses and alarms will be displays on any of the HMI's, and operator terminals contained within the city-wide SCADA system. Alarms that are medium priority will send a text and email to the operator and high priority alarms will call the operator using the existing alarm infrastructure.

2.7.4 Alarming

As the monitoring of both the septage receiving station and the Coarse Solids, Grit and Grease Removal system are to be tied into the existing control system at the WWTP, the alarms categorization shall remain consistent with which is present there. Alarms from Lift Station 1 will be consistent with the established methodology of the City-wide SCADA and will follow the same programming structure as seen in the recently installed and programmed WWTP and WTP.

Alarms for all three systems will be categorized into three groups – Safety, Major, and Minor. The categories are defined as follows:

- Safety alarms are conditions that are dangerous to personnel or property and require immediate response.
- Major alarms are conditions that require immediate attention.
- Minor alarms are conditions that do not require immediate attention.

Each category of alarm will have a resulting outcome with operator actions to manage the alarm condition (e.g. major alarms require immediate attention; minor alarm conditions should be noted but are non-urgent). The WWTP is fitted with an audible alarm system to advise operational personnel to go to the nearest plant computer system workstation or operator interface terminal to determine the source of alarm and to take the appropriate action depending upon the alarm priority.

For vendor supplied packaged equipment, such as the septage receiving station, a separate discrete visual warning display, provided with the package, will be located at the equipment but integrated with the plant computer alarm system.

A safety alarm can be defined as a condition that may potentially endanger lives if not given the appropriate attention immediately. The alarm could be generated from: process equipment, combustible gas detection systems or fire detection systems. Safety alarms initiating from the septage receiving station will be wired directly from the primary initiating device to the audible and visual warning devices installed around the WWTP. Safety alarm systems initiating from Lift Station No.1 will alarm at this



SEWER PROTECTION UPGRADES

Design Basis

building via local audible and visual warning devices but will not be tied into the remote devices at the WWTP. Instead, safety alarms from Lift Station No. 1 may be seen remotely via the plants existing SCADA system. Safety alarms will also be provided by an output to an existing auto dialer at the WWTP.

2.7.5 System Communications

2.7.5.1 Lift Station No. 1

Within the lift station, the system will utilize ethernet cables, if required, to transmit data. The pre-existing Cambium radio will be used to tie Lift Station No 1 into the SCADA radio network. The connection will be moved to the new Local Control Panel (LCP). As the HMI and UPS was just recently upgraded, they will be reused and moved to the new LCP. The City's SCADA system for monitoring, control, and alarming / notification of abnormal facility conditions requiring operator intervention.

2.7.5.2 Septage Receiving Station

As mentioned, the SRS will contain its own LCP as well and will communicate with the main control panel 900 at the WWTP through both hard-wired signals to the PLC for General Alarm and an ethernet link. All data will be displayed on the Iqaluit City SCADA for monitoring and alarming. An integrator will be able to go online with the PLC by utilizing the existing Engineering Terminal which contains the Rockwell Automation Software.

2.7.5.3 Coarse Solids, Grit and Grease Removal

As mentioned, the Coarse Solids, Grit and Grease Removal will contain its own LCP as well and will communicate with the main control panel 900 at the WWTP through both hard-wired signals to the PLC for General Alarm and an ethernet link. All data will be displayed on the Iqaluit City SCADA for monitoring and alarming. An integrator will be able to go online with the PLC by utilizing the existing Engineering Terminal which contains the Rockwell Automation Software.

2.7.6 Operation Sequence & Pump Control

2.7.6.1 Lift Station No. 1

The new pumps designed to be in the Lift Station No.1 will be controlled by Variable Frequency Drives (VFDs). These drives will be fed from the Lift Station No.1 Motor Control Center (MCC) and where possible located within the MCC to avoid the harsh environment of the lift station floor. The control system interface for fixed speed motor starters and the variable frequency drives within the MCC will be via EtherNet/IP communications protocol. These VFDs will provide an automatic control of the pumps based on values seen through the PLC connections.

2.7.6.2 Septage Receiving Station/Coarse Solids, Grit and Grease Removal

The pretreatment system and the septage receiving station will consist of two independent process trains operated in a duty/standby sequence to provide redundancy and ease of maintenance. Each train will be



SEWER PROTECTION UPGRADES

Design Basis

controlled via a vendor-supplied panel, integrated into the WWTP control system through Ethernet and hardwired I/O signals to the local PLC.

The process trains that are to run can be controlled by the operator, or the operator can take a train offline for maintenance.

In general, the septage receiving station will be integrated directly into the existing WWTP's control process and existing PLCs. This includes the addition of a Coarse Solids, Grit and Grease Removal System.

2.7.7 Commissioning and Testing

2.7.7.1 LS1/Septage Receiving Station/Coarse Solids, Grit and Grease Removal

In addition to the electrical commissioning and testing requirements, the contractor shall verify all wiring from instrumentation and electrical systems back to the control panel to ensure all equipment is wired accordingly. A detailed report form shall be used to sign off on the wiring of each I/O. Operation and maintenance manuals incorporating copies of shop drawings, complete schematic diagrams, recommended maintenance schedules and logs, system operation write-ups test results and safety procedures would also form part of the instrumentation and controls contractor's scope of work.



SEWER PROTECTION UPGRADES

Preliminary Equipment List

3.0 PRELIMINARY EQUIPMENT LIST

3.1 EQUIPMENT LIST

The preliminary discipline equipment lists are presented in **Appendix B**.

3.2 LONG LEAD DELIVERY ITEMS

The submersible chopper pumps, the septage station and the pre-treatment plants present the longest lead delivery of between 18 to 21 weeks after shop drawings are approved. Refer to preliminary process equipment list in **Appendix B** for individual delivery times.

The proposed project schedule has included the pre-ordering of long lead delivery of equipment to mitigate the effects of the long lead items on the construction schedule.



SEWER PROTECTION UPGRADES

Regulatory Requirements

4.0 REGULATORY REQUIREMENTS

In general, there are no extensive requirements for the work to be approved and proceed under current regulatory bodies. The work is not greenfield, but rather improvements on the existing operating system. The current wastewater treatment plant is currently capable of meeting license effluent limits which as the design exceeds these limits, will meet the Wastewater Systems Effluent Regulation (WSER) as established by the Canadian Council of the Environment (CCME) under the Fisheries Act.

However, there are several agencies, where in numerous points in the design and construction, they must, or it is recommended they be engaged.

The current water license states:

The Licensee may, without written consent from the Board, carry out Modifications to the potable Water Treatment Facility and Waste Treatment Facilities provided that such Modifications are consistent with the terms of this License and the following requirements are met:

- a. the Licensee has notified the Board in writing of such proposed Modifications at least sixty (60) days prior to beginning the Modifications;*
- b. Such Modifications are consistent with the NPC Land Use Planning (NPC) Conformity Determination and the NIRB Screening Decision;*
- c. such Modifications do not place the Licensee in contravention of the License or the Act;*
- d. the Board has not, during the sixty (60) days following notification of the proposed Modifications, informed the Licensee that review of the proposal will require more than sixty (60) days; and*
- e. The Board has not rejected the proposed Modifications.*

2. Modifications for which all of the conditions referred to in Part G, Item 1 have not been met can be carried out only with written approval from the Board.

3. The Licensee shall provide as-built plans and drawings of the Modifications referred to in this License within ninety (90) days of completion of the Modifications. These plans and drawings shall be stamped by an Engineer.

The main regulatory bodies that should be informed include:

Nunavut Health

They are the main body to obtain approval as they issue and monitor the water license requirements.

Government of Nunavut (GN) Technical Services

GN Technical Services provides the review of technical documents and issues the electrical approval for occupation. For direct Government of Nunavut projects, they involvement is more extensive throughout the life of the project.



SEWER PROTECTION UPGRADES

Regulatory Requirements

A suggested regulator “map” is summarized as follows:

Table 4.1. Proposed Regulatory Map for Sewer Protection Upgrades

Milestone Event	Regulatory Body	Comment
Planning and Design Stage		
Preliminary Design Report	Nunavut Health	Although it is not a requirement to provide them the initial design information, it is recommended they be provided the report as a courtesy and an indication of the future improvements being contemplated.
75% (or other) Design Submission	Nunavut Health	Again, provided as a courtesy.
	GN Technical Services	This is a good point in the design stage to solicit comments. Although they may not perform a detailed review, it provides a basis for their future review.
100% Design Documents	Nunavut Health	Comments may be provided. Mainly will deal with any license revisions if necessary.
	Iqaluit Fire Department	Package provided for information as anticipated referred to GN Technical Services.
	GN Technical Services	Comments are typically provided for all disciplines.
Construction		
Diversions	Nunavut Health	If at any point in the construction diversion to the Emergency Storage Pond will occur, they must be informed and provide approval.
Construction	Various Permits Building permit (City of Iqaluit) Boiler and Pressure Vessel permit	Depending on the improvements being made, the Contractor will be required to obtain the relevant construction related permits.
	GN Technical Services	Periodically throughout construction, the Contractor will be required to coordinate with the Electrical Inspector (GN Technical Services) to perform inspections.
Final Completion	Nunavut Health	As-builts and Operations and Maintenance Manuals to be provided to Nunavut Health, and although not anticipated, any changes to the Water License to be finalized.
	GN Technical Services	Final approval and issue of approved Final Inspection Report.



5.0 CONSTRUCTABILITY PLAN AND SCHEDULE

5.1 CONSTRUCTION STAGING, SEQUENCING AND OBSTACLES

5.1.1 Lift Station No. 01

Manhole No. 01 is considered to have potentially reached the limit of its practical life and as directed by the City this manhole should be replaced. Due to space restrictions on site, it will be necessary to replace Manhole No. 01 in the same location. This creates challenges as although the existing wetwell will remain in operation, temporary measures will be needed to direct the flow to the existing wetwell while construction is underway. This can be accomplished by installing a temporary manhole and associated piping adjacent the new manhole. Alternatively, the City may want to consider a more comprehensive review of the condition of Manhole No. 01 for its suitability to remain in operation, thus reducing the temporary measures. However, should Manhole No. 01 remain in place, it may still be necessary to divert flow temporarily as the chamber would need expansion.

The benefit of the current configuration is twofold, the existing station can stay in operation while all the construction is completed, and further remain in operation as a back-up system when the new wetwell is fully operational. There will be some minor interruptions while the power is revamped for the station, but the City has advised that a set-up for temporary bypassing is being put in place. Details of this bypass set-up have not been provided and are not incorporated or indicated in the current preliminary design.

The existing heating plant will be replaced in its entirety as there is not enough space to add an additional boiler to support the increased heating demands. The replacement of the heating plant should take place during non-heating season. If the work occurs during the heating season a means of temporary heating will be required.

5.1.2 Septage

In general, the vast majority of construction of the new components at the WWTP can proceed without impeding the current operations. Some challenges that will be needed to be addressed during construction include:

5.1.2.1 Septage

- Maintaining vehicle access to the plant for continued operations while septage station is being constructed. To mitigate this concern, the road widening at this location may need to be constructed prior to septage construction commencing.
- It is intended that the existing truck dump station will remain as a back-up for the new septage receiving station, allowing not only commissioning of the new system to be performed, and for use when potentially interrupted, but also as a future back-up in the case of septage receiving interruptions.



SEWER PROTECTION UPGRADES

Constructability PPlan and Schedule

5.1.2.2 Solids Handling Expansion

- The construction of the solids handling expansion encroaches on the existing fuel line ROW. The north wall, which is intended to act as a retaining wall also, may require temporary support to ensure the ROW is not disturbed.
- Process piping changes will necessitate the interruption of flow to the treatment process to enable the new tie-ins to be completed. This can be achieved by the installation of the majority of the piping prior to diverting the flow. Once the piping is complete, flow is able to be bypassed to the existing fine screens, enabling the new equipment to be fully commissioned, and relief in the event of shutdown of the new equipment. During the final tie-ins, flow will need to be diverted to the emergency storage lagoon for a minimal period.

5.1.2.3 Heating

- A new mechanical room will be created within the north side building addition. The existing two boilers will be relocated to this new mechanical room, and an additional boiler provided to meet the increased demands. The existing boiler fuel oil day tank (and associated filling controls), heating water expansion tanks, and glycol fill tank will also be relocated to the new mechanical room. Additionally, the existing HVAC controls system (devices and controllers) associated with the heating water primary system and secondary pumps will also be relocated to the new mechanical room and will include new controls to add the third boiler. As the existing building requires the heating plant to be operational for the continuous operation of the main air handling units during colder weather, it is imperative that the heating system remain operational during the heating season. Relocation of the existing boilers and associated primary heating system equipment shall occur during the non-heating season. If the work occurs during the heating season a means of temporary heating will be required.

5.1.2.4 Electrical

- Based on the projected new loading to the plant, it is anticipated that a new, increased power service to the plant will be necessary. To minimize power interruptions, the majority of the infrastructure (including new transformer) can be installed prior to converting to the new service. This will minimize power interruptions with the interruptions being brief, and diversion to the emergency storage lagoon may not be necessary.

5.2 CONSTRUCTION SCHEDULE

A detailed project schedule has been developed based on both the Lift Station and Septage being constructed by the same Contractor during the same period. However, should the City separate the projects into two different packages, or during different time periods, the schedule can apply to a singular project. See Appendix C for the detailed schedule.



SEWER PROTECTION UPGRADES

Preliminary Functional Specification

6.0 PRELIMINARY FUNCTIONAL SPECIFICATION

6.1 LIFT STATION NO. 1

The new wetwell of Lift Station No. 1 will be equipped with low-low (LSLL), low (LSL), high (LSH) and high-high (LSLL) level switches and a level indicator transmitter (LIT) to monitor the wastewater level.

Each of the three wastewater pumps that will be installed in the wetwell will have capacity of 40 L/s and will be driven by a variable frequency drive and motor combination to operate based on the influent flow and corresponding wastewater level of the wet well in a Lead/Lag/Standby operation. One wastewater pump will operate at low influent flows to the plant. Two wastewater pumps will operate at high influent flows to the plant with a total combined capacity of approximately 80 L/s, to handle future influent flows. The third pump will be on standby.

The bottom of the new wetwell will be located at an elevation of 1.372 meters above sea level and the top at an elevation of 6.858 meters. The lead wastewater pump will start to operate when the wastewater reaches an elevation of 3.3 meters. Under normal operating conditions, only one raw wastewater pump will be pumping; however, when influent flow increases beyond the maximum capacity of the pump and the wastewater level in the influent wet well reaches the predetermined elevation set point of 3.5 meters, the lag wastewater pump will start automatically.

Staging equipment to shutdown includes evaluating both the main influent flow and level in the wetwell; when influent flow decreases and the wastewater level in the wet well is confirmed below a predetermined elevation of 2.4 meters, the system allows the shutdown of the lag wastewater pump.

The lead pump is shut down when the wastewater level reaches an elevation of 2.0 meters. The last wastewater pump brought on-line is placed in the lead duty sequence and remains operational, and the non-operating unit is placed in the second duty position. Manual operation is permitted through both the SCADA system and locally at the MCC.

6.2 SEPTAGE STATION

The septage station will be implemented with two independent ports to discharge trucked septage to the influent wetwell of the wastewater treatment plant. The station will be provided with local control panel containing the controls for the automated control valves, the grinders, and the flowmeters. Each individual port will be provided with external lockable enclosures containing pushbuttons to energize them. Under normal operating conditions only one port will be required to be operational at the same time.

For septage discharge, the septage trucker will activate one of the ports from the external enclosure by pushing the start pushbutton. This action will open the automated control valve, start the grinder motor, and activate the flowmeter of that port. A truck is expected to be discharged after five minutes. Once the



SEWER PROTECTION UPGRADES

Preliminary Functional Specification

septage discharge is complete, the septage trucker will push the stop bottom at the external enclosure to close the automated control valve, stop the grinder motor and deenergize the in-line flowmeter.

Historical of septage discharged flows will be captured through the SCADA system.

6.3 PRELIMINARY TREATMENT PLANT

Flow from the raw wastewater pumps located in the influent wetwell is measured with flowmeter (FM- 01- 150) and directed to either pre-treatment plant train 1 or train 2. Automated on/off control valves located at the inlet of the trains will allow or avoid the wastewater flow to each train. Under normal operating conditions, the trains will operate in a duty/standby configuration. Each pre-treatment plant will be provided with a local control panel having the centralized control of the different pieces of equipment of the unit.

Wastewater will enter the pre-treatment plant at the coarse solids screen and solids compaction zone. Big solids will be trapped in the screen and conveyed by a screw to the solids compaction zone and finally to the solids chute. An automated on/off control valve installed in the solids chute will allow the flow of solids to a trailer for off-site disposal. The control valve will be closed when the train is not operational or when the trailer is not available to receive solids. The screen will have a rated 10 mm opening size. The screen will be equipped with level indicator transmitters (LIT) to control the water level inside the unit. The influent flow from the raw wastewater pumps to the screen will be shut down if a high-water level condition is reached in the screen. During the screening operation, an internal spray bar will clean the screen and the solids compaction zone of the unit utilizing non-potable water from the plant utility system. Solenoid valves will provide for the spray system cycle per the setting on their own repeat timer whenever the motor is running.

The wastewater will flow from the solids screen to the main rectangular compartment of the pre-treatment plant. The flow of wastewater passing through this compartment will be aerated from a regenerative blower that will be operational while the train is operational. Aeration will help to mix the influent wastewater for grit settling to the bottom of the tank and grease flotation to the surface.

A grit extractor, which is basically a horizontal screw, installed at the bottom of the tank will receive the grit and convey it to a vertical grit conveyor that will transport the grit to a grit discharge chute. An automated on/off control valve installed in the grit chute will allow the flow of grit to a trailer for off-site disposal. The control valve will be closed when the train is not operational or when the trailer is not available to receive grit.

Greases will flow from the surface of the wastewater to a separate compartment to be intermittently and automatically skimmed off by a travelling paddle that is the main part of the grease removal system. Grease will flow by gravity to a grease storage tank. The tank will be kept at a temperature between 30-40 °C to avoid grease settling and plugging while stored. Two manually actuated grease pumps operating in a duty/standby configuration will continuously recirculate the grease from/to the grease storage tank to contribute to mix the grease to avoid settling/plugging. The discharge line from the grease pumps will be provided with a camlock for hose connection to a truck for off-site disposal.



SEWER PROTECTION UPGRADES

Preliminary Functional Specification

Overflows from the pre-treatment plant will be captured by the overflow line connected to the solids screen and directed to the influent wetwell. Pre-treated wastewater will flow from the pre-treatment plant to the existing fine screens by gravity to continue the current installed process at the wastewater treatment plant (fine screens – primary filters – MBBR trains, DAF units – effluent to the ocean).

Pre-treated discharge pipelines from each pre-treatment train to the fine screens and return pipelines to the influent wetwell will be installed and equipped with on/off automated control valves to have the option to feed the fine screens or drain the trains to the influent wetwell for maintenance purposes.



SEWER PROTECTION UPGRADES

Project Costs

7.0 PROJECT COSTS

7.1 PRELIMINARY COST ESTIMATE

The table below summarizes the preliminary cost estimate for the Sewer Protection Upgrades facilities (Lift Station No. 1, Septage Receiving Station, and Pre-treatment addition). The costs are broken down by discipline, for each facility. The preliminary (+/-30%) cost estimate carries an added contingency of 20% and includes engineering and administrative costs as an additional 20% to the construction subtotal.

For further breakdown of the upgrade costs for each discipline, refer to the detailed cost estimate table presented in **Appendix D**.

Table 7.1. Preliminary Cost Estimate Summary

Discipline	Lift Station No.1	Septage Receiving Station	Pre-treatment Plant
General	\$197,000	\$106,440	\$679,340
Civil	\$375,800	\$32,000	\$292,000
Buildings	\$658,800	\$139,000	\$2,873,400
HVAC Mechanical	\$257,500	—	\$913,000
Process	\$364,600	\$813,400	\$1,792,000
Electrical	\$117,000	\$20,000	\$580,000
Instrumentation & Controls	\$200,000	\$60,000	\$343,000
Subtotal	\$2,171,100	\$1,170,800	\$7,472,700
Contingency (20%)	\$434,000	\$234,000	\$1,495,000
Engineering & Admin. (20%)	\$434,000	\$234,000	\$1,495,000
Total	\$3,039,000	\$1,639,000	\$10,463,000
Total			\$15,141,000



SEWER PROTECTION UPGRADES

Project Costs

7.2 SCHEMATIC TO PRELIMINARY COST INCREASE

Based on the additional information and details established in the preliminary design stage, significant cost increases were identified. Cost increases include:

Lift Station No. 01

- Replacement of Manhole No. 01
- Engineering and Administration (20%) and a Contingency (20%) was not included

WWTP

- Schematic detail was not sufficient to identify the need for Electrical room addition
- Schematic detail was not sufficient to identify need for additional mechanical room
- Addition of redundant process train and subsequent larger building footprint
- Replacement of treatment train with more features including grease handling
- Engineering and Administration (20%) and a Contingency (20%) was not included

7.3 PROJECT EXPENDITURES

Based on the Preliminary Construction Schedule provided in **Appendix C**, it is anticipated that expenditures would be forecast approximately as follows:

Table 7.2. Anticipated Expenditures

Item	Amount
2021	
Design	\$1,500,000
2022	
Construction Administration	\$331,500
Construction	\$6,489,000
2023	
Construction Administration	\$331,500
Construction	\$6,489,000
Total	\$15,141,000

7.4 COST SAVING POTENTIALS

Potential cost savings or deferral of costs that can be considered include (note: estimated values do not include 20% contingency or engineering & administration):



SEWER PROTECTION UPGRADES

Project Costs

Table 7.3: Cost Savings Potential

Item	Potential Cost Savings	Comment
Lift Station No. 1		
Delete replacement of MH1	\$175,000	The condition of MH1 is questionable and an evaluation of its structural integrity is suggested prior to consideration.
Reduce Building Addition Size	\$150,000	A geotechnical investigation is recommended prior to considering a size reduction to determine if soil conditions permit the relocation of the new wetwell closer to the existing slab on grade.
WWTP		
Reduce Pre-Treatment redundancy	\$658,000	Provide one pre-treatment unit with provisions for future addition.
Relocate new electrical room to treatment addition	\$65,000	Additional investigation likely required to determine available space in treatment addition, pending other cost savings selected.
Maintain existing boiler room and provide only for new area services in building addition	\$50,000	Very little cost savings can be achieved by keeping existing in place, and additional operating costs would result.
Reduce Pre-Treatment redundancy with no provisions for future standby unit	\$1,600,000	Savings would increase due to reduction in building size, but no space would be available for a future standby unit.
Delete Septage Handling Station	\$1,064,000	With the loss of macerating the septage, significant unprocessed solids would be deposited in the wetwell.
Delete pre-treatment, provide septage and wetwell pump upgrades only	\$6,500,000	With the addition of septage handling (macerating) and more robust wetwell handling pumps, the overall process would still achieve marginal improvements.
Maximum Cost Saving Potential <i>(identifies potential cost savings by proceeding with different upgrade options)</i>		
All Upgrades	\$1,975,000	Keep LS#1, Septage Station, and Pre-Treatment Addition (reduced building footprints, and only 1 treatment train)
LS#1 and Pre-Treatment Only	\$3,039,000	Remove septage receiving station from upgrades (reduced building footprints, and only 1 pre-treatment train)
LS#1 and Septage Receiving Only	\$6,875,000	Remove Pre-Treatment Addition from upgrades (reduced building footprints)



SEWER PROTECTION UPGRADES

Appendix A Preliminary Design Drawings

Appendix A PRELIMINARY DESIGN DRAWINGS

Under Separate Cover



SEWER PROTECTION UPGRADES

Appendix B Preliminary Equipment Lists

Appendix B PRELIMINARY EQUIPMENT LISTS



CITY OF IQUALUIT
PROCESS EQUIPMENT LIST
SEWER PROTECTION SYSTEM UPGRADES



Plant Area	Area Name	Equipment
Area 1	Influent Pumping (Pre-treatment)	3/4 Station No. 1 Pumping (Pre-treatment Plant)
Area 3	Sewage Handling	

Plant Area	Equipment Tag	Name	Duty / Standby	Operation (Continuous / Intermittent)	Location	Description	kW	Electrical	VFD	Area Class	Delivery	Weight in Operation (kg)	Comments	
1 - INFLUENT PUMPING (NEW LS No. 1)	P-01-100	3/4 Station No. 1	Standby	Intermittent	LS No. 1	Concrete tank wetwell							New 3/4 Station No. 1 equipment to the existing one	
	P-01-100	New wastewater Pump 1	Duty	Intermittent	LS No. 1 Well Wall	Submersible chopper type	30	575V/32A/60Hz	Yes	Explosion Proof	19-21 Weeks after Approved Shop Drawings	330	Leakage operation	
	P-01-200	New wastewater Pump 2	Duty	Intermittent	LS No. 1 Well Wall	Submersible chopper type	30	575V/32A/60Hz	Yes	Explosion Proof	19-21 Weeks after Approved Shop Drawings	330	Leakage operation	
	P-01-300	New wastewater Pump 3	Standby	Intermittent	LS No. 1 Well Wall	Submersible chopper type	30	575V/32A/60Hz	Yes	Explosion Proof	18-20 weeks		Risk for pump removal from wetwell in LS No. 1 (2 speeds as 2 winding motor)	
	P-01-100	Hoist	Duty	Intermittent	LS No. 1	Motorized Hoist (2 speeds as 2 winding motor)	4.3 & 0.7	575V/32A/60Hz	No	Explosion Proof	18-20 weeks			
1 - INFLUENT PUMPING (EXISTING PUMP REPLACEMENT)	P-01-110	New wastewater Pump 1	Duty	Intermittent	WWTP Influent Wellwall	Submersible chopper type	19.0	575V/32A/60Hz	Yes	Explosion Proof	19-21 Weeks after Approved Shop Drawings			Existing Flygt pumps to be replaced with Vaughan chopper pumps
	P-01-120	New wastewater Pump 2	Duty	Intermittent	WWTP Influent Wellwall	Submersible chopper type	19.0	575V/32A/60Hz	Yes	Explosion Proof	19-21 Weeks after Approved Shop Drawings			Existing Flygt pumps to be replaced with Vaughan chopper pumps
	P-01-130	New wastewater Pump 3	Standby	Intermittent	WWTP Influent Wellwall	Submersible chopper type	19.0	575V/32A/60Hz	Yes	Explosion Proof	19-21 Weeks after Approved Shop Drawings			Existing Flygt pumps to be replaced with Vaughan chopper pumps
	B-01-200	PRE-TREATMENT PLANT TRAIN 1 COMPOSED OF:	Duty	Continuous	PRE-TREATMENT PLANT	VENDOR PACKAGED PRE-TREATMENT PLANT								PRE-TREATMENT PLANT TRAIN 1 VENDOR PACKAGE
	SCR-01-201	Pre-treatment Plant Blower Train 1	Duty	Continuous	PRE-TREATMENT PLANT	Regeneration Blower Package (with enclosure)	5.5	575V/32A/60Hz	No	Explosion Proof				Blower provides process air to Pre-treatment Plant Train 1
1 - PRE-TREATMENT PLANT	SCR-01-201	Coarse Solids Screen - Pre-treatment Train 1	Duty	Continuous	PRE-TREATMENT PLANT	Integrated to Pre-treatment Train 1	1.5	575V/32A/60Hz	No	Explosion Proof		45,000	Screen remove coarse solids from sewage	
	SCR-01-201	Grit Collector	Duty	Continuous	PRE-TREATMENT PLANT	Integrated to Pre-treatment Train 1	0.5	575V/32A/60Hz	No	Explosion Proof				Conveyor transport grit vertically
	SCR-01-202	Grease Screw	Duty	Continuous	PRE-TREATMENT PLANT	Integrated to Pre-treatment Train 1	0.55	575V/32A/60Hz	No	Explosion Proof				Conveyor transport grit horizontally
	SCR-01-202	Grease Storage Tank	Duty	Continuous	PRE-TREATMENT PLANT	Integrated to Pre-treatment Train 1 (with enclosure)	1.5	575V/32A/60Hz	No	Explosion Proof	18-20 Weeks after Approved Shop Drawings			Grease removed system
	B-01-200	Pre-treatment Plant Blower Train 2	Standby	Continuous	PRE-TREATMENT PLANT	Regeneration Blower Package (with enclosure)	5.5	575V/32A/60Hz	No	Explosion Proof				Blower provides process air to Pre-treatment Plant Train 2
	SCR-01-204	Coarse Solids Screen - Pre-treatment Train 2	Standby	Continuous	PRE-TREATMENT PLANT	Integrated to Pre-treatment Train 2	1.5	575V/32A/60Hz	No	Explosion Proof			45,000	Screen remove coarse solids from sewage
	SCR-01-203	Grit Collector	Standby	Continuous	PRE-TREATMENT PLANT	Integrated to Pre-treatment Train 2	0.5	575V/32A/60Hz	No	Explosion Proof				Conveyor transport grit vertically
	SCR-01-253	Grit Collector	Standby	Continuous	PRE-TREATMENT PLANT	Integrated to Pre-treatment Train 2	0.5	575V/32A/60Hz	No	Explosion Proof				Conveyor transport grit horizontally
	SCR-01-252	Grease Screw	Standby	Continuous	PRE-TREATMENT PLANT	Integrated to Pre-treatment Train 2	0.55	575V/32A/60Hz	No	Explosion Proof				Grease removed system
	H51-01-250	Hoist	Duty	Intermittent	PRE-TREATMENT PLANT	Motorized Hoist (2 speeds as 2 winding motor)	4.3 & 0.7	575V/32A/60Hz	No	Explosion Proof	18-20 Weeks			Hoist for equipment removal from pre-treatment plant trains 1&2 for maintenance (2 speeds as 2 winding motor)
	L01-215	Grease Storage Tank	Duty	Continuous	PRE-TREATMENT PLANT	HDPE tank				Explosion Proof	8 Weeks			Stores grease removed from pre-treatment plant trains 1&2
	P-01-220	Grease Pump	Duty	Continuous	PRE-TREATMENT PLANT	Rotary Lobe	3.7	575V/32A/60Hz	No	Explosion Proof	12-14 Weeks after Approved Shop Drawings			Pump removes grease from grease storage tank
	P-01-220	Grease Pump	Standby	Continuous	PRE-TREATMENT PLANT	Rotary Lobe	3.7	575V/32A/60Hz	No	Explosion Proof				Pump removes grease from grease storage tank
TR-01-260	Grit and Solids Trailer	Duty	Continuous	PRE-TREATMENT PLANT	Dump Trailer								Trailer removes grit and solids from plant	
5 - SEPTAGE HANDLING	R1-06-20	Rock Trap 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package							Rock trap removes rocks from septage	
	GR-05-30	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package	3.7	575V/32A/60Hz	No	Explosion Proof	18-20 Weeks after Approved Shop Drawings			Grinder macerates solids in septage
	R1-06-20	Rock Trap 2 - Port 2	Standby	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package						12,000	Rock trap removes rocks from septage	
	GR-05-30	Grinder 2 - Port 2	Standby	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package	3.7	575V/32A/60Hz	No	Explosion Proof			Grinder macerates solids in septage	
	GR-05-30	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package	10.0	575V/32A/60Hz	No	Explosion Proof			Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package	10.0	575V/32A/60Hz	No	Explosion Proof				Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 1 - Port 1	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package								Grinder macerates solids in septage	
	Grinder 2 - Port 2	Duty	Intermittent	Septage Station Enclosure	Integrated to dual port septage station package									

CITY OF IOALUIT



Plant Area	Area Name	Equipment
Area 1	Influent Pumping, Pre-treatment	Lift Station No. 1 Pumping, Pre-treatment Plant
Area 5	Septage Handling	Septage Station

Plant Area	Equipment Tag	Name	Duty / Standby	Operation (Continuous / Intermittent)	Location	Description	kW	Electrical	Area Class	Delivery	Comments	
1 - IN-LEAK PUMPING (NEW IS No. 1)	LTC-01-011	Wellwell Level Transmitter - Ultrasonic	Duty	Continuous	IS No. 1 Wet Well	Wellwell Level Transmitter - Ultrasonic		24VDC	Zone 2			
	LTC-01-012	Wellwell Level Transmitter - Radar	Standby	Continuous	IS No. 1 Wet Well	Wellwell Level Transmitter - Radar		24VDC	Zone 2			
	LTC-01-013	Wellwell High Level Switch	Standby	Continuous	IS No. 1 Wet Well	Wellwell High Level Switch		24VDC	Zone 2			
	LSH-01-014	Wellwell High-High Level Switch	Standby	Continuous	IS No. 1 Wet Well	Wellwell High-High Level Switch		24VDC	Zone 2			
	RQT-01-150	Discharge Flow Meter	Standby	Continuous	IS No. 1 Electrical Room	Discharge Flow Meter		120V/1ph/60Hz	General			
	AT-01-201	H2S/IEL Gas Detector	Duty	Continuous	IS No. 1 Electrical Room	H2S/IEL Gas Detector		120V/1ph/60Hz	General			
	AT-01-202	H2S/IEL Gas Detector	Duty	Continuous	IS No. 1 Wet Well Room	H2S/IEL Gas Detector		120V/1ph/60Hz	Zone 2	4-6 weeks		
	TTC-1-905	Building Temperature Transmitter	Duty	Continuous	IS No. 1 Electrical Room	Building Temperature Transmitter		24VDC	General			
	TTC-1-906	Building Temperature Transmitter	Duty	Continuous	IS No. 1 Wet Well Room	Building Temperature Transmitter		24VDC	Zone 2			
	ASO-1-911	Building Smoke Detector	Duty	Continuous	IS No. 1 Electrical Room	Building Smoke Detector		24VDC	General			
1 - IN-LEAK PUMPING (NEW IS No. 1)	ASO-1-912	Building Smoke Detector	Duty	Continuous	IS No. 1 Wet Well Room	Building Smoke Detector		24VDC	Zone 2			
	25-01-221	Building Door Switch	Duty	Continuous	IS No. 1 Electrical Room	Building Door Switch		24VDC	General			
	25-01-222	Building Door Switch	Duty	Continuous	IS No. 1 Wet Well Room	Building Door Switch		24VDC	Zone 2			
	25-01-223	Building Door Switch	Duty	Continuous	IS No. 1 Wet Well Room	Building Door Switch		24VDC	Zone 2	8 - 12 weeks		
	CP-01-200	LP Station Control Panel	Duty	Continuous	IS No. 1 Electrical Room	Control Panel		1	120V/1ph/60Hz	General		
	n/a											
	B-01-200	PRE-TREATMENT PLANT TRAIN 1 COMPOSED OF:	Duty	Continuous	Preliminary Treatment - Upper	VENDOR PACKAGED PRE-TREATMENT PLANT						
	LTC-01-250	Pre-treatment Point Level Transmitter	Duty	Continuous	Preliminary Treatment - Upper	Integrated to Pre-treatment Train 1			120V/1ph/60Hz	Zone 2		
	LTC-01-251	Pre-treatment Point Level Transmitter	Duty	Continuous	Preliminary Treatment - Upper	Integrated to Pre-treatment Train 1			120V/1ph/60Hz	Zone 2		
	SV-01-201	Rawwater Solenoid Valve	Duty	Intermittent	Preliminary Treatment - Upper	Integrated to Pre-treatment Train 1			120V/1ph/60Hz	Zone 2	18-20 Weeks after Approved Shop Drawings	
1 - PRE-TREATMENT	SV-01-202	Rawwater Solenoid Valve	Duty	Intermittent	Preliminary Treatment - Upper	Integrated to Pre-treatment Train 1			120V/1ph/60Hz	Zone 2		
	B-01-250	PRE-TREATMENT PLANT TRAIN 2 COMPOSED OF:	Standby	Continuous	Preliminary Treatment - Upper	VENDOR PACKAGED PRE-TREATMENT PLANT						
	LTC-01-251	Pre-treatment Point Level Transmitter	Duty	Continuous	Preliminary Treatment - Upper	Integrated to Pre-treatment Train 2			120V/1ph/60Hz	Zone 2		
	LTC-01-252	Pre-treatment Point Level Transmitter	Duty	Continuous	Preliminary Treatment - Upper	Integrated to Pre-treatment Train 2			120V/1ph/60Hz	Zone 2		
	SV-01-251	Rawwater Solenoid Valve	Duty	Intermittent	Preliminary Treatment - Upper	Integrated to Pre-treatment Train 2			120V/1ph/60Hz	Zone 2		
	SV-01-252	Rawwater Solenoid Valve	Duty	Intermittent	Preliminary Treatment - Upper	Integrated to Pre-treatment Train 2			120V/1ph/60Hz	Zone 2		
	PSH-01-221	Grease Pump 1 Pressure Switch	Duty	Continuous	Preliminary Treatment	MotORIZED Host (2 speeds to 2 winding motor)			24VDC	Zone 1		
	PSH-01-231	Grease Pump 2 Pressure Switch	Duty	Continuous	Preliminary Treatment	HDPE tank			24VDC	Zone 1		
	LTC-01-220	Grease Tank Level Transmitter	Duty	Continuous	Preliminary Treatment	Rotary Lobe			24VDC	Zone 1		
	LSL-01-220	Grease Tank Low-Low Level Switch	Duty	Continuous	Preliminary Treatment	Rotary Lobe			24VDC	General	4-6 Weeks	
1 - PRE-TREATMENT	LSH-01-220	Grease Tank High-High Level Switch	Duty	Continuous	Preliminary Treatment	Rotary Lobe			24VDC	General		
	AT-01-291	H2S/IEL Gas Detector	Duty	Continuous	Preliminary Treatment	H2S/IEL Gas Detector			120V/1ph/60Hz	Zone 2		
	AT-01-291	H2S/IEL Gas Detector	Duty	Continuous	Preliminary Treatment	H2S/IEL Gas Detector			120V/1ph/60Hz	Zone 2		
	TTC-1-292	Building Temperature Transmitter	Duty	Continuous	Preliminary Treatment	Building Temperature Transmitter			24VDC	General		
	25-01-293	Building Door Switch	Duty	Continuous	Preliminary Treatment	Building Door Switch			24VDC	General		
	UCP-01-292	Pre-treatment Plant Control Panel	Duty	Continuous	Preliminary Treatment	Control Panel for integrating pretreatment into plant controls			120V/1ph/60Hz	General	8 - 12 weeks	
	SV-05-101	Push Valve - Port 1	Duty	Continuous	Sewage Station Enclosure	Control Panel for integrating pretreatment into plant controls			120V/1ph/60Hz	General		
	SV-05-102	Push Valve - Port 2	Standby	Intermittent	Sewage Station Enclosure	Integrated to dual port sewage station package			120V/1ph/60Hz	General		
	FOIT-05-101	Foamater - Port 1	Duty	Intermittent	Sewage Station Enclosure	Integrated to dual port sewage station package			120V/1ph/60Hz	General	18-20 Weeks after Approved Shop Drawings	
	FOIT-05-102	Foamater - Port 2	Standby	Intermittent	Sewage Station Enclosure	Integrated to dual port sewage station package			120V/1ph/60Hz	General		
5 - SEPTAGE HANDLING	AT-01-291	H2S/IEL Gas Detector	Duty	Continuous	Sewage Station Enclosure	H2S/IEL Gas Detector			120V/1ph/60Hz	Zone 2		
	TTC-1-292	Building Temperature Transmitter	Duty	Continuous	Sewage Station Enclosure	Building Temperature Transmitter			24VDC	General		
	25-01-293	Building Door Switch	Duty	Continuous	Sewage Station Enclosure	Building Door Switch			24VDC	General		
	25-01-293	Building Door Switch	Duty	Continuous	Sewage Station Enclosure	Building Door Switch			24VDC	General		
	LCF-05-197	Septage Receiving Station Control Panel	Duty	Continuous	Sewage Station Enclosure	Integrated to dual port sewage station package		12	120V/1ph/60Hz	General		

CITY OF IQALUIT
ELECTRICAL EQUIPMENT LIST
SEWER PROTECTION SYSTEM UPGRADES



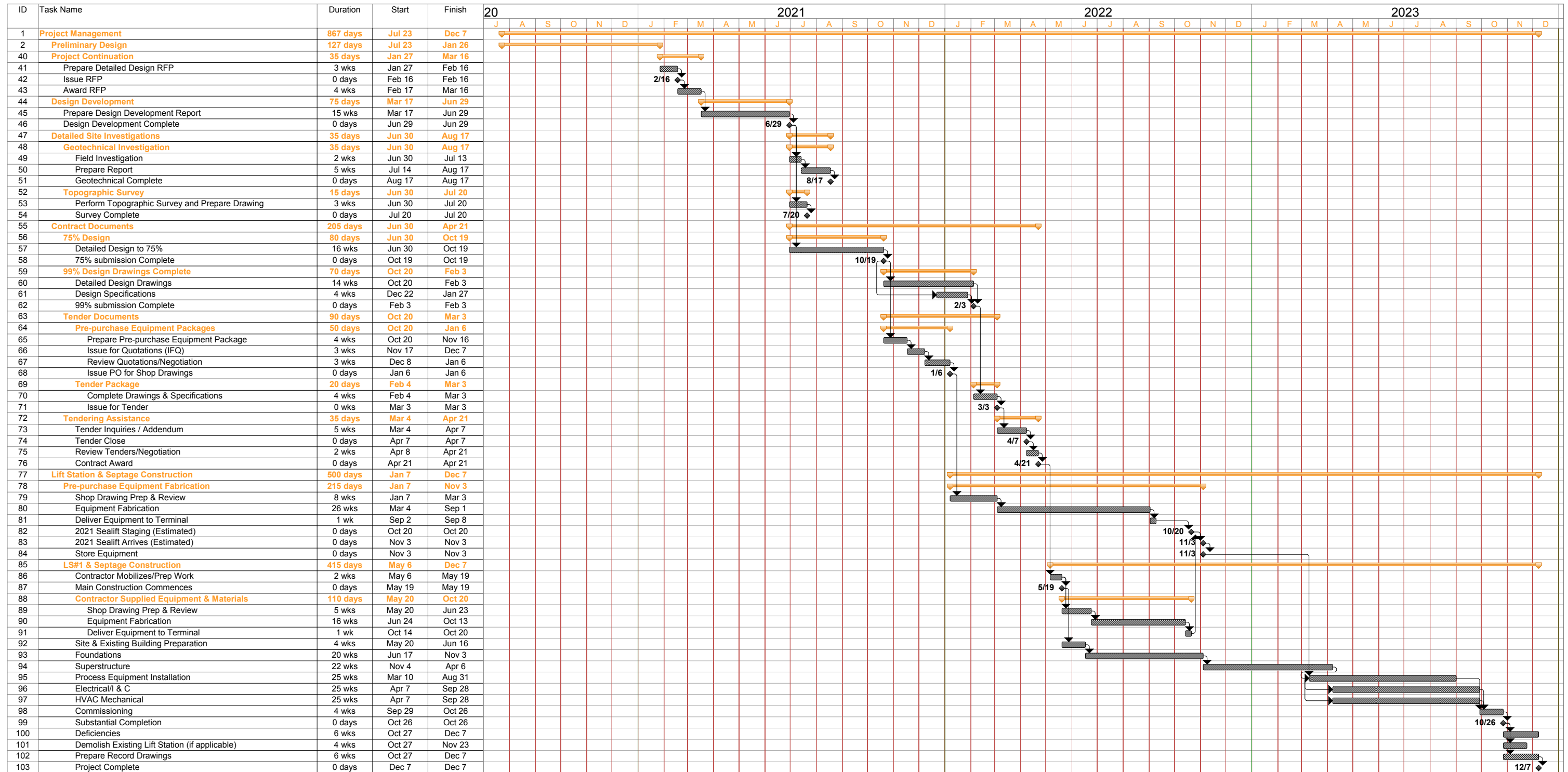
Plant Area	Equipment tag	Name	Location	Description	Electrical	Delivery	Comments
Lift station	VFD 1	Variable Frequency Drive	LS No. 1	VFD for RAW Wastewater Pump 1	600v/3ph/60Hz	5-7 weeks after approval shop drawings	
	VFD 2	Variable Frequency Drive	LS No. 1	VFD for RAW Wastewater Pump 2	600v/3ph/60Hz		
	VFD 3	Variable Frequency Drive	LS No. 1	VFD for RAW Wastewater Pump 3	600v/3ph/60Hz		
WWTP	MDP - 1	Main Distribution Panel	New electrical room	Main Distribution Panel	347/600v/3ph/60Hz	10-12 Weeks after Approved Shop Drawings	
	CDP-1	Central Distribution Panel	New electrical room	Central Distribution Panel	120/208v/3ph/60Hz		
	PNL - 2D	Distribution panel	New electrical room	Distribution panel	120/208v/3ph/60Hz		
	PNL - 2E	Distribution panel	New electrical room	Distribution panel	120/208v/3ph/60Hz		
	MCC-3	Motor Control Centers	New mechanical room	Motor Control Centers	600v/3ph/60Hz		
	PNL - 2F	Distribution panel	New mechanical room	Distribution panel	120/208v/3ph/60Hz		
	PNL - 2G	Distribution panel	New mechanical room	Distribution panel	120/208v/3ph/60Hz		
	Tx-4	Transformer 150kVA	New electrical room	Transformer	600/120/208v/3ph/60Hz		
	PNL - 2H	Distribution panel	Septage Enclosure	Distribution panel	120/208v/3ph/60Hz		
Septage Enclosure						10-12 Weeks after Approved Shop Drawings	

SEWER PROTECTION UPGRADES

Appendix C Preliminary Construction Schedule

Appendix C PRELIMINARY CONSTRUCTION SCHEDULE





SEWER PROTECTION UPGRADES

Appendix D Preliminary Cost Estimate

Appendix D PRELIMINARY COST ESTIMATE



City of Iqaluit
Iqaluit Sewer Protection System Upgrades
Preliminary Design - Capital Cost Estimate +/- 30%
Capital Cost Estimate Breakdown

Item No	Description	Unit	Quantity	Material or Equipment Cost		Total Costs
				Unit Price	Total Price	
1.0 GENERAL REQUIREMENTS						
1.1	General Requirements (10%)	LS	1	\$ 983,150	\$ 983,150	\$ 983,150
2.0 CIVIL/SITEWORKS						
2.1	Lift Station No.1					
2.1.1	Excavation and Backfill	m3	30	\$ 800	\$ 24,000	\$ 24,000
2.1.2	Site Grading	m3	50	\$ 100	\$ 5,000	\$ 5,000
2.1.3	Insulated 250 mm DR 11 HDPE SS Supply and Install	lm	5	\$ 950	\$ 4,750	\$ 4,750
2.1.4	Demolition of MH1 & New AV	LS	1	\$ 175,000	\$ 175,000	\$ 175,000
2.1.5	Bollards	each	17	\$ 1,000	\$ 17,000	\$ 17,000
2.1.6	Bypass Allowance	LS	1	\$ 150,000	\$ 150,000	\$ 150,000
	Subtotal Civil/Siteworks - Lift station No.1					\$ 375,800
2.2	Septage Station					
2.2.1	Excavation and Backfill	m3	40	\$ 800	\$ 32,000	\$ 32,000
	Subtotal Civil/Siteworks - Septage Station					\$ 32,000
2.3	Pre-treatment Plant					
2.3.1	Excavation and Backfill	m3	40	\$ 800	\$ 32,000	\$ 32,000
2.3.2	Site Grading	m3	2,500	\$ 100	\$ 250,000	\$ 250,000
2.3.3	Bollards	each	10	\$ 1,000	\$ 10,000	\$ 10,000
	Subtotal Civil/Siteworks - Pre-treatment Plant					\$ 292,000
3.0 BUILDINGS						
3.1	Lift Station No.1					
3.1.1	Lift Station - Structural Concrete	LS	1	\$ 208,000	\$ 208,000	\$ 208,000
3.1.2	Lift Station - Piles	LS	1	\$ 195,000	\$ 195,000	\$ 195,000
3.1.3	Roof Assembly	LS	1	\$ 38,600	\$ 38,600	\$ 38,600
3.1.4	Exterior Walls	LS	1	\$ 160,200	\$ 160,200	\$ 160,200
3.1.5	Interior Walls Demo	LS	1	\$ 22,400	\$ 22,400	\$ 22,400
3.1.6	Doors	LS	1	\$ 22,500	\$ 22,500	\$ 22,500
3.1.7	Firestopping & Sealants	LS	1	\$ 7,900	\$ 7,900	\$ 7,900
3.1.8	Finishes	LS	1	\$ 4,200	\$ 4,200	\$ 4,200
	Subtotal Buildings - Lift Station No.1					\$ 658,800
2.2	Septage Station					
2.2.1	Structural Slab	LS	1	\$ 21,600	\$ 21,600	\$ 21,600
2.2.2	Septage Piles	LS	1	\$ 117,000	\$ 117,000	\$ 117,000
	Subtotal Buildings - Septage Station					\$ 139,000
3.2	Pre-treatment Plant					
3.2.1	WWTP - Structural Concrete	LS	1	\$ 818,000	\$ 818,000	\$ 818,000
3.2.2	WWTP - Structural Steel	LS	1	\$ 1,113,000	\$ 1,113,000	\$ 1,113,000
3.2.3	WWTP - Piles	LS	1	\$ 566,000	\$ 566,000	\$ 566,000
3.2.3	Roof Assembly	LS	1	\$ 195,000	\$ 195,000	\$ 195,000
3.2.4	Exterior Walls	LS	1	\$ 52,300	\$ 52,300	\$ 52,300
3.2.5	Interior Walls	LS	1	\$ 34,900	\$ 34,900	\$ 34,900
3.2.6	Doors	LS	1	\$ 33,600	\$ 33,600	\$ 33,600
3.2.7	Firestopping & Sealants	LS	1	\$ 33,600	\$ 33,600	\$ 33,600
3.2.8	Stairs	LS	1	\$ 11,200	\$ 11,200	\$ 11,200
3.2.9	Finishes	LS	1	\$ 15,800	\$ 15,800	\$ 15,800
	Subtotal Buildings - Pre-treatment Plant					\$ 2,873,400

City of Iqaluit
Iqaluit Sewer Protection System Upgrades
Preliminary Design - Capital Cost Estimate +/- 30%
Capital Cost Estimate Breakdown

4.0 PROCESS						
4.1	Lift Station No.1					
4.1.1	Raw Wastewater Pump 1 (w rail system)	LS	1	\$ 77,700	\$ 77,700	\$ 77,700
4.1.2	Raw Wastewater Pump 2 (w rail system)	LS	1	\$ 108,780	\$ 108,780	\$ 108,780
4.1.3	Raw Wastewater Pump 3 (w rail system)	LS	1	\$ 108,780	\$ 108,780	\$ 108,780
4.1.4	Hoist (Removal of Pumps from LS No.1)	each	1	\$ 57,400	\$ 57,400	\$ 57,400
4.1.5	Pipeline within LS No.1	LS	1	\$ 11,900	\$ 11,900	\$ 11,900
	Subtotal Process - Lift Station No.1					\$ 364,600
4.2	Septage Station					
4.2.1	Septage Station	LS	1	\$ 798,000	\$ 798,000	\$ 798,000
4.2.2	Pipeline for Septage Station	LS	1	\$ 15,400	\$ 15,400	\$ 15,400
	Subtotal Process - Septage Station					\$ 813,400
4.3	Pre-treatment Plant					
4.3.1	Submersible Pump Replacement in Wetwell	LS	1	\$ 231,000	\$ 231,000	\$ 231,000
4.3.2	Pre-Treatment Plant Train 1	LS	1	\$ 658,000	\$ 658,000	\$ 658,000
4.3.3	Pre-Treatment Plant Train 2	LS	1	\$ 658,000	\$ 658,000	\$ 658,000
4.3.4	Grease Storage Tank	LS	1	\$ 8,400	\$ 8,400	\$ 8,400
4.3.5	Grease Pump	each	1	\$ 40,600	\$ 40,600	\$ 40,600
4.3.6	Grease Pump	each	1	\$ 40,600	\$ 40,600	\$ 40,600
4.3.7	Pipeline within Pre-Treatment Plant	LS	1	\$ 70,000	\$ 70,000	\$ 70,000
4.3.8	Hoist (Removal of Solids Screw from Pre-treatment Plant)	each	1	\$ 57,400	\$ 57,400	\$ 57,400
4.3.9	Grit and Solids Trailer	each	1	\$ 28,000	\$ 28,000	\$ 28,000
	Subtotal Process - Pre-treatment Plant					\$ 1,792,000
5.0 MECHANICAL						
5.1	Lift Station No.1					
5.1.1	Lift Station - Documents, TAB, CX, Seismic	LS	1	\$ 12,500	\$ 12,500	\$ 12,500
5.1.2	Lift station - Demolition	LS	1	\$ 7,500	\$ 7,500	\$ 7,500
5.1.3	Lift station - Relocate	LS	1	\$ 8,000	\$ 8,000	\$ 8,000
5.1.4	Lift station - Heating Plant & Distribution	LS	1	\$ 60,000	\$ 60,000	\$ 60,000
5.1.5	Lift station - Terminal heating	LS	1	\$ 13,500	\$ 13,500	\$ 13,500
5.1.6	Lift station - Ventilation - Exhaust fans	LS	1	\$ 50,000	\$ 50,000	\$ 50,000
5.1.7	Lift station - Ventilation - Cooling fans	LS	1	\$ 15,500	\$ 15,500	\$ 15,500
5.1.8	Lift station - Fuel Oil	LS	1	\$ 1,500	\$ 1,500	\$ 1,500
5.1.9	Lift station - Sanitary	LS	1	\$ 4,000	\$ 4,000	\$ 4,000
5.1.10	Lift station - Potable water	LS	1	\$ 55,000	\$ 55,000	\$ 55,000
5.1.11	Lift station - Controls	LS	1	\$ 30,000	\$ 30,000	\$ 30,000
	Subtotal Mechanical - Lift Station No.1					\$ 257,500
5.2	Pre-treatment Plant					
5.2.1	WWTP - Documents, TAB, CX, Seismic	LS	1	\$ 25,000	\$ 25,000	\$ 25,000
5.2.2	WWTP - Demolition	LS	1	\$ 6,000	\$ 6,000	\$ 6,000
5.2.3	WWTP - Relocate	LS	1	\$ 47,500	\$ 47,500	\$ 47,500
5.2.4	WWTP - Heating Plant & Distribution	LS	1	\$ 228,000	\$ 228,000	\$ 228,000
5.2.5	WWTP - Terminal heating	LS	1	\$ 55,000	\$ 55,000	\$ 55,000
5.2.6	WWTP - Ventilation - AHU-4	LS	1	\$ 313,500	\$ 313,500	\$ 313,500
5.2.7	WWTP - Ventilation - Cooling fans	LS	1	\$ 37,500	\$ 37,500	\$ 37,500
5.2.8	WWTP - Fuel Oil	LS	1	\$ 21,500	\$ 21,500	\$ 21,500
5.2.9	WWTP - Sanitary	LS	1	\$ 35,500	\$ 35,500	\$ 35,500
5.2.10	WWTP - Non-potable water	LS	1	\$ 53,500	\$ 53,500	\$ 53,500
5.2.11	WWTP - Controls	LS	1	\$ 90,000	\$ 90,000	\$ 90,000
	Subtotal Mechanical - Pre-treatment Plant					\$ 913,000

City of Iqaluit
Iqaluit Sewer Protection System Upgrades
Preliminary Design - Capital Cost Estimate +/- 30%
Capital Cost Estimate Breakdown

6.0 ELECTRICAL						
6.1	Lift Station No.1					
6.1.1	Documents, TAB, CX, Seismic	LS	1	\$15,000	\$15,000	\$15,000
6.1.2	Demolition	LS	1	\$3,000	\$3,000	\$3,000
6.1.3	Relocate	LS	1	\$4,000	\$4,000	\$4,000
6.1.4	Power Distribution	LS	1	\$50,000	\$50,000	\$50,000
6.1.5	Lighting	LS	1	\$25,000	\$25,000	\$25,000
6.1.6	Wiring	LS	1	\$20,000	\$20,000	\$20,000
	Subtotal Electrical - Lift Station No. 1					\$117,000
6.2	Septage Station					
6.2.1	Main Power Feed and connection	LS	1	\$ 20,000	\$ 20,000	\$ 20,000
	Subtotal Electrical - Septage Station					\$ 20,000
6.3	Pre-treatment Plant					
6.3.1	Documents, TAB, CX, Seismic	LS	1	\$40,000	\$40,000	\$40,000
6.3.2	Demolition	LS	1	\$5,000	\$5,000	\$5,000
6.3.3	Relocate	LS	1	\$15,000	\$15,000	\$15,000
6.3.4	General/Mobilization/Demobilization	LS	1	\$20,000	\$20,000	\$20,000
6.3.5	Preparation on site, permits	LS	1	\$10,000	\$10,000	\$10,000
6.3.6	Electrical Distribution	LS	1	\$230,000	\$230,000	\$230,000
6.3.7	Building power and lights	LS	1	\$80,000	\$80,000	\$80,000
6.3.8	Mechanical power	LS	1	\$50,000	\$50,000	\$50,000
6.3.9	Process power	LS	1	\$60,000	\$60,000	\$60,000
6.3.10	Underground work	LS	1	\$20,000	\$20,000	\$20,000
6.3.11	Fire Alarm, Security, Data	LS	1	\$50,000	\$50,000	\$50,000
	Subtotal Electrical - Pre-treatment Plant					\$580,000
7.0 CONTROLS						
7.1	Lift Station No.1					
7.1.1	Lift Station control panel	LS	1	\$ 91,000	\$ 91,000	\$ 91,000
7.1.2	Lift Station Instrumentation	LS	1	\$ 84,000	\$ 84,000	\$ 84,000
7.1.3	PLC / SCADA Programming	LS	1	\$ 25,000	\$ 25,000	\$ 25,000
	Subtotal Controls - Lift Station No.1					\$ 200,000
7.2	Septage Station					
7.2.1	Septage Receiving Instrumentation	LS	1	\$ 60,000	\$ 60,000	\$ 60,000
	Subtotal Controls - Septage Station					\$ 60,000
7.3	Pre-treatment Plant					
7.3.1	Pretreatment system plant control panel	LS	1	\$ 56,000	\$ 56,000	\$ 56,000
7.3.2	Pretreatment system instrumentation	LS	1	\$ 112,000	\$ 112,000	\$ 112,000
7.3.3	PLC / SCADA Programming	LS	1	\$ 175,000	\$ 175,000	\$ 175,000
	Subtotal Controls - Pre-treatment Plant					\$ 343,000
	Subtotal - Construction for General Contract					\$ 10,814,700
Contingencies (20% of Subtotal)						\$ 2,163,000
Engineering and Administration Services (20% of Subtotal)						\$ 2,163,000
TOTAL						\$ 15,141,000