NEEGAN BURNSIDE

Whitesand First Nation
Cogeneration and Pellet Mill Project

Effluent Management Plan Report

Sagatay Cogeneration LP

October 2014

Whitesand First Nation
Cogeneration and Pellet Mill Project

Effluent Management Plan Report

Prepared By:

Neegan Burnside Ltd.
292 Speedvale Avenue West Unit 20 Guelph ON N1H 1C4

Prepared for:

Sagatay Cogeneration LP, with its General Partner, Sagatay Cogeneration Ltd., and Whitesand First Nation as agent

October 2014

File No: 300030895.0000

Record of Revisions

Revision	Date	Description
0	December 16, 2013	Draft Report Submission for Consultation
1	October 17, 2014	Application to the Ministry of the Environment and Climate Change

Executive Summary

Sagatay Cogeneration LP, with its General Partner, Sagatay Cogeneration Ltd., and Whitesand First Nation as agent, is proposing to develop, construct and operate a biomass fueled electric power and heat cogeneration plant, and wood pellet facility.

This Effluent Management Plan Report has been prepared in support of an Application for Renewable Energy Approval (REA) and addresses the wastewater generated by the Project. The proposed Project will produce three wastewater streams: process wastewater from the cogeneration plant, sanitary wastewater generated by employees that work at the facilities and wash-up water from various washing activities. There is no municipal wastewater servicing at the Site, therefore, all wastewater streams will need to be treated and discharged on site.

Wastewater is to be collected via pump station or gravity piping at each applicable building and either treated at the building, or pumped to the treatment facility in the woodyard.

Sanitary sewage flows are estimated to be 3,900 L/day and are expected to be similar in quality to domestic sewage. Therefore, sanitary sewage is proposed to be treated via conventional septic system.

Process wastewater flows will be produced by the cogeneration plant and are estimated to be 92,000 L/day. The process wastewater will have a low concentration of solids and other contaminants and will be similar in quality to the raw water supply from the groundwater wells. Therefore, the process wastewater does not require treatment prior to disposal. A settling tank has been proposed to settle out any solids or particulates.

Wash-up wastewater flows will be produced from washing activities at the cogeneration plant, Chip Dryer, and maintenance garage, and are estimated to be 10,300 L/day. The wash-up wastewater is expected to contain wood particles, dust, and other solids that will settle out. A conventional septic system has been proposed to treat the wash-up water.

The Site conditions are conducive to subsurface infiltration; therefore, sanitary, process and wash-up effluent are proposed to be disposed of in a common in-ground leaching bed rated for 106,200 L/day.

The wastewater management system described in this report has been designed to meet reasonable use guidelines as regulated by the Ministry of the Environment and Climate Change.

Table of Contents

Tables

Appendices

Drawings

1.0 Introduction

Sagatay Cogeneration LP, with its General Partner, Sagatay Cogeneration Ltd., and Whitesand First Nation ("Whitesand") as agents, is proposing to develop, construct and operate a biomass fueled electric power and heat cogeneration plant, and wood pellet facility (the "Project"). The Project is located on Crown Land in an unorganized territory of the Thunder Bay District near Whitesand First Nation and Armstrong, Ontario. The unorganized territory is administered by the Armstrong Local Service Board and the Project will be located solely on the traditional territory of Whitesand First Nation.

The general Project components include a biomass fueled electric power and heat cogeneration plant (Cogen plant), wood pellet plant, maintenance garage, material storage and handling areas, wastewater management system, water storage pond, wells, pump building, and transformer substation. The only biomass used to fuel the cogeneration plant will be woodwaste, making it a Class 1 Thermal Facility under Ontario Regulation 359/09 (O.Reg. 359/09) of the *Environmental Protection Act*. The proposed Class 1 Thermal Facility would have a nameplate capacity of 3.6 MW, and would displace the energy supply from existing diesel generators servicing the community via a local grid, operated by Hydro One Remote Communities Inc., as well as supply electricity for the Project. The local grid is not connected to the Provincial grid, and there are no such future plans for a transmission connection.

The proposed Project will produce three wastewater streams: process wastewater from the Cogen plant, wash-up water from various wash down activities and sanitary wastewater generated by employees that work at the facilities. There is no municipal wastewater servicing at the Site, therefore, all wastewater streams will need to be treated and discharged on-site. Because of the difference in quality of the wastewater streams, they will be treated separately. Once treated, the wastewater streams can be disposed of in a common disposal system.

This Effluent Management Plan Report has been prepared in support of an Application for Renewable Energy Approval (REA) and addresses the wastewater generated by the Project as identified above. The wastewater characteristics described in this report are based on the September 25, 2013 Project design by WSP, supplemental information, and revisions made in June 2014. Details regarding stormwater management are briefly discussed, and are addressed comprehensively in the Surface Water Assessment Report under a separate cover.

1.1 Report Requirements

This Effluent Management Plan Report has been prepared in accordance with the requirements of O.Reg. 359/09, as listed in **Table 1**. This report was also prepared according to guidance from the Technical Guide to Renewable Energy Approvals (MOE, 2013).

Table 1 Report Requirements

Item	Requirement Met	Reference in the Report
Set out a description of the following in respect of the renewable energy project:		
The quality and quantity of all sewage that is expected to be produced by or at the renewable energy generation facility.	Yes	Section 2.0, 3.0 & 4.0
The manner in which the sewage mentioned in paragraph 1 is proposed to be treated and disposed of, including details of any sediment control features and storm water management facilities.	Yes	Section 2.4, 3.3, 3.4 & 4.3
Mitigation measures to ensure that the sewage mentioned in paragraph 1 will not result in negative environmental effects on the quality of any water.	Yes	Section 2.4, 3.3, 3.4 & 4.3
If the sewage mentioned in paragraph 1 is proposed to be discharged into surface water, the assimilative capacity of the receiving water body.	N/A	N/A

2.0 Sanitary Wastewater Flows

Sanitary wastewater flows generated by employees at the Cogen Plant, Pellet Plant, and Garage and will be treated by an on-site sewage system. Based on the September 25, 2013 Project design and supplemental information provided by WSP, it is assumed that one sewage system will service the Cogen Plant, Pellet Plant, and maintenance garage, as the facilities are in close proximity. The on-site sewage system will service the washrooms and lunchrooms at these facilities. It has been assumed that there will be no accommodation facilities on-site and no large-scale meal preparation, cafeterias, or commercial cooking facilities in the lunchrooms.

Sanitary wastewater will be collected at each building and pumped or directed via gravity sewer to a septic system in the woodyard. See Drawing SS1 for a plan of the wastewater system.

2.1 Sanitary Wastewater Design Flows

Sewage flow estimates were generated based on values contained in the Ontario Building Code (OBC) Table 8.2.1.3.B. **Table 2** outlines the design daily sanitary wastewater flow rate for the Site uses.

Table 2 Daily Design Flows for Sanitary Effluent

	No. of Units	Daily Flow per Unit	Total Flow (L/d)
Cogen Plant			
Operations	6	188 L/employee per 12 hour shift[a]	1,128
Maintenance	1	188 L/employee per 12 hour shift	188
		Subtotal	1,316
Pellet Plant			
Biomass Yard and Processing	4	188 L/employee per 12 hour shift	940
Dryer/Pellet Plant	6	188 L/employee per 12 hour shift	1,128
Office	2	75 L/employee per 8 hour shift [b]	150
Maintenance	1	188 L/employee per 12 hour shift	188
		Subtotal	2,406
Garage			
Finished Pellet Load Truck Drivers	8	20 L/person [c]	160
		Subtotal	160
		Total	**3,882**
		Total Design flow (rounded)	**3,900**

a. Based on OBC value of 125 L/employee per 8 hour shift for a Factory (including showers, excluding process or cleaning waters)
b. Based on OBC value of 75 L/employee per 8 hour shift for an Office Building.
c. Based on OBC value of 20 L/person for Public Parks with toilets only.

Based on information provided by WSP, it has been assumed that the lunchroom facilities for the Site will be located in the Pellet Plant. The Cogen Plant and maintenance garage will contain only washrooms.

2.2 Expected Sanitary Wastewater Quality

Raw wastewater is expected to be similar in quality to domestic strength sewage, as the wastewater will consist of flows from the washrooms and lunchrooms for the Cogen Plant, Pellet Plant, and maintenance garage. The expected raw wastewater quality for Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS) and ammonia (NH_3) are presented in **Table 3**.

Table 3 Anticipated Sanitary Wastewater Characteristics

Parameter	Raw Wastewater Concentration (mg/L)
BOD	180
TSS	180
NH_3	40

2.3 Sanitary Wastewater Collection

Sanitary wastewater will be collected at the Cogen Plant and Pellet Plant into individual grinder pump stations (SPS No. 2 and 3). The grinder pump stations will be Liberty Pumps D3672 Duplex Grinder Packages equipped with duplex 2 hp Liberty LSG200x grinder pumps on demand dosing. The pumps in SPS No. 2 are rated for 3.0 L/s at 14.1 m TDH. The pumps in SPS No. 3 are rated for 3.1 L/s at 10.8 m TDH. See **Appendix A** for pump sizing calculations. The pumps will direct sanitary sewage to MH1 via one 50 mm diameter HDPE forcemain.

Sanitary wastewater from the garage will be collected via gravity sewer to MH1. Sanitary wastewater will flow via gravity from MH1 to Primary Tank No. 3 located in the woodyard. See Drawing SS2 for the wastewater system layout.

2.4 Sanitary Wastewater Effluent Quality and Treatment

It is recommended that the sanitary wastewater from the Cogen Plant, Pellet Plant, and maintenance garage be treated and disposed of using a conventional septic system. The system would be comprised of a septic tank, pump chamber, and leaching bed. The leaching bed will be sized to accommodate sanitary, process, and wash-up wastewater flows and is described further in Section 4.0. The primary tank will produce secondary effluent with a quality similar to that outlined in **Table 4**.

Table 4 Sanitary Wastewater Effluent Quality

Parameter	Secondary Effluent Quality (mg/L)
BOD_5	40
$CBOD_5$	30
Suspended Solids	30
NH_3	40

Wastewater from wash-up activities will be treated alongside the sanitary wastewater. This is based on the logistics of the collection system as well as the quality of the wash-up wastewater. The wash-up flows are assumed to have no contaminants that are harmful to the sewage system and are described further in Section 4.0. The daily design flow for the wash-up wastewater that will be directed to the sanitary treatment system is 3,482 L/day (rounded to 3,500 L/day).

The primary/pre-treatment tank has been sized in accordance with Ontario Building Code (OBC) Section 8.2.2.3., which requires the minimum working capacity of a septic tank to be three times the daily design sewage flow for non-residential occupancies. Using a daily design flow of 3,900 L for the sanitary wastewater and 3,482 L/day for the wash-up wastewater (7,400 L/day rounded total), the minimum volume required for Primary Tank No. 3 is 22,200 L. Effluent from Primary Tank No. 3 in the woodyard will flow by gravity to the Bed Dosing Chamber (SPS No. 4) where it will be pumped to the leaching bed.

The proposed tank is to be heavy duty, pre-cast concrete (Wilkinson Heavy Pre-Cast or approved equivalent), and will be equipped with access hatches to grade. The tank will be equipped with an effluent filter rated for a minimum 7,400 L/day to prevent solids from leaving the tank.

3.0 Process Wastewater Flows

Process wastewater is expected to be produced by the Cogen Plant and its cooling tower. The design flows for the process wastewater were provided by WSP. These effluent sources are described in **Table 5**.

Table 5 Process Wastewater Flow Descriptions

Building	Source	Description
Cogen Plant	Boiler Blow Down	Water is wasted from the boiler to avoid increasing the concentration of impurities inside the boiler.
	RO System Blow Down	Flush-out and reject water from the reverse osmosis machines and water softeners.
Cooling Tower	Cooling Tower Bleed Off	Water is wasted from the cooling tower to avoid increasing the concentration of impurities inside the tower.

3.1 Process Wastewater Design Flows

The design flows for the process wastewater were provided by WSP. The average flow rate is expected to be approximately 1.0 L/s (16 USgpm). The average flow rate does not include rare flows such as emergency showers or water treatment system overflows, as these would occur only in rare emergency situations. The resulting total daily design flow for the process wastewater system is 92,000 L/day.

3.2 Expected Process Wastewater Quality

Process wastewater quality was provided by WSP (see **Appendix B**). This wastewater stream will originate from the Boiler, Reverse-Osmosis System, and Cooling Tower, and is expected to have a low concentration of solids and other contaminants. The process wastewater will be similar in quality to the raw water supply from the groundwater wells. See **Appendix B** for a table of wastewater quality characteristics.

3.3 Process Wastewater Collection and Treatment

Process wastewater will be collected in the Cogen Plant (and cooling tower) into a primary tank located under the floor of the water treatment room. The treatment tank, Primary Tank No. 1, is a 45,000 L cast-in-place concrete, two-compartment septic tank. This tank will provide approximately a half day retention for the process wastewater. A filter screen will be provided at the outlet of the septic tank to prevent any solids or floating material from exiting the tank and entering the leaching bed. It is recommended to provide the process wastewater primary tank with a high water level alarm in order to monitor the liquid levels in the tank, and to prevent any back-ups from occurring.

The process effluent will be collected in SPS No. 1, also located in the Cogen Plant. The pump station will be a 2.5 m x 2.5 m (2.1 m x 2.1 m I.D.) cast-in-place concrete pump chamber equipped with duplex Little Giant 20E 2 hp sewage handling pumps rated for 4.1 L/s at 23.5 m TDH on demand dosing. The pumps will direct process wastewater to the Bed Dosing Chamber (SPS No. 4) via a 50 mm diameter HDPE forcemain. See Drawing SS2 for the servicing layout.

3.4 Process Wastewater Effluent Quality

Based on the impact assessment presented in Section 5.0, the process wastewater effluent does not require treatment prior to disposal. Neegan has assumed that any solids or particulates in the wastewater can be treated via a settling tank and filter screen.

4.0 Wash-up Activities

There will be additional wastewater produced from washing activities, including wash-up from the Cogen Plant, its Ash Transfer Shed, Chip Dryer and Garage. These effluent sources are described in **Table 6**. This stream is expected to have wood dust, ash, and other solids.

Table 6 Wash-up Wastewater Flow Sources

Building	Source	Description
Cogen Plant	Wash-up and Floor Drains	Cleaning plant operations. The resulting wastewater will have dirt dust as well as some trace oils and chemicals.
	Ash Transfer Shed Wash-up	High-pressure wash system for cleaning and to remove ash build-up from trucks. Flow will be 23 kg (50 lbs) of ash mixed with 1,900 L (500 USgal) water per week.
Chip Dryer	Chip Dryer	Cleaning and washing down equipment. The resulting wastewater will contain dirt and biomass as well as some trace oil and chemicals.
Maintenance Garage	Garage wash-up and floor drains	Cleaning and washing down equipment and vehicles. The resulting wastewater will contain dirt and oil. A grit removal sump and oil separator will be included in the maintenance garage and will be designed and sized accordingly by WSP.

4.1 Wash-up Activities Design Flows

The design flows for the wash-up wastewater were provided by WSP. The total daily design flow for the wash-up activity wastewater is approximately 10,300 L/day. See **Table 7** for a breakdown of the wash-up flows. These flows are expected to be intermittent as wash-up of some areas may only occur once per week for 30 minutes. A peak flow of approximately 6.0 L/s would be expected if all washing activities were occurring concurrently. It is predicted that all wash-up activities will not occur at the same time; therefore, the peak flow is expected to be less.

Table 7 Daily Design Flows for Wash-up Wastewater

Building	Source	Peak Flow (L/s)	Daily Flow (L/day)[a]
Cogen Plant	Wash-up and Floor Drains	2.5	4,542
	Ash Transfer Shed Wash-up	1.3	2,271
		Subtotal	6,813
Chip Dryer	Chip Dryer	0.7	1,211
Maintenance Garage	Garage wash-up and floor drains	1.3	2,271
		Subtotal	3,482
		Total	**10,296**
		Total (Rounded)	**10,300**

a. Assuming a wash-up time of 30 minutes per day.

4.2 Expected Wash-up Wastewater Quality

The wash-up wastewater stream is expected to have wood dust, ash and other solids that will settle or float out of the wastewater stream. The wash-up water from the Cogen Plant will contain wood ash that may cause the wastewater to be slightly caustic.

A conventional septic system is recommended to treat the wash-up wastewater. A grit removal sump and oil separator will also be included in the maintenance garage and will be designed by WSP to remove dirt and oil from washing activities.

Neegan has assumed that no other contaminants that are harmful to the sewage system will enter from the Garage or from the Chip Dryer.

4.3 Wash-up Wastewater Collection and Treatment

Due to the location of the wash-up wastewater sources, it is recommended to separate the wash-up water from the Cogen Plant from the Garage and Chip Dryer.

Wash-up wastewater from the Cogen Plant will be collected into a treatment tank located under the floor of the water treatment room (adjacent to the process wastewater treatment tank). The treatment tank is a 22,000 L cast-in-place concrete, two-compartment septic tank (Primary Tank No. 2). The daily design flow for this tank will be 6,813 L/day. As per the Ontario Building Code (OBC) Section 8.2.2.3., the minimum volume required for the Primary Tank No. 2 is 20,440 L. The wash-up tank will be equipped with an effluent filter rated for minimum 6,813 L/day to prevent solids from leaving the tank. Effluent from this tank will flow by gravity to the Cogen Plant pump chamber (SPS No. 1) shared with the process effluent. See Section 3.3 for a description of the pump chamber. Effluent will be pumped from the SPS No. 1 to the Bed Dosing Chamber (SPS No. 4) located in the woodyard.

Wash-up wastewater from the Chip Dryer and Maintenance Garage will be collected via gravity and directed to MH1. Wastewater will flow from MH1 by gravity to Primary Tank No. 3 in the woodyard to be treated alongside the sanitary wastewater. See Section 2.4 for a description of the treatment system.

5.0 Impact Assessment

The impact of subsurface discharge on local groundwater supplies is normally assessed in accordance with the MOE Guideline B-7 (Reasonable Use Policy) and Chapter 22 of the MOE's 2008 Design Guidelines for Sewage Works, which provide general guidelines to determine what level of development activity a particular Site can sustain without adversely impacting existing or possible future off-site land uses. The contaminant of concern for domestic subsurface discharge systems is typically nitrate; however due to the process wastewater flows at this Site, other parameters (i.e., metals) will also be considered. Parameters with Ontario Drinking Water Quality Standards (ODWQSs) have been included in this analysis.

Effluent from the disposal system will likely enter the groundwater system. The movement of groundwater is typically influenced by the surface topography and surface water drainage. Based on the hydrogeological assessment for the site, the direction of groundwater flow is from the north to the southeast and southwest. See Neegan Burnside's Design and Operations Report, Appendix D - Hydrogeological Assessment for details regarding groundwater characteristics and direction of flow.

It can be assumed that some attenuation, mixing and dilution of the nutrients and metals in the effluent will occur on the Site. This assessment is based on the estimated dilution of the effluent plume that occurs between the leaching bed and the property boundary. The contaminant concentrations at the property boundary have been estimated according to Chapter 22 of the MOE Design Guidelines for Sewage Works (2008), and are based on the following assumptions:

- Daily sanitary wastewater flow of 3,900 l/d;
- Daily process wastewater flow of 92,000 l/d;
- Daily wash-up wastewater flow of 10,300 l/d;
- An estimated annual infiltration of 250 mm/y;
- Available dilution area of 10.47 ha; and,
- Concentrations of contaminants in effluent as presented in **Appendix C**.

Based on these parameters, we have assessed the theoretical concentration of each parameter that would be present in the groundwater at the limits of the property. The results of the analysis are summarized in **Appendix C**.

The impact assessment demonstrates that Reasonable Use has been met at the down-gradient property boundary for all of the parameters with ODWQSs, and therefore, no unacceptable impacts to down-gradient water resources are anticipated.

Hoodoo Creek flows at least 400 m north of the Project Location. Portions of this creek have been identified as having cold water characteristics. It is important to note that since the groundwater direction has been determined to be southeast and southwest, no impacts to Hoodoo Creek as a result of the wastewater system are anticipated.

6.0 Disposal

The process, sanitary and wash-up wastewater will be disposed of in a common leaching bed. Due to the relatively high permeability of the underlying soils, it is recommended that an in-ground conventional absorption trench leaching bed be installed.

Neegan Burnside staff was on-site during the drilling of the water supply wells. The soil conditions at the Site were observed at this time. The soil is described as gravelly sand with cobbles. Based on this description, the soil can be classified as 'SW' according to the Unified Classification System (USCS). Percolation rates (T-times) for SW soils range from 2 to 12 min/cm. Based on the information available to us at this time, we have based our analysis on an estimated T-time of 5 min/cm. The T-time may need to be refined upon completion of more detailed field work in the area specific to the leaching bed. There was no evidence of a shallow groundwater table or shallow bedrock during the drilling of the wells on-site.

Based on the estimated design flow of 106,200 L/day (3,900 L/d for sanitary and 92,000 L/d for process and 10,300 L/d for wash-up), the requirements for an in-ground, conventional leaching bed system have been calculated using:

$L = QT/200$

Where: L = length of distribution piping required (m)
Q = daily design flow (L/d)
T = T-time of the native soils, assumed to be 5 min/cm

The required length of distribution pipe is 2,655 m. The leaching bed is proposed to have 100 runs of 100 mm diameter PVC distribution piping, each with a length of 29 m (95 ft.), for a total length of 2,800 m. The leaching bed will be constructed along the north boundary of the Project Location, as shown in Drawing SS1. A minimum depth of cover of 1.0 m has been provided on the infiltration system to prevent freezing.

The bed will be installed in 12 cells, grouped in three (3) sections of four (4) cells each. One group, or one third of the bed, will be dosed per pump cycle.

Since the total length of distribution piping in the bed exceeds 150 m, the disposal bed will need to be dosed by a pumping system to ensure good dispersal of effluent throughout the bed (in accordance with OBC 8.6.1.3.). Treated sanitary, process and wash-up effluent will be collected in a final Bed Dosing Chamber (SPS No. 4) in the woodyard and will be collectively dosed to the leaching bed.

The Bed Dosing Chamber (SPS No. 4) will be a 2.5 m x 2.5m (I.D.) pre-cast concrete square manhole chamber. The chamber will be equipped with three Little Giant 20E 2.0 hp submersible sewage pumps rated for 6.3 L/s at 15.3 m TDH, to be in a demand-dosed arrangement.

7.0 Other Equipment and Considerations

7.1 Control Panels

Control panels will be required for each of the sewage pumping stations. The location of the panels will be determined in consultation with the owner. The control panel for the Bed Dosing Chamber should be located in the closest building, the Maintenance Garage.

7.2 Flow Metering

It is recommended to monitor the daily volume of wastewater entering the wastewater system and being discharged to the leaching bed. This can be achieved by recording the pump run times, or by monitoring the raw water supply. Flow monitoring will be discussed with the owner and will be implemented in accordance with the conditions of the renewable energy approval.

7.3 Freezing

The wastewater management infrastructure proposed in this report and detailed in Drawings SS1 to SS4 have been designed considering the depth of frost and anticipated freezing conditions at the site. A combination of strategies including infrastructure location (i.e., under the Site buildings), wastewater temperature, insulation, and design depth, have been used to mitigate potential impacts associated with freezing.

8.0 Stormwater Management

Stormwater management is proposed to be addressed by erosion and sediment control measures during construction, and a bio-swale during operation. Stormwater flows are intended to leave the Site via sheet flow and infiltration through the bio-swale noted above. Refer to the Surface Water Assessment Report under a separate cover for a more detailed assessment of stormwater management at the Site.

9.0 Conclusion

The Whitesand First Nation Cogeneration and Pellet Mill Project can be adequately serviced with on-site sewage treatment and disposal facilities. The wastewater management system described in this report has been designed to meet reasonable use guidelines as regulated by the Ministry of the Environment and Climate Change.

The sewage system will consist of the following components:

- Two (2) raw sanitary sewage pump stations (SPS No. 2 and 3), equipped with duplex submersible grinder pumps;
- One (1) two-compartment pre-cast concrete Primary Tank No. 3 to treat sanitary and wash-up wastewater with a minimum capacity of 22,000 L, equipped with an effluent filter on the outlet, discharging by gravity to the Bed Dosing Chamber;
- One (1) two-compartment cast-in-place concrete Primary Tank No. 1 to treat process wastewater with a working capacity of 45,000 L, equipped with a filter screen on the outlet, discharging by gravity to the Cogen Plant Pump Chamber (SPS No. 1);
- One (1) two-compartment cast-in-place concrete PrimaryTank No. 2 to treat wash-up wastewater from the Cogen Plan with a working capacity of 20,440 L, equipped with an effluent filter on the outlet, discharging by gravity to the Cogen Plant Pump Chamber (SPS No. 1);
- One (1) Cogen Plant Pump Chamber (SPS No. 1), 2.1 m by 2.1 m (I.D.) cast-in-place concrete pump chamber, equipped with duplex submersible sewage pumps;
- One (1) Bed Dosing Chamber (SPS No. 4), 2.5 m by 2.5 m (I.D.) precast concrete square manhole chamber, equipped with three submersible sewage pumps;
- One (1) in-ground conventional leaching bed rated for 106,200 L/day with 96 runs at 29 m each (total length of 2,800 m), equipped with perforated PVC distribution piping;
- All required control panels and ancillary equipment as required for the successful operation of the system.

Respectfully submitted,

Neegan Burnside Ltd.

Written by:

Signature ______________________ Date: October, 2014

Caitlin Larwa, E.I.T.
On-site Wastewater Specialist
Neegan Burnside Ltd.

Reviewed by:

Signature ______________________ Date: October, 2014

Anne Egan, M.Sc.(Eng.), P.Eng.
Senior On-site Wastewater Specialist
Neegan Burnside Ltd.

Signature ______________________ Date: October, 2014

Chris Shilton, P.Eng., LEED ®AP
Project Manager
Neegan Burnside Ltd.

Approved By:

Signature ______________________ Date: October, 2014

Craig Toset
Project Manager
Whitesand First Nation

Appendix A

Pumping Size Calculations

Determine System Curve
TOTAL DYNAMIC HEAD from SANITARY GRINDER PUMP STATION 1 (SPS 1) TO MH1

1 Enter Flows
Enter flows in L/s. Flow #3 will be the approximate operating point.

	FLOW #1	FLOW #2	FLOW #3	FLOW #4
Igpm	13.2	26.4	39.6	66.0
L/s	1.00	2.00	3.00	5.00
USgpm	15.9	31.7	47.6	79.3

2 SMALL FITTINGS
Enter quantity and diameter of pipe fittings

ITEM	Dia, mm	K	QUANTITY	FLOW #1 Hf (m)	FLOW #2 Hf (m)	FLOW #3 Hf (m)	FLOW #4 Hf (m)
PIPEWORK INSIDE THE PUMPING STATION							
Threaded 90 deg elbow	32	0.90	5	0.35	1.42	3.19	8.87
Threaded coupling	32	0.05	1	0.00	0.02	0.04	0.10
flng ball check valve	32	2	1	0.16	0.63	1.42	3.94
flng gate valve	32	0.15	2	0.02	0.09	0.21	0.59
T flow through	32	0.90	1	0.07	0.28	0.64	1.77
Coupling	32	0.05	1	0.00	0.02	0.04	0.10
			SUBTOTAL:	0.61	2.46	5.53	15.37

3 SPECIAL FITTINGS
Enter losses for special fittings (e.g. automatic distribution valves, etc.)

ITEM	QUANTITY	FLOW #1 Hf (m)	FLOW #2 Hf (m)	FLOW #3 Hf (m)	FLOW #4 Hf (m)
NONE		0.000	0.000	0.000	0
	SUBTOTAL:	0.00	0.00	0.00	0.00

4 EXPANSIONS/CONTRACTIONS
Enter quantity and diameters for pipe transitions

Dia 1, mm	Dia 2, mm	QUANTITY	FLOW #1 Hf (m)	FLOW #2 Hf (m)	FLOW #3 Hf (m)	FLOW #4 Hf (m)
NONE						
32	50	1	0.03	0.11	0.25	0.69
		SUBTOTAL:	0.03	0.11	0.25	0.69

5 ENTRANCE/EXIT LOSSES

ITEM	k	QUANTITY	FLOW #1 Hf (m)	FLOW #2 Hf (m)	FLOW #3 Hf (m)	FLOW #4 Hf (m)
Exit Loss	1.0		0.01	0.05	0.12	0.33
		SUBTOTAL	0.01	0.05	0.12	0.33

6 (a)PIPING - Higher C value - lower friction losses
Enter diameter and length of piping

DESCRIPTION	Inside Dia, mm	Design C	(m) LENGTH	FLOW #1 Hf (m)	FLOW #2 Hf (m)	FLOW #3 Hf (m)	FLOW #4 Hf (m)
Piping within pump stn	32	130	3	0.21	0.75	1.58	4.07
From PS to MH1	50	130	105	0.82	2.97	6.29	16.20
			SUBTOTAL:	1.03	3.71	7.87	20.27

(b) PIPING- Lower C value - higher friction losses
Enter diameter and length of piping

DESCRIPTION	Inside Dia, mm	C Design	(m) LENGTH	FLOW #1 Hf (m)	FLOW #2 Hf (m)	FLOW #3 Hf (m)	FLOW #4 Hf (m)

Piping within pump stn	32	110	3	0.28	1.02	2.15	5.54
From PS to MH1	50	110	105	1.12	4.04	8.57	22.07
			SUBTOTAL:	1.40	5.06	10.72	27.61

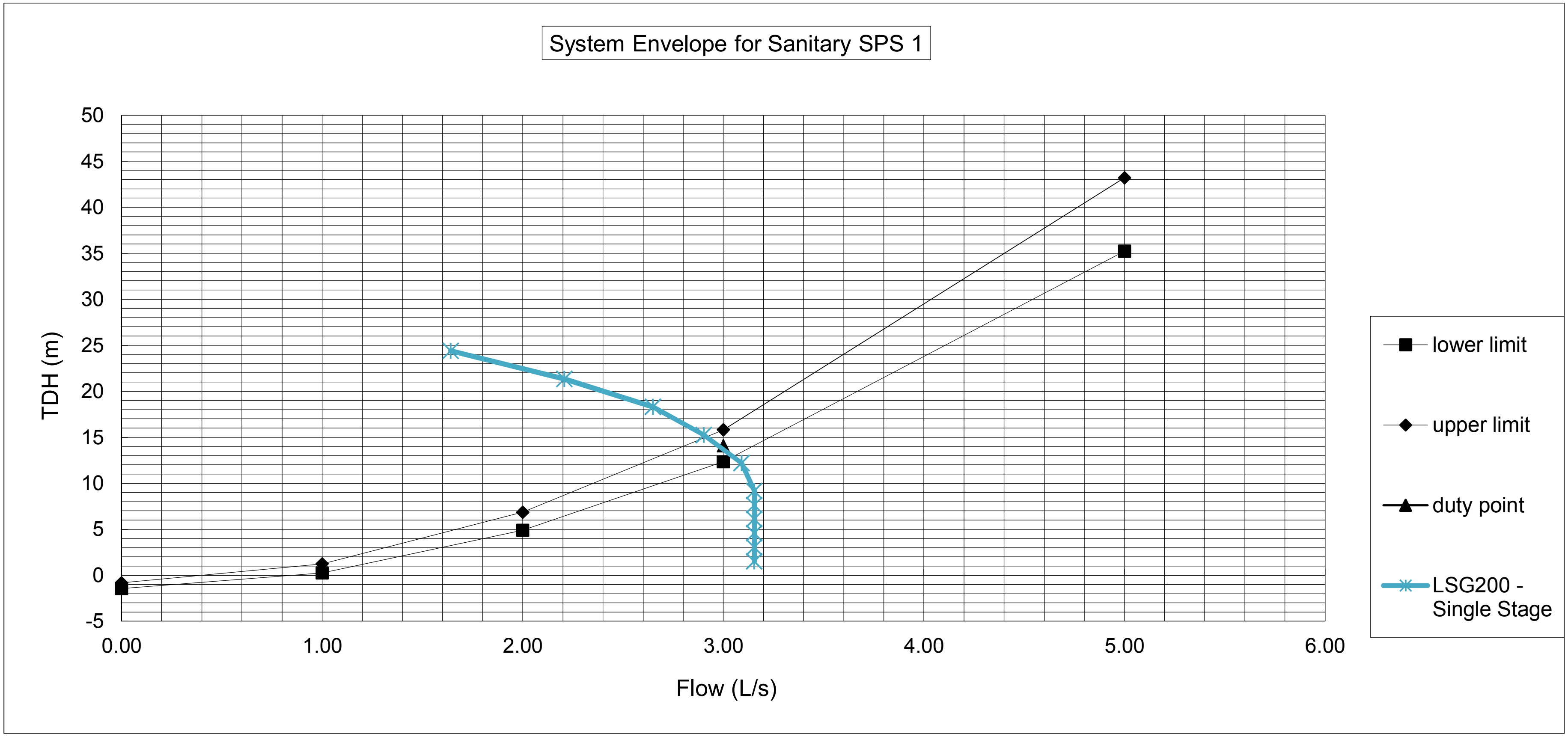
6.7 ELEVATION HEAD

Enter elevations

Elevation of MH1 invert	360.37	m
Elevation of MH1 invert	360.37	m
High Water Level in SPS	361.8	m
Low water level in SPS	361.2	m
ELEVATION HEAD:	-0.8	m

8 TOTAL DYNAMIC HEAD

Flow	Friction		Elevation		System Curves	
	High C	Low C	LWL	HWL	Lower	Upper
L/s	(m)	(m)	(m)	(m)	(m)	(m)
0.00	0.0	0.0	-0.8	-1.4	-1.4	-0.8
1.00	1.7	2.1	-0.8	-1.4	0.2	1.2
2.00	6.3	7.7	-0.8	-1.4	4.9	6.9
3.00	13.8	16.6	-0.8	-1.4	12.3	15.8
5.00	36.7	44.0	-0.8	-1.4	35.2	43.2


System Envelope for Sanitary SPS 1
TDH (m)
50
45
40
35
30
25
20
15
10
5
0
-5
0.00
1.00
2.00
3.00
4.00
5.00
6.00
Flow (L/s)
lower limit
upper limit
duty point
LSG200 - Single Stage

Determine System Curve
TOTAL DYNAMIC HEAD from SANITARY GRINDER PUMP STATION (SPS 2) TO MH1

1 Enter Flows
Enter flows in L/s. Flow #3 will be the approximate operating point.

	FLOW #1	FLOW #2	FLOW #3	FLOW #4
Igpm	13.2	26.4	40.9	66.0
L/s	1.00	2.00	3.10	5.00
USgpm	15.9	31.7	49.1	79.3

2 SMALL FITTINGS
Enter quantity and diameter of pipe fittings

ITEM	Dia, mm	K	QUANTITY	FLOW #1 Hf (m)	FLOW #2 Hf (m)	FLOW #3 Hf (m)	FLOW #4 Hf (m)
PIPEWORK INSIDE THE PUMPING STATION							
Threaded 90 deg elbow	32	0.90	5	0.35	1.42	3.41	8.87
Threaded coupling	32	0.05	1	0.00	0.02	0.04	0.10
flng ball check valve	32	2	1	0.16	0.63	1.52	3.94
flng gate valve	32	0.15	2	0.02	0.09	0.23	0.59
T flow through	32	0.90	1	0.07	0.28	0.68	1.77
Coupling	32	0.05	1	0.00	0.02	0.04	0.10
			SUBTOTAL:	0.61	2.46	5.91	15.37

3 SPECIAL FITTINGS
Enter losses for special fittings (e.g. automatic distribution valves, etc.)

ITEM	QUANTITY	FLOW #1 Hf (m)	FLOW #2 Hf (m)	FLOW #3 Hf (m)	FLOW #4 Hf (m)
NONE		0.000	0.000	0.000	0
	SUBTOTAL:	0.00	0.00	0.00	0.00

4 EXPANSIONS/CONTRACTIONS
Enter quantity and diameters for pipe transitions

Dia 1, mm	Dia 2, mm	QUANTITY	FLOW #1 Hf (m)	FLOW #2 Hf (m)	FLOW #3 Hf (m)	FLOW #4 Hf (m)
NONE						
32	50	1	0.03	0.11	0.27	0.69
		SUBTOTAL:	0.03	0.11	0.27	0.69

5 ENTRANCE/EXIT LOSSES

ITEM	k	QUANTITY	FLOW #1 Hf (m)	FLOW #2 Hf (m)	FLOW #3 Hf (m)	FLOW #4 Hf (m)
Exit Loss	1.0		0.01	0.05	0.13	0.33
		SUBTOTAL	0.01	0.05	0.13	0.33

6 (a)PIPING - Higher C value - lower friction losses
Enter diameter and length of piping

DESCRIPTION	Inside Dia, mm	Design C	(m) LENGTH	FLOW #1 Hf (m)	FLOW #2 Hf (m)	FLOW #3 Hf (m)	FLOW #4 Hf (m)
Piping within pump stn	32	130	3	0.21	0.75	1.68	4.07
From PS to MH1	50	130	45	0.35	1.28	2.88	6.99
			SUBTOTAL:	0.56	2.03	4.56	11.06

(b) PIPING- Lower C value - higher friction losses
Enter diameter and length of piping

DESCRIPTION	Inside Dia, mm	C Design	(m) LENGTH	FLOW #1 Hf (m)	FLOW #2 Hf (m)	FLOW #3 Hf (m)	FLOW #4 Hf (m)

Piping within pump stn	32	110	3	0.28	1.02	2.29	5.54
From PS to MH1	50	110	45	0.48	1.74	3.93	9.52
			SUBTOTAL:	0.76	2.76	6.22	15.06

6.7 ELEVATION HEAD

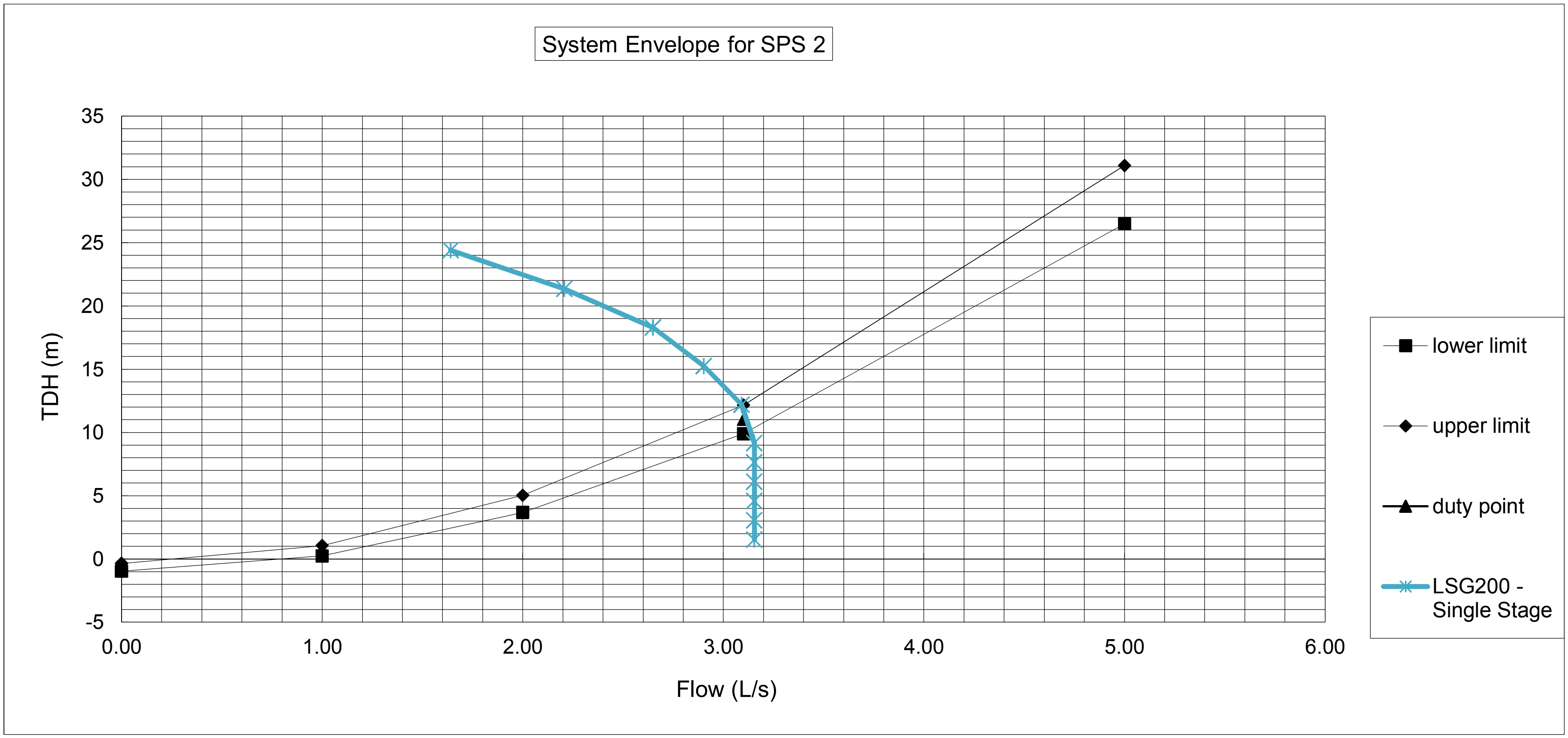
Enter elevations

Elevation of MH1 invert	360.58	m	*Assume for now that the elevations and comparable between th
Elevation of MH1 invert	360.58	m	
High Water Level in SPS	361.6	m	
Low water level in SPS	360.9	m	

ELEVATION HEAD: -0.4 m

8 TOTAL DYNAMIC HEAD

Flow	Friction		Elevation		System Curves	
	High C	Low C	LWL	HWL	Lower	Upper
L/s	(m)	(m)	(m)	(m)	(m)	(m)
0.00	0.0	0.0	-0.4	-1.0	-1.0	-0.4
1.00	1.2	1.4	-0.4	-1.0	0.2	1.1
2.00	4.6	5.4	-0.4	-1.0	3.7	5.0
3.10	10.9	12.5	-0.4	-1.0	9.9	12.2
5.00	27.5	31.5	-0.4	-1.0	26.5	31.1


System Envelope for SPS 2
TDH (m)
35
30
25
20
15
10
5
0
-5
0.00
1.00
2.00
3.00
4.00
5.00
6.00
Flow (L/s)
lower limit
upper limit
duty point
LSG200 - Single Stage

Determine System Curve
TOTAL DYNAMIC HEAD from COGEN PLANT PUMP STATION TO BED DOSING CHAMBER

1 Enter Flows
Enter flows in L/s. Flow #3 will be the approximate operating point.

	FLOW #1	FLOW #2	FLOW #3	FLOW #4
Igpm	26.4	39.6	54.1	79.2
L/s	2.00	3.00	4.10	6.00
USgpm	31.7	47.6	65.0	95.1

2 SMALL FITTINGS
Enter quantity and diameter of pipe fittings

ITEM	Dia, mm	K	QUANTITY	FLOW #1 Hf (m)	FLOW #2 Hf (m)	FLOW #3 Hf (m)	FLOW #4 Hf (m)
PIPEWORK INSIDE THE PUMPING STATION							
Threaded 90 deg elbow	50	0.90	5	0.24	0.54	1.00	2.14
Threaded coupling	50	0.05	1	0.00	0.01	0.01	0.02
flng ball check valve	50	2	1	0.11	0.24	0.44	0.95
flng gate valve	50	0.15	2	0.02	0.04	0.07	0.14
T flow through	50	0.90	1	0.05	0.11	0.20	0.43
Coupling	50	0.05	1	0.00	0.01	0.01	0.02
			SUBTOTAL:	0.41	0.93	1.73	3.71

3 SPECIAL FITTINGS
Enter losses for special fittings (e.g. automatic distribution valves, etc.)

ITEM	QUANTITY	FLOW #1 Hf (m)	FLOW #2 Hf (m)	FLOW #3 Hf (m)	FLOW #4 Hf (m)
NONE		0.000	0.000	0.000	0
	SUBTOTAL:	0.00	0.00	0.00	0.00

4 EXPANSIONS/CONTRACTIONS
Enter quantity and diameters for pipe transitions

Dia 1, mm	Dia 2, mm	QUANTITY	FLOW #1 Hf (m)	FLOW #2 Hf (m)	FLOW #3 Hf (m)	FLOW #4 Hf (m)
NONE						
50	50	0	0.00	0.00	0.00	0.00
		SUBTOTAL:	0.00	0.00	0.00	0.00

5 ENTRANCE/EXIT LOSSES

ITEM	k	QUANTITY	FLOW #1 Hf (m)	FLOW #2 Hf (m)	FLOW #3 Hf (m)	FLOW #4 Hf (m)
Exit Loss	1.0		0.05	0.12	0.22	0.48
		SUBTOTAL	0.05	0.12	0.22	0.48

6 (a)PIPING - Higher C value - lower friction losses
Enter diameter and length of piping

DESCRIPTION	Inside Dia, mm	Design C	(m) LENGTH	FLOW #1 Hf (m)	FLOW #2 Hf (m)	FLOW #3 Hf (m)	FLOW #4 Hf (m)
Piping within pump stn	50	130	3	0.08	0.18	0.32	0.65
From PS to Bed Dosing Chamber	50	130	176	4.98	10.54	18.80	38.06
			SUBTOTAL:	5.06	10.72	19.12	38.71

(b) PIPING- Lower C value - higher friction losses
Enter diameter and length of piping

DESCRIPTION	Inside Dia, mm	C Design	(m) LENGTH	FLOW #1 Hf (m)	FLOW #2 Hf (m)	FLOW #3 Hf (m)	FLOW #4 Hf (m)
Piping within pump stn	50	110	3	0.12	0.24	0.44	0.88
From PS to Bed Dosing Chamber	50	110	176	6.78	14.36	25.62	51.86
			SUBTOTAL:	6.89	14.61	26.05	52.74

6.7 ELEVATION HEAD

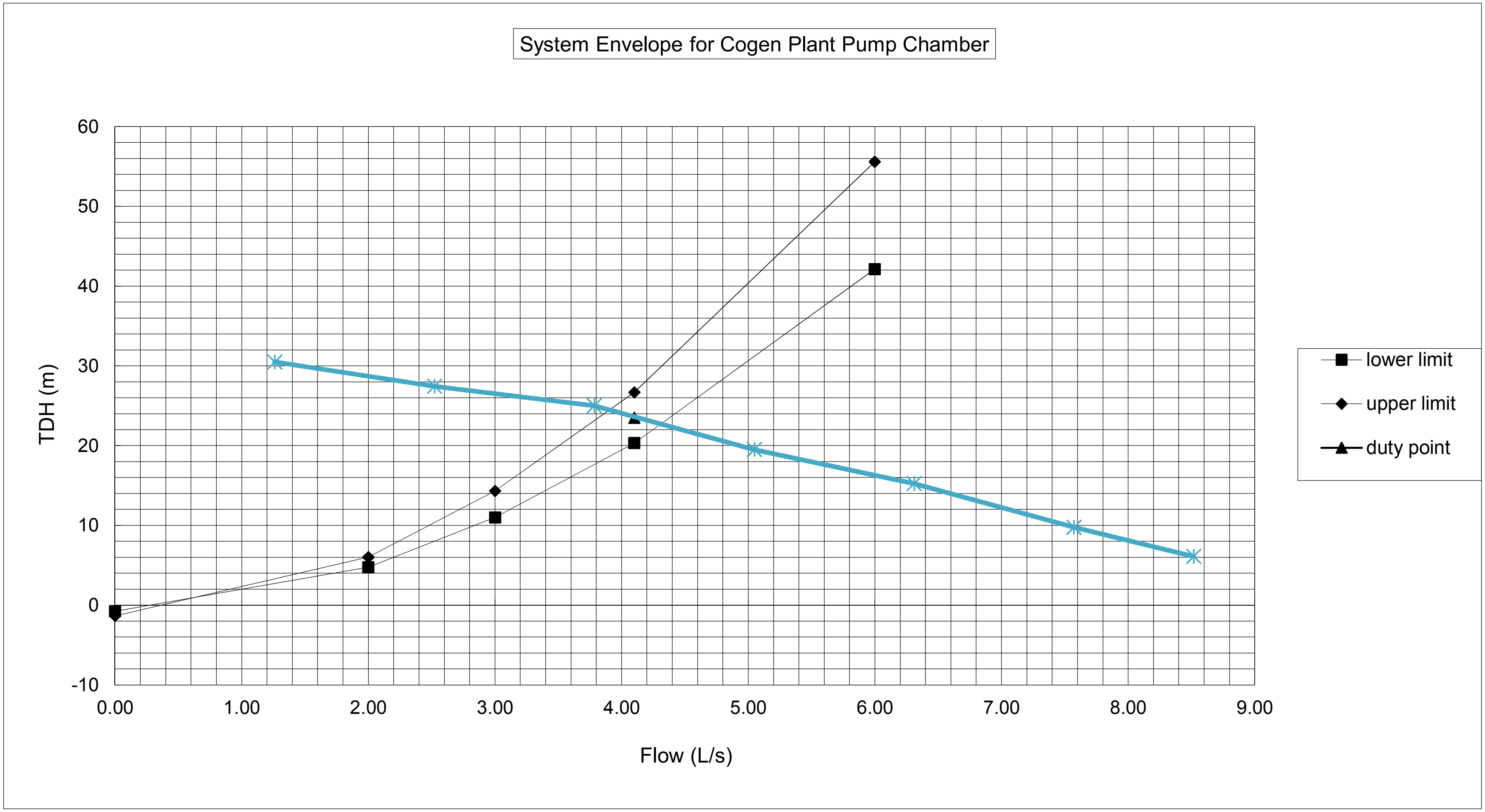
Enter elevations

Elevation of Chamber inlet invert	360.26	m
Elevation of Chamber inlet invert	360.26	m
High Water Level in SPS	361.0	m
Low water level in SPS	361.6	m

ELEVATION HEAD: -1.3 m

8 TOTAL DYNAMIC HEAD

Flow	Friction		Elevation		System Curves	
	High C	Low C	LWL	HWL	Lower	Upper
L/s	(m)	(m)	(m)	(m)	(m)	(m)
0.00	0.0	0.0	-1.3	-0.8	-0.8	-1.3
2.00	5.5	7.4	-1.3	-0.8	4.8	6.0
3.00	11.8	15.7	-1.3	-0.8	11.0	14.3
4.10	21.1	28.0	-1.3	-0.8	20.3	26.7
6.00	42.9	56.9	-1.3	-0.8	42.1	55.6


System Envelope for Cogen Plant Pump Chamber
TDH (m)
60
50
40
30
20
10
0
-10
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
Flow (L/s)
lower limit
upper limit
duty point

Determine System Curve
TOTAL DYNAMIC HEAD from BED DOSING CHAMBER TO DISTRIBUTION BOX

1 Enter Flows
Enter flows in L/s. Flow #3 will be the approximate operating point.

	FLOW #1	FLOW #2	FLOW #3	FLOW #4
Igpm	26.4	33.0	83.2	105.6
L/s	2.00	2.50	6.30	8.00
USgpm	31.7	39.6	99.9	126.8

2 SMALL FITTINGS
Enter quantity and diameter of pipe fittings

ITEM	Dia, mm	K	QUANTITY	FLOW #1 Hf (m)	FLOW #2 Hf (m)	FLOW #3 Hf (m)	FLOW #4 Hf (m)
PIPEWORK INSIDE THE PUMPING STATION							
Threaded 90 deg elbow	50	0.90	3	0.14	0.22	1.42	2.29
Threaded coupling	50	0.05	1	0.00	0.00	0.03	0.04
flng ball check valve	50	2	1	0.11	0.17	1.05	1.69
flng gate valve	50	0.15	2	0.02	0.02	0.16	0.25
T flow through	50	0.90	1	0.05	0.07	0.47	0.76
Coupling	50	0.05	1	0.00	0.00	0.03	0.04
			SUBTOTAL:	0.32	0.50	3.15	5.08

3 SPECIAL FITTINGS
Enter losses for special fittings (e.g. automatic distribution valves, etc.)

ITEM	QUANTITY	FLOW #1 Hf (m)	FLOW #2 Hf (m)	FLOW #3 Hf (m)	FLOW #4 Hf (m)
NONE		0.000	0.000	0.000	0
	SUBTOTAL:	0.00	0.00	0.00	0.00

4 EXPANSIONS/CONTRACTIONS
Enter quantity and diameters for pipe transitions

Dia 1, mm	Dia 2, mm	QUANTITY	FLOW #1 Hf (m)	FLOW #2 Hf (m)	FLOW #3 Hf (m)	FLOW #4 Hf (m)
NONE						
50	75	1	0.02	0.03	0.16	0.26
		SUBTOTAL:	0.02	0.03	0.16	0.26

5 ENTRANCE/EXIT LOSSES

ITEM	k	QUANTITY	FLOW #1 Hf (m)	FLOW #2 Hf (m)	FLOW #3 Hf (m)	FLOW #4 Hf (m)
Exit Loss	1.0		0.01	0.02	0.10	0.17
		SUBTOTAL	0.01	0.02	0.10	0.17

6 (a)PIPING - Higher C value - lower friction losses
Enter diameter and length of piping

DESCRIPTION	Inside Dia, mm	Design C	(m) LENGTH	FLOW #1 Hf (m)	FLOW #2 Hf (m)	FLOW #3 Hf (m)	FLOW #4 Hf (m)
Piping within pump stn	50	130	3	0.08	0.13	0.71	1.11
From PS to Distribution box	75	130	250	0.98	1.48	8.21	12.78
			SUBTOTAL:	1.07	1.61	8.92	13.89

(b) PIPING- Lower C value - higher friction losses
Enter diameter and length of piping

DESCRIPTION	Inside Dia, mm	C Design	(m) LENGTH	FLOW #1 Hf (m)	FLOW #2 Hf (m)	FLOW #3 Hf (m)	FLOW #4 Hf (m)

Piping within pump stn	50	110	3	0.12	0.17	0.97	1.51
From PS to Distribution box	75	110	250	1.34	2.02	11.19	17.42
			SUBTOTAL:	1.45	2.20	12.16	18.93

6.7 ELEVATION HEAD

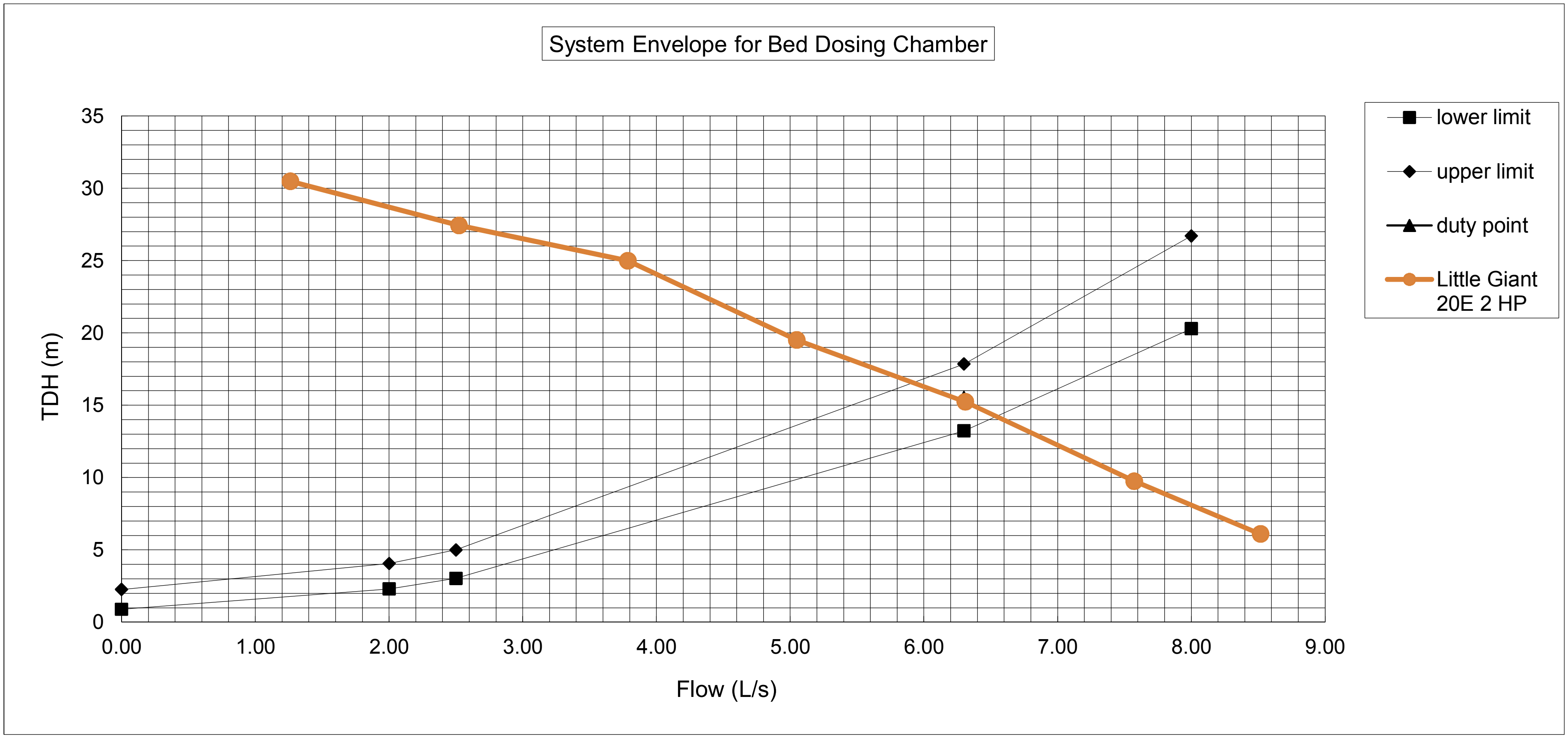
Enter elevations

Elevation of D-box inlet invert	360.37	m	*Assume for now that the elevations and comparable between th
Elevation of D-box inlet invert	360.37	m	
High Water Level in SPS	359.5	m	
Low water level in SPS	358.1	m	

ELEVATION HEAD: 2.3 m

8 TOTAL DYNAMIC HEAD

Flow	Friction		Elevation		System Curves	
	High C	Low C	LWL	HWL	Lower	Upper
L/s	(m)	(m)	(m)	(m)	(m)	(m)
0.00	0.0	0.0	2.3	0.9	0.9	2.3
2.00	1.4	1.8	2.3	0.9	2.3	4.1
2.50	2.1	2.7	2.3	0.9	3.0	5.0
6.30	12.3	15.6	2.3	0.9	13.2	17.8
8.00	19.4	24.4	2.3	0.9	20.3	26.7



System Envelope for Bed Dosing Chamber
35
30
25
20
15
10
5
0
TDH (m)
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
Flow (L/s)
lower limit
upper limit
duty point
Little Giant 20E 2 HP

Process Wastewater Quality Provided by WSP

Appendix B

U.S. WATER ENGINEERING & EQUIPMENT
Supporting You Every Step of the Way.

WATER QUALITIES:
Genivar - Whitesands

		3	33	34	35	42	43	44	48	50	53
PARAMETER		**Water Supply**	**RO #1 Feed**	**RO #1 Reject**	**RO #1 Permeate**	**Soft #1 Feed**	**Soft #1 Regen**	**Soft #1 Soft**	**Tower #1 Bleed**	**Boiler #1 Bleed**	**Outfall #1**
pH	---	7.7	8.2	8.4	8.0	8.0	8.0	8.0	8.6	11.0	8.8
Conductivity (mmhos/cm)	---	240	256	1,011	5	5	41,286	5	1,142	27	1,002
TOC (mg/l)	---	1.4	1.4	5.5	0.0	0.0	0.0	0.0	7.0	0.1	6.0
P-Alkalinity ($CaCO_3$)	$CaCO_3$										
M-Alkalinity ($CaCO_3$)	$CaCO_3$	89	89	351	2	2	2	2	445	9	378
Bicarbonate Alkalinity	meq/l	1.78	1.78	7.01	0.04	0.04	0.04	0.04	8.89	0.19	7.56
Bromide	Br	0.1	0.1	0.2	0.0	0.0	0.0	0.0	0.3	0.0	0.2
Chloride	Cl	19	19	73	0	0	16037	0	96	2	84
Fluoride	F	0.1	0.1	0.2	0.0	0.0	0.0	0.0	0.3	0.0	0.2
Nitrate	NO_3	1.7	1.7	6.5	0.0	0.0	0.0	0.0	8.3	0.2	7.0
Nitrite	NO_2	0.5	0.5	2.0	0.0	0.0	0.0	0.0	2.5	0.1	2.1
Total Phosphorus	P	0.02	0.02	0.07	0.00	0.00	0.00	0.00	3.41	0.00	2.32
Total Phosphate	PO_4	0.1	0.1	0.2	0.0	0.0	0.0	0.0	10.3	0.0	7.0
Total Inorganic Phosphate	PO_4								10.0		6.8
Dissolved Ortho Phosphate	PO_4										
Reactive Silica	SiO_2	13	13	50	0	0	0	0	63	1	54
Sulfur	SO_4	3	5	21	0	0	0	0	17	1	16
Total Hardness	$CaCO_3$	88	88	347	2	2	7000	0	440	0	374
Calcium Hardness	$CaCO_3$	70	70	276	1	1	5568	0	350	0	298
Magnesium Hardness	$CaCO_3$	18	18	71	0	0	1432	0	90	0	77
Aluminum	Al	0.0	0.0	0.1	0.0	0.0	1.2	0.0	0.1	0.0	0.064
Arsenic	As	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.003
Barium	Ba	0.013	0.01	0.05	0.00	0.00	1.05	0.00	0.07	0.00	0.056
Beryllium	Be	0.001	0.00	0.00	0.00	0.00	0.08	0.00	0.01	0.00	0.004
Boron	B	0.010	0.01	0.03	0.00	0.00	15.91	0.00	0.05	0.00	0.043
Cadmium	Cd	0.000	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.001
Chromium	Cr	0.001	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.004
Cobalt	Co	0.001	0.00	0.00	0.00	0.00	0.08	0.00	0.01	0.00	0.004
Copper	Cu	0.004	0.00	0.02	0.00	0.00	0.32	0.00	0.02	0.00	0.017
Iron	Fe	0.010	0.01	0.04	0.00	0.00	0.80	0.00	0.05	0.00	0.043
Lead	Pb	0.001	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.002
Manganese	Mn	0.002	0.00	0.01	0.00	0.00	0.16	0.00	0.01	0.00	0.009
Molybdenum	Mo	0.002	0.00	0.01	0.00	0.00	0.16	0.00	0.01	0.00	0.009
Nickel	Ni	0.003	0.00	0.01	0.00	0.00	0.24	0.00	0.02	0.00	0.013
Potassium	K	2.13	2.1	8.4	0.0	0.0	169.4	0.0	10.7	0.0	9.1
Selenium	Se	0.001	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.003
Sodium	Na	12.5	16	65	0	0	6974	1	70	6	63.2
Strontium	Sr	0.035	0.0	0.1	0.0	0.0	2.8	0.0	0.2	0.0	0.149
Thallium	Tl	0.006	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.026
Tin	Sn	0.002	0.00	0.01	0.00	0.00	0.16	0.00	0.01	0.00	0.009
Titanium	Ti	0.002	0.00	0.01	0.00	0.00	0.16	0.00	0.01	0.00	0.009
Vanadium	V	0.002	0.00	0.01	0.00	0.00	0.16	0.00	0.01	0.00	0.009
Zinc	Zn	0.028	0.03	0.11	0.00	0.00	2.23	0.00	0.14	0.00	0.119
Temperature	°F	60	60	60	60	60	60	60	85	444	117
Flow Capacity of Stream	GPM	82.0	17	4	12	12	0	12	13	2	19
TDS	ppm	134	143	564	3	3	25,598	3	708	17	621

Impact Assessment Calculations

Appendix C

BURNSIDE

IMPACT ASSESSMENT

MOE, 2008

Project Name: Whitesand FN CHP Plant and Pellet Mill
Project Number: 300030895
Date: 15-Jul-14

Calculate the <u>Contaminant Concentration at a Boundary</u> (Property *or* Surface Water)

Infiltration Volume

Area of Dilution to Property Boundary =	10.47	ha
Area of Dilution to Pond =		
Background Nitrate Quality in Groundwater =	0	mg/L
Annual Infiltration Rate =	250	$mm/m^2/yr$
	6,849.32	L/ha/day
Annual Infiltration Volume =	26,175	m^3/year

Sewage Effluent Volume

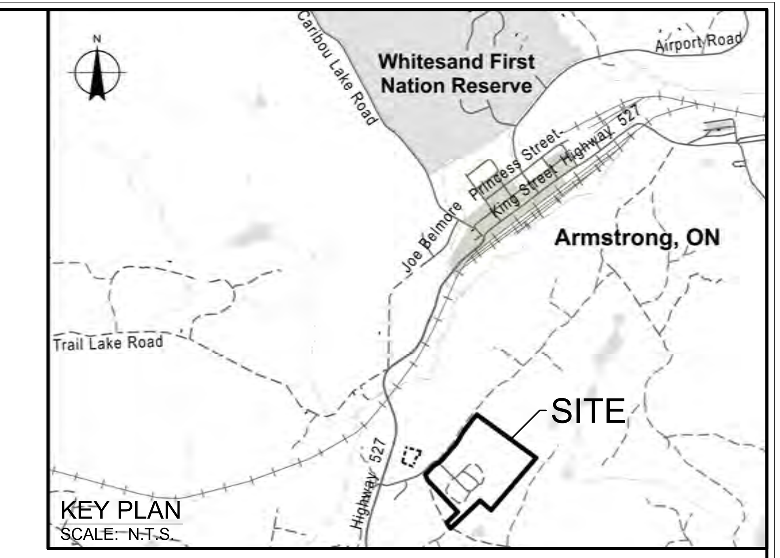
Daily volume of **Sanitary** Effluent =	3,900	L/day
Daily Volume of **Process** Effluent =	92,000	L/day
Daily Volume of **Wash-up** Effluent =	10,300	L/day
Number of Days of Operation/Use =	365	days/year
Annual Volume of Sewage Effluent =	38,763	m^3/year

Totals

Total Dilutant = wastewater V + infiltration V =	177,912	L/day

Parameter	Process Effluent Concentration (Outfall #1) (mg/L)	Sanitary Effluent Concentration (mg/L)	Wash-up Effluent Concentration (mg/L)	Concentration in Percolate at Boundary (mg/L)	Ontario Drinking Water Quality Standards (ODWQS) (mg/L)	Allowable Concentration at Boundary (mg/L)
Inorganics						
Fluoride	0.2	0	0.1	0.1	1.5	0.375
Organics						
Nitrate	1.58	40.00	0.38	2.06	10	2.5
Nitrite	0.64	0.00	0.15	0.0	1	0.25
Metals						
Arsenic	0.003	0	0.001	0.002	0.025	0.00625
Barium	0.056	0	0.013	0.030	1	0.25
Boron	0.043	0	0.01	0.023	5	1.25
Cadmium	0.001	0	0	0.001	0.005	0.00125
Chromium	0.004	0	0.001	0.002	0.05	0.0125
Lead	0.002	0	0.001	0.001	0.01	0.0025
Selenium	0.003	0	0.001	0.002	0.01	0.0025
Sodium	63.2	40	12.5	34.28	n/a	n/a

Assumptions:
All nitrites have been converted to nitrates by the time the groundwater has reached the property boundary and is leaving the site.



Notes
1. This drawing is the exclusive property of Neegan Burnside Ltd. The reproduction of any part without prior written consent of this office is strictly prohibited.
2. The contractor shall verify all dimensions, levels, and datums on site and report any discrepancies or omissions to this office prior to construction.
3. This drawing is to be read and understood in conjunction with all other plans and documents applicable to this project.

No.	Issue / Revision	Date	Auth.
1	APPLICATION TO THE MINISTRY OF ENVIRONMENT	2014/10/24	AE

LICENSED PROFESSIONAL ENGINEER
A.E.D. EGAN
100076805
OCT 24/2014
PROVINCE OF ONTARIO

NEEGAN BURNSIDE
Neegan Burnside Ltd.
292 Speedvale Ave. W., Unit 20
Guelph, Ontario, N1H 1C4
telephone (519) 823-4995
fax (519) 836-5477
web www.neeganburnside.com

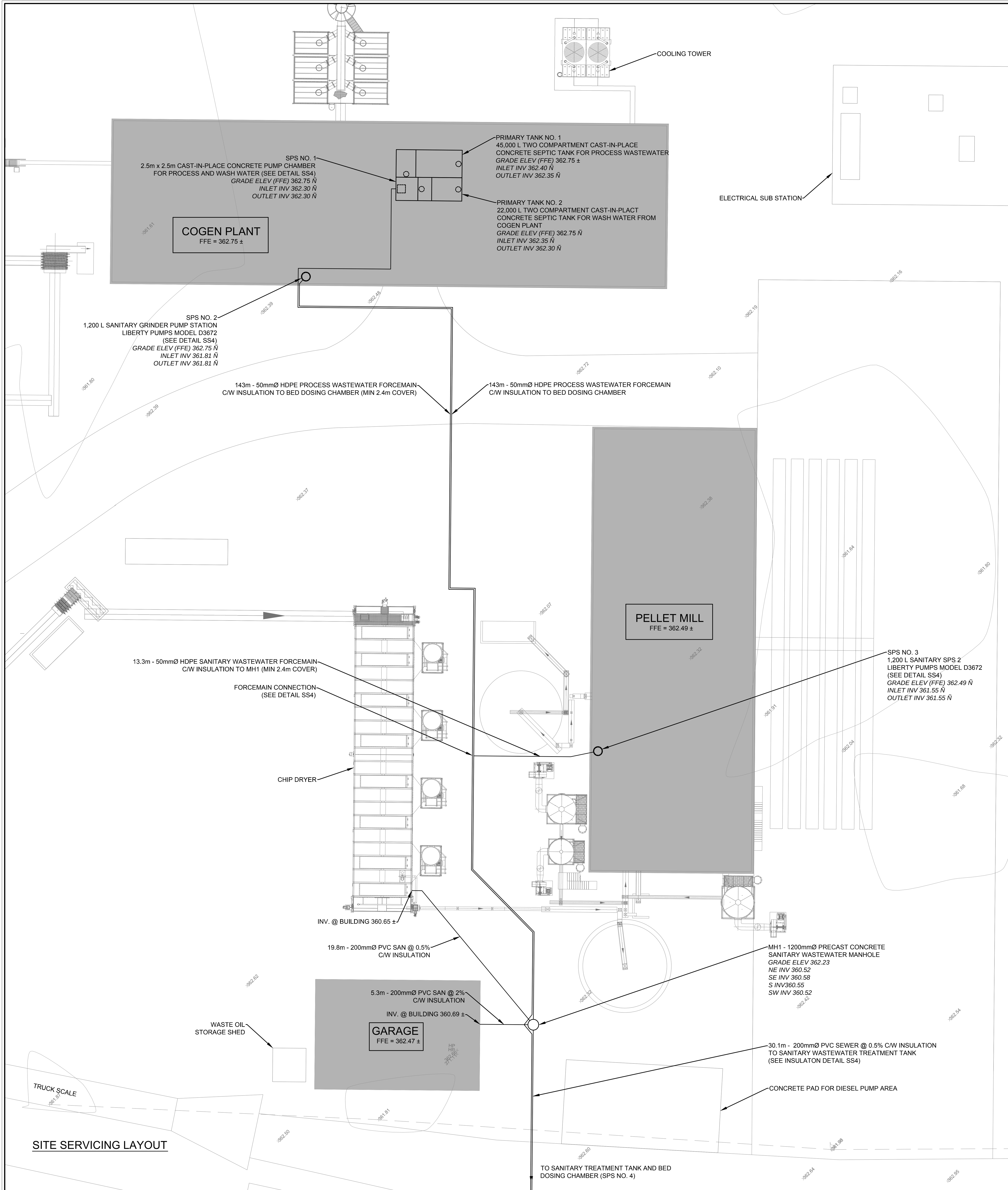
Client
WHITESAND FIRST NATION
PO BOX 68
ARMSTRONG, ON
P0T 1A0

Drawing Title
WHITESAND FIRST NATION COGENERATION AND PELLET MILL PROJECT
SITE PLAN

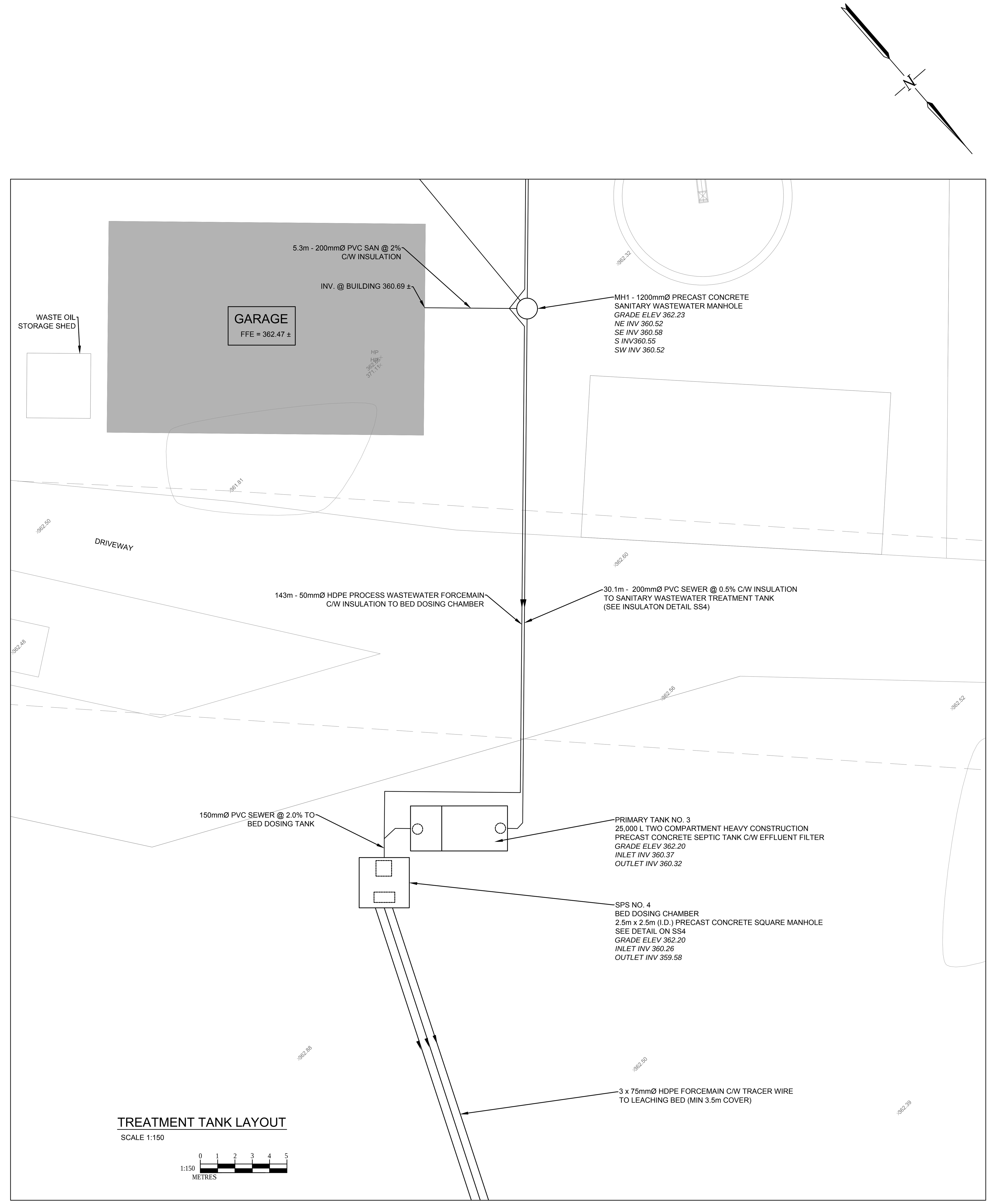
Drawn	Checked	Designed	Checked	Date	Drawing No.
CL	AE	CL/AE	AE	2014/10/24	SS1

Project No.: 300030895
Contract No.: ----
Revision No.: 1
Scale: 1:1,500 (0, 30, 60, 90m)

File Name: 030895_SS1.dwg Date Plotted: October 23, 2014 - 3:27 PM



SITE SERVICING LAYOUT



TREATMENT TANK LAYOUT

SCALE 1:150

Notes

1. This drawing is the exclusive property of Neegan Burnside Ltd. The reproduction of any part without prior written consent of this office is strictly prohibited.
2. The contractor shall verify all dimensions, levels, and datums on site and report any discrepancies or omissions to this office prior to construction.
3. This drawing is to be read and understood in conjunction with all other plans and documents applicable to this project.

No.	Issue / Revision	Date	Auth.
1	APPLICATION TO THE MINISTRY OF ENVIRONMENT	2014/10/24	AE

LICENSED PROFESSIONAL ENGINEER
A.E.D. EGAN
100076805
OCT 24/2014
PROVINCE OF ONTARIO

NEEGAN BURNSIDE

Neegan Burnside Ltd.
6990 Creditview Road, Unit 2
Mississauga, Ontario, L5N 8R9
telephone (905) 821-1800
fax (905) 821-1809
web www.neeganburnside.com

Client
WHITESAND FIRST NATION
PO BOX 68
ARMSTRONG, ON
P0T 1A0

Drawing Title
WHITESAND FIRST NATION
COGENERATION AND PELLET MILL PROJECT
SERVICING AND TREATMENT TANK LAYOUT

Drawn	Checked	Designed	Checked	Date	Drawing No.
CL	AE	CL/AE	AE	2014/10/24	SS2
Project No. 300030895		Contract No. ----		Revision No. 1	
Scale 1:250					

Notes

1. This drawing is the exclusive property of Neegan Burnside Ltd. The reproduction of any part without prior written consent of this office is strictly prohibited.
2. The contractor shall verify all dimensions, levels, and datums on site and report any discrepancies or omissions to this office prior to construction.
3. This drawing is to be read and understood in conjunction with all other plans and documents applicable to this project.

No.	Issue / Revision	Date	Auth.
1	APPLICATION TO THE MINISTRY OF ENVIRONMENT	2014/10/24	AE

LICENSED PROFESSIONAL ENGINEER
A.E.D. EGAN
100076805
OCT 24/2014
PROVINCE OF ONTARIO

Neegan Burnside Ltd.
292 Speedvale Ave. W., Unit 20
Guelph, Ontario, N1H 1C4
telephone (519) 823-4995
fax (519) 836-5477
web www.neeganburnside.com

Client
WHITESAND FIRST NATION
PO BOX 68
ARMSTRONG, ON
P0T 1A0

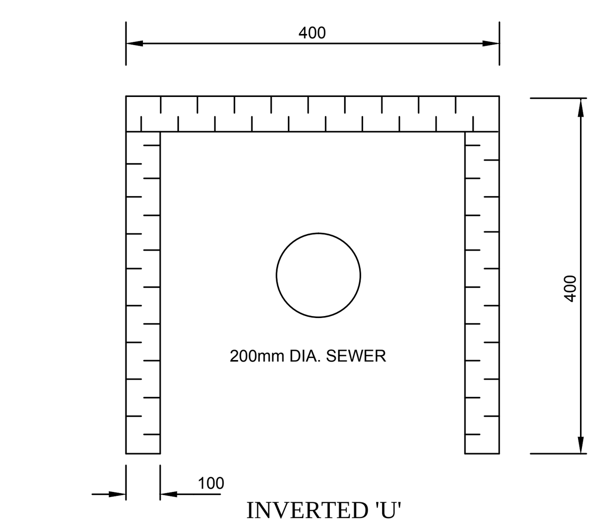
Drawing Title
WHITESAND FIRST NATION
COGENERATION AND PELLET MILL PROJECT
LEACHING BED PLAN AND CROSS SECTIONS

Drawn	Checked	Designed	Checked	Date	Drawing No.
CL	AE	CL/AE	AE	2014/10/24	SS3
Project No. 300030895		Contract No. ----		Revision No. 1	
Scale H 1:250 V 1:50					

File Name: 030895_SS1.dwg Date Plotted: October 23, 2014 - 3:27 PM

RIGIDBOARD INSULATION DETAIL

SCALE N.T.S.

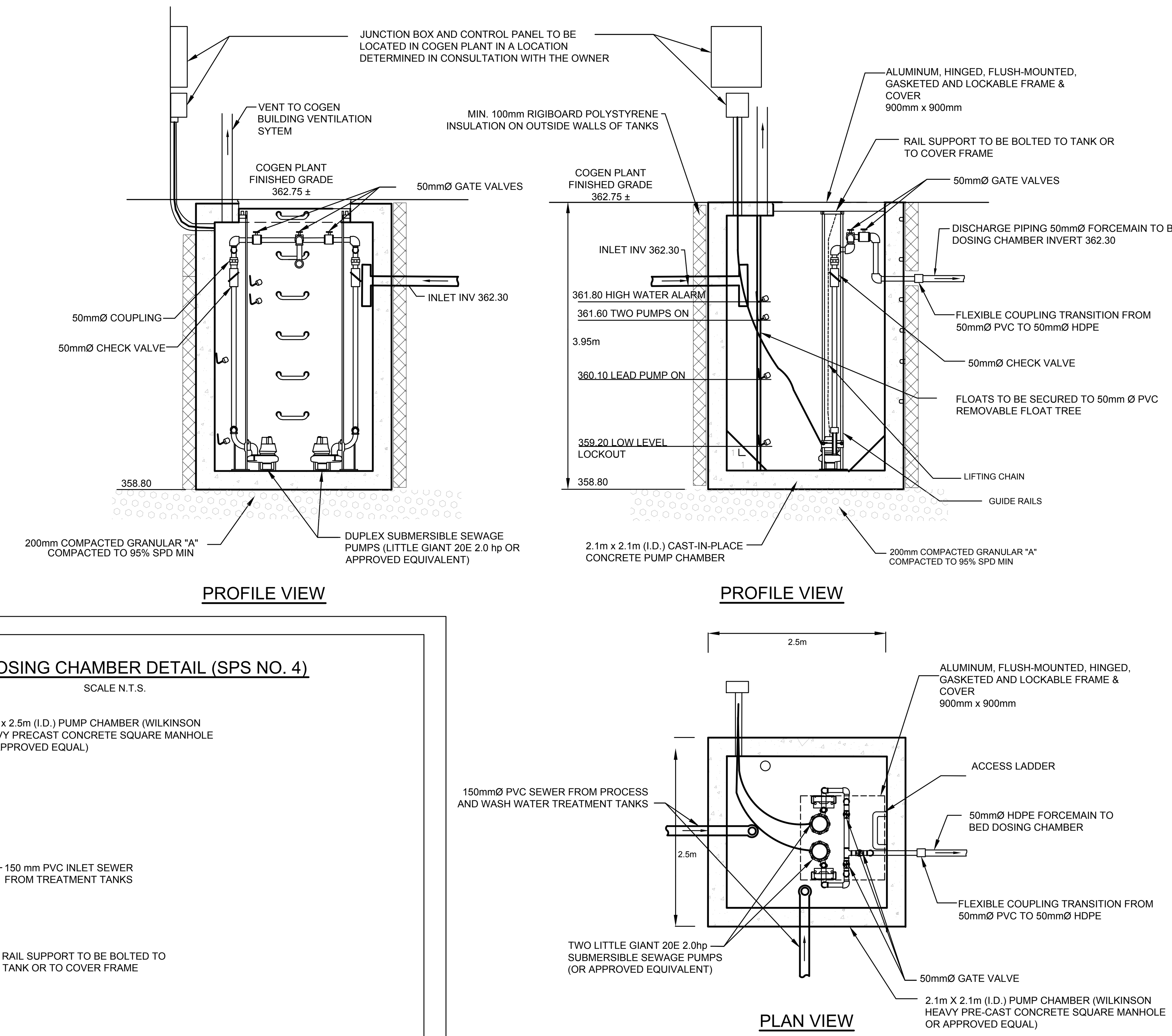


NOTES:

- -TO BE USED OVER PIPES AS PER NOTE 9, OR WHEN OTHERWISE DIRECTED BY ENGINEER
- -RIGIDBOARD TO BE DOW HI 60 OR CELFORT 600
- -TRENCH EXCAVATION, BEDDING AND BACKFILL AS PER OPSS.

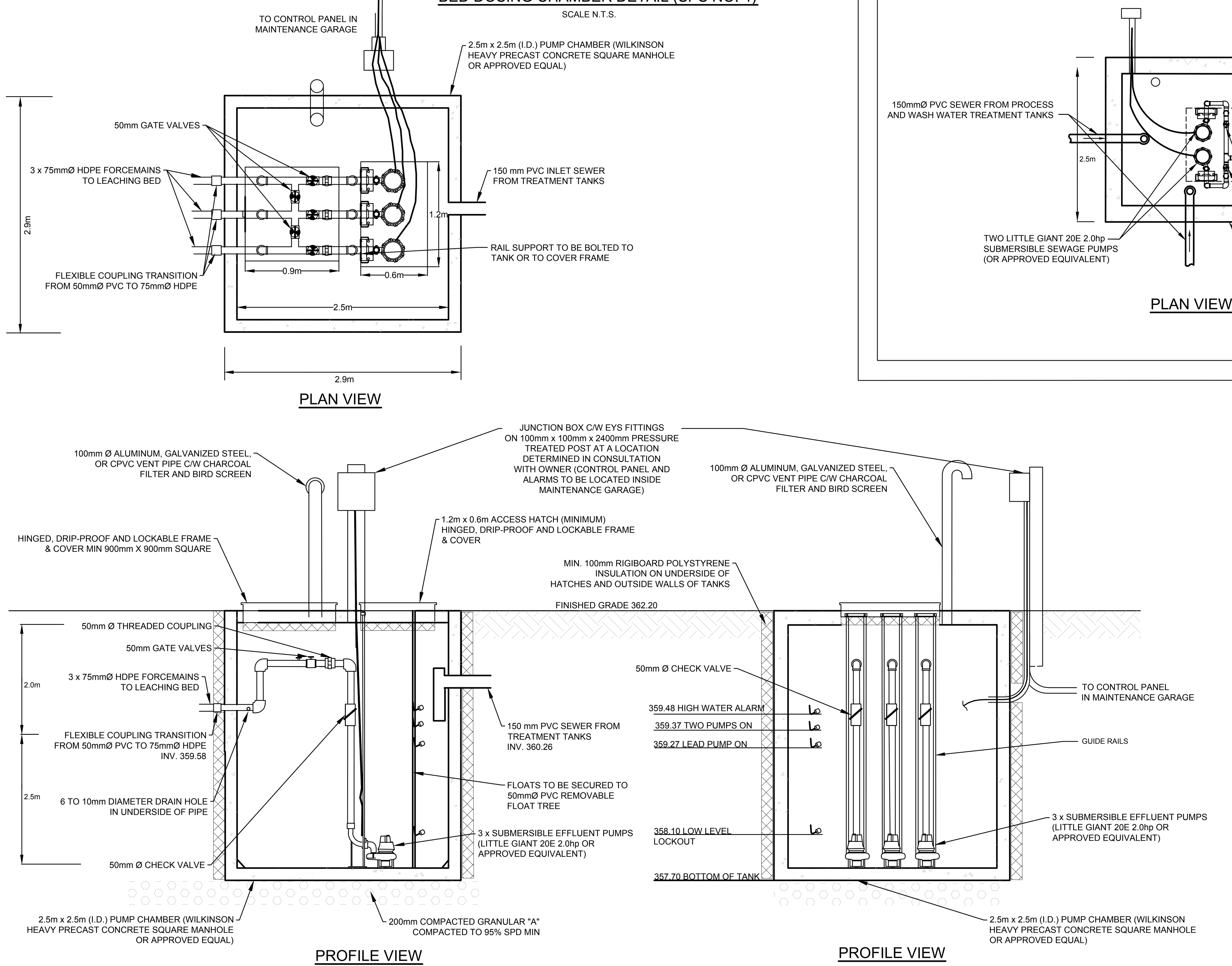
COGEN PLANT PUMP CHAMBER DETAIL (SPS NO. 1)

SCALE N.T.S.



BED DOSING CHAMBER DETAIL (SPS NO. 4)

SCALE N.T.S.



CONSTRUCTION NOTES

1. PROPOSED SEWAGE SYSTEM CONSTRUCTION WILL BE DONE IN ACCORDANCE WITH THE MANUAL OF POLICY, PROCEDURES AND GUIDELINES FOR ONSITE SEWAGE SYSTEMS, ONTARIO MINISTRY OF THE ENVIRONMENT, ONTARIO'S BUILDING CODE, MOE'S DESIGN GUIDELINES FOR SEWAGE WORKS (2008) AND THE MANUFACTURER'S RECOMMENDATIONS.
2. TOPSOIL IN AREA OF PROPOSED LEACHING BED AND MANTLE SHALL BE REMOVED AND STOCK PILED IN AN AREA SPECIFIED BY THE ENGINEER.
3. ALL EARTH WORKS, INCLUDING PLACEMENT OF FILL, ARE TO BE UNDERTAKEN WITH A SMALL TRACK MACHINE TO KEEP COMPACTION TO A MINIMUM. KEEP ALL TRAFFIC IN THE AREA OF THE PROPOSED LEACHING BED TO A MINIMUM.
4. ALL COMPONENT LOCATIONS SHALL BE FIELD VERIFIED WITH THE ENGINEER PRIOR TO INSTALLATION.
5. THE AREA OF THE PROPOSED LEACHING BED SHALL BE SCARIFIED TO A MINIMUM DEPTH OF 200mm AND SHALL BE VERIFIED BY THE ENGINEER BEFORE THE PLACEMENT OF ANY IMPORTED FILL.
6. UNLESS OTHERWISE SHOWN, ALL DISTRIBUTION PIPES TO BE SPACED 1.6m O/C.
7. THE AREA SURROUNDING THE PROPOSED TREATMENT TANK AREA AND LEACHING BED SHALL BE GRADED TO ENSURE THAT SURFACE DRAINAGE IS DIRECTED AWAY FROM OR AROUND THE PROPOSED TREATMENT TANK AREA AND LEACHING BED.
8. UNLESS OTHERWISE NOTED, GRAVITY PIPING TO BE PVC (SDR-35) AND FORCEMAINS TO BE HDPE SERIES 100.
9. ALL FORCEMAINS TO HAVE 3.5m OF COVER, OR SHALL BE INSULATED WITH BOX INSULATION AS PER DETAIL. PIPES SUBJECT TO VEHICULAR LOADING SHALL BE ADEQUATELY PROTECTED. FORCEMAIN TO BE PROVIDED WITH TRACER WIRE, AWG 12 TYPE, SECURED TO THE TOP OF THE FORCEMAIN AT MAXIMUM INTERVALS OF 2.5m WITH WATER PROOF TAPE OR ZIPTIES.
10. BEDDING, COVER, AND BACKFILL TO BE IN ACCORDANCE WITH OPSS.
11. ALL DISTURBED AREAS SHALL BE TOPSOILED (100mm DEPTH UNLESS OTHERWISE SPECIFIED), COMPLETE WITH FERTILIZER AND MULCH IN ACCORDANCE WITH OPSS 570 AND 572.
12. ALL TRENCHES AND EXCAVATIONS SHALL BE KEPT OPEN FOR FINAL INSPECTION PRIOR TO BACKFILL. ALL TANKS TO BE LEFT UNCOVERED AND MANUFACTURER'S MARKINGS VISIBLE FOR FINAL INSPECTION.
13. THE INSTALLING CONTRACTOR SHALL INSTALL THE SEWAGE SYSTEM WITH TRANSIT/LEVEL AND PROVIDE SAME FOR FINAL INSPECTION.
14. NO PORTION OF THE SEWAGE SYSTEM SHALL BE INFRINGED UPON WITH ANY STRUCTURAL COMPONENTS SUCH AS BUILDINGS, POOLS, GARAGES, VEHICLES, ETC. NO EARTH, SNOW OR OTHER MATERIAL SHALL BE PILED WITHIN 3m OF THE LEACHING BED. NO TREES SHALL BE PLANTED WITHIN 6m OF THE LEACHING BED.
15. ALL IMPORTED SAND FILL FOR USE IN THE LEACHING BED SHALL HAVE A T TIME BETWEEN 6 AND 10 min/cm AND A SILT/CLAY CONTENT OF NO GREATER THAN 5%, AND SHALL BE VERIFIED IN WRITING BY A SOIL TESTING FIRM PRIOR TO PLACEMENT.
16. ALL SLOPES SHALL BE CONSTRUCTED NO STEEPER THAN 4:1 (HORIZONTAL:VERTICAL) UNLESS OTHERWISE NOTED.
17. ALL ELEVATIONS TO BE VERIFIED PRIOR TO BACKFILL.
18. IF GROUNDWATER LEVEL RISES ABOVE THE BASE OF THE TANKS PRIOR TO COMPLETE INSTALLATION, INCLUDING PLACEMENT OF SOIL ON TANK LIDS TO SHOWN GRADES, CONTRACTOR TO TAKE ACTION REQUIRED TO PREVENT BUOYANCY OF TANKS (EXAMPLE: FILL TANK WITH WATER).
19. PRIOR TO ACCEPTANCE OF THE SEWAGE SYSTEM CONSTRUCTION, CONTRACTOR TO PROVIDE DOCUMENTATION THAT ALL ELECTRICAL WORK HAS BEEN INSPECTED AND APPROVED BY THE ELECTRICAL AUTHORITY HAVING JURISDICTION.
20. ALL JOINTS BELOW THE HIGH WATER LEVEL IN PRE-CAST TANKS SHALL BE SEALED WITH MASTIC SEALANT.
21. ALL METALS IN SEPTIC TANKS, PUMP CHAMBERS AND TREATMENT TANKS TO BE GALVANIZED OR STAINLESS.
22. CONTRACTOR TO LOCATE ALL UNDERGROUND UTILITIES PRIOR TO CONSTRUCTION.
23. ALL VALVES TO PROVIDE NO OBSTRUCTION TO FLOW WHEN FULLY OPENED.
24. ALL PUMP CHAMBERS TO BE EQUIPPED WITH AUDIBLE/VISIBLE HIGH LEVEL ALARM.
25. ALL PUMP CHAMBERS TO BE ADEQUATELY VENTED.
26. PROCESS WASTEWATER PUMP CHAMBER IN COGEN PLANT (SPS NO. 1) TO BE EQUIPPED WITH TWO LITTLE GIANT 20E, 2 HP, 230 V, 1Ø SUBMERSIBLE SEWAGE PUMPS RATED FOR 4.1 L/s @ 23.5m TDH (OR APPROVED EQUIVALENT) AND SHALL BE SUPPLIED WITH THE FOLLOWING:

   A) SUFFICIENT ELECTRICAL CABLE TO REACH FROM THE PUMP CHAMBER TO THE JUNCTION BOX AND FROM THE JUNCTION BOX TO THE CONTROL PANEL. JUNCTION BOX TO BE MOUNTED OUTSIDE THE PUMP CHAMBERS ON A 100mm X 100mm PRESSURE TREATED POST AT A LOCATION DETERMINED IN CONSULTATION WITH THE OWNER.
   B) LEVEL CONTROLS (NON-MERCURY) WITH SAME ELECTRICAL CABLE LENGTH AS IN A)
   C) DUPLEX INDOOR CONTROL PANEL C/W EEMAC 4X PVC ENCLOSURE, PILOT LIGHTS, HAND-OFF-AUTO SWITCH, HIGH WATER ALARM BUZZER, LOW LEVEL LOCKOUT, TEST OFF/ON SELECTOR SWITCH, CIRCUIT BREAKERS FOR PUMP AND CONTROL CIRCUIT. CONTROL PANEL TO BE LOCATED IN THE COGEN PLANT IN A LOCATION DETERMINED IN CONSULTATION WITH THE OWNER.

26. SANITARY WASTEWATER PUMP CHAMBERS TO BE EQUIPPED WITH TWO LIBERTY LSG200, 2 HP, 230 V, 1Ø SUBMERSIBLE GRINDER PUMPS (OR APPROVED EQUIVALENT) . PUMPS IN SANITARY SPS NO. 1 RATED FOR 3.0 L/s @ 14.1m TDH. PUMPS IN SANITARY SPS NO. 2 RATED FOR 3.1 L/s @ 12.2m TDH. BOTH PUMP STATIONS SHALL BE SUPPLIED WITH THE FOLLOWING:

   A) SUFFICIENT ELECTRICAL CABLE TO REACH FROM THE PUMP CHAMBER TO THE JUNCTION BOX AND FROM THE JUNCTION BOX TO THE CONTROL PANEL. JUNCTION BOX TO BE MOUNTED OUTSIDE THE PUMP CHAMBER ON A 100mm X 100mm PRESSURE TREATED POST AT A LOCATION DETERMINED IN CONSULTATION WITH THE OWNER.
   B) LEVEL CONTROLS (NON-MERCURY) WITH SAME ELECTRICAL CABLE LENGTH AS IN A)
   C) DUPLEX INDOOR CONTROL PANEL C/W EEMAC 4X PVC ENCLOSURE, PILOT LIGHTS, HAND-OFF-AUTO SWITCH, HIGH WATER ALARM BUZZER, LOW LEVEL LOCKOUT, TEST OFF/ON SELECTOR SWITCH, CIRCUIT BREAKERS FOR PUMP AND CONTROL CIRCUIT. CONTROL PANEL TO BE LOCATED IN THE COGEN PLANT AND THE PELLET MILL IN A LOCATION DETERMINED IN CONSULTATION WITH THE OWNER.

27. BED DOSING CHAMBER (SPS NO. 4) TO BE EQUIPPED WITH THREE LITTLE GIANT 20E, 2 HP SUBMERSIBLE EFFLUENT PUMPS RATED FOR 6.3 L/S AT 15.5m TDH (OR APPROVED EQUIVALENT) AND SHALL BE SUPPLIED WITH THE FOLLOWING:

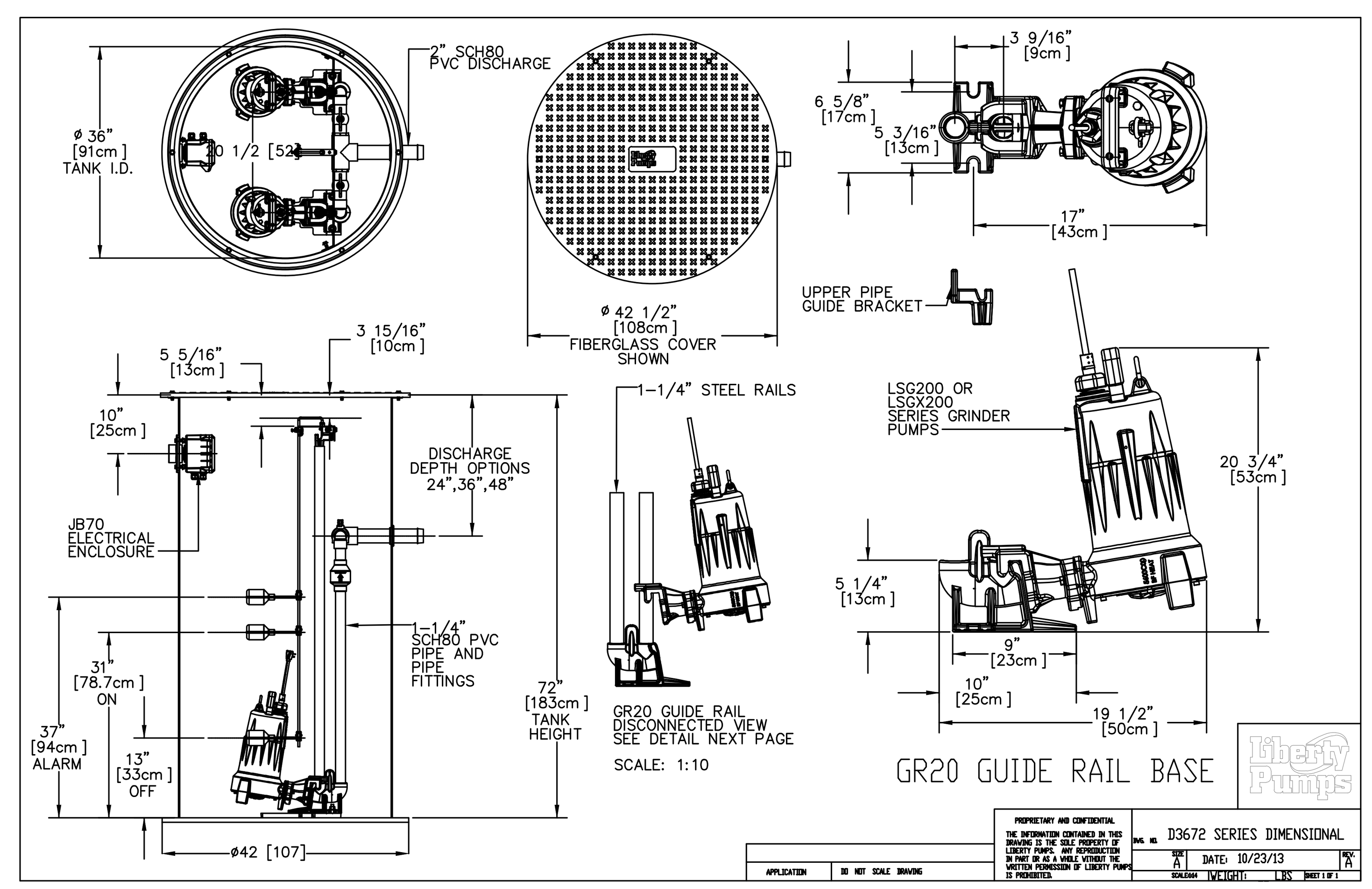
   A) SUFFICIENT ELECTRICAL CABLE TO REACH FROM THE PUMP CHAMBER TO THE JUNCTION BOX AND FROM THE JUNCTION BOX TO THE CONTROL PANEL.
   B) LEVEL CONTROLS (NON-MERCURY) WITH SAME ELECTRICAL CABLE LENGTH AS IN A)
   C) INDOOR CONTROL PANEL C/W EEMAC 4X PVC ENCLOSURE, PILOT LIGHTS, HAND-OFF-AUTO SWITCH, HIGH WATER ALARM BUZZER, FIELD ADJUSTABLE RUN TIMER, TEST OFF/ON SELECTOR SWITCH, CIRUIT BREAKERS FOR PUMP AND CONTROL CIRCUIT. CONTROL PANEL TO BE LOCATED IN THE MAINTENANCE GARAGE IN A LOCATION DETERMINED IN CONSULTATION WITH THE OWNER.

29. ALL TANKS TO BE PROVIDED WITH PRE-CAST CONCRETE OR PVC ACCESS RISERS TO SURFACE AS REQUIRED. HATCHES TO BE BOLTED AND GASKETED AND ACCESSIBLE AT GRADE. UNLESS OTHERWISE NOTED ALL HATCHES TO BE MINIMUM 600mm Ø.
30. UNLESS OTHERWISE SPECIFIED, ALL TANK INLETS AND OUTLETS TO BE FITTED WITH TEES.
31. PRIMARY TANK NO. 2 AND 3 TO BE FITTED WITH EFFLUENT FILTERS. PRIMARY TANK NO. 1 FOR PROCESS WASTEWATER TO BE FITTED WITH SCREEN FILTER. PRIMARY TANK NO. 1 AND 2 TO BE FITTED WITH BACK UP ALARMS.

ENGINEERING INSPECTION SCHEDULE

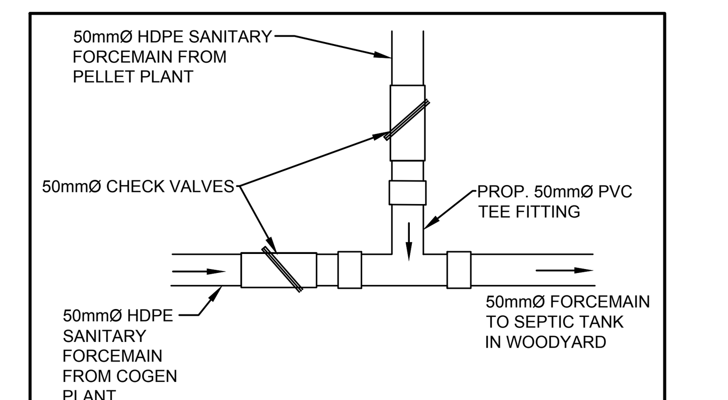
THE FOLLOWING MILESTONES ARE TO BE INSPECTED AND APPROVED BY THE ENGINEER (OR THEIR REPRESENTATIVE) BEFORE THE CONTRACTOR PROCEEDS. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATING INSPECTIONS FOR THE MILESTONES LISTED BELOW (MINIMUM)

1. ALL EXCAVATIONS FOR TANKS, TANK INSTALLATION AND BACKFILLING.
2. INSTALLATION OF DISPOSAL BED COMPONENTS PRIOR TO BACKFILL.
3. ALL PIPE CONNECTIONS, SEWERS AND FORCEMAINS PRIOR TO BACKFILL.
4. FINAL GRADING AND SEEDING, RESTORATION OF DISTURBED AREAS.
5. SYSTEM TESTING WITH CLEAN WATER.



FORCEMAIN CONNECTION DETAIL

SCALE N.T.S.



Notes

1. This drawing is the exclusive property of Neegan Burnside Ltd. The reproduction of any part without prior written consent of this office is strictly prohibited.
2. The contractor shall verify all dimensions, levels, and datums on site and report any discrepancies or omissions to this office prior to construction.
3. This drawing is to be read and understood in conjunction with all other plans and documents applicable to this project.

No.	Issue / Revision	Date	Auth.
1	APPLICATION TO THE MINISTRY OF ENVIRONMENT	2014/10/24	AE

LICENSED PROFESSIONAL ENGINEER
A.E.D. EGAN
100076805
OCT 24/2014
PROVINCE OF ONTARIO

NEEGAN BURNSIDE
Neegan Burnside Ltd.
292 Speedvale Ave. W., Unit 20
Guelph, Ontario, N1H 1C4
telephone (519) 823-4995
fax (519) 836-5477
web www.neeganburnside.com

Client
WHITESAND FIRST NATION
PO BOX 68
ARMSTRONG, ON
P0T 1A0

Drawing Title
WHITESAND FIRST NATION
COGENERATION AND PELLET MILL PROJECT

DETAILS AND NOTES

Drawn	Checked	Designed	Checked	Date	Drawing No.
CL	AE	CL/AE	AE	2014/10/24	SS4
Project No. 300030895		Contract No. ----		Revision No. 1	
Scale NOT TO SCALE					


Neegan Burnside Ltd.