ENVIRONMENT ACT PROPOSAL-
CITY OF THOMPSON
WASTEWATER TREATMENT PLANT

PROVINCE OF MANITOBA
S.K.
BASU
Jan 24/14
REGISTERED ENGINEER

APEGM
Certificate of Authorization
Stantec Consulting Ltd.
No. 1301

Prepared for:
Manitoba Water Services Board
2010 Currie Blvd.
Brandon, MB R7A 6Y9

City of Thompson
226 Mystery Lake Road
Thompson, MB R8N 1S6

Prepared by:
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905 Waverley Street
Winnipeg, MB R3K 2B9

Project No. 111214440

January 24, 2014

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Environment Act Proposal Form

Manitoba
Conservation and Water Stewardship

Name of the development:
City of Thompson Wastewater Treatment Plant Project

Type of development per Classes of Development Regulation (Manitoba Regulation 164/88):
Class 2

Legal name of the proponent of the development:
City of Thompson

Location (street address, city, town, municipality, legal description) of the development:
Part of Township Seventy – eight in Range 3 west of the Principal Meridian in Manitoba at Thompson, MB Lot C of Plan 4657

Name of proponent contact person for purposes of the environmental assessment:
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Mailing address:
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905 Waverley Street, Winnipeg, MB R3T 5P4

Email address: saibal.basu@stantec.com

Webpage address: www.stantec.com

Date:
January 24, 2014

Signature of proponent, or corporate principal of corporate proponent:

Printed name: GARY CEPPETELLI

A complete **Environment Act Proposal (EAP)** consists of the following components:

- **Cover letter**
- **Environment Act Proposal Form**
- **Reports/plans supporting the EAP** (see "Information Bulletin - Environment Act Proposal Report Guidelines" for required information and number of copies)
- **Application fee** (Cheque, payable to Minister of Finance, for the appropriate fee)

Per Environment Act Fees Regulation (Manitoba Regulation 168/96):

Class 1 Developments	$500
Class 2 Developments	$5,000
Class 3 Developments:	
Transportation and Transmission Lines	$5,000
Water Developments	$50,000
Energy and Mining	$100,000

Submit the complete EAP to:

Director
Environmental Approvals Branch
Manitoba Conservation and Water Stewardship
Suite 160, 123 Main Street
Winnipeg, Manitoba R3C 1A5

For more information:
Phone: (204) 945-8321
Fax: (204) 945-5229
http://www.gov.mb.ca/conservation/eal

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APPENDICES

1.0 Introduction

1.1 BACKGROUND

The City of Thompson (City) is located approximately 740 km north of Winnipeg. The community was formally established with the discovery of nickel following several years of mining exploration in the region. The City currently serves as a major hub for Northern Manitoba and plays a key role as the region's service and trade centre. Vale Ltd. operations continue to be the largest employer in the area which also operates and supplies drinking water to the City.

The City currently operates two existing wastewater treatment facilities which function independent of each other. The mechanical WWTP is located near the end of Nelson Road and provides only primary treatment and handles approximately two thirds (2/3) of the City's total wastewater flows. The second facility is a single cell continuous discharge aerated lagoon, and is located south of Seal Road. The aerated lagoon provides secondary treatment and treats the remaining one third (1/3) of the wastewater flow from the south and south-western catchment of the City. The City has created a new water and sewer utility that came into effect beginning of 2011 to maintain its aging water and sewer infrastructure. This utility model allows the City to generate revenue through utility rates rather than property tax assessment. To address the current state of the wastewater treatment infrastructure and the need to meet the current regulations, the City initiated a plan to upgrade/expand its wastewater treatment facility/facilities.

Stantec Consulting Ltd. (Stantec) was retained by the City and Manitoba Water Services Board (MWSB) in 2013 to prepare a pre-design report, develop a functional design report and file an Environmental Act Proposal (EAP) for the City of Thompson Wastewater Treatment Plant (WWTP) Upgrade and Expansion project. As a part of the preliminary design, options for upgrading and expansion of the existing facilities were investigated. Based on technical and financial analysis, it was concluded that the City's WWTP upgrade/expansion project be based on a single centralized wastewater treatment facility utilizing a Sequencing Batch Reactor (SBR) process and servicing a projected population of 15,000 people.

The preliminary design also addressed the challenges anticipated with the total nitrogen due to the dilute nature of the wastewater in Thompson. To address these concerns, a special meeting was organized by MWSB with key members from Manitoba Conservation and Water Stewardship (CWS) on September 16, 2013. The meeting included Dave Shwaluk (MWSB), Jocelyn Baker (CWS), Tracey Braun (CWS), Siobhan Burland Ross (CWS), Don Labossiere (CWS), Nicole Armstrong (CWS) and Saibal Basu (Stantec). Based on the discussions, it was agreed that using an external carbon source (e.g., methanol) to effect consistent denitrification to meet 15 mg/L of Total Nitrogen was not practical for Thompson. It was realized that besides high operating costs, the use of a chemical like methanol poses considerable safety risks. However, CWS indicated that the design should be developed to achieve the maximum denitrification that is possible with the current wastewater quality. CWS hopes that with proper water conservation and maintenance of the sewer collection system to reduce inflow and infiltration in the future, the City will be able to improve the strength of the raw wastewater which will ultimately favor better denitrification. Stantec indicated that, based on preliminary process modeling, it is anticipated that the effluent Total Nitrogen would vary from 15 mg/L to 25 mg/L.

The information developed in the preliminary design was utilized to advance the design concepts of the proposed centralized WWTP and is presented in the Functional Design Report (refer to **Appendix A**). The primary purpose of the functional design was to further define and size the key components of the proposed WWTP including establishing the design basis for structural, architectural, building mechanical, electrical, instrumentation and controls and site services components of the project. The Functional Design report was presented to the community residents via a Public Open House on November 26, 2013 and is basis for the submission of this Environment Act Proposal (EAP). Following the successful start-up and commissioning of the proposed WWTP, the existing treatment infrastructure will be decommissioned.

2.0 Description of Proposal Development

2.1 CERTIFICATE OF TITLE

The proposed development will be constructed Part of Township Seventy – eight in Range 3 west of the Principal Meridian in Manitoba at Thompson, MB Lot C of Plan 4657.

A Certificate of Title for the proposed site is provided in **Appendix B.**

2.2 MINERAL RIGHTS

Mineral rights are owned by the Crown.

2.3 EXISTING AND ADJACENT LAND USE AND ZONING

The proposed WWTP will be located on a site adjacent to the existing WWTP. The available space where the proposed WWTP will be located is presently utilized as a snow dump by the City.

The site is currently zoned as Public Institution Zone (PI). Refer to **Appendix C** for the zoning map for the City.

2.4 PREVIOUS STUDIES

There have been several past studies completed on this project. These include the following:

1. Aerated Lagoon Study, UMA Engineering (1999).
2. City of Thompson Wastewater Infrastructure Upgrade – Preliminary Design Report, UMA Engineering, 2002.
3. City of Thompson Wastewater Treatment Plant Assessment Upgrading Study 04-12, Wardrop Engineering (2006).
4. Wastewater Treatment Plant Upgrade Plan – City of Thompson Department of Water Utility Implementation Phase, CH2M Hill, 2009.
5. Thompson Planning District – Sustainability Community Plan, AECOM, 2010.
6. City of Thompson WWTP Preliminary Design, Stantec, 2013.

Most recently, Stantec completed the functional design of the proposed development which forms the basis of this Environment Act Proposal for the proposed upgrade/expansion project.

2.5 PROPOSED DEVELOPMENT

2.5.1 Description

The proposed development consists of the construction of a greenfield centralized WWTP facility adjacent to the existing WWTP near the Nelson Road site. The proposed WWTP will be designed for secondary treatment including nutrient removal and will handle all the domestic wastewater generated from the City's service area including some truckhaul wastewater (not septage). Treated effluent will be discharged via a new 750 mm outfall to the Burntwood River. A site plan showing the proposed development is shown in **Figure 2.1**.

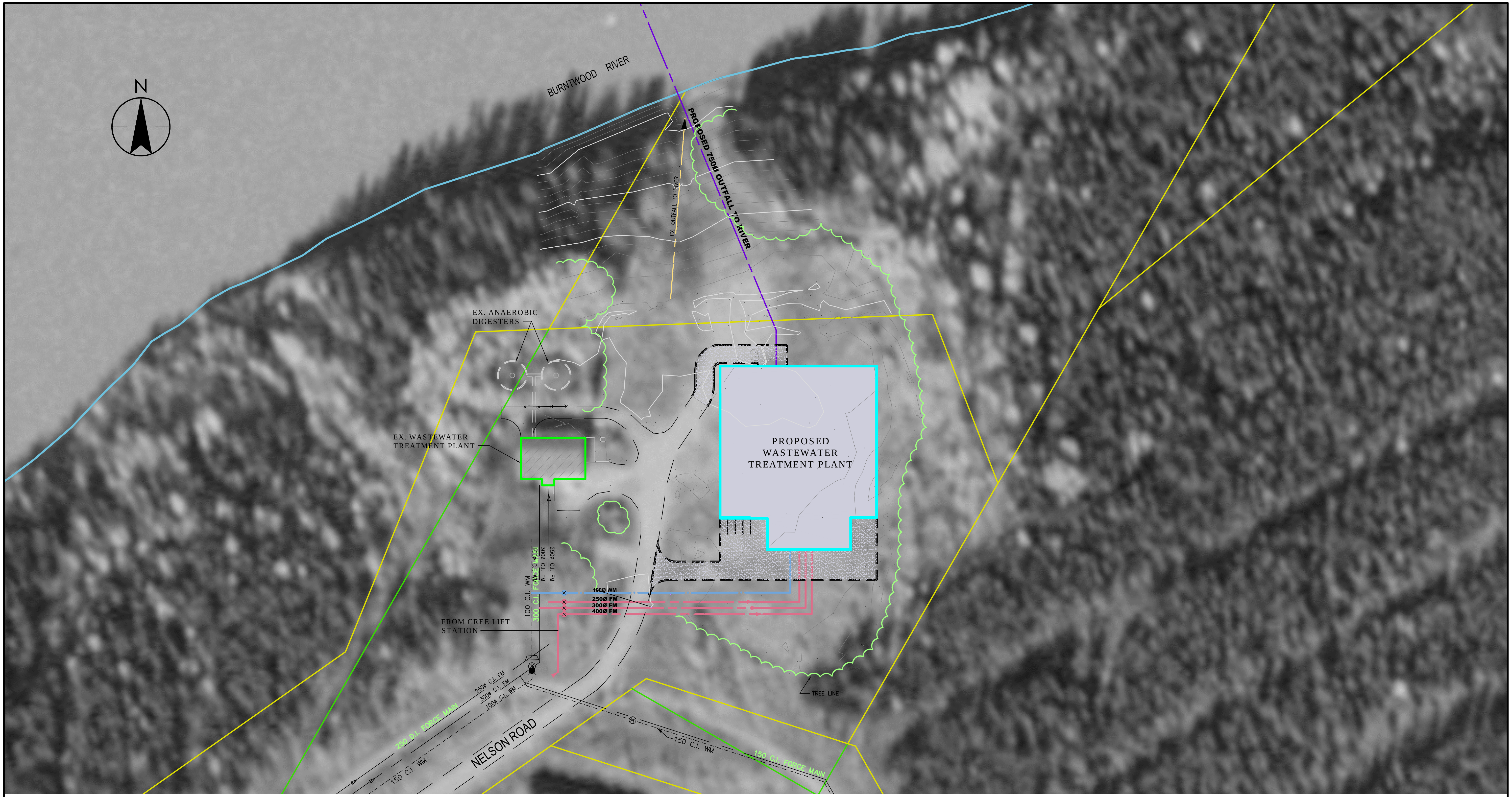
The WWTP will consist of the following key process components. For detailed information on these components, please refer to the Functional Design Report provided in **Appendix A**.

Wastewater Collection System/Lift Station Upgrades: The City intends to decommission the existing aerated lagoon and divert the wastewater from the southern catchment of the City limits to the proposed centralized WWTP. This approach requires the modification to the forcemain between the Severn and Cree Road lift stations to allow all flows to be directed to the Cree Road Lift station utilizing the existing forcemain and subsequently to the proposed WWTP via a new 400 mm diameter forcemain. Similarly, existing forcemains from the Riverside, Nelson Road and CNR Lift Stations that currently conveys wastewater to the existing WWTP will be redirected to the inlet channel of the proposed WWTP. These concepts are shown in Figure C-101 and C-102 of the Functional Design Report

- **Headworks Facility:** Raw domestic wastewater will be pumped to a headworks facility consisting of 6 mm fine screens and a high efficiency grit removal system. The captured screening and grit will be washed, dewatered and hauled to the landfill for final disposal. Both the screening and the grit removal system are sized to handle the proposed peak hourly flow of 324 L/s.

- **Secondary Process:** Following screening, wastewater is directed to the secondary biological process. The secondary process design is based on a Sequencing Batch Reactor (SBR) process to meet the design criteria presented in Section 2.0 of the Functional Design Report (refer to **Appendix A**). The SBR system is based on the principles of activated sludge process and is designed for organics removal, nitrification and denitrification along with phosphorus removal. For this project, two SBR trains are proposed. Additional details are presented in Section 6.0 of the Functional Design Report (refer to **Appendix A**).

- **Effluent Equalization:** The SBR basins will decant treated wastewater (effluent) by gravity to an Effluent Equalization (EQ) chamber on an intermittent basis. As the SBR is a batch process, this decant rate is higher than influent flow to the SBR basin. The EQ chamber therefore provides a more uniform flow to the downstream disinfection system. In absence of an EQ chamber, the size of disinfection facility would have to be considerably larger to handle the high SBR decant rate. The EQ chamber will consist of a single compartment concrete tank located in between the SBR basins. The EQ basin will be equipped with submersible turbine pumps with variable frequency drive to transfer the SBR



ORIGINAL SHEET - ANSI B

January, 2014
111214440

Stantec

905 Waverley Street
Winnipeg, MB Canada
Tel.

Legend

0 15 45 75m
1:1500

Notes

Client/Project
CITY OF THOMPSON
WASTEWATER TREATMENT PLANT
UPGRADE / EXPANSION PROJECT

Figure No.
2.1

Title
SITE PLAN

effluent from the EQ chamber to the disinfection system. Refer to Section 7.0 of the Functional Design Report (**Appendix A**) for additional details.

- **Disinfection and Final Effluent Disposal:** Final effluent (pumped from the EQ basin) will undergo ultraviolet (UV) disinfection prior to final disposal. UV disinfection involves the use of ultraviolet light to inactivate pathogens present in the wastewater. The main component of the UV disinfection system consists of UV lamps, UV channel, lamp ballasts and control panel. The UV lamps can be configured in a horizontal or vertical configuration. The Functional Design Report was based on a low pressure high output UV (LPHO) system with horizontal lamp configuration. However, a final selection on the UV lamp technology will be made prior to the detailed design.

  The Functional Design assumes that the final effluent following UV disinfection will be discharged to the Burntwood River via a new 750 mm diameter outfall pipe and dispersed in the Burntwood River via a new outfall structure.

- **Sludge Processing and Disposal:** The sludge handling practice in most WWTPs in Northern Manitoba (e.g., Flin Flon, Gilliam and Snow Lake) involves sludge stabilization, dewatering followed by disposal of dewatered biosolids (i.e., stabilized sludge) to a landfill. This is similar to what is currently being undertaken by the City and is the basis of Functional Design. Recent discussion with the City indicates that there is an interest to convert the existing aerated lagoon site (following decommissioning) to a future composting facility. In addition, the Thompson Multi-Cultural Center (TMCC) is proposing to launch a community garden project which could utilize the stabilized biosolids or compost for use within the community. Additional feedback received during the Public Open House held in Thompson indicates an interest for use of stabilized biosolids for land application (under Manitoba Hydro towers) for growing hay for the horse farms. The City intends to develop these concepts as a part of the detailed design in the future and it is beyond the scope of this assessment.

- **Chemical Feed System:** The proposed WWTP will require chemical feed systems consisting of Sodium Hydroxide (50% strength) for alkalinity adjustments and Alum (48.5% strength) to meet the phosphorus compliance level ≤ 1.0 mg/L.

- **Odor Control:** Due to the proximity of the WWTP to existing and future residential sub-divisions, an odor control system was included. Odours are expected from the Headworks channel headspace (screen, grit removal); Sludge dewatering room; Aerobic Digester tanks and Dewatered Sludge/Screenings/grit bin storage room. To control the potential odour emission form the above areas/processes, a biofiltration system is proposed. The biofilters will be located on top of the SBR tanks and is designed in a forced-draft, up flow configuration. Foul air enters the base of the tower and then passes up through the biotrickling media. This highly porous media provides an immobilized matrix, supporting a large microbial population, which forms a biofilm layer. As air comes in contact with this layer, hydrogen sulphide and other odourous compounds are solubilized and subsequently bio-oxidized to carbon dioxide and water by the microbes.

2.5.2 Project Schedule

The proposed City of Thompson WWTP requires funding approval prior to proceeding to construction. A tentative project implementation schedule is provided as follows:

• Submit Environment Act Proposal to Manitoba Conservation and Water Stewardship	January 24, 2014
• Receive Environment Act Licence (estimated)	May 2014

Design and Construction (Estimated)

• Complete Detailed Design	June 2014 to December 2014
• Tender Proposed Works	February/March 2015
• Construction Contract Award	May 2015
• Construction Period	May 2015 to December 2016
• Commissioning/Start-up	January 2017
• Performance Testing	April 2017
• Substantial Completion	May 2017

2.5.3 Funding

The funding for the project is yet to be confirmed. The City intends to apply for infrastructure funding from the Building Canada /Canada-Manitoba Infrastructure Fund for the construction of the proposed WWTP.

2.5.4 Approvals

Pending any Federal involvement in this project, the EAP process is the only known approval anticipated for this project at this time.

2.5.5 Public Consultation

As a part of the public consultation process, a Public Open House was organized by the City on November 26, 2013. The open house was held between 6:00 PM and 9:00 PM at the Multi-Purpose Room of Thompson Regional Community Centre (TRCC). Information presented in the Public Open House, photos and public feedback is provided in **Appendix D**.

2.6 STORAGE OF GASOLINE OR ASSOCIATE PRODUCTS

It is anticipated that large quantities of fuel will not be stored on-site at any given time. Fuel will be supplied by fueling trucks which are regulated under *The Storage and Handling of Petroleum Products and Allied Products Regulation*. Records of fuel volumes and an emergency response plan which includes spill prevention, notification and response will be implemented as a part of the construction specifications and enforced at site. No fuelling or servicing activities will be permitted within 100 m of watercourses during construction.

3.0 Description of Existing Environment in the Project Area

Thompson is located approximately 740 km north of Winnipeg, located within the Thompson Nickel Belt of northern Manitoba. The community was formally established with the discovery of nickel following several years of mining exploration in the region. Thompson currently serves as a major hub for Northern Manitoba and plays a key role as the region’s service and trade centre.

The surficial geology conditions in the Thompson, MB area generally consist of a 10 m± thick layer of lacustrine silty clay that was post glacially deposited from Lake Agassiz. Underlying the lacustrine clay are varying thickness of pre-glacial or glacial till and sand materials. The underlying bedrock likely consists of varying thickness sedimentary rock.

The proposed site for the centralized WWTP facility proposed for the City of Thompson is located immediately north of Nelson Road, within the existing fenced compound of the current WWTP. The site is presently used by the City as a snow dump. A site layout of the proposed development was presented earlier in **Figure 2.1**. The site layout also shows the proposed route of the effluent discharge pipe to the Burntwood River. The existing site conditions of the proposed site are shown in **Figures 3.1 to 3.2.** As seen from these site photos, the existing site is relatively flat open land (following removal of the debris left behind after snow melt) to accommodate development of the proposed works.

The general soil stratigraphy, as interpreted from the testhole logs revealed a general soil profile consisting of topsoil, clay fill, clay and sand to the depths explored in the testholes. These depths vary from 3.0 m to 15.8 m depending on the location of the test holes. Silty clay was encountered in some of the testholes.

Topsoil was encountered in the majority of testholes at the surface with thickness ranging from approximately 75 mm to 300 mm and with a water content of from 7 to 42%. Clay was encountered below the clay fill and topsoil in the testholes and extended to depths ranging from 2.6 to 11.4 m. Along the proposed alignment for the forcemain, clay typically extended to 3.8 m, the maximum depth explored in the testholes. The clay was brown to grey, firm to very stiff, moist, and of medium to high plasticity with some silt. Water contents of the clay ranged from 25 to 47%. Silty clay was also encountered below the clay fill in some testholes at depths ranging from 0.8 m to 2.5 m and extended to depths ranging from 1.4 to 6.9 m. The silty clay was tan to brown to grey, soft to firm, moist, and of medium to high plasticity. Water contents of the silty clay ranged from 22 to 32%.

Figure 3.1: Proposed Site Viewed towards North and showing the existing Snow Dump and the existing WWTP building to the left. The entrance to the fenced area is to the right of the photo

Figure 3.2: A close-up view of the proposed site (existing snow dump) viewed towards Northeast

The proposed development is located within the Grass-Burntwood Rivers Watershed. The proposed WWTP facility is located approximately 75 m south of the Burntwood River (Apussigamasi Lake), which is a tributary to the Nelson River at Split Lake. From Split Lake the Nelson River flows northeast to Stephen’s Lake prior to its outlet into Hudson Bay approximately 375 km downstream. The Burntwood River at the site location forms part of the Churchill River Diversion.

According to provincial records, fish species previously recorded in the Burntwood River include spring, summer and fall spawning species, such as walleye, northern pike, white sucker, goldeye, mooneye, and lake whitefish (MWS 2004).

Located within the Hayes River Upland Ecoregion of the larger Boreal Shield Ecozone, characteristic vegetation includes forested stands of black spruce, jack pine with some paper birch. Moose, black bear, woodland caribou, lynx, wolf, beaver, muskrat and snow-shoe hare are common wildlife species in the ecoregion. Ducks, geese and pelicans also use the ecoregion, with sandhill crane, spruce grouse, willow ptarmigan, raven, Canada jay and other species common (Smith et al. 1998).

The City of Thompson population is described in Section 2.2 of the Functional Design Report (refer to **Appendix A**). According to the 2011 Census of Canada, there are 5,391 private dwellings within the City of Thompson, with 4,738 of those occupied by usual residents. The median age of the population is 30.6 years old, compared to the provincial average of 38.4 years of age. No economic data is available for the 2011 census year; however, the 2006 unemployment rate for the City of Thompson was 6.9%, as compared to provincial unemployment rate of 5.5% for that same year.

The nearest Aboriginal communities to the site are the Monahawuhkan Reserve and Odei River Reserve of the Nisichawayasihk Cree Nation (NCN) Band located approximately 20 km southwest and northwest of the site, respectively. The only Aboriginal community located downstream on the Burntwood River system is the Split Lake Reserve, located approximately 100 km downstream. The site is not located within a Community Interest Zone. On Feb. 26, 2010, Statistics Canada released its 2006 *Aboriginal Population Profile* for Thompson, showing "the census agglomeration of Thompson, with 4,930 aboriginal people, had the largest proportion of aboriginal people of any city in Canada in 2006" (Source: Thompson Citizen, 2012). More than one in three (36 per cent) people in Thompson were aboriginal. Between 2001 and 2006, the aboriginal population in Thompson grew by nine per cent, from 4,520 to 4,930 people. The First Nations population of Thompson grew by 13 per cent over this time period, while the Métis population grew by 10 per cent.

Figure 3.3: Concrete debris at the WWTP Site

4.0 Description of Environmental Effects of the Proposed Development

4.1 GENERAL

A desktop analysis of the proposed development associated with the construction of the City of Thompson's Centralized WWTP indicates that the overall mitigated impacts will be low. The proposed WWTP designed for nutrient removal (both N and P) in conjunction with UV disinfection is expected to produce a high quality effluent. This will have a net positive impact on the receiving water body, i.e., Burntwood River, overall water quality in the watershed and community of the surrounding area. The implementation of the proposed Centralized WWTP will allow the City to decommission both the single cell Aerated Lagoon as well as the Primary WWTP that currently serve the City.

The performance of the aerated lagoon which treats approximately 30% of the City's wastewater is currently governed by an "ordinary licence" from the Province's Clean Environment Commission dated June 1, 1970. The document requires a minimum 80% removal of the biochemical oxygen demand (BOD_5), chlorination of the lagoon effluent on a continuous basis and maintenance of a chlorine residual of 0.5 mg/L following a 15 minute contact time. A review of available historical information indicates that only limited data for effluent BOD_5 were recorded. One sample collected on November 23, 2004 as a part of a study was reported as < 6 mg/L. The second sample collected by the City on October 2012 was reported at 61 mg/L. It is our understanding that the City does not monitor the performance of the lagoon with respect to the licence requirements for BOD_5 removal. However, considering only 24 to 25 out of the original 72 Aero-Hydraulics aeration devices are in operation and considerable build-up of sludge has occurred (the existing lagoon has never been cleaned since it was put into operation in 1970), the performance of the lagoon remains questionable.

The fecal and total coliforms are tested monthly (single sample). The effluent fecal coliform limits vary from 930 to 110,000 MPN/100 mL range, although a majority of the values are in around 110,000 MPN/mL based on recent results. The total coliforms also vary from 4,300 to 110,000 MPN/100 mL with a historical average closer to 110,000 MPN/100 mL. Although the current Licence does not stipulate a numeric limit for the fecal and total coliforms, values in excess of 200 MPN/100 mL (for fecal coliform) and 1500 MPN/100 mL (for total coliform) is an indicator that the disinfection system is inadequate and may not be functioning properly.

In addition to the poor quality of effluent from the lagoon, the effluent discharge route following disinfection is not very well defined. Based on the information reported in previous studies and feedback from the City, the final effluent is discharged through an outlet pipe into a natural drain, southeast of the lagoon cell. The drain then makes its way around the Vale (Inco) mine site and eventually flows northward for several kilometers through undeveloped, marshy/muskeg areas and finally discharges into the Burntwood River north of where the existing WWTP discharges.

The City also operates a primary WWTP that treats approximately 70% of the total flows. Presently, the primary effluent is discharged via an outfall to the Burntwood River without any disinfection. The WWTP is operated under a current Environment Act Licence No. 2589 dated February 4, 2003 based on a Notice of Alteration filed by the City. Effluent BOD5 ranges from 35 ~ 155 mg/L (average 69 mg/L). Effluent TSS ranges from 39 ~ 129 mg/L (average 81 mg/L). Limited data on Fecal and Total Coliforms indicates values in the range of 9,300 to > 110,000 MPN/100 mL.

The potential impacts of the proposed development are summarized as follows:

4.1.1 Air Quality

Vehicle emissions will occur from activities during construction and transportation of goods to the construction sites. Dust will be generated as a result of construction activities such as open excavations at the proposed WWTP site and along the proposed forcemain route. Vehicle and any equipment exhaust emissions are expected to result in a potentially minor decrease in air quality. These decrease in air quality will be of short term duration, occurring on a continuous basis during work hours of the construction period on a local scale. Some grubbing activities will be necessary at the WWTP construction site which may generate dust.

Additional air quality impacts include potential odorous emission from the future WWTP operations.

4.1.2 Surface Water

Minor and short term impacts on surface water quality may occur as a result of construction of the effluent outfall in close proximity of the Burntwood River. The impact on surface water quality would include contribution of sediment that may be eroded from excavation activities. In addition, the discontinued use of this site as a snow dump will remove a potential point source of impacted overland surface water drainage.

Current surface water impacts from the operation of both the wastewater treatment facilities will be mitigated by the implementation of the proposed centralized WWTP. The proposed WWTP will produce a very high quality effluent prior to the discharge to Burntwood River. However, like most biological processes, there will be an initial period of 1 to 2 weeks when the effluent quality may be deteriorated while process goes through an acclimation period and the viable microorganisms gets established.

4.1.3 Groundwater

Considering the location of the site in Northern Manitoba, the proposed development is not anticipated to have any impacts on groundwater either during construction or long-term operation of the facility.

Groundwater was encountered in certain testholes during the field drilling program undertaken as a part of the geotechnical investigations. It should be noted that only short-term seepage and sloughing conditions were observed in the testholes. Groundwater levels were checked in the monitoring well installed in Testhole TH No. 6. Groundwater levels varied from no water on

August 14 to 7.56 m on August 15 and 2.59 m on September 9. Groundwater levels will normally fluctuate during the year and will be dependent on precipitation and surface drainage.

4.1.4 Soil and Vegetation

The impacts on soil and vegetation are considered minor. Soil may be disturbed, compacted and lost during construction activities. There is potential for soil to become contaminated as a result of leaks and spills from construction equipment and refueling activities. The present site is currently used as a snow dump and has a clay fill (see **Figure 4.1** below).

Figure 4.1: Clay Fill Exposed at the Surface of the WWTP Site

Also, as the site is currently clear, loss of vegetation as a result of clearing and grubbing will be minimal. The proposed construction will be located well within the current clearing immediately east of the existing WWTP building.

4.1.5 Wildlife

The proposed development will be located within an existing, partially-fenced site in close proximity to built-up areas of the city. This is expected to have a minimal impact on wildlife habitat; however, there is a potential for ground disturbance activities, such as clearing, stripping and excavating, to disturb breeding wildlife, including nesting birds. As the site to be developed is currently disturbed, this disturbance is anticipated to be minor.

4.1.6 Fisheries

There is a potential that the in-water work and shoreline work associated with the installation of a new outfall on the Burntwood River could disrupt spawning activity and/or contribute sediment to the waterbody. It is anticipated that appropriate best management practices for working in or near fish-bearing waterways will be employed (see Section 5.0).

The proposed development with full secondary treatment followed by UV disinfection will add considerable improvement to the current situation. The proposed treatment process has been designed for nitrification and will meet the CCME criteria for unionized ammonia. The environmental impact on fisheries is expected to be minimal.

4.1.7 Heritage Resources

Manitoba Heritage Resources Branch (Archaeological Assessment Services Unit) has been provided with the necessary information on this project. It is anticipated that the potential impact on heritage resources is low, and therefore, the Historic Resources Branch is expected to have no concerns with the project.

4.1.8 Socio-Economic

No adverse socio-economic effects are expected as a result of proposed development. There may be some minor economic impacts on the City due to the capital costs associated with the construction of the WWTP, new forcemain and associated infrastructure. However, it is anticipated that City will be making an application for funding from the Building Canada Fund which will help to alleviate impacts on the community if any.

Overall, the project will have a positive impact on the environment by providing an appropriate treatment for wastewater generated in the community and significantly improving the overall quality of the effluent discharged to the Burntwood River. In addition, by constructing the modern centralized WWTP, odor complaints from the nearby residents of Nelson Road will be eliminated. The new facility will also attract new development to proceed (e.g., the planned development of the Yale-Newman Lands) and allow this City to grow. There will also be some local economic benefits during construction by engaging local contractors and personnel. The project is not anticipated to result in effects on Aboriginal communities, due to the distance of nearest communities.

5.0 Mitigation Measures and Residual Environmental Effects

5.1 GENERAL

The following sections provide the mitigation measures and residual environmental effects of the proposed development.

5.1.1 Air Quality

Emissions resulting from construction and transportation equipment may be mitigated by the utilization of well-maintained and operated vehicles while reducing unnecessary vehicle idling. The impact of dust may be mitigated by the use of an approved dust suppressant, limiting construction during high wind periods, and re-establishment of vegetation as soon as possible following construction.

In anticipation of any air quality impacts due to potential odorous emission from the future WWTP operations, a biofiltration system has been proposed. Odorous air from the headworks channel headspace (screen, grit removal); sludge dewatering room; aerobic digester tanks and dewatered sludge/screenings/grit bin storage room will be directed to the proposed biofiltraiton system. Foul air enters the base of the tower and then passes up through the biotrickling media. This highly porous media provides an immobilized matrix, supporting a large microbial population, which forms a biofilm layer. As air comes in contact with this layer, hydrogen sulphide and other odorous compounds are solubilized and subsequently bio-oxidized to carbon dioxide and water by the microbes. The clean air is then discharged to the atmosphere from the top of the biofilter. Further details are provided in Section 11.0 of the WWTP Functional Design Report appended to this document.

5.1.2 Surface Water

<u>During Construction</u>

Mitigation of surface water issues may be achieved by limiting open cut trenching to within 30 m ahead or behind the pipe laying, redirecting surface water runoff, pumping accumulated water to adjacent ditches and providing erosion control practices such as silt fences as required. These requirements will be incorporated in the Tender Specifications for the Project. Department of Fisheries and Oceans Canada requirements will be met with respect to the construction of the effluent outfall to the Burntwood River to minimize any harmful alteration, disruption or destruction of fish habitat.

Petroleum leaks or spills will be mitigated by use of properly maintained equipment, use of spill clean-up equipment and materials, and use of appropriate fueling equipment. The General Contractor will be responsible for maintaining an emergency response plan that can be implemented immediately in the event of a major spill. In the event of a reportable spill, Manitoba Conservation and Water Stewardship (CWS) will be notified through the emergency response line and appropriate measures will be taken according to CWS requirements. A 100 m setback to watercourses will be maintained for all fueling and servicing activities.

WWTP Start-Up and Operations

To mitigate any short-term impacts on the receiving stream, the proposed WWTP will be seeded with a viable nitrifying biomass trucked from a regional facility. This will facilitate the system reaching steady-state operations in a short period of time. It should be noted that that the flows on the Burntwood River are quite high year round and are regulated by Manitoba Hydro since October 1977 as a part of the Churchill River Diversion.

As stated earlier, the proposed WWTP is designed to meet the Manitoba Water Quality Standards, Objectives, and Guidelines (2011), Tier I - Water Quality Standards with the exception of Total Nitrogen as discussed previously in Section 1.1. A summary of the anticipated treated effluent discharge limits based on which the Functional Design was developed is provided in Table 4.1. The confirmation of these limits is necessary through Environment Act Licencing process prior to the completion of detailed design.

Table 4.1 - Estimated Effluent Limits for Thompson WWTP for Functional Design

Effluent Parameter	Value	Notes
cBOD5	≤ 25 mg/L	daily never-to-exceed basis.
TSS	≤ 25 mg/L	daily never-to-exceed basis.
Ammonia Nitrogen1	≤ 3.0 mg/L (at 16 degrees C) ≤ 5.0 mg/L (at 8 degrees C)	Maximum daily concentration of Ammonia-Nitrogen
Total Nitrogen2	≤ 15.0 mg/L ~ 25 mg/L	30-day rolling average
Total Phosphorus	≤ 1.0 mg/L	30-day rolling average
Fecal Coliform	200 MPN / 100 mL	Monthly geometric mean of a minimum 12 samples
Total Coliforms	1500 MPN/100 mL	Monthly geometric mean of a minimum 12 samples

1 Manitoba Conservation and Water Stewardship may choose to derive site-specific limits based on Manitoba Water Quality objectives. 2 Subject to the availability of readily biodegradable soluble carbon for denitrification.

The above mentioned limits represent a considerable improvement in the overall quality of effluent being discharged to the Burntwood River compared to current discharges from either the Primary WWTP or the Aerated Lagoon. The proposed WWTP will incorporate UV disinfection and will help to eliminate the current chlorination being utilized at the Aerated Lagoon site.

5.1.3 Groundwater

Groundwater is primarily protected by the natural hydrogeology in the area and through design of the facility to minimize leaks from the underground tanks. Also, the use of hazardous chemicals in the proposed facility is not anticipated. There will be no pollutants directly released or disposed on or into the ground either during construction or long term operations.

5.1.4 Soil and Vegetation

Built-in mitigation includes soil conservation techniques used during the placement of any underground tanks associated with the treatment process. Also, mitigations to potential soil contamination from petroleum products include preparation of an emergency response plan for potential spills, use of spill clean-up equipment and materials, using properly maintained equipment, and using appropriate fuelling equipment. Surplus soil excavated from the project footprint will be removed to an appropriate facility. Testing may be required to determine the appropriate disposal location for surplus soil from the former snow dump area.

Vegetation impacts will be mitigated by minimizing the vehicle activities, and clearing and grubbing areas. Displacing whole portions of topsoil with any known rare or endangered plant species will be implemented, if necessary, such that this material and plants can be placed back in its original location with minimal disturbance. The General Contractor will undertake selective re-vegetation of the site when construction work is complete.

5.1.5 Wildlife

Impacts to wildlife habitat will be limited by minimizing the area of construction, soil disturbance and vegetation disturbance. Other impacts resulting from dust or exhaust will be minimized as previously indicated. Noise disturbance will be limited by use of muffling vehicles and equipment, limiting idling and limiting the construction area.

Ground disturbance activities, including clearing, stripping and excavating will not be undertaken between May 15 and August 15 to protect breeding wildlife. If ground disturbance must be undertaken during this period, a pre-work nest sweep should be conducted by a qualified biologist. As the area to be developed is currently disturbed and devoid of any woody vegetation, the area affected constitutes marginal habitat at best.

With implementation of the mitigation measures identified above, the potential residual effect to wildlife is anticipated to be low in magnitude, geographic extent and duration, lasting only as long as construction and not significant.

5.1.6 Fisheries

The construction specifications will require that the Contractor implement practices to reduce soil and contaminant runoff and by providing erosion control practices such as silt fences during work related to the outfall near the bank of the primary water body i.e., Burntwood River.

Also, any in-water and shoreline works will be undertaken outside of the restricted activity period based on spawning species potentially present within the Burntwood River. Specifically, work will be timed to occur between July 15 and September 1 of any given year, to avoid disrupting fish spawning and egg/fry development.

During the operations period, fisheries impacts will be minimized by implementing an appropriate secondary wastewater treatment process.

5.1.7 Heritage Resources

There are no archeological concerns anticipated. If any heritage resources are unearthed during construction, work will be halted temporarily in the area and the project team will work with Heritage Resources Branch to mitigate concerns as required.

5.1.8 Socio-Economic

There are no known negative socio-economic impacts that need mitigation. The impact of the development on socio economics is primarily positive as indicated before. The proposed design of the facility has been based on cost effectiveness utilizing processes that were both economical and practical. This minimizes the cost of the proposed WWTP and subsequently the cost of the services that will limit the impact on the water and sewer utility rates.

The local economy will be positively impacted as the project presents employment opportunities and the requirements of various services during the construction phase.

6.0 Follow-Up Plans, Monitoring and Reporting

6.1 GENERAL

Applicable warranties will be applied to the operation and performance of all structures, equipment and process components related to the WWTP and associated works. Following commissioning and acceptance testing, the Contractor will collect and analyze final effluent samples and report the results to the Engineer. This is to confirm that the effluent quality meets the requirements of the Environment Act License.

The WWTP will be operated by certified operators (currently engaged or new hire) by the City. Specific training for the proposed plant operation and maintenance will be provided during start-up and commissioning. This includes plant optimization, plant monitoring, and laboratory techniques to monitor day-to-day treatment operations for meeting the target effluent requirements.

The proposed SBR process recommended for the proposed WWTP is an established treatment system with numerous installations in Manitoba (e.g., Flin Flon, Gimli, Gillam, Portage la Prairie, Headingley, East St. Paul) and several other locations in North America. As a part of this project, a plant operation and management manual will be prepared which will outline preventative maintenance requirements, detailed process operations, troubleshooting and testing requirements. Safety equipment will be provided for use by the operations staff including continuous monitoring of hydrogen sulfide gas in the process areas.

6.2 CONCLUSIONS

Based on the studies undertaken to date, the City of Thompson Wastewater Treatment Plant Project creates no basis for predicting any significant impacts to the environment, while providing significant improvement to wastewater treatment and effluent quality.

7.0 References

1. Aerated Lagoon Study, UMA Engineering (1999)

2. City of Thompson Wastewater Infrastructure Upgrade – Preliminary Design Report, UMA Engineering, 2002

3. City of Thompson Wastewater Treatment Plant Assessment Upgrading Study 04-12, Wardrop Engineering (2006)

4. Wastewater Treatment Plant Upgrade Plan – City of Thompson Department of Water Utility Implementation Phase, CH2M Hill, 2009

5. Thompson Planning District – Sustainability Community Plan, AECOM, 2010.

6. City of Thompson WWTP Preliminary Design, Stantec, 2013

7. City of Thompson WWTP Upgrade/Expansion Project , Functional Design Report, 2013

8. City of Thompson WWTP Upgrade/Expansion Project - Public Open House, November 2013

9. Manitoba Water Stewardship (MWS). 2004. Fish Inventory and Habitat Classification System Database. Information available from Manitoba Water Stewardship in 2004.

10. Smith, R.E., H. Veldhuis, G.F. Mills, R.G.Eilers, W.R. Fraser, and G.W. Lelyk. 1998. Terrestrial Ecozones, Ecoregions, and Ecodistricts of Manitoba: an ecological stratification of Manitoba's Natural Landscapes. Research Branch Technical Bulletin 1998-9E. Land Resource Unit, Brandon Research Centre, Research Branch, Agriculture and Agri-Food Canada, Winnipeg, Manitoba. Report and map at 1:1,500,000 scale.

APPENDIX A
WWTP Functional Design Report

Stantec

City of Thompson Wastewater Treatment Plant Upgrade/Expansion

Functional Design Report

Prepared for:

City of Thompson and
Manitoba Water Services Board

Prepared by:
Stantec Consulting Ltd.

January 2014

File: 111214440

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APEGM
Certificate of Authorization
Stantec Consulting Ltd.
No. 1301

This report was prepared by Stantec Consulting Ltd. for the City of Thompson and the Manitoba Water Services Board. The material in it reflects Stantec's judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibility of such third parties. Stantec accepts no responsibility for damages, if any suffered by any third party as a result of decisions made or actions based on this report.

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Acronyms

AAF	Annual Average Day Flow
BOD_5	Biochemical Oxygen Demand
BNR	Biological Nutrient Removal
COD	Chemical Oxygen Demand
$cBOD_5$	Carbonaceous Biochemical Oxygen Demand
CWS	Manitoba Conservation and Water Stewardship
FRP	Fibre Reinforced Plastic
MMF	Maximum Monthly Flow
MDF	Maximum Day Flow
MWSB	Manitoba Water Services Board
RAS	Return Activated Sludge
SBR	Sequencing Batch Reactor
SLR	Solids Loading Rate
SRT	Sludge Retention Time
SVI	Sludge Volume Index
TKN	Total Kjeldahl Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids.
TWRS	Truck Haul Wastewater Receiving Station
UV	Ultra Violet
VFD	Variable Frequency Drive
VSS	Volatile Suspended Solids
WAS	Waste Activated Sludge
WWTP	Wastewater Treatment Plant

1.0 Introduction

1.1 BACKGROUND

The City of Thompson (City) is located approximately 740 km north of Winnipeg. The community was formally established with the discovery of nickel following several years of mining exploration in the region. The City currently serves as a major hub for Northern Manitoba and plays a key role as the region’s service and trade centre. Vale Ltd. operations continue to be the largest employer in the area which also operates and supplies drinking water to the City.

The City has two existing wastewater treatment facilities which function independent of each other. The mechanical WWTP (refer to **Figure 1.1**) is located near the end of Nelson Road and provides primary treatment only for approximately two-thirds (2/3) of the City’s total wastewater flows. The second facility is a single cell continuous discharge aerated lagoon (refer to **Figure 1.2**), and is located south of Seal Road. The aerated lagoon provides secondary treatment and treats the remaining one-third (1/3) of the wastewater flow from the south and south-western catchment of the City. The City has created a new water and sewer utility that came into effect starting 2011 to maintain its aging water and sewer infrastructure. This utility model allows the City to generate revenue through utility rates rather than property tax assessment.

Stantec Consulting Ltd. (Stantec) was retained by the City and Manitoba Water Services Board (MWSB) in 2013 to prepare a pre-design report, develop a functional design report and file an Environmental Act Proposal (EAP) for the City of Thompson Wastewater Treatment Plant (WWTP) Upgrade and Expansion project. As a part of the preliminary design, three (3) technical memorandums were prepared. Technical Memorandum (TM) No. 1 addresses the design criteria and provides discussions on population projections, wastewater flows, raw wastewater characteristics, associated plant loadings and the anticipated effluent criteria. TM No. 2 discusses options for upgrading and expansion of the existing WWTP and aerated lagoon. The memorandum compares the upgrade/expansion scenarios as two (2) independent treatment systems and a single centralized wastewater treatment plant (WWTP) for the City. TM No. 3 was developed in response to MWSB’s request to develop options for total nitrogen removal given the challenges with the dilute nature of the wastewater in Thompson. One of the key conclusions of the Pre-design was to develop the City’s WWTP upgrade/expansion project based on a single centralized treatment facility utilizing a Sequencing Batch Reactor (SBR) process and servicing a projected population of 15,000 people. Following the successful start-up and commissioning of the proposed centralized WWTP, the existing facilities will be decommissioned.

The information developed in TM No. 1, 2 and 3 will form the basis for the Functional Design. The Functional Design report will be presented to the community residents via a Public Open House on November 26, 2013 and will ultimately lead to the submission of an Environment Act

Proposal (EAP) to Manitoba Conservation and Stewardship to secure an Environment Act Licence for the proposed wastewater system upgrade/expansion project.

Figure 1.1: Existing Mechanical WWTP

Figure 1.2: Existing Aerated Lagoon

1.2 PURPOSE OF FUNCTIONAL DESIGN

The primary purpose of the functional design is to further define and sizing of the key components of the proposed WWTP including establishing the design basis for structural, architectural, building mechanical, electrical, instrumentation and controls and site services components of the project. As stated earlier, information developed in this report and feedback received from the City residents during the Public Open House will also form the basis to file an Environment Act Proposal (EAP) for the project. Once the Licence is received, further work related to the detailed design of the proposed WWTP can proceed. The scope of work for this assignment is summarized as follows:

- Review of previous reports and documents relating to the project including reference to the previous work completed in the preliminary design stage by Stantec.
- Review of existing plans and records.
- Conduct site surveys, geotechnical investigations to establish the existing surface and subsurface conditions of the proposed site.
- Consult with the City and MWSB, on local conditions and preferences.
- Conduct pre-consultations with Manitoba Conservation and Water Stewardship regarding effluent criteria and environmental licensing requirements.
- Develop an opinion of probable construction costs for the upgrade/expansion works.
- Prepare and submit, to the City and the MWSB, a draft functional design report outlining all of the above, with recommendations for approval.
- Conduct Public Open House in Thompson to present project details.
- Submit to Manitoba Conservation and Water Stewardship an Environment Act Proposal for the proposed wastewater treatment facility.

2.0 Design Criteria

2.1 BACKGROUND

The following section summarizes the data analysis related to population projection, wastewater flows, raw wastewater characteristics and effluent criteria. Although a majority of this information was presented as a part of TM No. 1 and 2 during the pre-design stage, additional information and analysis related to revised design population, wastewater flows, wastewater characteristics and effluent criteria were also developed during the functional design. During a meeting to discuss the findings from TM No. 3, further direction was received from Manitoba Conservation and Water Stewardship on the effluent requirements which are presented further in this section.

2.2 DESIGN POPULATION

The City has experienced a general decline in population since 1971 (see Table 2.1). The latest census data from 2011 reported a population of 12,829 people, approximately 4.6 percent lower than the 2006 census data of 13,446 people. This trending seems to be in line with many northern communities such as Flin Flon, Snow Lake, Cranberry Portage, The Pas and Churchill who had experienced a decline in growth since the 2006 census.

Table 2.1 – Historical City of Thompson Population

Year	Population
1971	19001
1976	17291
1981	14288
1986	14701
1991	14977
1996	14385
2001	13256
2006	13446
2011	13123[1]

[1] Note: The official 2011 census data of 12,829 reported by Statistics Canada was adjusted to 13,123 people based on feedback received from the City

Since the publication of 2011 census data in February 2012, Statistics Canada had re-adjusted the 2011 census data to 13,123 people when challenged by the City officials. This data was used as the basis for population projections as directed by the City during the project start-up meeting. The stability of the current City's population is anticipated to be influenced by the local mining activity, primarily by Vale – the single largest employer in the immediate region (42%), followed by the three levels of government (25%) and the 14% by School District of Mystery Lake (The Canadian CED Network – Profile on Thompson).

2.2.1 Population Projections

Based on the anticipated start of construction for the proposed WWTP upgrades by 2016, a design horizon of 20 years and growth scenarios reported in the study titled "Thompson and Planning District – Sustainability Community Plan" (AECOM, 2010), population projections were developed. A summary of these projections are shown in Table 2.2 and graphically in Figure 2.1.

Table 2.2 – City of Thompson Population Projections (Adapted from AECOM, 2010)

Year	Future Annual Growth Rates		
	0.25%	**0.52%**	**1.05%**
2011	13123	13123	13123
2012	13156	13191	13261
2013	13189	13260	13400
2014	13222	13329	13541
2015	13255	13398	13683
2016	13288	13468	13827
2017	13321	13538	13972
2018	13354	13608	14118
2019	13388	13679	14267
2020	13421	13750	14417
2021	13455	13822	14568
2022	13488	13893	14721
2023	13522	13966	14875
2024	13556	14038	15032
2025	13590	14111	15189
2026	13624	14185	15349
2027	13658	14258	15510
2028	13692	14333	15673
2029	13726	14407	15838
2030	13761	14482	16004
2031	13795	14557	16172
2032	13829	14633	16342
2033	13864	14709	16513
2034	13899	14786	16687
2035	13933	14863	16862
2036	13968	14940	17039

Although the Pre-design work was completed based on a growth rate of 1.05% (as discussed during the project start-up meeting), following the development of preliminary Opinion of Costs, the City accepted a less optimistic growth scenario of 0.52% and an associated 20-years population of 14,940 people, rounded to 15,000. The functional design was developed such that if there is a substantial growth in the future; the WWTP could be easily expanded to accommodate increased capacity.

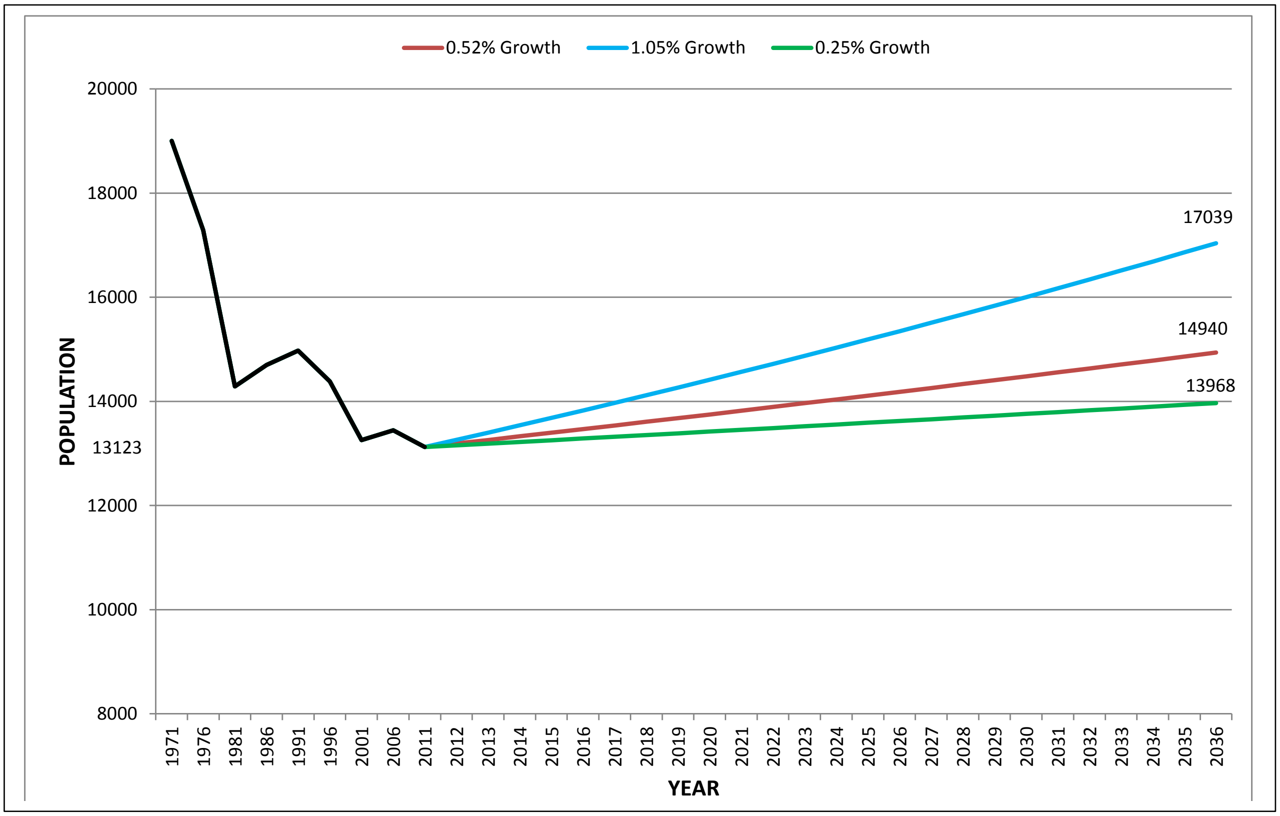

Figure 2.1: Population Projection for Various Growth Scenarios

2.3 INFLUENT FLOWS

As a part of the Pre-design, the City had elected to develop a new Centralized WWTP by decommissioning both the existing Primary WWTP as well as the Aerated Lagoon. This single new facility will therefore handle all the wastewater generated from the entire City.

The City currently monitors daily flows to the existing WWTP via two dedicated flow meters. The meters are located on the respective forcemain entering the plant from the Nelson Road and Riverside lift stations. A display is located on the main floor of the plant, immediately across the office areas that displays both the totalized flow as well as the instantaneous flows. Based on our review of the existing reports, it is our understanding that the flow meters were installed as a part of the 2003 infrastructure upgrades at the WWTP. As indicated in the 2006 report by

Wardrop, the accuracy of the flow meters may be comprised as adequate pipe diameters are not provided downstream of the elbows. Also, the City does not record the instantaneous peaks that are critical to sizing the future plant processes.

We also understand that the City accepts truck haul wastewater from areas not serviced by the gravity collection system. Based on our discussions with the plant operators, the hauled wastewater is discharged into a manhole upstream of the Nelson Road lift station. For the purpose of this study we have not allowed any additional allocation for this wastewater stream for the future based on the fact that it is included in the flow measurement to the WWTP. Flows to the aerated lagoon are received directly from the Cree and Severn lift stations. These stations are currently not equipped with any flow measuring devices. The City simply records the monthly pump hours for each pump which is then used to estimate a total monthly flow to the lagoon.

Stantec requested historical wastewater flow data that best represented the impact of installation of water meters in 2010~2011. Daily flow data to the WWTP was reviewed for the period of December 26, 2010 until March 12, 2013. For the flows to the lagoon, the total monthly pump hours were converted initially to total monthly flows in cubic meters (m^3) and then averaged over the respective month to estimate the daily flows (e.g., total monthly flows for say January 2011 ÷ 31 days). As such, the daily flows for the respective months were the same. Although this is never the case in any community, given the current mode of record keeping by the City, this approach was the only option available to estimate the total City flow.

It should be noted that for the year 2011, daily flow data to the WWTP was not recorded for the period of July 27 to October 26. Also, for the lagoon, the May 2012 pump hours were not recorded. For the purpose of our analysis, we assumed the May 2012 to be the same as May 2011. The flows to the WWTP, estimated daily flows to the aerated lagoon and the total City flow for the period of December 26, 2010 to March 12, 2013 is shown in Figure 2.2.

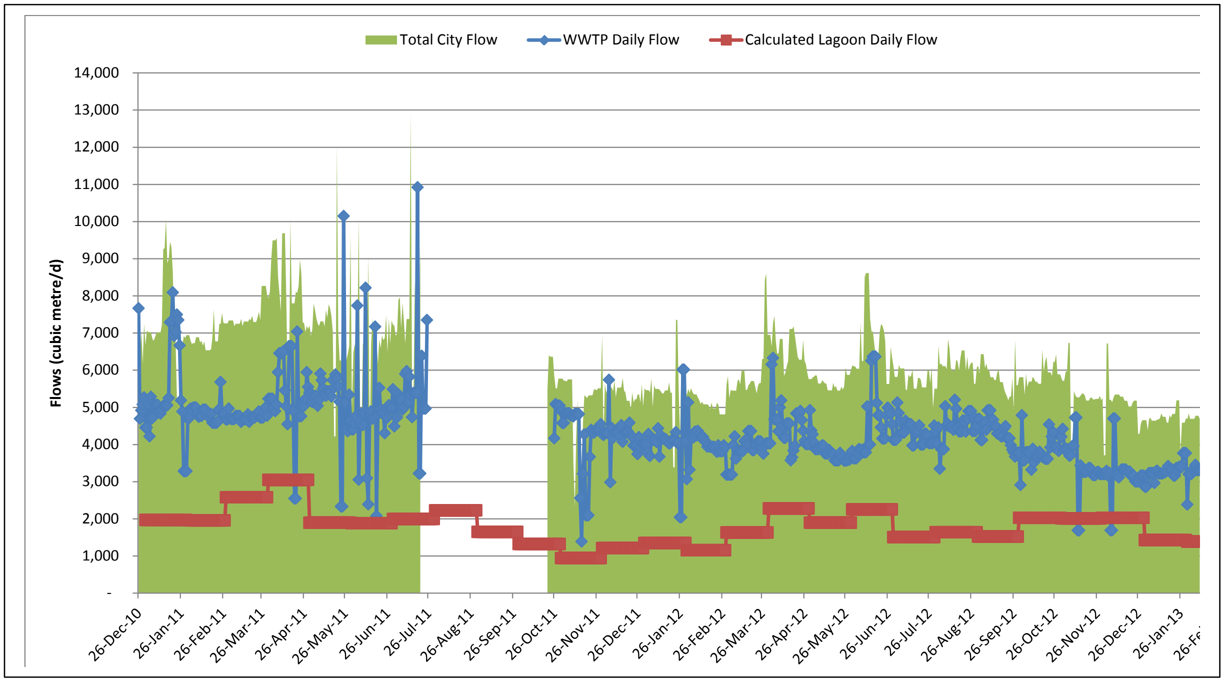

Figure 2.2: Daily Wastewater Flow (2010 to 2013)

Based on analysis of the existing flow data, the following information can be summarized for 2012:

- 2012 Annual Average Day Flow (Total City) = 5,286 m3/d
- Service Population: 13,123
- Hence, Estimated Annual Average Per Capita Flow: 402.77 L/person/d, say 400 L/person/d

To estimate the maximum month and maximum day conditions, daily flow data in 2012 to the WWTP only was analyzed. This was done since daily flow records was available compared to the monthly average for the lagoon. The analysis resulted in the following:

- 2012 Annual Average Flow to WWTP only: 4,029 m^3/d
- 2012 Maximum Month Flow to WWTP only: 4,791 m^3/d
- Hence, the estimated Maximum Month Factor for design: 1.19, say 1.2
- 2012 Maximum Day Flow to WWTP: 6,362 m^3/d

- Hence, the Maximum Day Factor: 1.6. However, the value has been rounded to 2.0 for design considering limited historical data available for analysis and also considering that 2012 was a dry year.

2.3.1 Estimation of Current Peak Hourly Flows

The City currently does not have any records of hourly flows. Although the existing WWTP is equipped with two magnetic flow meters and an associated recording device, hourly peaks are not recorded. For the purpose of this report, we have assumed that the existing lift station pumping rates will dictate the peak hourly flow at the current and future proposed centralized WWTP.

A lift station draw-down tests was undertaken by Stantec for the Riverside, Nelson Road, Cree Road and Severn Crescent lift stations. Currently the CNR lift station share a common forcemain with Nelson Road lift station immediately prior to entering the existing WWTP site. This setup is not ideal for the optimal operation of either of these two lift stations as it likely impacts the pumping efficiency noted during the drawdown tests. As a part of the proposed upgrade, this arrangement will be modified to allow a dedicated forcemain from CNR lift station to direct wastewater to the influent channel of the WWTP.

Once the WWTP is commissioned, the following four (4) lift stations will ultimately control the peak flow rates received at the upgraded centralized WWTP. For the purpose of this functional design, it was assumed that the critical peak hour flow will occur when all the lift stations duty pumps are in operation simultaneously. The following summarizes the estimated flows from each lift station with the duty pump "ON". The flows from the CNR lift station was based on the existing O & M manuals provided by the City.

1. Riverside: 98 L/s (2 duty pumps in operation with the third as a stand-by)
2. Nelson Road: 80 L/s (1 duty pump in operation with the second as a stand-by)
3. Upgraded Cree Road: 101 L/s (2 duty pumps in operation with the third as a stand-by)
4. CNR: 42 L/s (1 duty pump in operation with the second as a stand-by)

Hence the total estimated flow during peak hour condition with all the duty pumps in operation can be estimated as: 98 L/s + 80 L/s + 101 L/s + 42 L/s = 321 L/s or 27,735 m^3/d, say 28,000 m^3/d (rounded) or 1,167 m^3/h or 324 L/s

The existing wastewater conveyance and lift station infrastructure was established in the 60s and early 70s when the population of the City peaked at 19,000. Since then, the population has declined to 13,123 as per the latest census. Since the projected population is expected to reach 15,000 by the year 2036, we have assumed that the existing collection system/lift station infrastructure is more than adequate to handle the projected population growth and as such, the peak current pumping rates are unlikely going to change in the future.

2.3.2 Projected Design Flows

- Based on the previous analysis, the design flows can be calculated as follows:
- Design Population: 15,000 (Year 2036)
- Annual Average Per Capita wastewater generation: 400 L/person/d
- Projected Annual Average Flow (AAF): 6,000,000 L/d or 6,000 m^3/d
- Maximum Month Factor: 1.2
- Projected Maximum Month Flow (MMF): 6,000 m^3/d * 1.2 = 7,200 m^3/d
- Maximum Day Factor: 2.0
- Projected Maximum Day Flow: 6,000 m^3/d * 2.0 = 12,000 m^3/d
- Projected Peak Hourly Flow: 324 L/s or 1,167 m^3/h

2.4 INFLUENT CHARACTERISTICS AND DESIGN LOADINGS

The City collects raw wastewater samples from the channel, downstream of the existing static coarse bar screen and has historically tested it for total-biochemical oxygen demand (BOD_5) and total suspended solids (TSS). As a part of this study, Stantec requested the City to monitor additional parameters such as pH, alkalinity, temperature of the raw wastewater stream ammonia-nitrogen, total kjehldahl nitrogen (TKN), total phosphorus and soluble-phosphorus. This information was critical to understanding the raw wastewater quality for the development of functional design of the WWTP proposed expansion/upgrade. A summary of this information is presented in Table 2.3. The individual test data is provided in Appendix A.

Although the data set is very limited, it is quite evident that the raw wastewater quality can be characterized as “dilute” except for the TKN values. As seen from the data provided in Appendix A, the raw wastewater in Thompson is quite unique as it shows a disproportionate high influent TKN compared to the low BOD_5 values. The low BOD_5:TKN ratio will impact the ability of the proposed treatment process to sustain effective denitrification due to the lack of available readily biodegradable carbon.

Table 2.3 – Summary of Raw Wastewater Data

Wastewater Constituent	Unit	Maximum	Minimum	Average	Recommended Value for Functional Design
BOD_5	mg/L	175	35	104	140
COD	mg/L	537	119	326	448
TSS	mg/L	269	59	157	175
VSS	mg/L	218	27	125	150
TKN	mg/L	51	20	38	40
Ammonia-N	mg/L	37.4	13.6	22	25
TP	mg/L	7.0	2.73	4.7	5.5
Sol-P	mg/L	4.35	0.95	3.0	3.6
pH[1]	N/a	6.95	8.29	7.32	7.7
Alkalinity	mg/L as $CaCO_3$	256	126	194	190
Temperature[2]	degree Celcius	16	8	n/a	8 ~ 16°C

[1] pH values based on WWTP historical data

[2] Influent temperature data was unavailable. Values assumed based on similar northern WWTPs

Based on the above characteristics, a summary of influent loadings are summarized in Table 2.4.

Table 2.4 – Design WWTP Influent Loadings

Parameters	Wastewater Conc. (mg/L)	AAF (m^3/d)	Average Loading (kg/d)	MMF (m^3/d)	Maximum Month Loading (kg/d)
BOD_5	140	6,000	840	7,200	1,008
COD	448		2,688		3,225
TSS	175		1,050		1,260
TKN	40		240		288
Ammonia-N	25		150		180
TP	5.5		33		39.6

2.4.1 Target Effluent Quality

The target effluent quality is typically established by the Department of Manitoba Conservation and Water Stewardship (CWS) through the Environment Act Licencing Process. To obtain some directions for the development of the preliminary and functional design of this project, Stantec initiated a pre-consultation meeting which was attended by Ms. Siobhan Burland Ross, M.Eng., P.Eng. and Mr. Rafiqul Chowdhury, M. Eng., P.Eng. of CWS and Travis Parsons (via phone) of MWSB on March 20, 2013. In these discussions, the Department made reference to the latest Manitoba Water Quality Standards, Objectives, and Guidelines and indicated that the City will be required to meet the Tier 1 – Water Quality Standards. Since the City of Thompson proposed WWTP will serve more than 10,000 people, meeting a target of 15 mg/L of Total Nitrogen will also be necessary.

Given the challenges with dilute wastewater quality and concern for high operational costs, Stantec developed TM No. 3 to address these concerns. The TM highlights the fact that an external carbon source would be necessary to consistently meet the 15 mg/L Total Nitrogen limits based on the limited historic wastewater quality data available at this time. To address these concerns over meeting the Total Nitrogen limit of 15 mg/L and discuss the findings of TM No. 3, a special meeting was organized by MWSB with key members of the CWS on September 16, 2013. The meeting included Dave Shwaluk (MWSB), Jocelyn Baker (CWS), Tracey Braun (CWS), Siobhan Burland Ross (CWS), Don Labossiere (CWS), Nicole Armstrong (CWS) and Saibal Basu (Stantec).

Based on the discussions, it was agreed that using an external carbon source (e.g. methanol) to effect consistent denitrification to meet 15 mg/L of Total Nitrogen was not practical for Thompson. It was realized that besides high operating costs, the use of a chemical like methanol poses significant safety risks. However, CWS indicated that the design should be developed to achieve the maximum denitrification that is possible with the current wastewater quality. CWS hopes that with proper water conservation and maintenance of the sewer collection system to reduce inflow and infiltration in the future, the City will be able to improve the strength of the raw wastewater which will ultimately favor better denitrification. Stantec indicated that, based on preliminary process modeling, it is anticipated that the effluent Total Nitrogen would vary from 15 mg/L to 25 mg/L.

The anticipated treated effluent discharge limits for the proposed Thompson WWTP is provided in Table 2.5. As stated above, the confirmation of these limits is necessary through Environment Act Licencing process prior to the completion of detailed design.

Table 2.5 - Proposed Effluent Limits for Thompson WWTP

Effluent Parameter	Value	Notes
$cBOD_5$	≤ 25 mg/L	daily never-to-exceed basis.
TSS	≤ 25 mg/L	daily never-to-exceed basis.
Ammonia Nitrogen*	≤ 3.0 mg/L (at 16 degrees C) ≤ 5.0 mg/L (at 8 degrees C)	Maximum daily concentration of Ammonia-Nitrogen
Total Nitrogen[1]	≤ 15.0 mg/L ~ 25 mg/L	30-day rolling average
Total Phosphorus	≤ 1.0 mg/L	30-day rolling average
Total Residual Chlorine	≤ 0.02 mg/L	Monthly average basis
Fecal Coliform	200 MPN / 100 mL	Monthly geometric mean of a minimum 12 samples
Total Coliforms	1500 MPN/100 mL	Monthly geometric mean of a minimum 12 samples

[1] Subject to the availability of readily biodegradable soluble carbon for denitrification.

* Manitoba Conservation and Water Stewardship may choose to derive site-specific limits based on Manitoba Water Quality objectives.

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3.0 Design Basis and Sizing of Key Plant Components

3.1 BACKGROUND

The following provides a listing of the key process components of the proposed WWTP. A summary of the functional design of the proposed components are discussed in detail in the following sections.

- Wastewater Collection System/Lift Station Upgrades
- Headworks/Preliminary Treatment
    - Truck haul wastewater receiving station (TWRS)
    - Mechanical fine screens (6 mm)
    - High efficiency grit removal system
- Secondary process based on Sequencing Batch Reactor (SBR) system
    - Waste activated sludge (WAS) pumping system
    - High efficiency turbo blowers
- Equalization Tank (EQ) and pumping
- Ultraviolet Disinfection system
- Effluent flow monitoring
- Outfall
- Aerobic Digestion
    - Digested sludge pumping system to sludge dewatering
    - Digester blowers
    - Digester supernatant decant system (automatic telescopic valves)
- Sludge dewatering
- Sludge storage and disposal to landfill/beneficial reuse

- Odour Control system

Refer to the WWTP Process Flow Diagram, Figure DI-601 in Appendix B.

4.0 Wastewater Collection System/Lift Station Upgrades

The City intends to decommission the existing aerated lagoon and divert the wastewater from the southern catchment of the City limits to the proposed centralized WWTP. This approach requires the modification to the forcemain between the Severn and Cree lift stations to allow all flows to be directed to the Cree Road Lift station utilizing the existing forcemain and subsequently to the proposed WWTP via a new forcemain.

Stantec undertook pump drawdowns on four lift stations throughout Thompson on May 1 and 2, 2013 including Cree Road. Drawdown tests were conducted on each pump individually as well as multiple pumps within a station simultaneously. For stations in which gravity or force main sewer inlets are located below the liquid levels of the draw down tests, the volume of liquid in the pipe was taken into account since the liquid will be drawn down within the pipe concurrently with the wet well. This was the case with the Cree Road lift station, based on elevations shown in the 2003 Issued for Construction drawings by UMA Engineering (AECOM). The drawdown tests at Cree Road lift station resulted in the following results:

- Pump 1’s estimated performance is 56 L/s.
- Pump 2’s estimated performance is 43 L/s.
- Both pumps operating simultaneously have an estimated combined performance of 71 L/s.

It should be noted that the specified duty point for a single pump is 69.8 L/s as per current O&M manual provided by the City. The Cree Road lift station currently has a provision to add a third pump. As a part of this upgrade, a third pump of similar capacity i.e., 69.8 L/s (same as current) is proposed which will adequately handle the additional flow received from the Severn Road lift station. For the purpose of the functional design we have assumed that the upgraded Cree Road lift station will require replacement of the existing pumps allowing the station to pump at design capacity. Based on that, the peak flow condition will occur when two pumps operate on duty mode (third pump on stand-by) and the peak flow is estimated 101 L/s.

The discharge piping at the Cree Road lift station will be upgraded/modified to allow connection to a new 400 mmm forcemain which will convey all the wastewater collected from the southern section of the City that was previously treated at the aerated lagoon to be diverted to the proposed centralized WWTP. This concept is illustrated in Figure C-102 (see Appendix A).

In addition, dedicated forcemains from the Riverside, Nelson Road, CNR Lift Stations that already exists at this site will be redirected to the inlet channel of the proposed WWTP.

5.0 Preliminary Treatment/Headworks Facility

5.1 GENERAL

The key components of the Preliminary Treatment/Headworks Facility includes:

- Incoming forcemains
- Influent flow monitoring
- Truckhaul wastewater receiving station (TWRS)
- 6 mm mechanical fine screens and a 25 mm static coarse screen in the bypass channel
- High efficiency grit removal
- Emergency overflow

The following sections provide a brief discussion and design basis on each of the above components.

5.2 INCOMING FORCEMAINS

As stated earlier, the proposed WWTP will receive influent wastewater via four (4) dedicated forcemains as follows:

- Riverside: 300 mm diameter
- Nelson Road: 250 mm diameter
- Upgraded Cree Road: 400 mm diameter
- CNR: 150 mm diameter

Each forcemain will be equipped with a dedicated magnetic flow meter to record both the instantaneous and cumulative flows from the respective stations.

5.3 INFLUENT FLOW MONITORING

Influent flow measurement is critical to monitor the daily, hourly and instantaneous peak flows entering the plant. This information will be required to serve several plant controls including emergency overflows, should the peak plant capacity be exceeded due a major storm event. While there are several flow meter options available, considering the accuracy requirement and the present set-up of forcemains delivering the wastewater to the proposed WWTP, a magnetic type flow meter is recommended.

Similar to the existing set-up, dedicated in-line magnetic flow meters are proposed on the respective forcemains stated in Section 5.2. Instantaneous and total daily flows will be recorded and tracked by the WWTP Supervisory Control and Data Acquisition (SCADA) system.

Given the existing condition of the magnetic flow meters at the WWTP, we do not recommend their reuse in the proposed upgrade.

5.4 TRUCK HAUL WASTEWATER RECEIVING STATION

The City currently receives truck hauled wastewater from holding tanks from the surrounding areas that are not served by the collection system. Under current practice, the trucks discharge the wastewater to a manhole immediately upstream of the Nelson Road lift station. Volumes and the number of hauled truck loads are not monitored. The City has confirmed that it no longer receives any loads from the Manitoba Hydro camp site. A new truck haul receiving station is proposed at the WWTP site and will include the following key components:

- Cam-lock connection
- Hydrocarbon detector
- Electrically actuated discharge isolation valve
- Cast-in-place single chamber concrete equalization storage tank integral to the proposed treatment tankage of volume 70 m^3
- Level controls
- Magnetic flow meter
- Duty/stand-by pumps each rated at 10 L/s
- Motor size: 5 HP

The equalization tank will also serve to equalize and blend the return streams from plant processes such as grit dewatering, digester supernatant and centrate (from sludge dewatering) before they are pumped back to the inlet to the screening channel.

For the purpose of this report, we have assumed that the equalization tank will handle two (2) 1500 US gallons (5.7 m^3) septic truck successively i.e., 11.4 m^3 plus return flows from the grit dewatering, digester supernatant and centrate from sludge dewatering operations for a total active volume of 70 m^3. The truck dumping will be stopped via the discharge isolation valve should hydrocarbons be detected in the tank. Hauled wastewater from the equalization tank would be pumped via dry-pit type centrifugal pumps (located in the lower level) to the influent chamber, immediately upstream of the screen channel.

5.4.1 6 mm Mechanical Fine Screens and 25 mm Bypass Screen

Screening at WWTPs is critical to remove large objects such as rags and debris that could damage influent pumps and block flow in piping systems. It is also necessary to remove smaller and finer objects such leaves, hygiene and personal care products and human hair to protect sensitive, downstream equipment including membrane systems or filters. The passage of rags and debris into downstream processes is one of the largest causes for equipment maintenance and failure because of jammed pump impellers (WEF, MOP 8).

Most modern day WWTPs tend to employ some form of fine screens. Fine screens are typically considered to have openings/spacing of 6 mm or smaller and provide good capture of debris and larger particulate matter from raw wastewater streams. For the proposed WWTP upgrade in Thompson, a 6 mm Automatic Multiple Rake Bar Screen is proposed. This is based on our experience in similar plants in Western Canada, the degree of protection required for the downstream processes, the size of the proposed facility and the ease of operation. The captured screenings will be washed, dewatered and transferred to a common sludge/waste collection bin via a washer/compactor. The bypass channel will be equipped with a 25 mm static manual screen capable of passing 324 L/s. The manual screen will be activated when flows are bypassed from the primary screen channel during the maintenance of the 6 mm primary screen.

A summary of the proposed screening system functional is summarized as follows:

- Design basis: Duperon FlexRake® - Link Driven, Front Cleaning, Front Return Mechanically Cleaned Bar Screen
- Design flow: 324 L/s or 1,167 m3/h
- Number of channels: Two (2) screening channels (primary screening channel and a bypass channel).
- Channel dimensions: 1.20 m wide by 1.5 m deep
- Number of screens: One (1)
- Screen Opening: 6 mm (1/4”)
- Type of bar: Tear drop
- Angle of Inclination: 60^{o}
- Headloss and design flow: 85 mm

- Material of Construction: 304 L SS (bars are 316 SS)
- Motor horsepower: 0.5 hp (Screen) and 0.75 hp (Washer/compacter)
- Washwater required: 0.35 L/S gpm @ 60 psi for washer compactor

5.4.2 Grit Removal

Grit removal is critical to the protection of wastewater treatment equipment, as the heavier particles present in wastewater, such as sand and gravel requires removal. For Thompson, any slag (used as bedding material for some sewers) will also be captured. The primary purpose of grit removal is to reduce abrasion and wear of downstream mechanical equipment, deposits in pipelines, channels and in occupying valuable space in digesters, aeration basins and other process units. Grit removal is particularly critical for protection of dewatering centrifuges and high-pressure progressing cavity pumps. Grit is typically defined as particles larger than 0.008 inches (65 mesh) and with a specific gravity greater than 2.65.

The design is based on a proprietary Multi-Tray Vortex, high efficiency grit removal system utilizing the Hydro International's Eutek Headcell™ concept. The system is comprised of a 3.7 m diameter grit concentrator unit (Headcell™), a self-standing 600 mm stainless steel grit classifier (TeaCup™) and stainless steel grit washing dewatering unit (Grit Snail™).

A summary of the design is as follows:

- Design flow: 324 L/S
- Diameter of tray: 3.7 m diameter
- Number of trays per unit: 5
- System Efficiency: Removal of 95% of all grit ≥ 75 microns
- Washwater Requirement:
  Headcell™: 1.3 L/S @ 50 psig
  Teacup™: 1.3~1.9 L/S @ 50 psig
  Grit Snail™: 0.3 L/S @ 50 psig
- Headloss at design flow: 300 mm

  Grit transfer pump: 12.6 L/s (7.5 HP)
- One (1) Eutek TeaCup ® Grit Washing/Classification Unit
- One (1) Eutek Grit Snail® Dewatering Unit (drive motor 0.33 hp)

- One (1) Grit conveyor to transfer dewatered grit to a common screening/grit storage/sludge bin for final disposal

5.5 EMERGENCY OVERFLOW

An emergency overflow is provided to protect the plant from flooding if flows exceed the proposed peak wet weather flows especially during snow melt and peak rainfall season beyond a 3 hour sustained peak. A 400 mm emergency overflow pipe will divert the excess flows to the outfall from the influent channel, immediately upstream of the grit removal.

The headworks facility is shown in Figure D-101 and a process flow diagram is provided in Figure D1-601. (Refer to Appendix B).

6.0 Secondary Treatment Process

As discussed in TM No. 2, the secondary process design will be based on the Sequencing Batch Reactor (SBR) process to meet the effluent criteria presented earlier in Section 2.4 of this report. A SBR is a fill-and-draw, non-steady state activated sludge type treatment system where the biological oxidation of organic matter, nitrification, denitrification and clarification (solid/liquid separation) are carried out in the same tank, typically in a timed sequence. As such, the SBR process does not require any secondary clarifiers and in most cases operates without primary clarification. Also, the SBR process does not require any return activated sludge (RAS) or any internal mixed liquor recycle streams. In general, a typical treatment cycle consists of filling the bioreactor with wastewater (FILL), aeration and/or mixing of the bioreactor contents (i.e., mixed liquor or biomass) known as REACT, followed by settling (SETTLE) of the biomass. Aeration is provided by fine bubble diffusers and high efficiency turbo blowers.

Ammonia removal is achieved during the REACT phase and via control of appropriate solids residence time (SRT) in the system. While most SBRs can be designed to remove some phosphorus biologically (depends on the raw wastewater characteristics), a chemical polishing system is necessary to consistently meet the effluent criteria of ≤ 1 mg/L of TP. Chemicals such as alum or ferric chloride can be dosed into the tank at end of the aeration cycle to precipitate phosphorus. The chemical complex precipitated is wasted during the normal sludge wasting process. The chemical complex increases the solids concentration in the bioreactor and needs to be accounted in the design.

Treated effluent is then finally discharged via the decanter mechanism (DECANT). An IDLE stage may follow during which waste activated sludge is discharged and the SBR tank time sequence is adjusted prior to starting the cycle all over again.

Several variations of the SBR are available which includes the following variations:

- Continuous inflow and intermittent decant
- Intermittent or Batch inflow and intermittent decant (also referred to as the true batch system)
- Continuous inflow and continuous decant (also referred to as the modified SBR or MSBR)

A final selection of the type of SBR system will be undertaken prior to the detailed design. The design basis is summarized as follows:

- Basis of design: Xylem ICEAS^{TM} process (continuous inflow – discontinuous decant type SBR)

A. Design Flows:

Annual Average Day Flow (AAF):	6,000 m^3/d
Maximum Month Flow (MMF):	7,200 m^3/d (Design Flow)
Maximum Day Flow (MDF):	12,000 m^3/d
Peak Hourly Flow (PHF):	324 L/s

B. Design Loadings:

Constituent	At AAF	At MMF
BOD_5:	840 kg/d	1,008 kg/d
TSS:	1,050 kg/d	1,260 kg/d
TKN:	240 kg/d	288 kg/d
Ammonia-N	150 kg/d	180 kg/d
Total Phosphorus:	33 kg/d	39.6 kg/d

C. Additional Criteria:

Average Alkalinity:	190 mg/L as $CaCO_3$
Wastewater temperature:	
– Maximum:	16°C
– Minimum	8°C
Ambient air temperature:	-35°C to + 30°C
Site Elevation:	202 m

D. ICEAS Process Design Criteria:

F/M Ratio:	0.035 kg BOD_5/kg MLSS/day
SVI:	150 mL/g
MLSS at Botton Water Level:	5,130 mg/L
Sludge depth:	3.32 m
Decanter drawdown:	1.73 m
– Normal decant rate:	1,500 m^3/hr
– Peak decant rate:	2,400 m^3/hr
HRT at Design Flows	1.23 days
– Design Flow:	16.6 hrs
Sludge Age (SRT):	30.7 days

E. SBR Cycle Description:

Status	Normal Cycle	Storm Cycle	Second Storm
React	2.8 hr	2.1 hr	1.75 hr
Settle	1.0 hr	0.67 hr	0.75 hr
Decant	1.0 hr	0.75 hr	0.65 hr
TOTAL	4.8 hr	3.6 hr	3.0 hr

A cycle time distribution chart is shown in Figures 6.1, 6.2 and 6.3.

F. Estimated Waste Activated Sludge Production (WAS):

At Design (MMF)	900 kg/d or 106 m^3/d @ 0.85% solids

G. SBR Tank Design Details:

Number of SBR basins:	2
Volume of each basin (at max W.L.):	4,001 m^3
Top water level:	5.50 m
Bottom water:	3.89 m
Basin width:	15.0 m
Basin length:	48.5 m

H. Decanter

Number of decanters	One (1) per basin
Decanter length:	12.2 m (weir length)
Weir Loading (peak)	3.25 m^3/min/m of decanter weir
Decanter drive unit:	0.8 BHP

I. Aeration System Design

Type of aeration provided:	Fine bubble membrane disc diffusers
Design DO:	2 mg/L
Alpha factor:	0.65
Beta factor:	0.95
Theta:	1.024
Water temperature (max):	16°C
Number of Diffusers/basin:	962
Total Actual Oxygen Transfer (kg/d/basin):	831
AOR/SOR:	0.4842
SOR (kg/d/basin):	1,716
SOTR (kg/hr):	172
Avg. Aeration Depth (m)	4.1

- Max. Aeration Depth (m) 5.16
- Process Air Required (m^3/hr): 2,360

J. SBR Blowers

Number of blowers: 1 duty + 1 stand-by

- Type: High efficiency turbo with VFD
- Max. Blower output: 2,360 m^3/hr at 56 KPAG
- Motor horsepower: 100 hp

The SBR concept is shown in Figures D-101 and D-102 and a process flow diagram is provided in Figure D1-606 in Appendix B.

7.0 Effluent Equalization

The SBR basins will decant treated wastewater (effluent) by gravity to an Effluent Equalization (EQ) chamber on an intermittent basis. As the SBR is a batch process, this decant rate is significantly higher than influent flow to the SBR basin. The EQ chamber therefore provides a more uniform flow to the downstream disinfection system. In absence of an EQ chamber, the size of disinfection facility would have to be significantly larger to handle the high SBR decant rate.

The EQ chamber will consist of a single compartment concrete tank located between the SBR basins. The EQ basin will be equipped with submersible turbine pumps with variable frequency drive to transfer the SBR effluent from the EQ chamber to the disinfection system located on the main floor level. The pumps will be operated on a duty-standby mode. The pumping rates will be adjusted by variable frequency drives. Ultrasonic level probes will measure the water levels to control pump(s) start-stop sequences. A summary of the EQ tank and pumping system is as follows. The EQ plan is shown in Figure D-101 and D-102 in Appendix D and a process flow diagram is shown in Figure DI-607.

A. SBR Decant Volumes:

- Normal: 1,500 m^3/hr for 1 hr = 1,500 m^3
- Peak: 2,400 m^3/hr for 45 min = 1,800 m^3

B. EQ Pumping (UV Feed):

- Normal Pumping Rate: 990 m^3/hr
- Storm Conditions Pump Rate: 1,780 m^3/hr say 920 m^3/hr
- No. of EQ pumps: 2 (1 duty in series + 1 stand-by) c/w VFD

- Recommend Pumping capacity: 990 m^3/hr ~ 1,740 m^3/hr c/w VFD

ii. EQ Design Details:

- Operating Volume of Equalization Tank: 921 m^3
- Number of Tanks: 1
- Tank Dimensions
  - Tank width: 19.5 m
  - Tank length: 17.5 m
  - Max. water level: 2.7 m

Note: The effluent equalization tank will be provided with an emergency overflow pipe which will be connected to the existing outfall pipe.

8.0 Ultraviolet Disinfection

UV disinfection involves the use of ultraviolet light to inactivate pathogens in the wastewater. UV light is a physical and not a chemical disinfectant. UV light between the wavelength of 235 and 270 nanometers (nm) has been found to be effective to inactivate the target pathogenic organisms found in wastewater effluents. An UV disinfection system transfers electromagnetic energy from a mercury arc lamp to an organisms genetic material (DNA and RNA). When the UV light penetrates the cell wall of the microorganism, the microorganism is “inactivated” and rendered unable to reproduce or infect. The main component of the UV disinfection system consists of UV lamps, UV channel, lamp ballasts and control panel. The UV lamps can be configured in a horizontal or vertical configuration. The proposed design was based on a low pressure high output UV (LPHO) system horizontal lamp configuration.

A summary of the conceptual design is as follows:

A. Effluent Criteria:

- Meet Fecal Coliform limit of 200 MPN/100 mL
- Meet Total Coliform limit of 1500 MPN/100 mL
- Limit based on monthly geometric mean of a minimum of 12 grab samples a month.

B. Design Basis:

- % transmissivity: 60% (minimum)
- Design flow (disinfection): 990 m^3/hr or 275 L/s
- Maximum hydraulic capacity: 2,400 m^3/hr or 667 L/s
- Minimum UV dose: 30,000 mW-sec/sq. cm.

C. UV System Design Details:

- Type of system: low-pressure high output
- No. of channel: 1
- No. of banks 1 (no stand-by)
- No. of modules per bank 8

- No. of lamps per module: 8 in horizontal configuration
- Total no. of lamps: 64 (expandable to 104)
- End of lamp factor (Fp): 0.9
- Channel dimensions: 5.5 m (length) x 1.32 mm (width) x 1.57 m (deep)
- Number of Power Distribution Centers (PDC): 1
- Number of System Control Centers: 1
- Number of Level Controllers: 1
- Type of Level Controller: Weir
- Type of cleaning: Automatic in channel mechanical/ chem cleaning
- Other feature: Flow proportional dose pacing.

The UV disinfection floor plan is shown in Figure D-101 and a process flow diagram shown in Figure DI-607 in Appendix B.

9.0 Effluent Flow Monitoring and Outfall

9.1 EFFLUENT FLOW MONITORING

Most Environmental Act Licences issued by Manitoba Conservation and Water Stewardship requires monitoring of flows prior to discharge. An in-line magnetic flow meter is assumed on the discharge piping from the EQ pumps. Similar to influent flow monitoring, instantaneous and total flows will be recorded and tracked by the WWTP Supervisory Control and Data Acquisition (SCADA) system.

9.2 EFFLUENT OUTFALL PIPE AND OUTFALL STRUCTURE

The condition of the existing 375 mm (15 inch) steel outfall pipe is unknown. The outfall structure in the river could not be visually inspected due to accessibility in the winter. During the project initiation meeting, the City indicated that outfall structure is believed to be collapsed based on observed surging at the outfall manhole located at the riverbank. As stated in TM No. 2, the Functional Design assumes that the final effluent following UV disinfection will be discharged to the Burntwood River via a new 750 mm diameter outfall pipe and dispersed in the Burntwood River via a new outfall structure. The outfall pipe will extend approximately 50 m offshore and terminate at the outfall structure. The outfall will be provided with pre-cast concrete, bolt-on weights to keep it submerged at all times. The outfall structure will be a pre-cast concrete construction with peripheral openings to allow dispersion of the effluent into the river. The existing outfall pipe and outfall structure in the river will be abandoned in the future. As mandated by Fisheries and Oceans Canada, the construction of the outfall pipe and outfall structure must be carried out in a manner so that none of the following occurs:

- harm to fish or fish eggs
- destruction of fish or fish eggs
- harmful alteration, disruption or destruction of fish habitat.

The new outfall pipe from the proposed WWTP to the Burntwood River and the hydraulic profile are shown in Figures C-101 and DI-602 in Appendix B.

10.0 Sludge Processing and Disposal

10.1 GENERAL

The sludge handling practice in most WWTPs in Northern Manitoba (e.g., Flin Flon, Gilliam and Snow Lake) involves sludge stabilization, dewatering followed by disposal of dewatered biosolids (i.e., stabilized sludge) to a landfill. This is similar to what is currently being undertaken by the City. The Canadian Council of Ministers of the Environment (CCME) has approved a Canada-wide Approach for the management of wastewater biosolids on October 11, 2012. The approach encourages the beneficial use and sound management of municipal biosolids across Canada and does not promote disposal to landfills. The beneficial use takes advantage of the intrinsic value of the organic matter, nutrients, or energy content of the biosolids. Disposal to landfills is not being promoted due to increasing tipping fees, reduced landfill availability, and the understanding that landfill disposal does not capitalize on the resource contained in the biosolids. Some of the beneficial use options include composting, agricultural land application, land/forest reclamation and combustion for energy production. Based on our preliminary discussions with Manitoba Conservation and Water Stewardship, the Province has adopted this policy for all wastewater projects in Manitoba and is expecting that these be implemented at Thompson.

Land application of biosolids for the beneficial use of agriculture is not practical in Thompson. Also, the feasibility of land (mined and tailings pond areas) and forest reclamation opportunities can be challenging and combustion for energy recovery may require significant capital investments and environmental mitigation measures. Assuming that Manitoba Conservation and Water Stewardship will be insisting on a sustainable practice for disposal of biosolids and beneficial reuse, composting is one option that is worth considering in the future.

Recent discussion with the City indicates that there is a significant amount interest to convert the existing aerated lagoon site (following decommissioning) to a future composting facility. The City intends to develop this concept in the future and it is beyond the scope of this assignment to provide further details. It should be noted that there is currently no operating biosolids composting facility in Manitoba. The City of Winnipeg is currently in the early planning stages for developing a co-composting facility at the Brady Road Landfill site. The proposed functional design allows for utilizing the dewatered sludge in a future composting process or for use as a landfill cover material.

10.2 PROPOSED SLUDGE PROCESSING TRAIN

The sludge processing train is based on the characteristics of sludge anticipated from the secondary process. There will be no primary sludge generated in the WWTP. The key unit processes proposed is follows:

- Waste Activated Sludge (WAS) Pumping

- Aerobic Stabilization of WAS
- Sludge dewatering (Centrifuge)
- Centrifuge feed pumps
- Final disposal/beneficial reuse

A summary of the functional design is provided as follows:

10.3 WAS PUMPING

Design Basis:

- Pumping based on 15 minutes/cycle/basin
- 10 cycles/day for a total of 150 min/day or a total pumping time of 2.5 hrs/day.

A. Estimated WAS Production (based on 0.85% solids)

• AFF (future):	91 m^3/d
• MMF (future):	106 m^3/d

B. WAS pumping rate at:

• AFF :	91 ÷ 2.5 =	36 m^3/hr
• MMF:	106 ÷ 2.5 =	42 m^3/hr

Provide two (2) pumps (duty + stand-by) c/w VFD each rated at 21~42 m^3/hr.

Estimated motor size: 5 HP

The WAS pumps will be located in the lower level/basement as shown in Figure DI-102 in Appendix B.

10.4 SLUDGE STABILIZATION (AEROBIC DIGESTION)

• Sludge production at design MMF loadings:	106 m^3/d at 0.85% solids
• Influent suspended solids:	8,500 mg/L
• Number of digesters provided:	2 (each 50% capacity)
• Volume of each digester:	804 m^3
• Total volume of digester:	1,538 m^3
• SRT provided:	60 days > at 10° C
• Tank dimensions (each digester):	19.5 (L) x 7.5 (W) x 5.5 (max W.L.)
• Type of aeration system:	Fine Bubble (Stainless Steel)
• Type of supernatant decant system:	Automatic Telescopic valve (1 per tank)
• Solids concentration in digester:	1.2% (following supernatant decanting)

Aeration System:

• Type of diffusers:	Fine Bubble (Stainless Steel)
• Number of diffusers/digester:	580
• Total air-rate required:	1,461 m^3/hr (each digester)
• Number of blowers:	2 duty + 1 stand-by (shared with SBR)
• Estimated blower efficiency:	70%
• Estimated motor efficiency:	90%
• Blower output:	1,461 m^3/hr at 61 kPAG
• Motor horsepower:	60 hp

The location of the 2-aerobic digesters relative to the remaining SBR and EQ tanks are shown in Figures S-101 and D-102 and a process flow diagram is shown in Figure DI-612.

10.5 DIGESTED SLUDGE PUMPING (CENTRIFUGE FEED PUMP)

Design Basis: Digested sludge production at design loading and 40% VSS destruction in the digester (biological sludge only).

- Digested Sludge production at:
    - Design flow: 711 kg/D at 1.3 solids = 33 m^3/d
- Pump operates at 5 days/week at 8 hrs/day to match centrifuge operation.
- Rated capacity: 10 m^3/hr
- Number of units: Two (2) – duty/stand-by
- Type of pump: Progressive capacity
- Motor size: 7.5 HP

The Centrifuge Feed Pumps will be located in the lower level/basement as shown in Figures DI-102 in Appendix B.

10.6 SLUDGE DEWATERING (CENTRIFUGE)

Design Basis: Digested sludge production under design flow conditions and assuming maximum dewatering required at **<u>5 days/week at 8 hrs/day</u>**.

- Amount of digested sludge produced: 711 kg/d
- Volume of sludge at 1.3% solids: 55 m^3/d
- Volumetric loading: 10 m^3/hr (12 m$^{3/}$hr provided)
- Solids loading: 125 kg/hr (180 kg/hr provided)
- Solids capture efficiency: > 95%
- Amount of dewatered sludge: 675 kg/d
- Cake dryness > 18% solids (dry-weight basis)
- Dewatered sludge volume at 18% solids: 3.4 m^3/d
- Volume of centrate: 52 m^3/d

- No. of centrifuge provided: One (1)
- Main motor size: 40 hp
- Backdrive motor size: 10 hp
- Active polymer consumption: 8~12 active kg/tonne TS

10.7 FINAL DISPOSAL/BENEFICIAL REUSE

- Basis of design: Dewatered sludge will be stored in a roll-off-bin prior to being hauled to the Lanfill/future composting site on an as needed basis.
- Volume of dewatered sludge produced at MMF: 3.4 m^3/d
- Volume of sludge storage bin: 11.5 m^3 (15 cubic yard)
- Estimated holding capacity of dewatered sludge: 3.5 days (at MMF)

The dewatering room relative to the Sludge Storage Bin is shown in DI-101 and a process flow diagram is shown in Figure DI-612 in Appendix B.

11.0 Odour Control

Odours are expected from the following areas of the proposed WWTF:

- Headworks channel headspace (screen, grit removal)
- Sludge dewatering room
- Aerobic Digester tanks
- Dewatered Sludge/Screenings/grit bin storage room

To control the potential odour emission form the above areas/processes, a biofiltration system is proposed. The biofilters will be located on top of the SBR tanks. The biofilter is designed in a forced-draft, up flow configuration. Foul air enters the base of the tower and then passes up through the biotrickling media. This highly porous media provides an immobilized matrix, supporting a large microbial population, which forms a biofilm layer. As air comes in contact with this layer, hydrogen sulphide and other odourous compounds are solubilized and subsequently bio-oxidized to carbon dioxide and water by the microbes. The media and biofilm is kept adequately moistened by way of continuously re-circulated water maintaining proper air temperature, pH, moisture and nutrient levels are essential for favourable biofilter performance and removal efficiency. For this project, we intend to use the plant effluent as a water source for moisture control as well as a source of nutrient for sustaining the biological activity of the biofilter. The biofilter tower will be constructed out of FRP to address any corrosion issues. Also, the biofilter vessels will be insulated with polyurethane foam covered with 3 mm FRP jacket. The key parameters for the proposed biofilter are as folows:

- No. of biofilters: Two (2) – each 50% capacity
- Material of construction: FRP
- Foul air flow rate to be treated: 4,570 m^3/hr
- Media volume: 28.6 m^3 per vessel, 57.2 m^3 total
- Inlet foul air temperature: 5° to 40°C
- Ambient air temperature: -50° to 30°C
- Water hardness: 50 ppm or less
- Hydrogen Sulphide (H_2S) concentration: 15 ppm (avg.)
- Total reduced sulphur concentration: 1 ppm (avg.)
- Treated discharge H_2S concentration: less than 0.05 ppm

- Performance for H_2S removal: at least 99.6% removal
- For inlet air at 3,000 to 10,000 odor units (O.U.): at least 90% removal
- For inlet air below 3,000 O.U.: discharge < 300 O.U.
- Empty Bed Contact Time, total for all media vessels: at least 45 seconds
- Total weight of system with mature biofilm: 88,300 kg (max)
- Humidifier recirculation pump motor: 0.75 hp
- Exhaust fan motor: 7.5 hp
- Biofilter dimensions: 3.66 m in diameter, 4.6 m high
- Water consumption:
  - Humidification: 350 L/d (Continuous)
  - Irrigation: 285 L/d (Intermittent)

The location of the two (2) Biofilter towers are shown in Figure DI-101 and a process flow diagram is shown in Figure DI-612 in Appendix B.

12.0 Chemical Storage and Pumping System

12.1 GENERAL

The following chemical feed systems will be required for the Thompson WWTP project:

- Sodium Hydroxide (50%)
- Alum (48.5%)

A brief discussion on the proposed chemical feed system is provided as follows:

12.2 SODIUM HYDROXIDE

Sodium Hydroxide is provided for alkalinity supplement:

Raw wastewater alkalinity data provided by the City from May 16 to April 25, 2010 is as follows:

- Minimum: 126 mg/L as $CaCO_3$
- Maximum: 256 mg/L as $CaCO_3$
- Average: 194 mg/L as $CaCO_3$
- Recommended alkalinity level for design: 190 mg/L as $CaCO_3$

Alkalinity Balance:

Process	**Alkalinity Consumption/Required**	**Alkalinity Recovery/Present**
Alkalinity present in the influent		190 mg/L
Alkalinity consumed via nitrification (25 mg of NH_3-N to 1 mg/L of NH_3-N) at 7.1 mg/L of alkalinity per 1 mg/L of NH_3-N nitrified)	171 mg/L	
Alkalinity gained via denitrification to 25 mg/L of TN		54
Alkalinity consumed via Alum addition	38	
Min. alkalinity required in effluent	50 mg/L	
Total	**259 mg/L**	**244 mg/L**

- Hence total alkalinity supplement required: 259 - 244 = 15 mg/L as $CaCO_3$
- Alkalinity supplement provided: NaOH solution 50% strength and 1.523 S.G.
- Estimated Sodium Hydroxide provides 1.2 mg of alkalinity per 1 mg of NaOH
- Sodium Hydroxide dose required to supplement 15 mg/L of alkalinity.
  - At AAF of 6,000 m^3/d: 120 L/d
  - At MMF of 7,200 m^3/d: 144 L/d
- Total volume required for 30-day storage based on MMF of 7,200 m^3/d = 4,300 L
- Sodium Hydroxide is shipped in tankers with 13,072 L capacity. Hence, storage required = 13,072 L + 30% = 16,994.
- Storage tank provided (double wall tank): 20,912 L
- Tank dimensions: 3 m in diameter and 4.4 m high
- The pumping system consists of (1) one duty plus (1) stand-by rated at 5 L/hr ~ 10 L/hr.

12.3 ALUM

Alum addition is required to chemically precipitate the residual soluable phosphorus such that the total effluent Phosphorus (TP) of $\leq$ 1.0 mg/L can be maintained on a 30-day rolling average. A summary of the assumptions and design basis is provided as follows:

- Influent TP: 5.5 mg/L
- Target Effluent TP: 0.9 mg/L
- P removed via biological P removal: 2.7 mg/L
- Chemical P removal required: 5.5 – 2.7 – 0.9 = 1.9 mg/L
- TP removal required:
  - At AAF: 11.4 kg/d
  - At MMF: 13.7 kg/d
- Estimated Alum required for Chem-P removal: 30 L/kg of P-removal
- Alum required
  - At AAF: 342 L/d
  - At MMF: 411 L/d

- Storage required for 30 days at design MMF: 12,330 L
- Alum is transported by bulk tanker of capacity 15,000 L. Minimum storage required = 12,330 + 30% = 16,029 L.
- Storage tank provided (double-wall) 20,912 L
- Tank dimensions: 3 m diameter and 4.4 m high
- Alum pumping system is based on the chemical being dosed over the last 15 minutes of the last aeration period of each cycle (prior to the settling period).
- Total cycles/day: 10
- Total pumping/day: 10 cycles x 15 min./cycle ÷ 60 min/hr
  = 2.5 hrs/d
- Avg. feed rate: 342 L ÷ 2.5 hr/d
  = 136.8 L/hr. ,say a140 L/hr
- MMF feed rate: 411 L ÷ 2.5 hr/d
  = 164.4 L/hr. ,say a170 L/hr
- Provide 1 duty + 1 stand-by feed pump rated at 200 L/hr.

13.0 Structural Components

This section describes the structural components of the Operation Building, SBR tanks, effluent equalization digesters and basement.

13.1 CODES AND STANDARDS

Manitoba Building Code, Reg. 31/2011.

National Building Code of Canada, 2010

CAN/CSA A23.1-09 Concrete Material and Methods of Concrete Construction

CSA-A23.2-04 Methods of Test and Standard Practices for Concrete

CSA-A23.3-04 Design of Concrete Structures.

CSA-A371-04 Masonry Construction for Buildings.

CAN/CSA-A3000-03 Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

CAN/CSA-A3001-03 Cementitious Materials or Use in Concrete.

ACI 350-06 Code Requirements for Environmental Engineering Concrete Structures and Commentary

CAN/CSA-S16-01 Limit States Design of Steel Structures.

CAN/CSA-S16S1-05 Supplement No.1 to CAN/CSA-S16-01, Limit States Design of Steel Structures.

13.2 DESIGN CRITERIA

All concrete elements in contact with water shall be designed to the requirements of ACI-350.

Other concrete elements not in contact with water to the requirements of CSA23.3.

Underground tanks and basement will be designed to resist the buoyant uplift assuming the water table at grade unless a suitable perimeter drainage system with appropriate back-up is provided.

Design Live load:

- Office, electrical and Laboratories areas: 4.8 kPa.
- Process areas: 14.4 kPa+ equipment and tanks.
- Roof: Snow+ drift load, mechanical equipment.
- Stairs, landings, and elevated platforms: 4.8 kPa.

Building and structures should be treated as “Post Disaster”.

Soil: As per geotechnical report in Appendix B. Additional geotechnical investigation may required during the detailed design phase.

13.2.1 Superstructure

The superstructure of the proposed Headworks/Operation Building and Decanter/Disinfection Building will be concrete block masonry wall. Roof will be with metal deck supported by gable steel joists. There will be a hoist over the headworks, and UV channels. Monorail hoist beams will be supported from the concrete block masonry wall and/or roof frame. Interior partitions will be constructed using concrete block masonry as well.

The UV channels will be sunk in the main floor slab above the EQ tank. The main floor slab above the SBR, EQ and digesters that are located outside the proposed operations building footprint will be constructed with pre-cast slab. All concrete within the proposed building footprint will be cast-in-place concrete.

13.2.2 Substructure

The SBR tanks, EQ Chamber, aerobic digester and the basement will be founded on a below grade reinforced concrete raft slab. The tanks walls will also be constructed using cast-in-place reinforced concrete. The entrance vestibule, workshop, sludge/screenings/grit storage bin room, dewatering room and chemical storage room will be constructed on a structural slab supported by concrete pillars off a raft slab extended for this area. The main floor slab (both cast-in-place and precast will be supported by concrete columns along the length of the tank.

All underground concrete will be minimum of S-2 class exposure for severe sulphate attack.

13.2.3 Corrosion Protection

To address likely problems with hydrogen sulphide, allowances have been made to provide epoxy coating on the Concrete Channels in the Headworks Room. The coating will be applied on all concrete surfaces in contact with wastewater and in the head space above. Application of the coatings will be as per manufacturer’s instructions.

13.2.4 Waterproofing

Crystalline waterproofing will be applied on the inside face of walls and raft slab of SBR Tanks, aerobic digestion tanks, equalization tanks and UV chambers. Dampproofing will be provided on the exterior of all underground walls.

The foundation plan is shown in Figure S-101 in Appendix B.

14.0 Architectural Components

14.1 INTRODUCTION

Both the proposed Headworks/Operations Building and the Decanter/Disinfection Building will be constructed of durable, readily available, low maintenance materials to reduce operation and maintenance costs.

Design and materials are to meet or exceed the Manitoba Building Code, National Building Code, and Manitoba Water Services Board standard specifications.

14.2 BUILDING ENVELOPE

Both the Headworks/Operations Building and the Decanter/Disinfection Building will have similar construction assemblies and building envelopes.

The exterior walls will be clad with coloured architectural concrete block veneer in split face and smooth face patterns with a vented air space on the bottom 3 metres and clad with galvalume metal cladding with a vented air space above the 3 metre mark. Both lower and upper portions of the walls will have rigid insulation, an air/vapour barrier and load-bearing concrete block.

The roofing will consist of a galvalume standing seam metal roof, board insulation, air/vapour barrier, deck sheathing over the galvanized metal roof deck. Perimeter coping and roof flashings will be 24 gauge galvalume metal with purpose made rubber cone flashings at roof penetrations for pipes, conduit, etc. Equipment supports are to be secured to the roof and embedded in the roofing with metal counter flashing.

Windows will have anodized aluminum frames, incorporating thermal breaks, extruded aluminum sills, and operable sections with insect screens. Glazing will be double-glazed sealed units, argon-filled with low-e exterior coating. Operable sections will be awning type, outward opening, with aluminum insect screens. Window coverings will be solid vinyl vertical blinds with metal tracks and hardware.

14.3 BUILDING INTERIORS

All concrete floors in process areas, unless otherwise stated, are to receive a non-metallic hardener and liquid applied sealer.

The floors in the Operations Building main corridor, office areas, Laboratory and washroom are to receive sheet vinyl flooring with welded seams and 100mm high rubber base. The floors in the UV Disinfection Room, Decanter Room, Blower Room, Electrical/MCC Room, Headworks Room, Workshop, Sludge Dewatering Room, and stairwell, landings and basement are to be painted with a non-slip polyurethane paint. The floors in the Chemical Feed Room will be coated with an epoxy coating system resistant to the chemicals stored there.

All interior partitions/walls, unless otherwise stated, are to be constructed of non-loadbearing concrete block. The masonry partitions/walls in the Operations Building main corridor, office areas, Laboratory and Washroom will be painted with block filler and two coats of alkyd paint. The masonry walls enclosing the Blower Room will be constructed of sound absorbing acoustic block and left un-painted. The roof deck above the Blower Room will have acoustic roof deck to help mitigate sound levels within the room.

Suspended acoustic tile ceilings with recessed fluorescent lighting will be provided in the Operations Building main corridor, office areas, meeting/lunch room and Laboratory. Moisture resistant gypsum board ceilings will be used in the washroom.

Interior doors will be galvanized hollow metal set in galvanized hollow metal frames. Exterior doors will have insulted polyurethane cores and thermally broken frames with weather-stripping and aluminum thresholds. Weather-stripping will be provided on all exterior doors, doors in the Blower Room (for sound control) and for all doors in fire separations (for smoke control).

Hardware will generally be industrial grade, including stainless steel ball bearing hinges, rim mounted exit devices at exterior doors, bored lever handle lock sets at interior doors, and door closers with door stops at all doors. Kick plates are to be installed on all doors. Keying will comply with an approved master key system.

Roof hatches above the below-grade spaces in the Sludge Handling Building will be of aluminum construction with insulated pre-fab curbs and insulated lockable covers.

Metal stairs and landings are to be constructed of aluminum channels and structural framing supporting aluminum grating with abrasive nosings. Handrails and guards of aluminum tubing in anodized finish.

14.5 CONCEPTUAL DRAWINGS

The architectural floor plans, building elevations and 3-D renderings are shown on Figures A-101 to A-105 in Appendix B.

15.0 Electrical Systems

15.1 GENERAL

This section covers the functional design for the wastewater treatment facility’s new electrical power and distribution systems. These systems include main service, power distribution, motor control, lighting and miscellaneous building electrical systems.

15.2 MAIN SERVICE

A new 347/600 volt, 3-phase, 4-wire overhead main service will be provided for the proposed new WWTF building. Manitoba Hydro will provide the required pad mounted transformer, cables, protection equipment, and connections to the line-side of the service transformer.

The incoming service conductors, from the load-side of the service transformer, will be terminated on a main service entrance breaker mounted in Section 1 of a motor control centre (MCC) located in the Electrical Room. Preliminary sizing of plant electrical loads indicates a main service size of 1600 amps will be required. This service is sized to accommodate all required electrical loads including future process expansion.

Outdoor metering will be provided, powered from utility transformers mounted in Section 1 of the MCC directly below the main breaker.

Details of the proposed single line and the main power service distribution system are provided on Drawing E-101 in Appendix B.

15.3 POWER DISTRIBUTION

In addition to the main service entrance breaker and utility metering equipment, the MCC will house the automatic transfer switch, main surge protection device (SPD), harmonic filter, process equipment starters and VFDs, equipment circuit breakers and a control section. From here, 600V electrical power will be sub-distributed throughout the new building as required to feed all 3-phase motors and major electrical loads.

600 volt, 3-phase power will be utilized for all motors over ½-hp and all primary HVAC equipment.

A 45 kVA, 600V:120/208V volt dry-type transformer will feed a power distribution panelboard “A” to provide for lighting, receptacles, small motors, miscellaneous 120 volt loads, etc., in the new wastewater treatment plant.

A separate 600V, 3-phase power panelboard “H” will provide power for all vendor equipment panels (e.g., UV System, Centrifuge, Biofilters, etc.) that require such power.

15.4 EMERGENCY POWER

An outdoor diesel generator will be provided to back up all loads critical to the new building's operation. The generator will operate in conjunction with the transfer switch in the MCC to automatically transfer from normal utility power to emergency generator power during a power outage. The generator will be capable of backing up the following systems:

- All lead and duty process pumps;
- All vendor packages;
- Basic building electrical systems; and,
- Critical HVAC loads.

The generator system will be designed to automatically energize on utility failure, with a delayed shutdown on return to normal power. Preliminary sizing of the new wastewater treatment building's electrical loads indicates a 750 kW generator will be required to maintain normal facility operation during power outages.

The generator unit will be housed in a stand-alone outdoor enclosure located adjacent to the new building. The enclosure will be a self-contained structure housing the generator unit, fuel supply system, generator controller, etc., in addition to all necessary electrical, mechanical and HVAC systems required to support the generator's operation.

Details of the proposed emergency power system are included in the single line diagram provided on Drawing E-101 in Appendix B.

15.5 LIGHTING

15.5.1 General

The indoor lighting for the building will consist of industrial fluorescent lighting fixtures complete with energy saving ballasts and lamps controlled from local switches. Security lighting will consist of outdoor wall-mounted L.E.D. lighting fixtures controlled by photoelectric cells.

15.5.2 Emergency Lighting

Emergency lighting will be provided via ceiling-mounted dual-purpose fixtures. Each strategically placed fixture will contain its own battery-backup and will illuminate during any power outages to the regular building lighting circuits, or when called by the normal lighting switches.

15.6 MISCELLANEOUS ELECTRICAL

Wiring in the new building will be Teck90 in cable tray, or run in rigid PVC conduit and junction boxes, both in the wet corrosive areas and in the ordinary dry areas. Branch circuit wiring will be a minimum of #12 RW90. All conductors are to be copper. Feeders and major power circuits will be aluminium-sheathed PVC-jacketed copper cables, or equivalent conductors in conduit.

Receptacles and switches will be specification grade, installed in PVC boxes and covers, and weatherproof rated as required. Outdoor car block heater receptacles will be provided for employee parking.

A system of raceway, cabinets and outlets will be provided for telephone distribution, to the requirements of Manitoba Telecom Services (MTS). The MTS cost of service to the wastewater treatment plant will be included.

Motors shall be TEFC or submersible rated, of the latest energy efficiency design and in conformance with Manitoba Hydro’s Power Smart Program rating for energy efficiency where applicable.

All motor starters will be provided with HAND/OFF/AUTO selector switches, ammeters, elapsed time meters and disconnects to code requirements. Motors on VFDs will be provided with individual Human Machine Interfaces (HMIs) for manual speed control.

A multiple zone security system will be installed. A suitable arrangement of detection devices will be installed including door contact switches, motion sensors, etc. The security system will be tied into the facility alarm system.

16.0 Instrumentation and Control Systems

16.1 GENERAL

This section covers the functional design for the new treatment building's instrumentation and control system. This will include the Supervisory Controls and Data Acquisition (SCADA) system in addition to all of the monitoring and control devices throughout the building.

16.2 SCADA SYSTEM

A SCADA system will be installed to provide building-wide monitoring and control. The SCADA system operator station will consist of two personal computer stations located in the office, each complete with a 24" monitor. These two PCs will be connected to a local printer, a UPS, and to a remote backup harddrive. From this location an operator will be capable of monitoring all plant equipment operation and function. The operator will have the capability to adjust set points, turn equipment on and off, and monitor operational trends from real-time graphs (e.g., distribution flow, system pressure, tank levels, etc.). Software will be provided to allow for remote access to this system from any PC station, equipped with compatible software, via a telephone-to-Ethernet modem.

The SCADA computer operating platform will be Microsoft Windows. The report generation software will be designed to provide automatic report generation without the need for operators to develop their own templates. The system will also be configured to allow for password-protected secure remote access.

All of the system control logic functions will be monitored and controlled via several Programmable Logic Controllers (PLCs). A PLC is made up of a main Central Processing Unit (CPU) in addition to digital and analog signal input/output cards. The CPU houses the control firmware and software which provide the digital and analog functionality that monitors and controls equipment operations. The I/O cards provide the interface between the CPU and the various field devices. This facility will be provided with the following PLCs:

1. Main plant PLC located in the MCC controls Section.
2. Centrifuge System PLC.
3. UV System PLC.

The primary communication protocol between the SCADA PCs and the various PLCs will be via Ethernet/IP. This protocol will also be utilized to tie-in the following equipment / systems into the SCADA system:

1. "Intelligent" MCC components (starters, VFDs, etc.).

2. Automatic transfer switch.

3. Emergency Generator.

4. HMI displays (at MCC control section).

5. Panel power monitors.

The Ethernet/IP protocol allows for extensive equipment monitoring, control, data transfer, diagnostics, etc., capabilities over a reliable network utilizing a single CAT 6 cable per device.

Details of the proposed SCADA System architecture showing all system equipment and communication interconnections are shown on Drawing E-102 in Appendix A.

16.2.1 Instrumentation

All analog field instrumentation (e.g., flowmeters, level sensors, pressure transducers, etc.) will be provided with 4-20mA analog signals to transmit process variables to the SCADA system. Flowmeters will additionally provide a configurable pulse output to the SCADA system to allow for accurate flow volume totalization.

16.3 PROCESS & INSTRUMENTATION DIAGRAMS (P & IDS)

Prelminary P & IDs for the proposed WWTP new building are shown in Figures DI-603 to DI-614 in Appendix B.

17.0 Building Mechanical Systems

17.1 GENERAL

The heating, ventilation and air conditioning systems for the proposed WWTP with Office/Control Room, Storage Room, Washroom, Laboratory, Meeting/Lunch Room, Electrical Room, Vestibule, Corridor, Workshop, Headworks, Chemical Room, Dewatering Room, Sludge Bin Room, Blower Room, UV Disinfection Room, Decanter Rooms and Pump Room in Basement will be designed in accordance with the following codes:

- 2010 National Building Code, including Manitoba Amendments.
- 2010 National Plumbing Code, including Manitoba Amendments.
- 2010 National Fire Code.
- National Manual of Good Practice for Biosolids by Water Environment Research Foundation (WERF).
- NFPA 820-2012.
- ASHRAE 62.1-2010

17.2 CLIMATIC DATA

The elevation of the WWTP is approximately 205 m above sea level. The climatic conditions for Thompson located at 55º 44’, 97º 51’, is as follows:

- Winter: 2.5% January Design Temperature = -40.0 ºC (-40.0 ºF).
- Summer: 2.5% July Design Temperature = Dry Bulb 27 ºC (80.6 ºF) and Wet Bulb 19 ºC (66.2 ºF).

17.3 VENTILATION CRITERIA

Criteria for establishing ventilation rates for covered wastewater processes include:

- Maintenance of negative pressure between operation area and process areas.
- Maintaining a safe work environment. If the enclosure will be entered routinely, the hydrogen sulfide (H_2S) concentration must remain below 10 ppm.
- Minimize the potential for buildup of combustible gases such as methane.

- Control hydrogen sulfide levels to reduce corrosion.
- Control corrosive liquids or vapors that are likely to be present in quantities that are likely to interfere with the normal operation of electrical equipment.

17.4 VENTILATION AIR EXCHANGE RATE

AREA	AIR CHANGE RATE	NOTES
Office/Control Room	1.1	ASHRAE 62.1-2010
Meeting/lunch Room	2.3	ASHRAE 62.1-2010
Laboratory	2.6	ASHRAE 62.1-2010
Electrical Room	6.0	“Free cooling” exhaust
Washroom	15.0	ASHRAE 62.1-2010
Corridor	0.5	ASHRAE 62.1-2010
Workshop	2.5	ASHRAE 62.1-2010
Blower Room	6.0	“Free cooling” exhaust
Headworks	12.0	NFPA 820-2012
Chemical Room	6.0	NFPA 820-2012
Dewatering Room	12.0	NFPA 820-2012
Sludge Bin Room	12.0	NFPA 820-2012
UV Disinfection Room	6.0	NFPA 820-2012
Decanter Rooms	6.0	NFPA 820-2012
Pump Room in Basement	6.0	NFPA 820-2012

17.5 BUILDING INTERIOR CLIMATE

The basic building heating systems will be designed using electrical power as the primary source of heating. Heat recovery unit (HRV) C/W electric heating and DX cooling will be designed to provide ventilation in Operation area. The DX split air conditioners (ACs) C/W supplemental electric heating coils or electric unit heaters will be designed to provide heating/cooling and backup heating in this area. Makeup air units (MUAs) C/W electric heating and additional external exhaust fans will be designed to provide ventilation in Process areas. The electric unit heaters will be designed to provide regular and backup heating in these areas.

Operations Area Minimum Temperature	21 Degrees C
Operations Area Maximum Temperature	24 Degrees C
Operations Area Ventilation Air Rates in accordance with ASHRAE 62.1-2010	
Relative Space Pressurization	Positive
Headworks Area Minimum Temperature	16 Degrees C
Headworks Maximum Temperature	38 Degrees C
Headworks Ventilation Air Change Rate	12 per hour
Relative Space Pressurization	Negative
UV and Decanter Rooms Minimum Temperature	16 Degrees C
UV and Decanter Rooms Maximum Temperature	38 Degrees C
UV and Decanter Rooms Ventilation Air Change Rate	6 per hour
Relative Space Pressure	Negative
Pump Rm in Basement Min. Temp.	16 Degrees C
Pump Rm in Basement Max. Temp.	38 Degrees C
Pump Rm in Basement Ventilation Air Ch. Rate	6 per hour
Relative Space Pressure	Negative
Chemical Feed Room Minimum Temperature	16 Degrees C
Chemical Feed Room Maximum Temperature	38 Degrees C
Chemical Feed Room Ventilation Air Change Rate	6 per hour
Relative Space Pressurization	Negative

Sludge Bin and Dewatering Rooms Minimum Temperature	16 Degrees C
Sludge Bin and Dewatering Rooms Maximum Temperature	38 Degrees C
Sludge Bin and Dewatering Rooms Ventilation Air Change Rate	12 per hour
Relative Space Pressurization	Negative
Blower and Electrical Rooms Minimum Temperature	16 Degrees C
Blower and Electrical Rooms Maximum Temperature	38 Degrees C
Blower and Electrical Rooms “Free Cooling” Exhaust Air Ch. Rate	6 per hour
Relative Space Pressure	Negative

Controls for all buildings will be direct digital type, with an alphanumeric English language wall mounted keypad user interface.

17.5 BACKUP HEATING

In the event of an electrical power interruption, electrical resistance backup heating such as unit heaters and ACs indoor units with electric duct heaters would maintain the building interior temperature above freezing (+10ºC) but not of a size to provide human comfort (+20ºC). The backup heating will be sized to offset only the building skin losses and keep the building above freezing. The backup heating will be connected to the backup generator.

17.6 OPERATION AREA

The Operation area consisting of the office control room, meeting / lunch room, laboratory, corridor, workshop, storage room, washroom and electrical room will be ventilated with an electric heat recovery unit (HRV), heated/cooled with split DX ACs or heated with electric unit heaters. The HRV unit will be equipped with a supply and exhaust fan, MERV 3 filter, a direct expansion cooling coil, remote condensing unit and electric heating. Unit will be located on tanks’ roof outside the building.

Supply air from HRV will be ducted to every room in the Operation area and transferred to corridor. The corridor between the headworks and the operation areas will be pressurized as will the entire operations area. The Air from corridor will be transferred to washroom and exhausted through HRV.

Local exhaust fans (EF) and mini makeup air units (MMUA) will be provided in the laboratory, lunchroom and the Maintenance Room. Each MMUA will be interlocked with related to this unit EF.

The thermostat that controls the space temperature will be located in each room.

The entrance vestibule will be equipped with an electric unit heater with an integral thermostat for additional comfort.

17.6.1 Storage Room and Corridor

Supply air will be ducted to the room via ceiling diffusers and return air will be extracted via ceiling grilles. Outside air will be ducted to unit heater return air inlet.

17.6.2 Electrical Room

The electrical equipment generates heat and rejects it into the room. The air exchange rate is used to remove heat from the room. The EF will provide “free cooling” by exhausting hot air to outside.

17.6.3 Laboratory

Supply air will be ducted to the room via ceiling diffusers and return air will be extracted via ceiling grilles. Outside air will be ducted to AC indoor unit return air inlet.

A chemical fume hood will be provided to capture and exhaust toxic fumes from laboratory tests conducted by the operator. A corrosion resistant fan exhausts the air to the exterior. The mini makeup air unit (MMUA) will compensate exhausted air.

17.6.4 Meeting / Lunch Room

Supply air will be ducted to the room via ceiling diffusers and return air will be extracted via ceiling grilles. Outside air will be ducted to AC indoor unit return air inlet.

A manually operated exhaust fan would be provided to remove cooking fumes from the area. The mini makeup air unit (MMUA) will compensate exhausted air.

17.6.5 Office/Control Room

Supply air will be ducted to the room via ceiling diffusers and return air will be extracted via ceiling grilles. Outside air will be ducted to AC indoor unit return air inlet.

17.6.6 Workshop

Supply air will be ducted to the room via ceiling diffusers and return air will be extracted via ceiling grilles. Outside air will be ducted to AC indoor unit return air inlet.

A manually operated exhaust fan would be provided to remove different fumes from the area. The mini makeup air unit (MMUA) will compensate exhausted air.

17.6.7 Washroom

The Washroom exhaust air grilles would be connected to HRV exhaust air system.

17.6.8 Headworks, Dewatering Room and Sludge Room

The portion of the proposed building and structures will be heated by electric unit haters and ventilated by an electric heat makeup air units (MUA) and exhaust air fans (EF). All MUAs and EFs will be located on tanks' roof outside the building.

A series of supply air grilles will distribute the air from MUA to these rooms. A series of exhaust air grilles will collect the air and EFs will exhaust this air to outside. The grilles and exhaust air ductwork will be fabricated with stainless steel and the supply air ductwork would be constructed with galvanized steel with epoxy painted exterior.

17.6.9 UV Disinfection Room, Decanter Room, Chemical Room and Basement

The portion of the proposed building and structures will be heated by electric unit haters and ventilated by an electric heat makeup air units (MUA) and exhaust air fans (EF). All MUAs and EFs will be located on tanks' roof outside the building.

A series of supply air grilles will distribute the air from MUA to these rooms. A series of exhaust air grilles will collect the air and EF will exhaust this air to outside. The grilles will be fabricated with aluminum, the exhaust air ductwork with stainless steel and the outside air ductwork with galvanized sheet metal with epoxy painted exterior.

17.6.10 Blower Room

The blowers generate heat and reject it into the room. The air exchange rate is used to remove heat from the room. The EF will provide "free cooling" by exhausting hot air to outside. The exhaust air ductwork with stainless steel and the outside air ductwork with galvanized sheet metal with epoxy painted exterior.

17.6.11 HVAC Controls

Thermostats will be strategically positioned in the space environment to control the heating.

Controls for all buildings will be direct digital type, with an alphanumeric English language wall mounted keypad user interface.

The operation of ventilation equipment, fans and heating units, will be monitored at the office control room desktop. The run / fail status would be graphically represented on a desk top screen.

18.0 Site Development

18.1 GENERAL

The site plan showing the proposed works is shown in Figure C-101 in Appendix B.

18.2 FIRE PROTECTION

No dedicated fire protection system such as sprinkler is provided. The Headworks/Operations Building and the Decanter/Disinfection Building will be equipped with several fire extinguishers. Additional services will be provide by the City's Fire Department.

18.3 ROADWAYS AND PARKING

Access to the WWTP site will be via an existing approach from the Nelson Road.

All roadways and parking areas within the WWTP site will be constructed with gravel limestone of various sizes and thickness. A total pavement thickness will be 600 mm for roadways and 450 mm for the parking areas is proposed. This material would be placed on a suitable, compacted subgrade.

A 200 mm reinforced concrete pad is included in the truckhaul wastewater receiving.

18.4 SITE DRAINAGE

Surface works will be graded at a minimum slope of two (2) percent to ensure positive drainage.

18.5 TOPSOIL, MINOR LANDSCAPING

Topsoil, seeding and selective landscaping would be provided along all non-roadway/parking areas.

18.6 FENCE EXTENSION & GATES

The proposed WWTP site is already in a fenced area with a manual locking gate separating the site from the adjacent residential area.

19.0 Decommissioning

19.1 GENERAL

The decommissioning of the existing City's aerated lagoon and the WWTP will be undertaken following successful commissioning and start-up of the proposed centralized WWTP. Key aspects associated with decommissioning of these facilities are discussed in the following sections. Associated costs are presented in Section 23.0.

19.2 DECOMMISSIONING OF THE AERATED LAGOON

19.2.1 Sludge Volume and Characteristics

A desktop analysis was done to develop potential options for lagoon decommissioning. No attempt was made to quantify sludge or obtain a sample of the sludge chemical composition.

The existing lagoon has never been cleaned since it was put into operation in 1970. As a part of the study undertaken by UMA in 1998, sludge depths were measured along a grid of 9 points across the open water surface of the lagoon cell. A minimum three sludge depth measurements were taken at each location to verify the results. The depth of sludge varied from 0.38 m to 1.07 m (refer to UMA 1998 Report, Figure 2.3) and the total sludge accumulation was estimated to be 4,300 m^3. Sludge analysis indicated that approximately 10 to 25% of the sludge content was slag. Slag from Vale operation has been used as bedding and backfill material for the construction of sewers and has a tendency to infiltrate into the pipes through leaky joints. Disposal of accumulated sludge in the lagoon presents a similar challenge with disposal of biosolids (stabilized or digested sludge) from the WWTP. Due to high moisture content, some form of dewatering is warranted prior to final disposal. As a part of the lagoon decommissioning, we have assumed that once the lagoon is off-line, the liquid should be drawn down and discharged via the existing outfall. This will allow the accumulated sludge to dry. When the lagoon is dewatered, a more accurate estimate of sludge volume may be obtained. The accumulated sludge will be will removed and disposed to the landfill.

To estimate the current sludge accumulation, the following desktop analysis was conducted:

- Average sludge depth (accumulation from 1970 to 1998 or approx. 28 years): 0.47 m
- Assume additional 50% from 1998 to 2013 (i.e., 15 additional years): 0.71 m
- Lagoon end and slide slopes are 3:1 and bottom dimensions are 80 m by 113 m
- The estimated sludge volume in 2013: 6,600 m^3

Assuming a 50% safety factor, the estimated sludge volume = 1.5 * 6,600 m^3 = 9,900 m^3 say, 10,000 m^3.

Sludge quality can be determined once the lagoon is decommissioned prior to final disposal.

19.3 DECOMMISSIONING OF THE WWTP

The key components that will require decommissioning will include the existing primary clarifiers, anaerobic digesters, sludge dewatering, primary sludge pumping system and associated piping.

All existing tanks will be emptied of any sewage or sludge prior to demolishing the structures or any superstructure housing it. The City may choose to retain the existing WWTP building for a future use as a storage facility. The walls and bottom of the process tanks and digesters will then be hosed and disinfected. Sewage and liquid wastes will be hauled to the new truck haul wastewater receiving station while the sludge would be disposed of to the landfill following dewatering (existing filter press). The tanks, digesters and clarifiers would be backfilled and capped off with lean concrete mix. The area would be cleaned off of any debris, top soil applied and seeded.

20.0 Miscellaneous Plant Systems

20.1 GENERAL

This section briefly describes miscellaneous systems to be incorporated in the WWTP.

20.2 POTABLE WATER

There is currently City's piped water service available at the existing site. For this project, the existing watermain well will be extended to the proposed WWTP buildings.

Portable water is require for domestic use such as sinks, shower, eye wash stations, washing machine, toilet, polymer dilution water and WWTP plant washdown and plant flushing. The potable water demand is estimated to be 3.75 L/s (including a 25% safety factor) or approximately 50 usgpm. The supply system will consist of the following components:

20.3 AUTOMATIC SAMPLING

Two (2) refrigerated automatic composite samplers will be provided. They will be located respectively at the headworks area for influent sampling and one in the UV room for sampling the final effluent (following UV disinfection).

21.0 Facility Classification and Staffing Requirements

Classification of treatment facilities and certification of operators is currently mandatory based on Regulation No. 77/2003 titled “Water and Wastewater Facility Operators Regulation” passed April 23, 2003 by the Manitoba Government and amended November 1, 2005 and March 13, 2007. The legislation requires mandatory certification by examination, of all treatment and distribution facility operators in Manitoba. The intent of the legislation is that the operator will have to be certified to a level dictated by the complexity of the facility that they operate, and be retested every 5 years. Wastewater treatment facilities are classified in classes 1 to 4 in accordance with the following table, on the basis of the number of classification points assessed under the classification point system set out in the Water and Wastewater Facility Operators Regulation.

RANGE OF CLASSIFICATION POINTS	WWTP CLASSIFICATION
0 to 30	Class 1
31 to 55	Class 2
56 to 75	Class 3
76 or more	Class 4

The estimated number of classification points for the proposed facility is presented in Table 21-1. The following classification was developed based on the population and flows stated in Section 2.0 – Design Criteria.

Table 21-1: Proposed Regional WWTP Estimated Classification Criteria

Classification Criteria	**Points**
Size (2 point minimum to 20 point maximum)	
• Maximum population or part served	1
• Design flow based on maximum month	1
Variation in Raw Waste:	
• Recurring deviations or excessive variations of 100%-200% in strength and flow	2
• Septage or truck-hauled waste discharge accepted at the facility	2

Classification Criteria	**Points**
Preliminary treatment • Facility pumping of main flow • Screening or comminution • Grit removal	 3 3 3
Secondary Treatment: • Activated Sludge	 15
Tertiary Treatment: • Biological or chemical/biological advanced waste treatment (includes alum addition for P removal)	 12
Additional Treatment Process: • Chemical addition (Polymer, sodium hydroxide)	 4
Solids Handling: • Aerobic digestion of soilds • Mechanical dewatering • Disposal in landfill (See note below)	 6 8 2
Disinfection: • Ultraviolet irradiation	 5
Effluent Discharge: • Discharge to surface water	 0
Instrumentation: SCADA or similar instrumentation systems are used to provide: • Data with moderate process operation	 4
Laboratory Control • Bacteriological/Biological – lab work done outside • Additional procedures such as DO, COD, BOD, gas analysis, titration, solids content or volatile content	 0 5
Total	**76**

Note: if composting is implemented in the future, solids disposal points will change from 2 (landfill) to 10 (composting), resulting in a net 84 total points for the City.

Based on Table 21-1 above and our preliminary evaluation, the proposed Regional WWTF is estimated to have 76 classification points. This would likely result in a Class 4 facility and the operator-in-charge would therefore require a Class 4 Operators Certificate. The final designation will depend on a review conducted by Manitoba Conservation following project completion.

22.0 Project Implementation

22.1 GENERAL

The implementation of the proposed Regional WWTF is subject to available funding and Environmental approval. The following provides a tentative schedule.

• Submit draft Functional design to MWSB/City	November 19, 2013
• Conduct Public Open House	November 26, 2013
• Obtain Comments/Finalize Functional Design	December 13, 2013
• Submit Environmental Act Proposal to Manitoba Conservation and Water Stewardship	January 24, 2013
• Receive Environmental Act Licence (estimated)	May 2014

Design and Construction (Estimated)

• Complete Detailed Design	June 2014 to December 2014
• Tender proposed works	February/March 2015
• Construction Contract Award	May 2015
• Construction Period	May 2015 to December 2016
• Commissioning/Start-up	January 2017
• Performance testing	April 2017
• Substantial Completion	May 2017

23.0 Opinion of Probable Construction Costs

23.1 GENERAL

This section outlines the opinion of probable construction costs based on the level of details developed in this functional design report. These costs are based on best available information available to date and contain contingencies and estimation allowances to allow for details yet to be designed and uncertainty in the tendering process.

23.2 OPINION OF PROBABLE COSTS

A summary of the costs are presented below. A detailed breakdown is provided in Appendix D.

	Description		**Total Amount**
A.	Headworks	$	3,201,000
B.	Truck Haul Wastewater Receiving Station	$	193,000
C.	Secondary Process	$	10,577,150
D.	Effluent Disinfection	$	763,000
E.	Solids Handling	$	2,222,000
F.	Operations Building	$	879,500
G.	Building Mechanical (HVAC, Domestic Water/Plumbing)	$	1,100,000
H.	Odor Control	$	600,000
I.	Siteworks	$	848,800
J.	Decommissioning of Existing WWTP/Lagoon	$	425,000
K.	Lift Station./Forcemain from Cree Road to WWTP	$	1,810,000
L.	SUBTOTAL A (Rounded)	$	22,620,000
M.	Electrical/Instrumentation & Controls	$	3,000,000
N.	General Conditions (10% of Subtotal A)	$	2,262,000
O.	SUBTOTAL B (L+M+N)	$	27,882,000
P.	Engineering (11% of Subtotal B)	$	3,067,000
Q.	Contingency (10% of Subtotal B)	$	2,788,000
R.	Estimating Allowance (10% of Subtotal B)	$	2,788,000
	TOTAL OF OPINION OF PROBABLE COST FOR THE PROJECT (O+P+Q+R)	$	36,500,000 (Rounded)

23.2.1 Limitations of Opinion of Probable Cost

The Project Team has agreed to basic design criteria, process and components. However, there are still many unknown details related to the City of Thompson WWTP project that could impact the opinion of probable cost presented in this section. Because the project is in the conceptual state, there will be design decisions made during detailed design that will affect the cost. Sufficient work has been undertaken on each of the components of the functional design for Stantec to make informed assumptions based on our past experience on similar treatment facilities. The opinion of probable cost includes a contingency allowance of 10 percent. This is included to account for changes during construction and to mitigate the impact of small changes made during detailed design.

The opinion of probable cost is prepared based on the Functional Design work completed to date, as outlined in the preceding technical sections. It reflects our best judgment at this stage of the project. Stantec has no control of future construction market conditions, which could significantly impact construction costs. No inflation allowance is included in these costs In addition, the following notes apply to the costs:

- Costing is based on 2013 Canadian Dollars. Imported equipment exchange rate is based on $1 US = $1.05 Canadian.
- RST has been included in the mechanical and electrical costs. **GST is not included.**
- All Subtotal Costs are rounded to the nearest thousand dollars.
- The costs for the WWTP also includes a new Effluent Outfall to the Burntwood River and decommissioning of the existing WWTP and aerated lagoon.

23.2.2 Estimated Annual O & M Costs

This section outlines the opinion of probable annual operation and maintenance costs. The evaluation has been completed with the following assumptions:

- Plant operation at full design capacity based on Annual Average Flow.
- 2013 economic conditions and dollars.
- All values are yearly costs.
- Taxes are not included.
- Sludge disposal to landfill (future composting)

Estimated costs are as follows:

Power/Heating	$ 525,000
Labor[1]	$ 150,000
Chemicals	$ 110,000
Sludge Hauling/Disposal[2]	$ 25,000
Miscellaneous/Testing[3]	$ 150,000
Total	**$960,000**

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[1] Manpower is based on 2 full time operators (one at least Level 4) plus electrical/mechanical journeyman.

[2] Sludge disposal fees based on $12 per tonne for tipping and $250/load or $30/m^3 for hauling.

[3] Miscellaneous costs include annual UV lamp replacement, wastewater testing via external laboratory, allowance of 1% of mechanical/electrical capital costs for replacement and maintenance.

24.0 References

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2. City of Thompson Wastewater Treatment Plant Assessment Upgrading Study 04-12, Wardrop Engineering (2006)
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5. Manitoba Water Quality Standards, Objectives and Guidelines (MWQSOG) Regulation
6. Aerated Lagoon Study, UMA Engineering (1999)
7. Wastewater Treatment Plant Upgrade Plan – City of Thompson Department of Water Utility Implementation Phase, CH2M Hill, 2009
8. The Public Utility Board – City of Thompson Application for Water and Sewer rate – 2012, 2013,2014, Order No. 10/12, January 25, 2012.
9. Minutes of Meeting with Manitoba Conservation and Water Stewardship Dept. Training Room, 4th Floor, 123 Main Street, Winnipeg March 20, 2013.
10. Water Environment Federation (WEF), Natural System for Wastewater Treatment, Manual of Practice No. FD-16, 2001.
11. Water Environment Federation (WEF), Design of Municipal Wastewater Treatment Plants, 5th Edition, Vol. 2: Liquid Treatment Processes, 2009.
12. United States Environmental Protection Agency, Wastewater Technology Fact Sheet – Ultraviolet Disinfection, September 1999.

13. City of Thompson Wastewater Treatment Plant Upgrading, Stantec Project No. 111214440, Minutes of Meeting, March 4, 2013.

14. City of Thompson WWTP Upgrading/Expansion Technical Memorandum Nos. 1 and 2, Stantec Consulting Ltd. (2013)

APPENDIX A

Wastewater Characteristics

Wastewater Constituent	Pre-design	April 15th	April 23rd	April 24th	April 29th	May 6th	May 13th	May 21st	May 28th	Aug 6th	Aug 12th	Aug 19th	Aug 26th	Sept 6th	Sept 9th	October 7th	October 16th	Average of Tested Data	Median Value of Tested Data	Recommended Value for Functional Design
BOD_5	130	134	98	111	62.4	131	96	175	124	35.3		77.3	105	58.5	142	130	84	104	105	140
Soluble-BOD5		55	27	60	35	38	37	78	50	10.6		28.2	19.5	27.4	61	71	18.8	41	37	
COD		430	238	440	284	423	251	537	449	119	166	242	286	156	490	473	230	326	285	448
TSS	175	188	121	269	71	240	135	224	155	59		99	152	91	239	191	118	157	152	175
VSS		81	71	191	27	218	123	198	140	51		88	132	80	211	164	105	125	123	150
TKN (as N)	40	40	39.2	36.6	34.5	45.3	43.6	41.7	47.4	33.4	23.2	34.2	31.4	20.1	51.3	47	35.9	38	38	40
Ammonia (as N)	30	22.1	19.3	17.9	15.6	29.8	21.3	14.4	25	24.1	18.4	22.8	16	13.6	37.4	30.1	21	22	20	25
TP	7.4	5.29	4.42	3.91	4.3	4.99	5.4	6.95	5.6	3.68	3.01	4.19	4.53	2.73	7	5.65	4.15	4.7	4.5	5.5
Soluble-P		3.8	2.64	2.68	2.74	3.3	3.59	4.35	3.75	0.945		3.07	2.7	2.65	3.35	2.99	1.86	3.0	3	3.6
Alkalinity		175	172	126	198	155	209	235	214	138		189	212	188	227	216	256	194	189	190
COD/BOD Ratio		3.2	2.4	4.0	4.6	3.2	2.6	3.1	3.6	3.4		3.1	2.7	2.7	3.5	3.6	2.7	3.23	3.21	
VSS/TSS Ratio		0.43	0.59	0.71	0.38	0.91	0.91	0.88	0.90	0.86		0.89	0.87	0.88	0.88	0.86	0.89	0.79	0.88	
NH3-N/TKN Ratio	0.75	0.55	0.49	0.49	0.45	0.66	0.49	0.35	0.53	0.72	0.79	0.67	0.51	0.68	0.73	0.64	0.58	0.58	0.54	
Sol-P/TP Ratio		0.72	0.60	0.69	0.64	0.66	0.66	0.63	0.67	0.26	0.00	0.73	0.60	0.97	0.48	0.53	0.45	0.58	0.65	
sol BOD/T-BOD5		0.410	0.276	0.541	0.561	0.290	0.385	0.446	0.403	0.300		0.365	0.186	0.468	0.430	0.546	0.224	0.39	0.40	

APPENDIX B

Functional Design Drawings

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Client/Project

CITY OF THOMPSON
WASTEWATER TREATMENT PLANT

UPGRADE / EXPANSION PROJECT

Thompson, MB Canada

Title

SITE PLAN

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Drawing No.	Sheet	Revision
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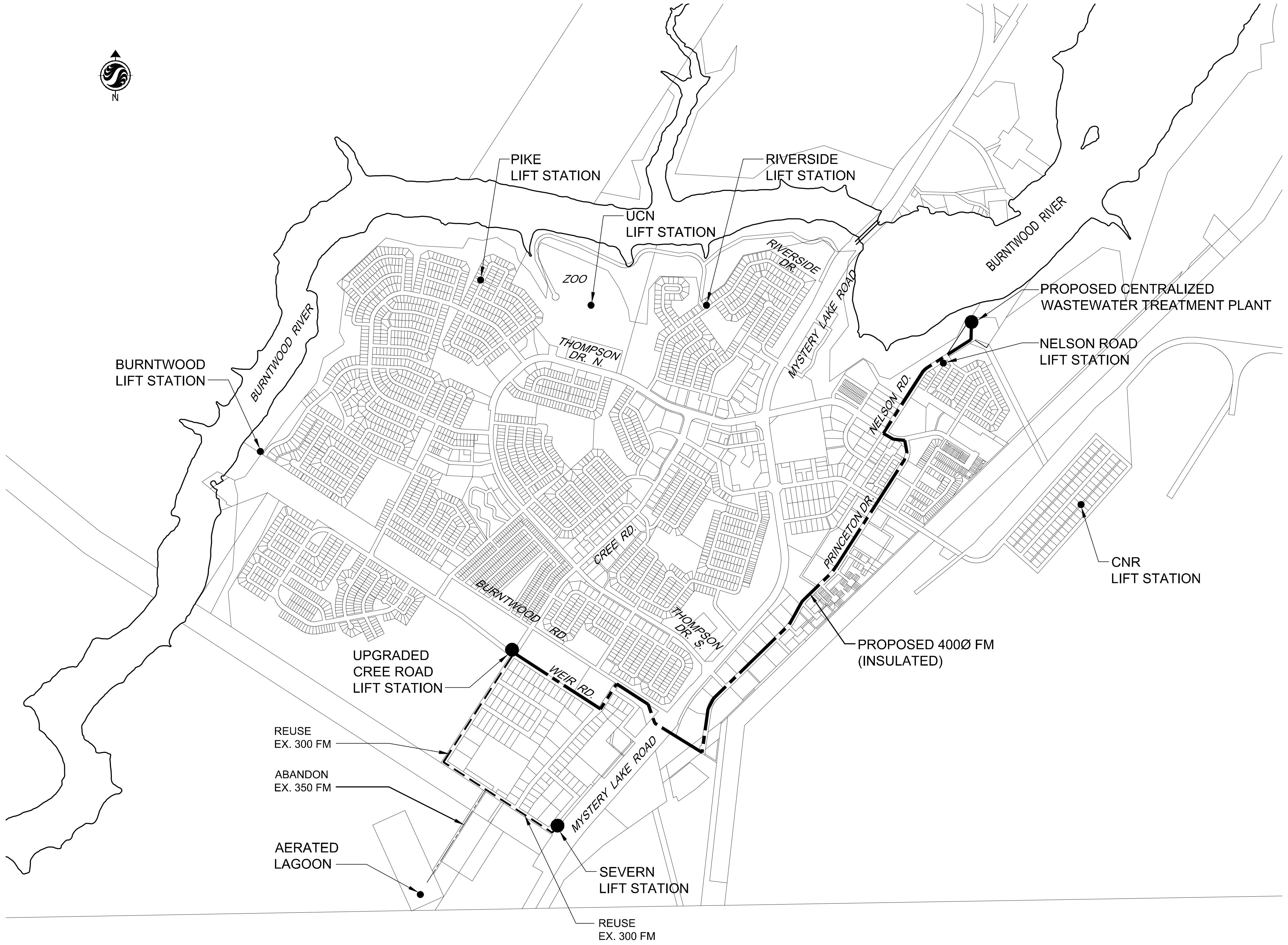

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WASTEWATER TREATMENT PLANT

UPGRADE / EXPANSION PROJECT

Thompson, MB Canada

Title
PROPOSED FORCEMAIN
MODIFICATIONS / LIFT STATION
UPGRADE (OPTION 2)

Project No.	Scale
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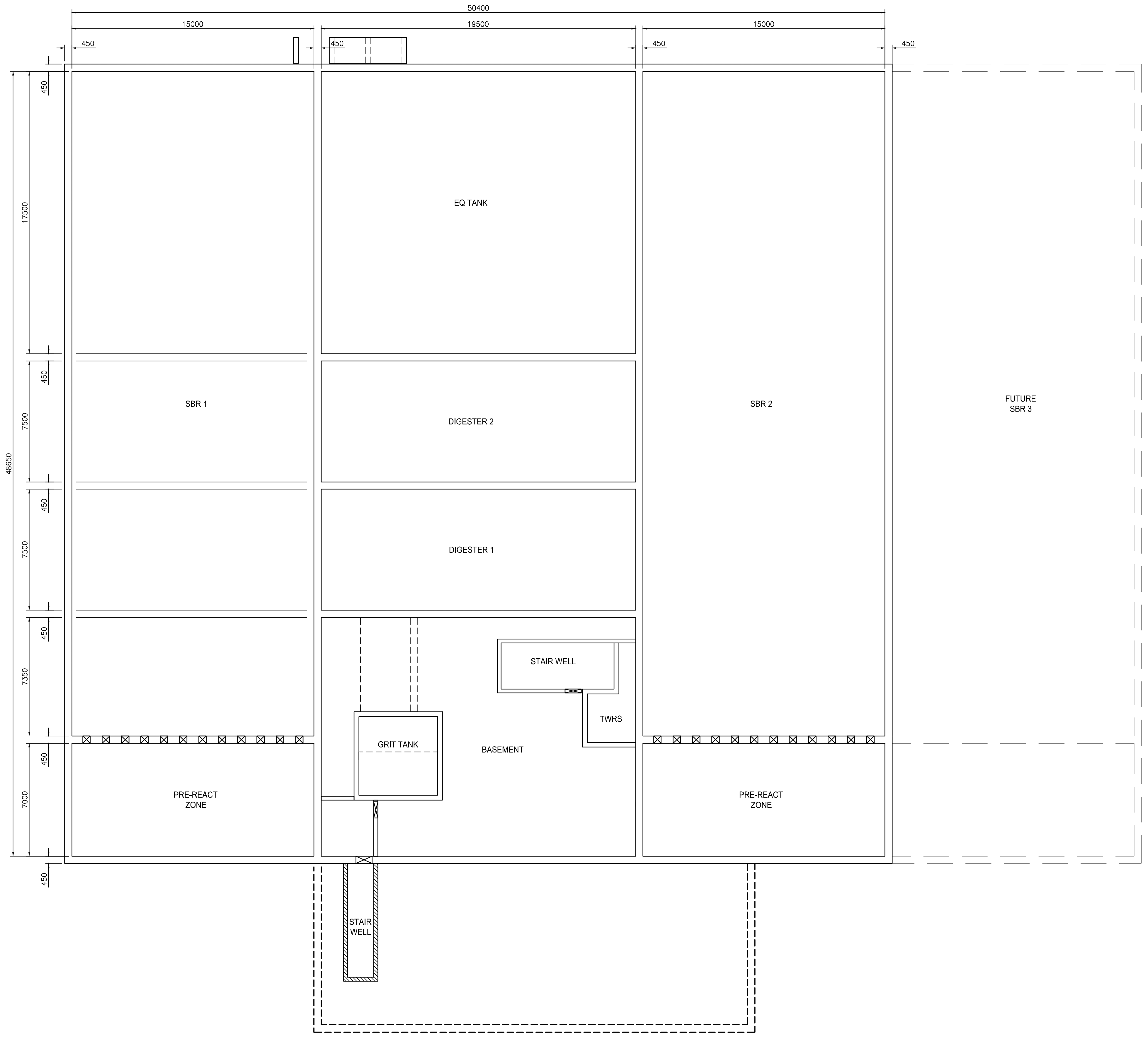

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TWRS TRUCKED WASTEWATER RECIEVING STATION

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Thompson, MB Canada

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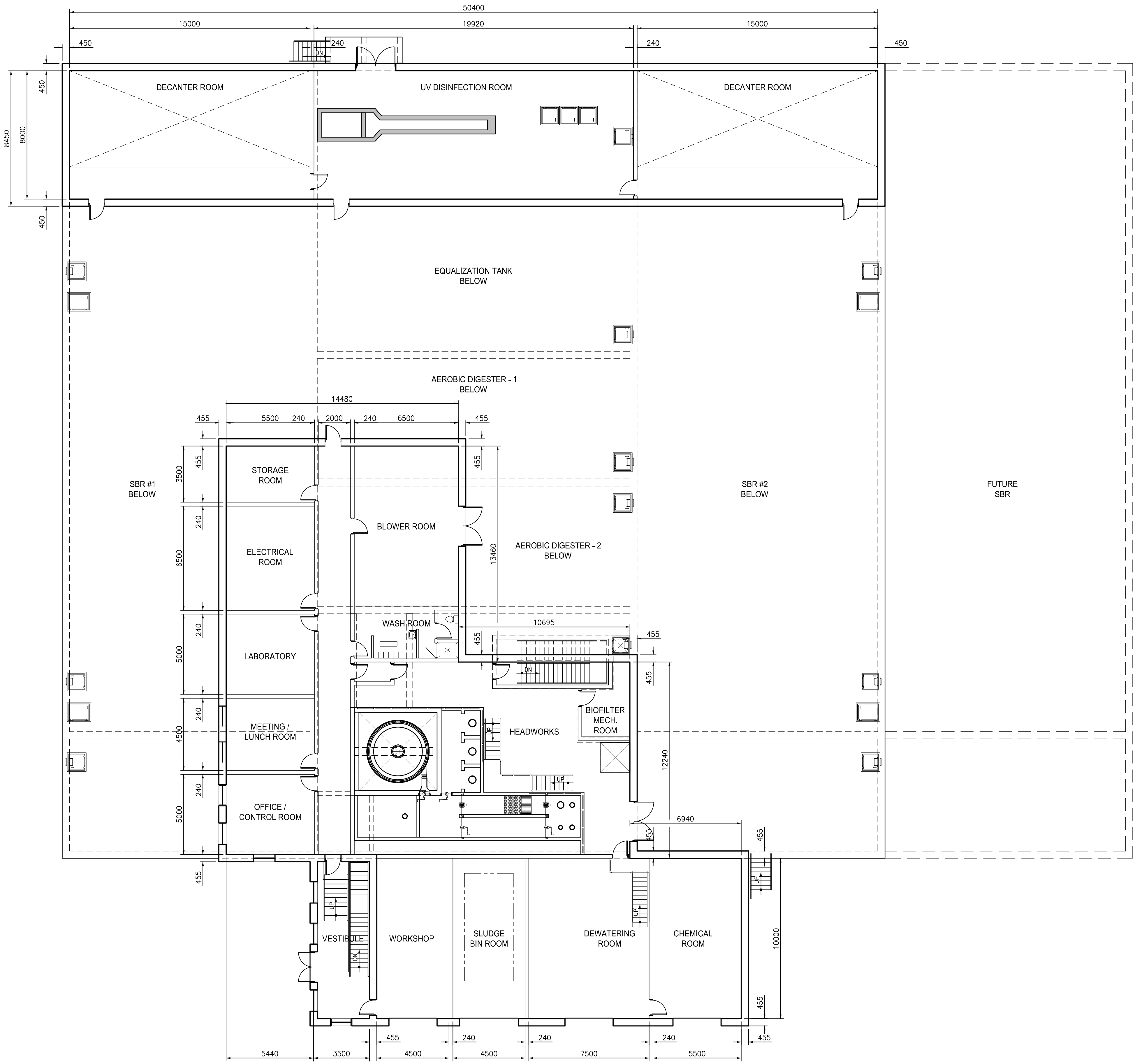

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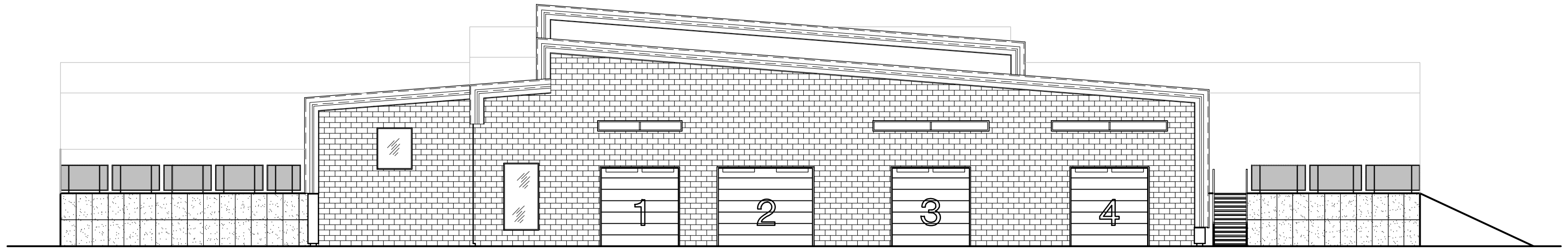

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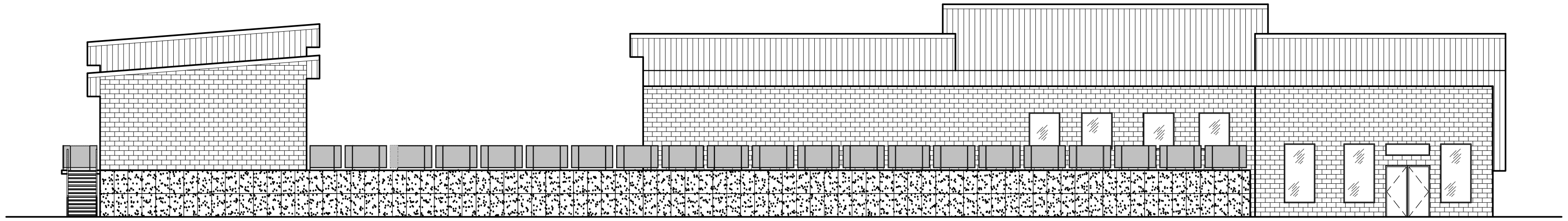

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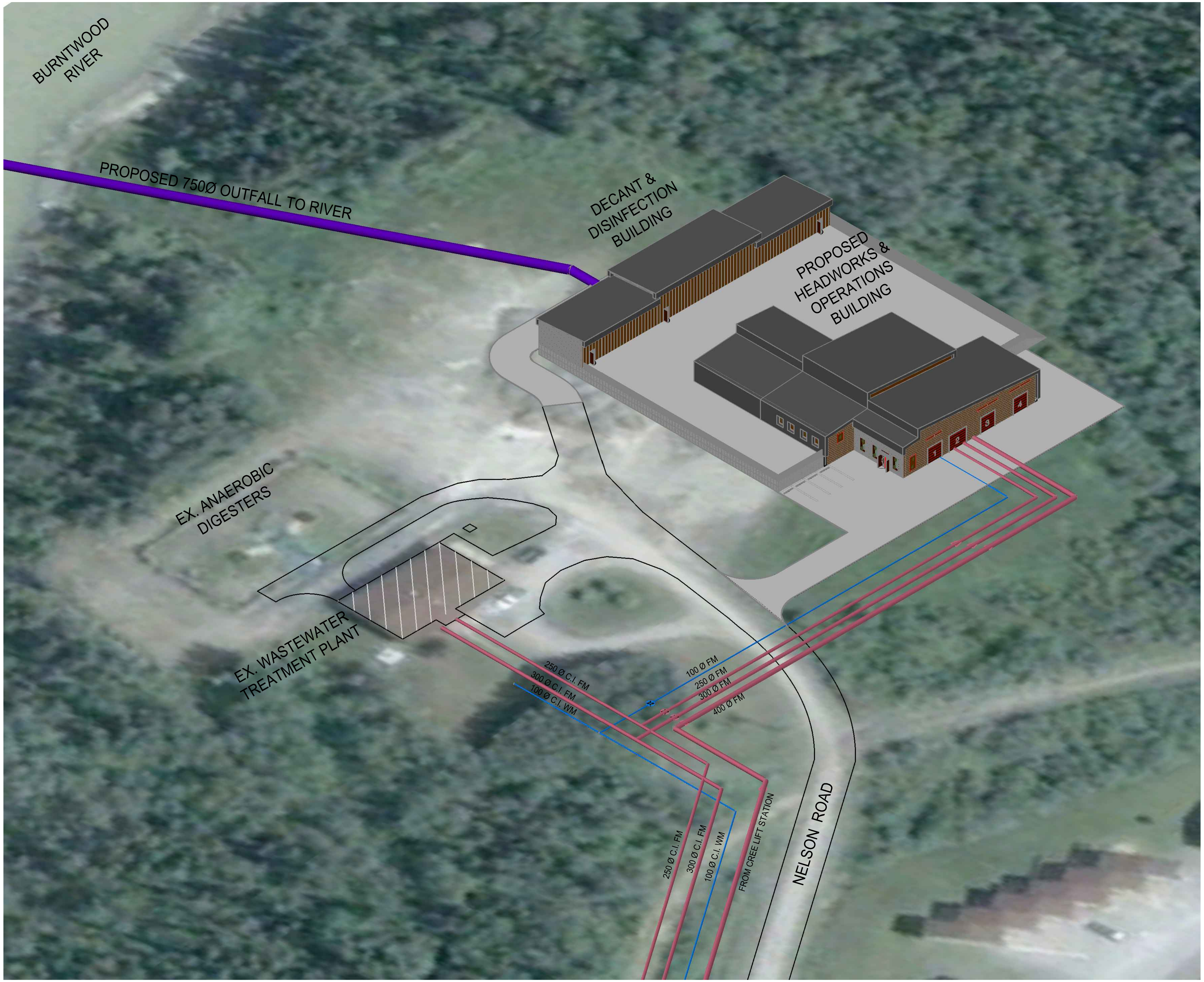

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3-D PERSPECTIVE
SITE PLAN

Project No.
111214440

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WASTEWATER TREATMENT PLANT

UPGRADE / EXPANSION PROJECT

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3-D PERSPECTIVE
ELEVATION

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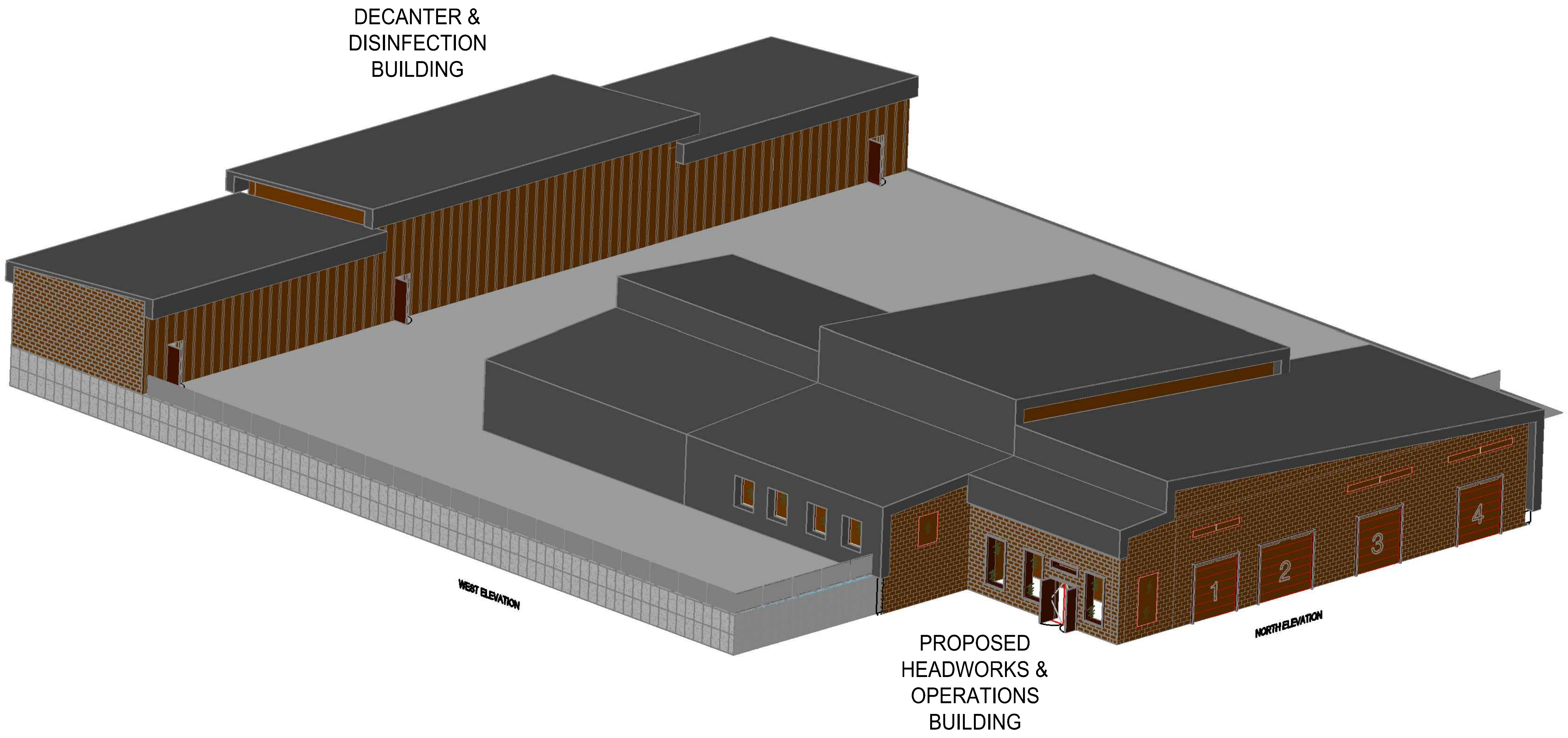

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Client/Project
CITY OF THOMPSON
WASTEWATER TREATMENT PLANT
UPGRADE / EXPANSION PROJECT

Thompson, MB Canada

Title
3-D PERSPECTIVE

Project No.
111214440

Scale
N.T.S.

Drawing No.
A-105

Sheet
of

Revision
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2014/01/23 10:49 AM By: Ramnarace, Kesh

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PROCESS MECHANICAL – COMMODITY SYMBOLS

SYMBOL	COMMODITY
ADS	AEROBICALLY DIGESTED SLUDGE
AF	ALUM FEED
BI	BIOFILTER IRRIGATION
BS	BIOSOLIDS
CC	CENTRIFUGE CENTRATE
DCW	DOMESTIC COLD WATER
DHW	DOMESTIC HOT WATER
DR	DRAIN
DS	DEGRITTED & SCREENED
DCS	DEWATERED COMPACTED SCREENINGS
DG	DEWATERED GRIT
DWS	DEWATERED SLUDGE
DWW	DOMESTIC WASTEWATER
EW	ELUTRIATION WATER
FA	FOUL AIR
FE	FINAL EFFLUENT
FW	FLUSHING WATER
GNS	GALVANIZED STEEL
GR	GRIT
GRW	GRAY WATER
HI	HUMIDIFICATION IRRIGATION
IA	INSTRUMENT AIR
MUW	MAKE–UP WATER
OF	OVERFLOW
P	PUMP
PA	PROCESS AIR
PF	POLYMER FEED
PV	PROCESS VENT
PW	POTABLE WATER
PWD	PROCESS WASTE DRAIN
RS	RAW SEWAGE
RW	RECYCLE WATER
SA	SAMPLING
SAN	SANITARY SEWERS
SE	SECONDARY EFFLUENT
SH	SODIUM HYDROXIDE
SL	SAMPLING LINE
SUB	SUBNATANT
SUP	SUPERNATANT
TA	TREATED AIR
TD	TANK DRAINAGE
ULY	UTILITY
V	VENT, VALVE
WAS	WASTE ACTIVATED SLUDGE

PROCESS EQUIPMENT SYMBOLS

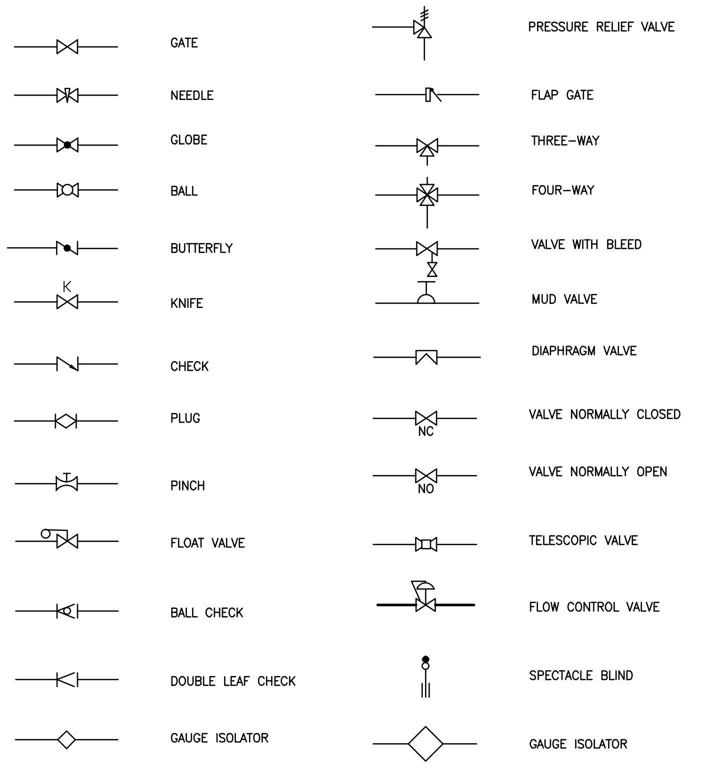
SYMBOL	EQUIPMENT
AB	AERATION BLOWER
AD	AEROBIC DIGESTER
AFP	ALUM FEED PUMP
BEF	BIOFILTER EXHAUST FAN
BF	BIOFILTER
BFP	BACKFLOW PREVENTER
BLO	BLOWER
BRP	BIOFILTER RECYCLE PUMP
CEN	CENTRIFUGE
CFP	CENTRIFUGE FEED PUMP
COM	COMPRESSOR
CON	CONVEYOR
CR	CRANE
CS	COMPOSITE SAMPLER
DEC	DECANTER
EQ	EQUALIZATION TANK
FLC	FLOCCULATOR
GSD	GRIT SNAIL DEWATERING
GTP	GRIT TRANSFER PUMP
IC	INFLUENT CHAMBER
MRBS	MULTIRAKE BAR SCREEN
PFP	POLYMER FEED PUMP
PD	PULSATION DAMPENER
PMU	POLYMER MIXING UNIT
QC	QUICK CONNECT
RSP	RAW SEWAGE PUMP
SBR	SEQUENCING BATCH REACTOR
SCR	SCREEN
SHP	SODIUM HYDROXIDE PUMP
SPB	SPLITTER BOX
SWC	SCREENINGS WASHER/COMPACTOR
TCGW	TEA CUP GRIT WASHING
TNK	TANK
TP	TRANSFER PUMP
TWRS	TRUCKED WASTEWATER RECIEVING STATION
UV	UV DISINFECTION BANK
VGR	VORTEX GRIT REMOVAL
WASP	WASTE ACTIVATED SLUDGE PUMP
WB	WATER BOX
WWC	WET WELL CHAMBER

PIPE MATERIAL CODE

1. MATERIAL CODES FOR PIPING IN THE PHASE III UPGRADE

CODE	PIPING MATERIAL
ADU	ALUMINIUM DUCT
PE1	HDPE SDR17
PE2	HDPE SDR11
PPT	POLYPROPYLENE TUBING
PVC 1	PVC SHEDULE 80
PVC 2	PVC SHEDULE 40
RC	REINFORCED CONCRETE
SS1	304L STAINLESS STEEL SCHEDULE 10
SS2	304L STAINLESS STEEL SCHEDULE 40

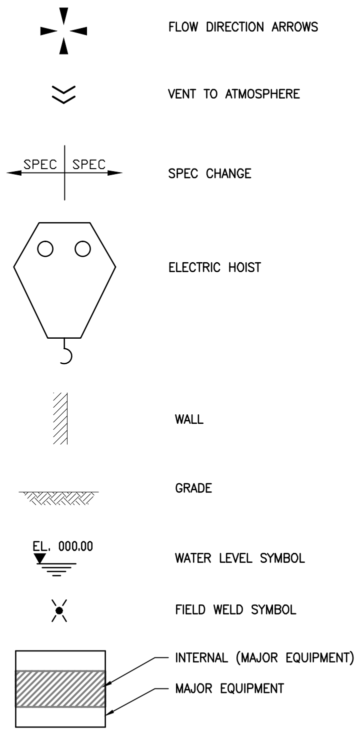
PROCESS VALVES



VALVE SYMBOLS

SYMBOL	VALVE
AR	AIR RELEASE VALVE
ARV	AIR RELEASE / VACUUM VALVE
AVV	AIR VACUUM VALVE (ANTI–SYPHON)
BAV	BALL VALVE
BCH	BALL CHECK VALVE
BUV	BUTTERFLY VALVE
CHV	CHECK VALVE
()CV	CONTROL VALVE () – PRIMARY CONTROLLED VALVE MAY HAVE SEVERAL FUNCTIONS F – FLOWRATE L – LEVEL P – PRESSURE S – SURGE T – TEMPERATURE
BG	BYPASS SLUICE GATE VALVE
SG	SLUICE GATE VALVE
GAV	GATE VALVE
KGV	KNIFE GATE VALVE
PIV	PINCH VALVE
PLV	PLUG VALVE

MISCELLANEOUS SYMBOLS



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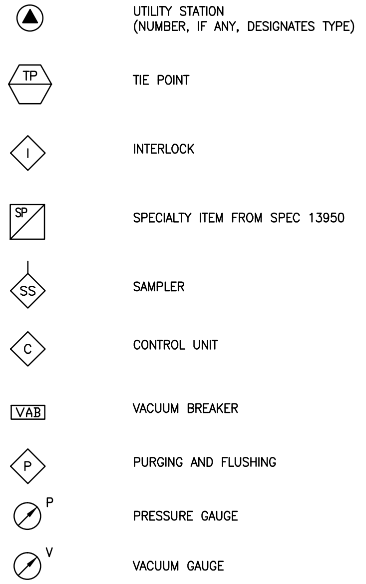
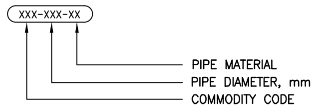


PROCESS, EQUIPMENT AND VALVE IDENTIFICATION



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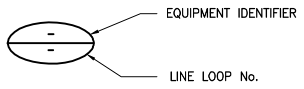

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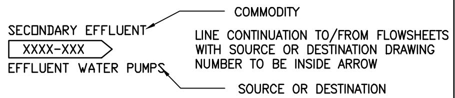

LINE SOURCE OR DESTINATION TAG

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Client/Project
CITY OF THOMPSON
WASTEWATER TREATMENT PLANT

UPGRADE / EXPANSION PROJECT

Thompson, MB Canada

Title
P&ID ABBREVIATIONS, LEGENDS AND SYMBOLS - SHEET 1

Project No.
111214440

Scale
NO SCALE

Drawing No.
DI-601

Sheet
of

Revision
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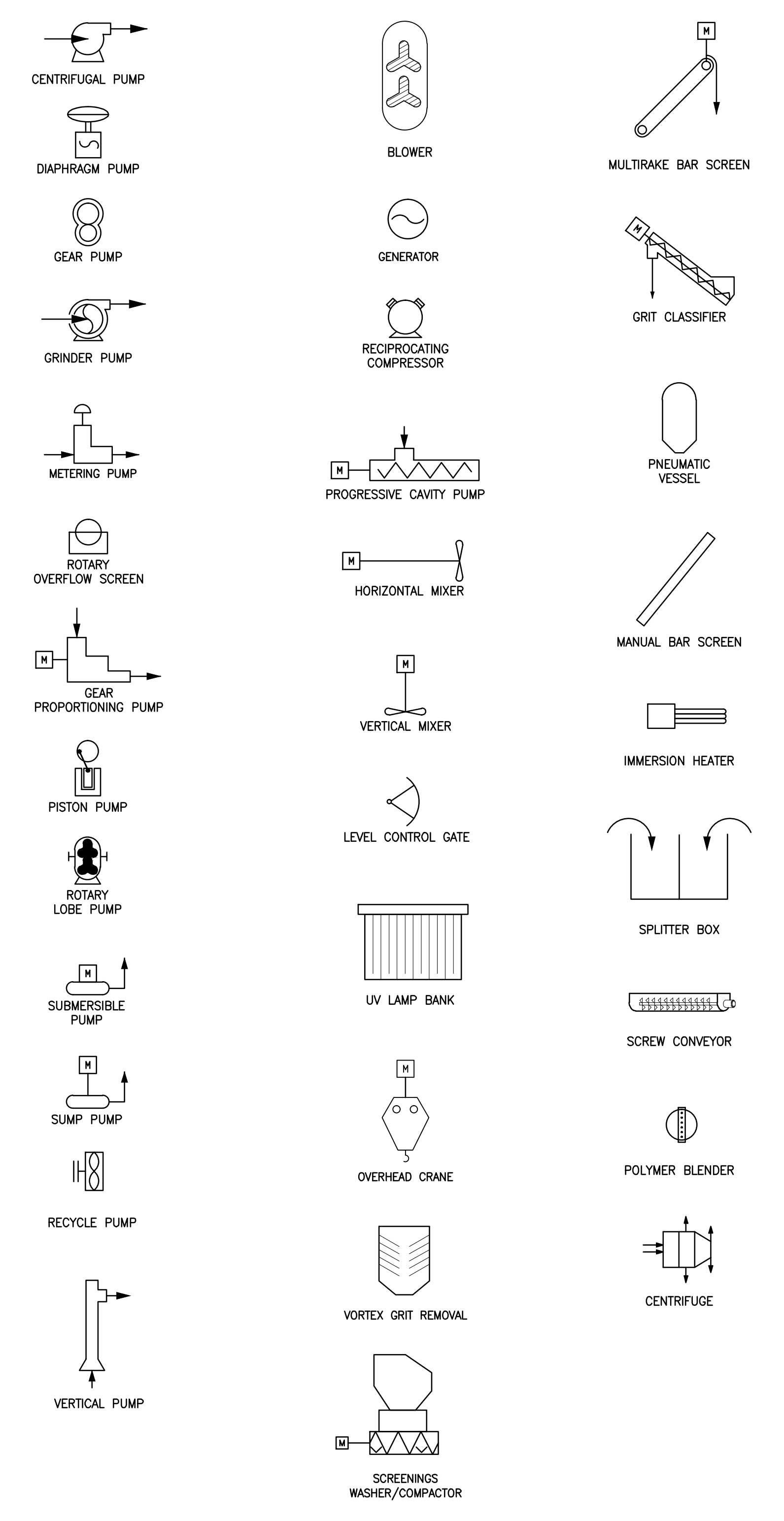

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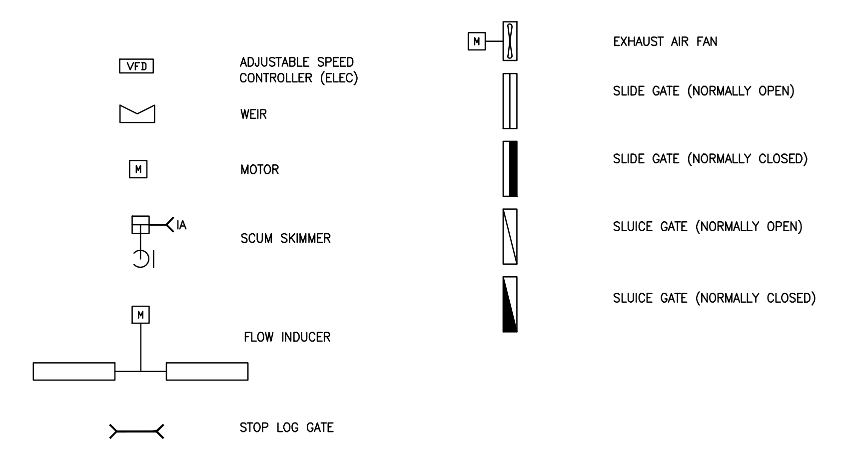

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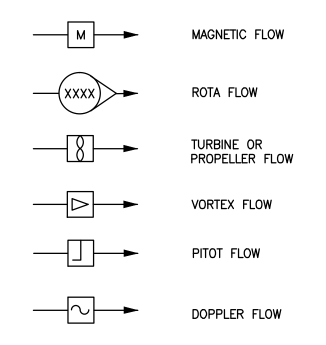

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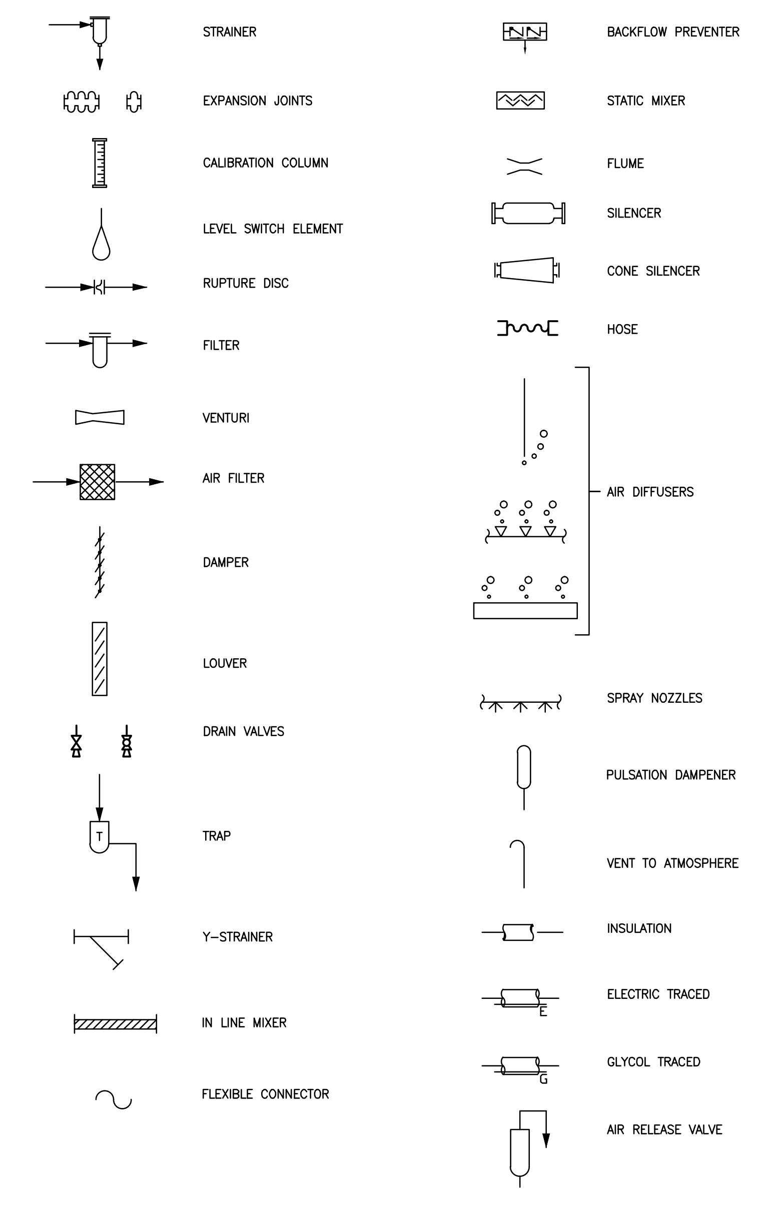

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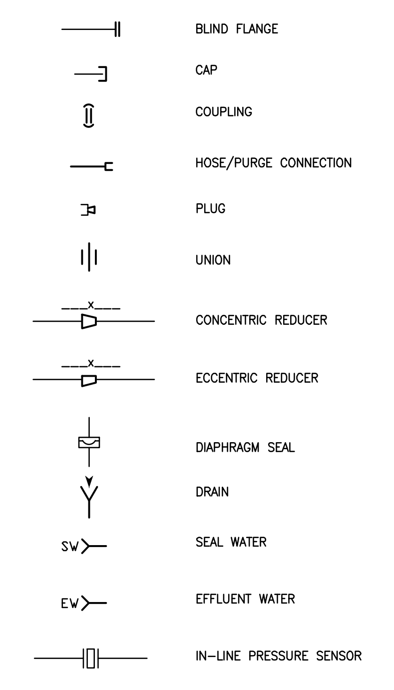

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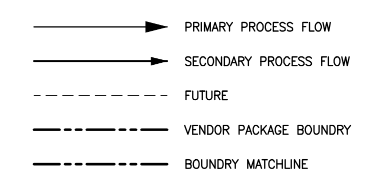

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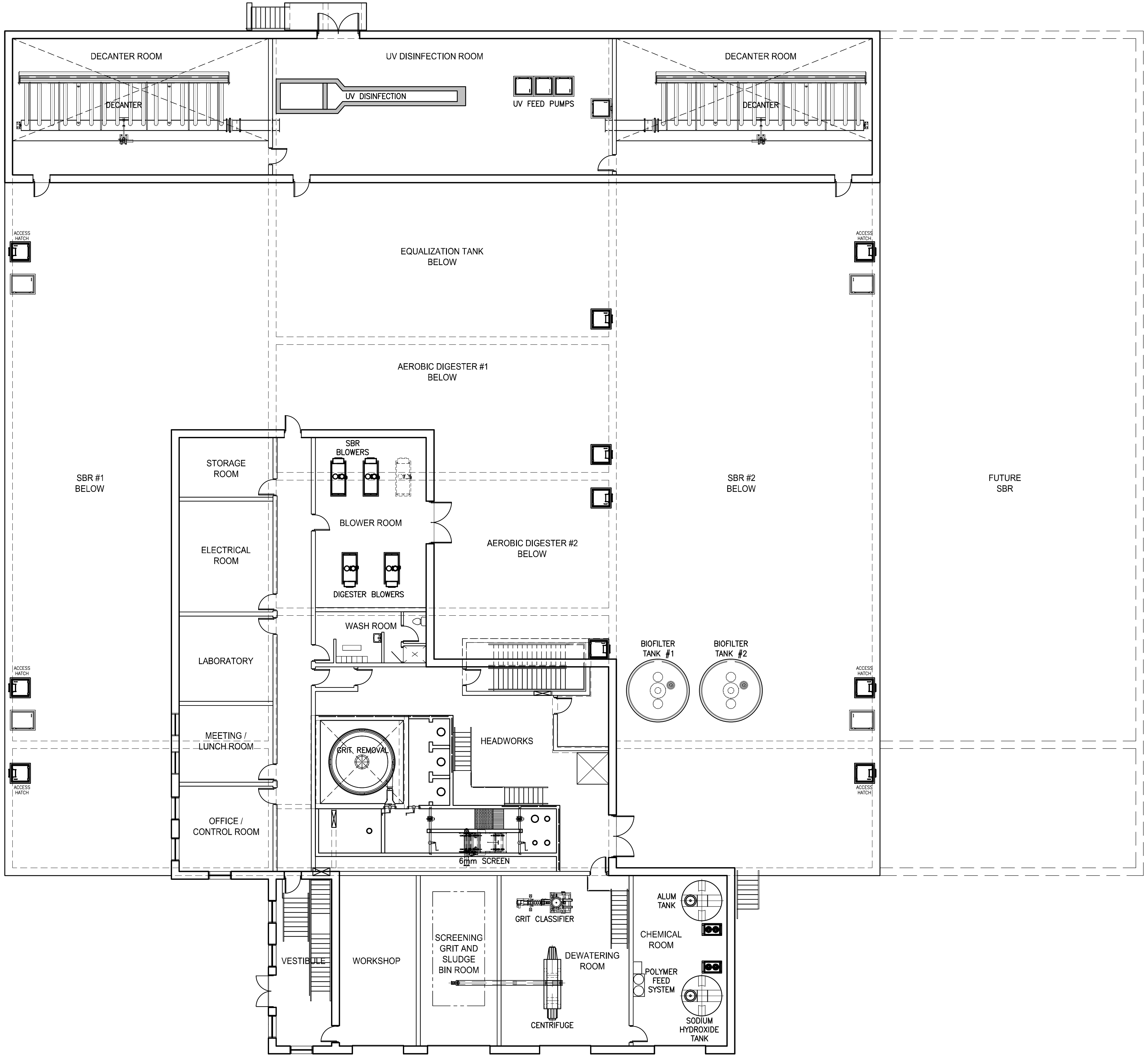
Client/Project
CITY OF THOMPSON
WASTEWATER TREATMENT PLANT
UPGRADE / EXPANSION PROJECT

Thompson, MB Canada

Title
P&ID ABBREVIATIONS, LEGENDS AND SYMBOLS - SHEET2

Project No. 111214440
Scale NO SCALE

Drawing No. DI-602
Sheet of
Revision 0



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Client/Project
CITY OF THOMPSON
WASTEWATER TREATMENT PLANT

UPGRADE / EXPANSION PROJECT

Thompson, MB Canada

Title
UPPER LEVEL
FLOOR PLAN

Project No.
111214440

Scale
1:125

Drawing No.
D-101

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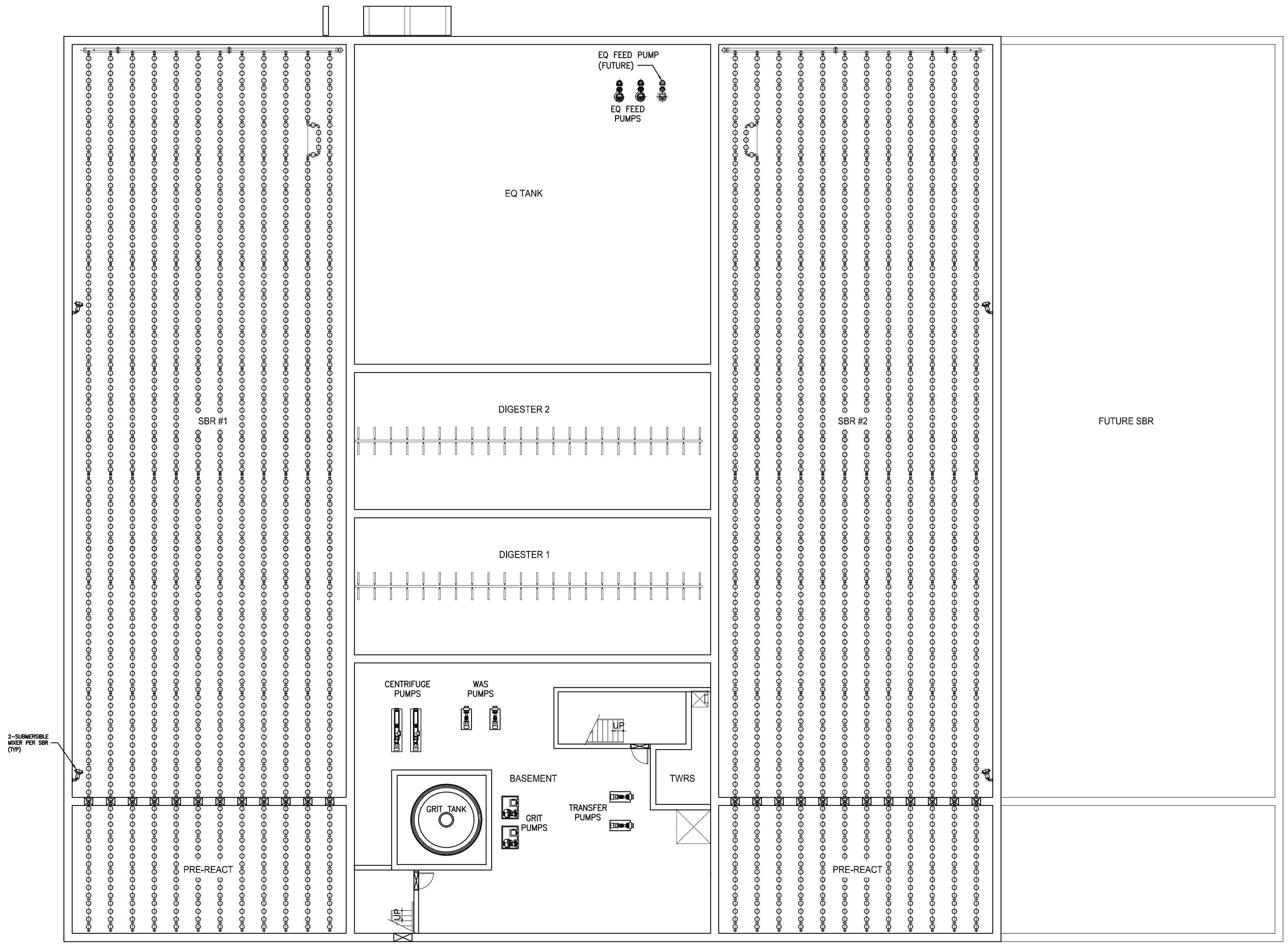

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WASTEWATER TREATMENT PLANT

UPGRADE / EXPANSION PROJECT

Thompson, MB Canada

Title
LOWER LEVEL
BASEMENT PLAN

Project No.
111214440

Scale
1:125

Drawing No.
D-102

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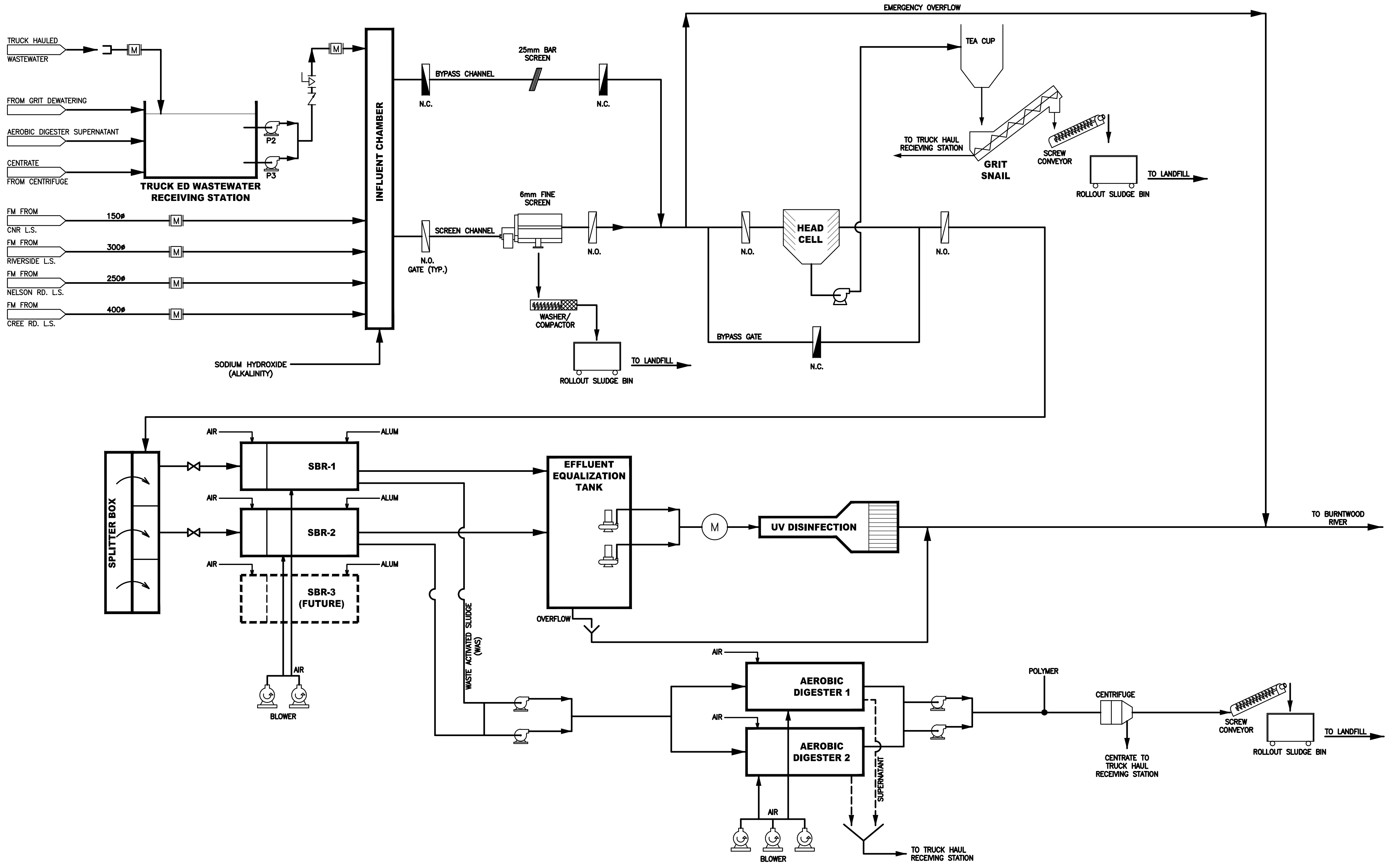

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WASTEWATER TREATMENT PLANT
UPGRADE / EXPANSION PROJECT

Thompson, MB Canada

Title
PROCESS FLOW DIAGRAM

Project No.
111214440

Scale
NO SCALE

Drawing No.
D-601

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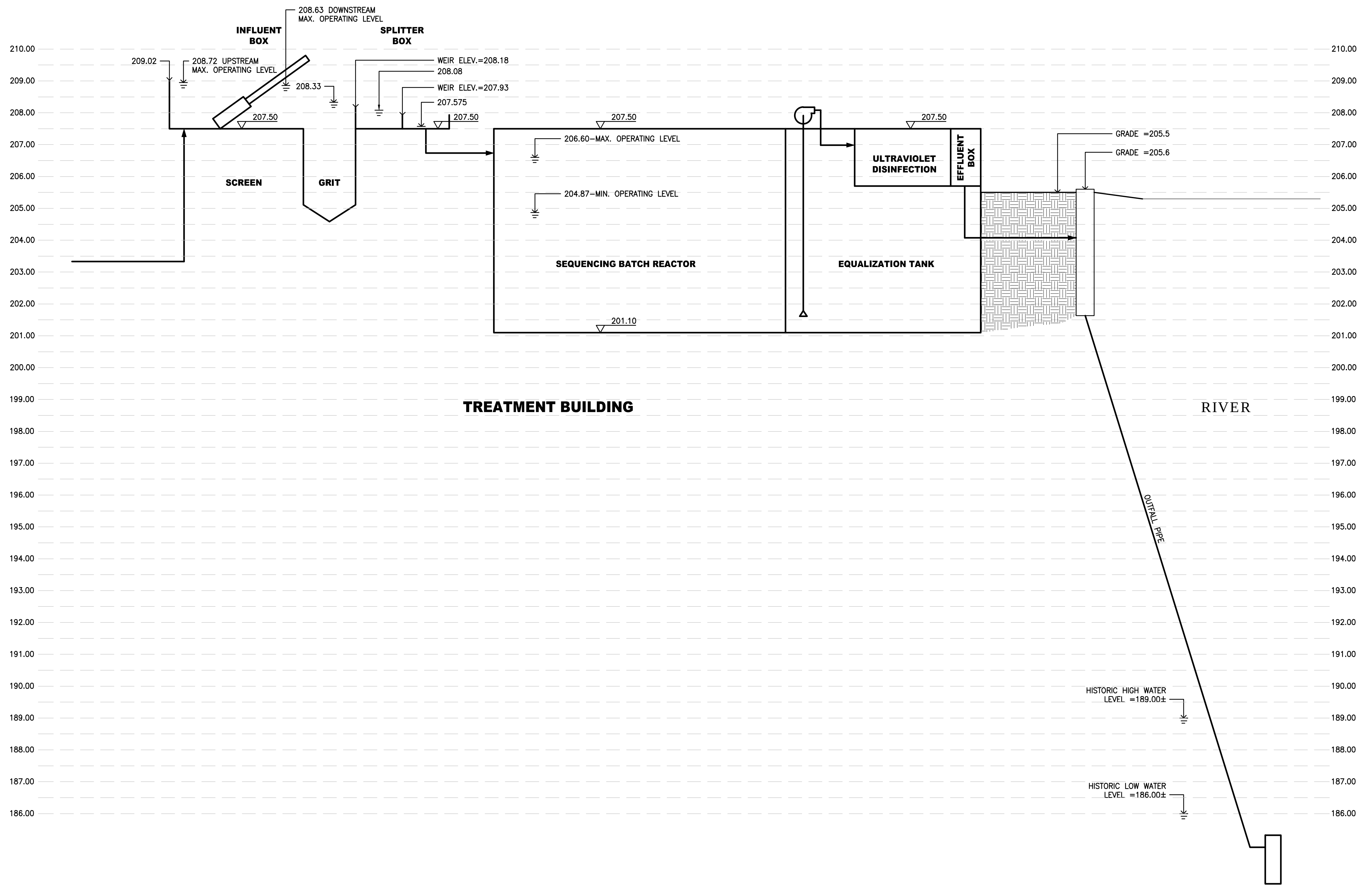

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CITY OF THOMPSON
WASTEWATER TREATMENT PLANT
UPGRADE / EXPANSION PROJECT

Thompson, MB Canada

Title
PROCESS HYDRAULIC PROFILE

Project No.
111214440

Scale
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Drawing No.
D-602

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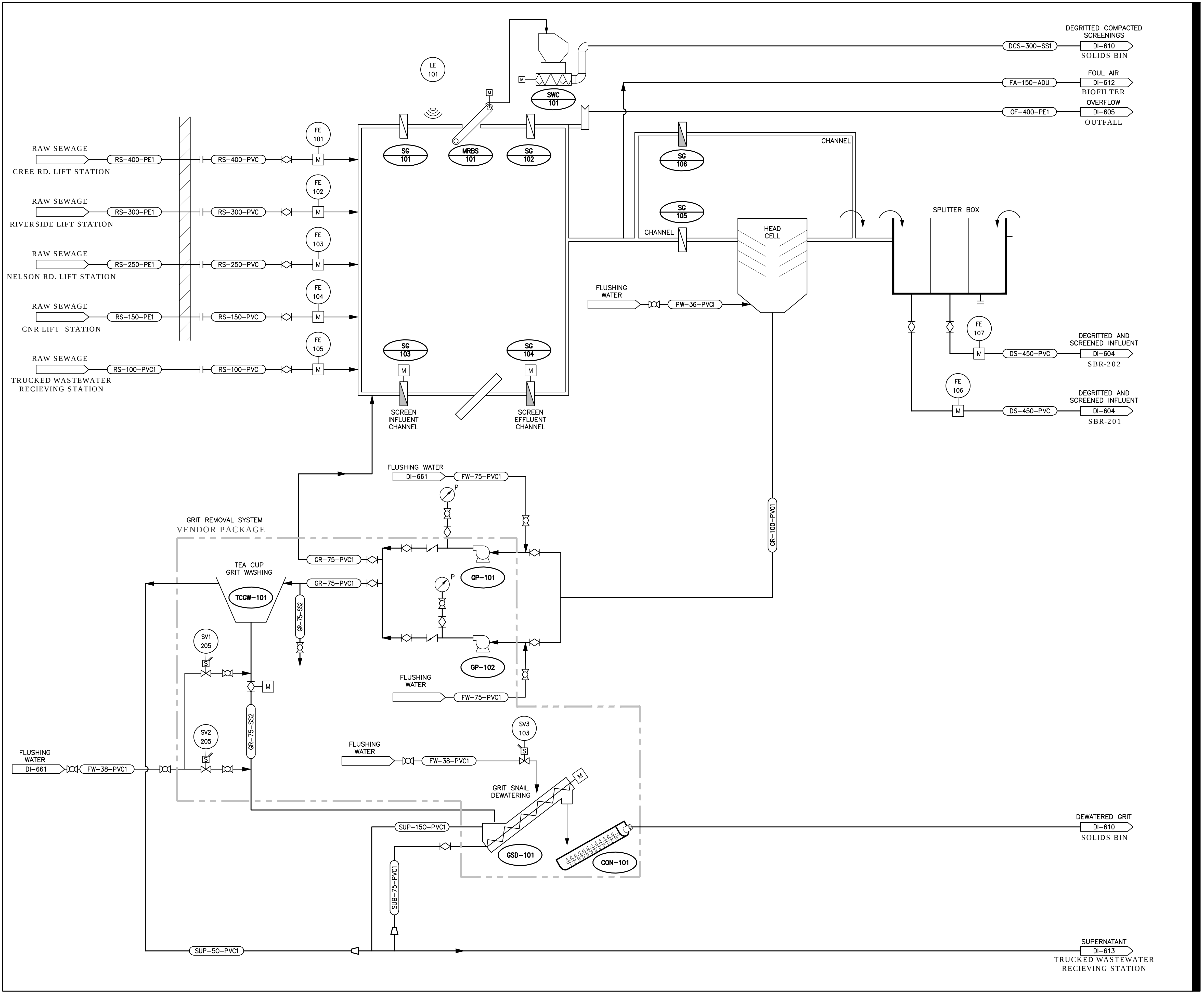

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CITY OF THOMPSON
WASTEWATER TREATMENT PLANT
UPGRADE / EXPANSION PROJECT

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Title
HEADWORKS
P & ID

Project No. 111214440
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Drawing No. DI-603
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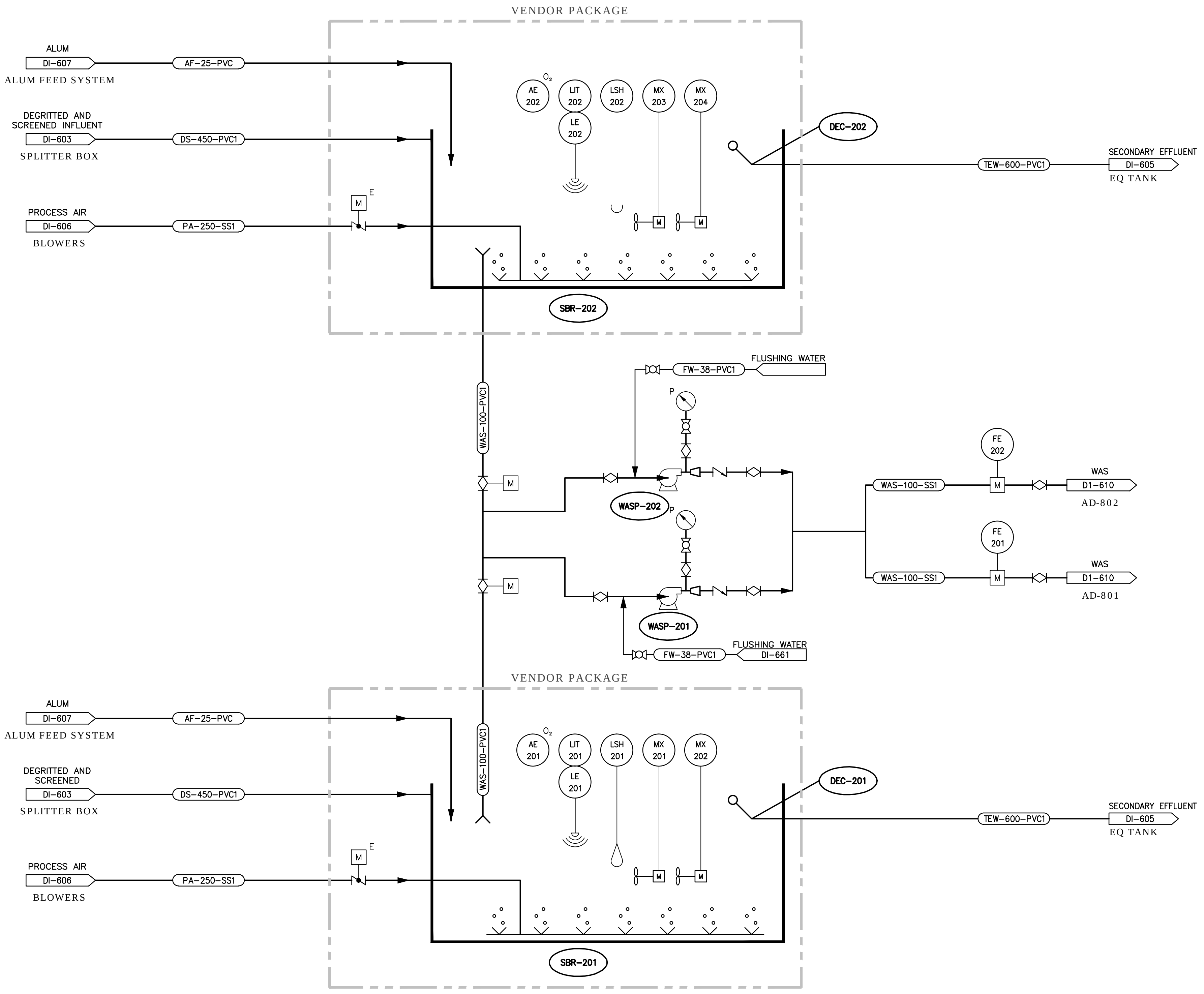
Revision 0



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CITY OF THOMPSON
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Title
SBR
P & ID

Project No. 111214440
Scale NO SCALE
Drawing No. DI-604
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Revision 0

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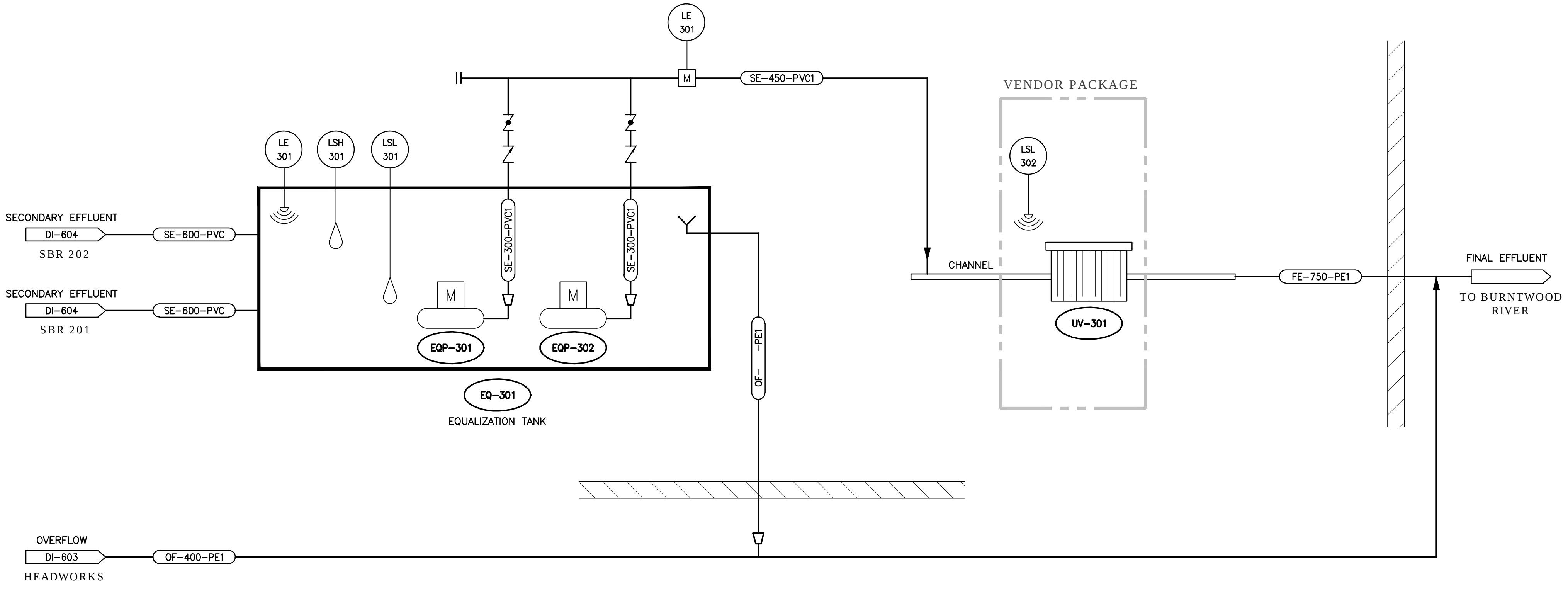

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CITY OF THOMPSON
WASTEWATER TREATMENT PLANT

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Thompson, MB Canada

Title
EQ & UV
P & ID

Project No.
111214440

Scale
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Drawing No.
DI-605

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of

Revision
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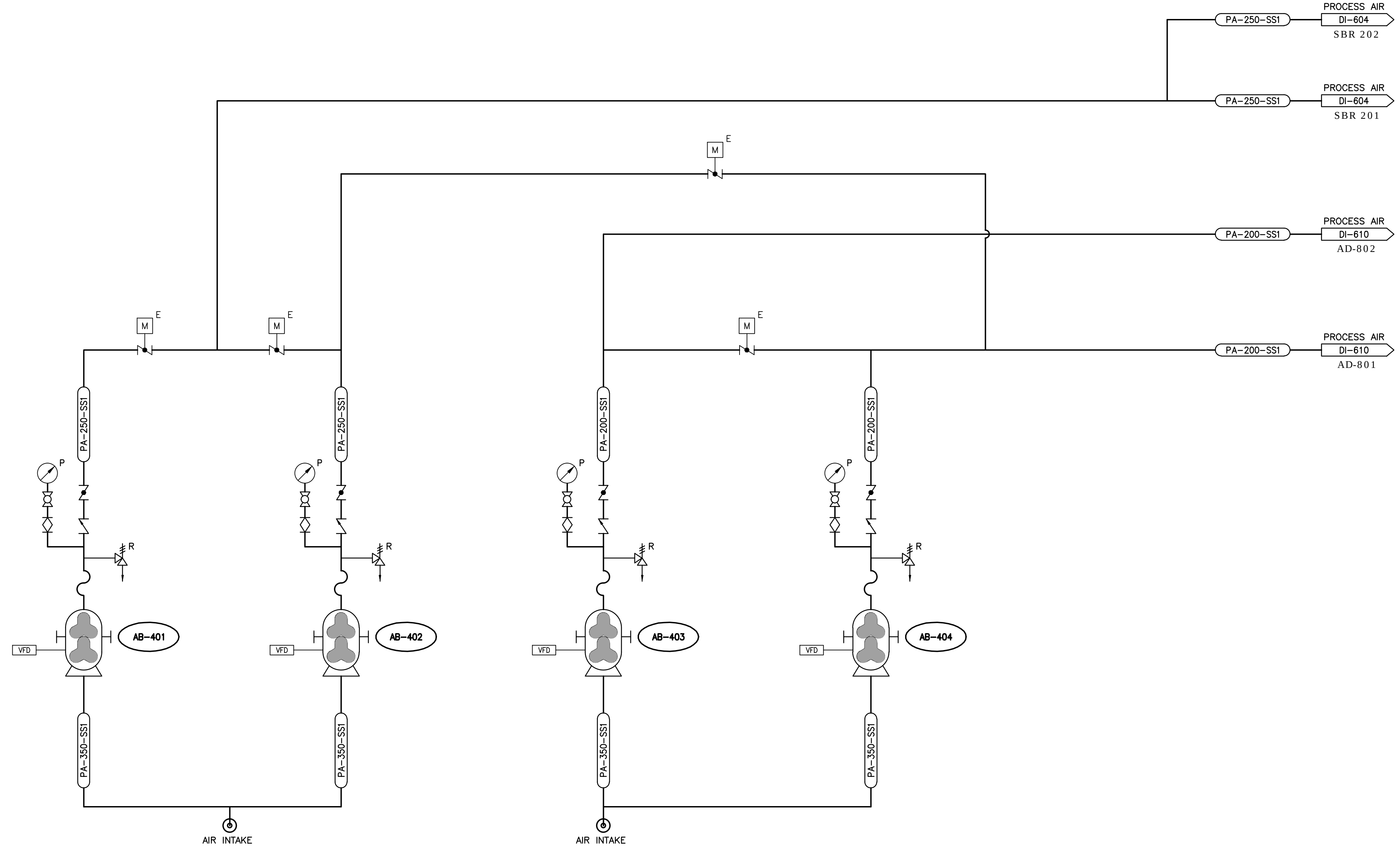

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Client/Project
CITY OF THOMPSON
WASTEWATER TREATMENT PLANT

UPGRADE / EXPANSION PROJECT

Thompson, MB Canada

Title
BLOWERS
P & ID

Project No.
111214440

Scale
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Drawing No.
DI-606

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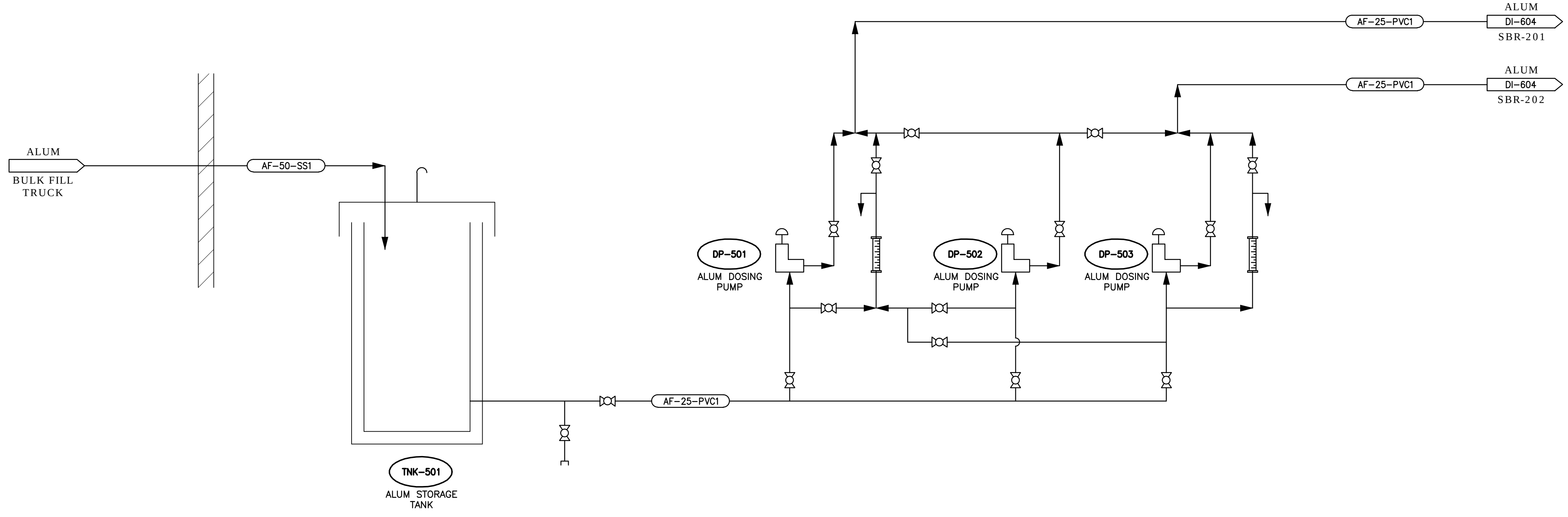

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Client/Project
CITY OF THOMPSON
WASTEWATER TREATMENT PLANT
UPGRADE / EXPANSION PROJECT

Thompson, MB Canada

Title
ALUM FEED
P & ID

Project No. 111214440
Scale NO SCALE

Drawing No. DI-607
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Revision 0

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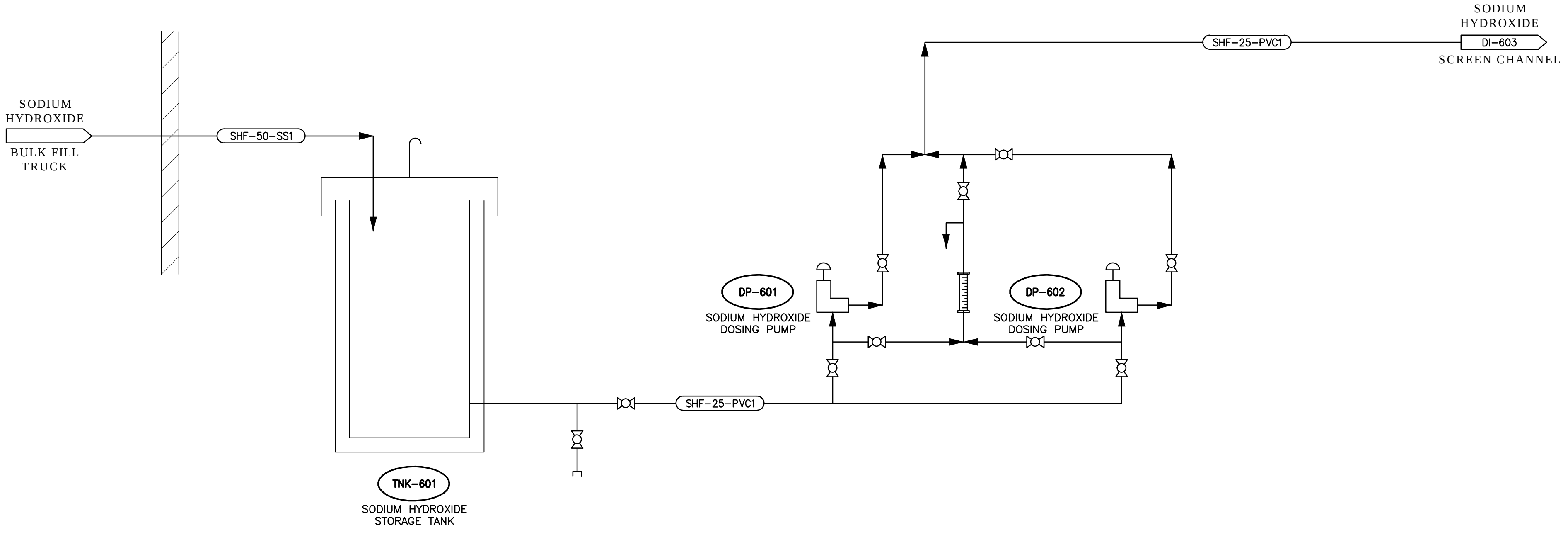

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Client/Project
CITY OF THOMPSON
WASTEWATER TREATMENT PLANT
UPGRADE / EXPANSION PROJECT

Thompson, MB Canada

Title
SODIUM HYDROXIDE FEED
P & ID

Project No.
111214440

Scale
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Drawing No.
DI-608

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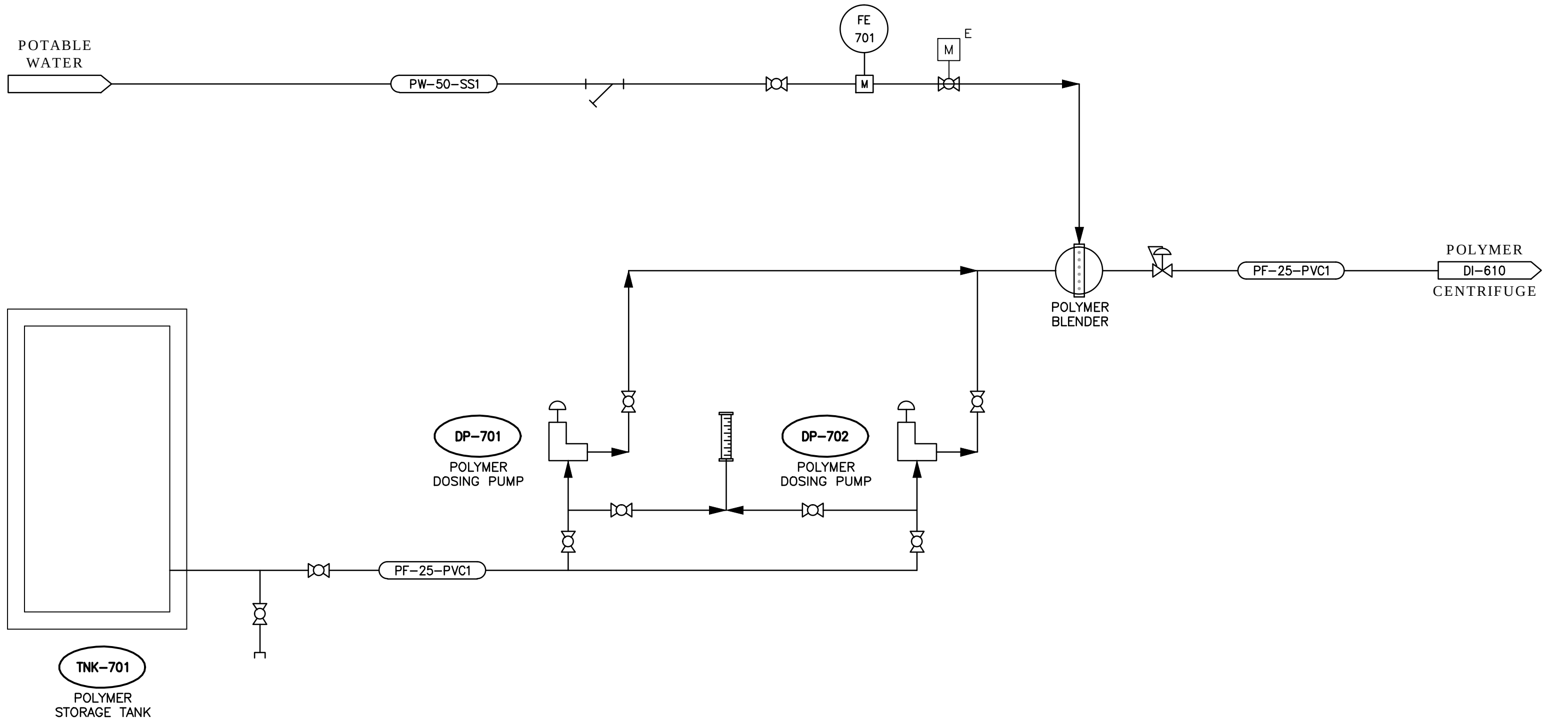

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CITY OF THOMPSON
WASTEWATER TREATMENT PLANT

UPGRADE / EXPANSION PROJECT

Thompson, MB Canada

Title

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P & ID

Project No.
111214440

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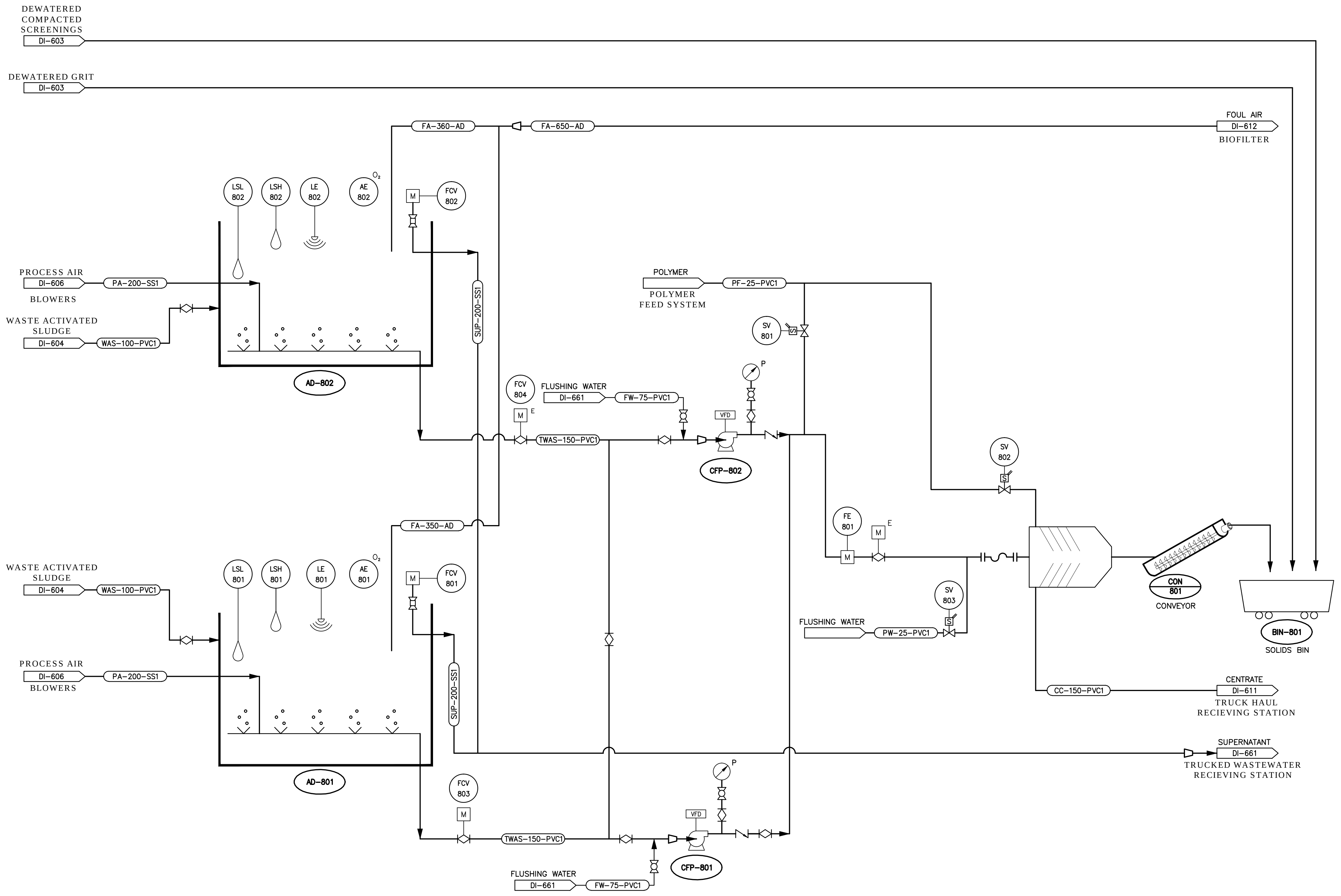

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Client/Project
CITY OF THOMPSON
WASTEWATER TREATMENT PLANT

UPGRADE / EXPANSION PROJECT

Thompson, MB Canada

Title
SLUDGE STORAGE AND DEWATERING
P & ID

Project No. 111214440
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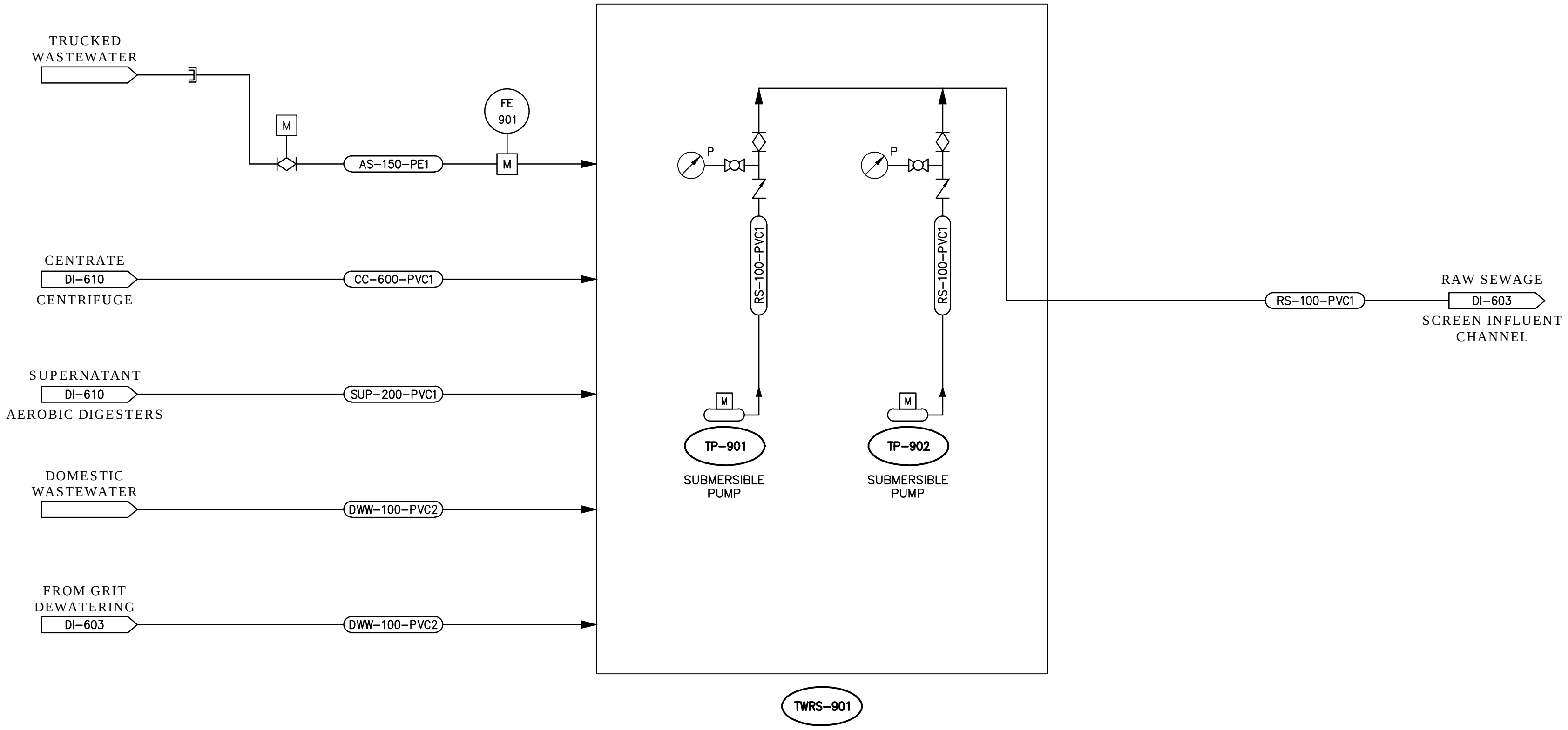

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Client/Project
CITY OF THOMPSON
WASTEWATER TREATMENT PLANT
UPGRADE / EXPANSION PROJECT

Thompson, MB Canada

Title
TRUCKED WASTEWATER RECIEVING
STATION P & ID

Project No.
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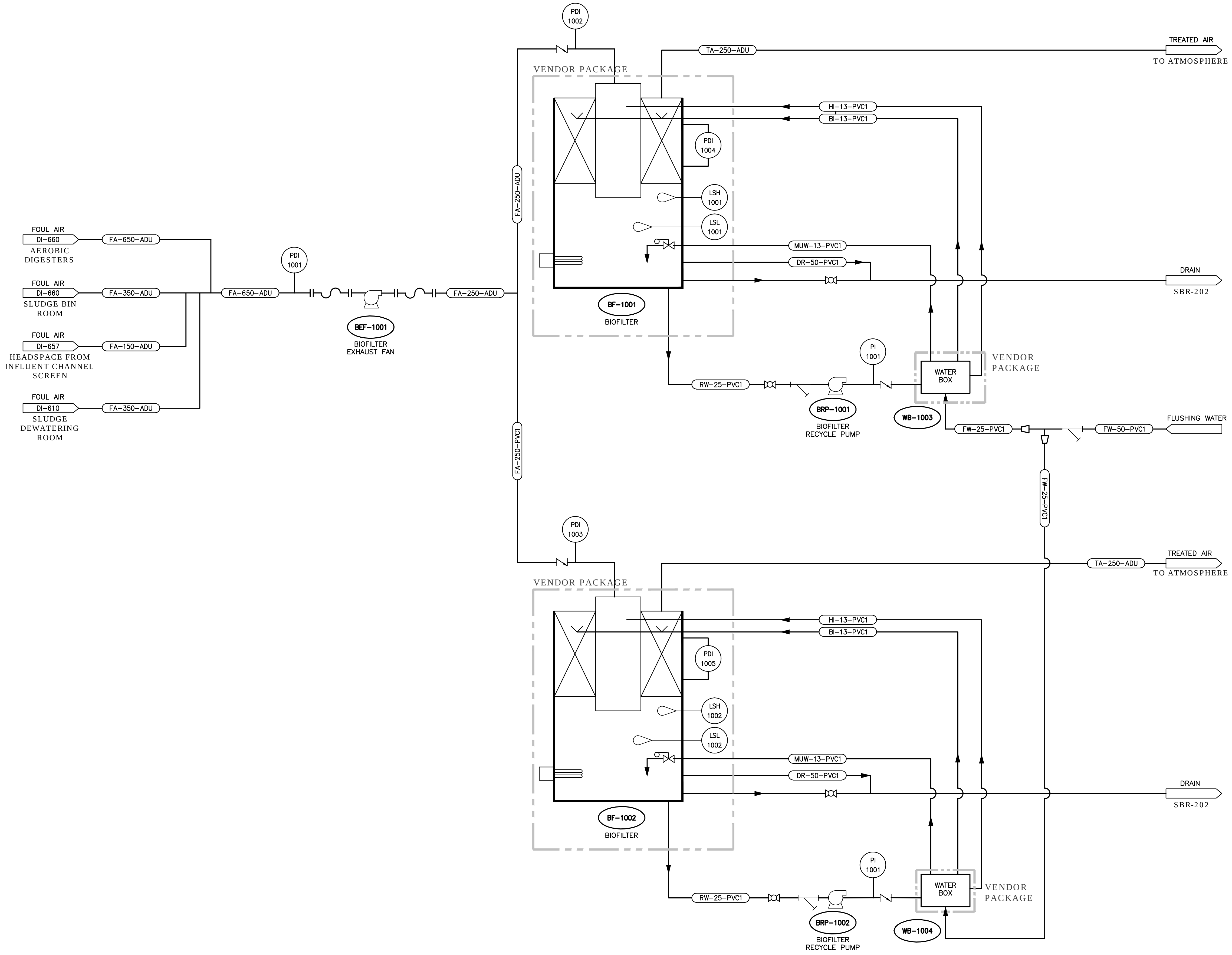

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Client/Project
CITY OF THOMPSON
WASTEWATER TREATMENT PLANT

UPGRADE / EXPANSION PROJECT

Thompson, MB Canada

Title
BIOFILTER
P & ID

Project No.
111214440

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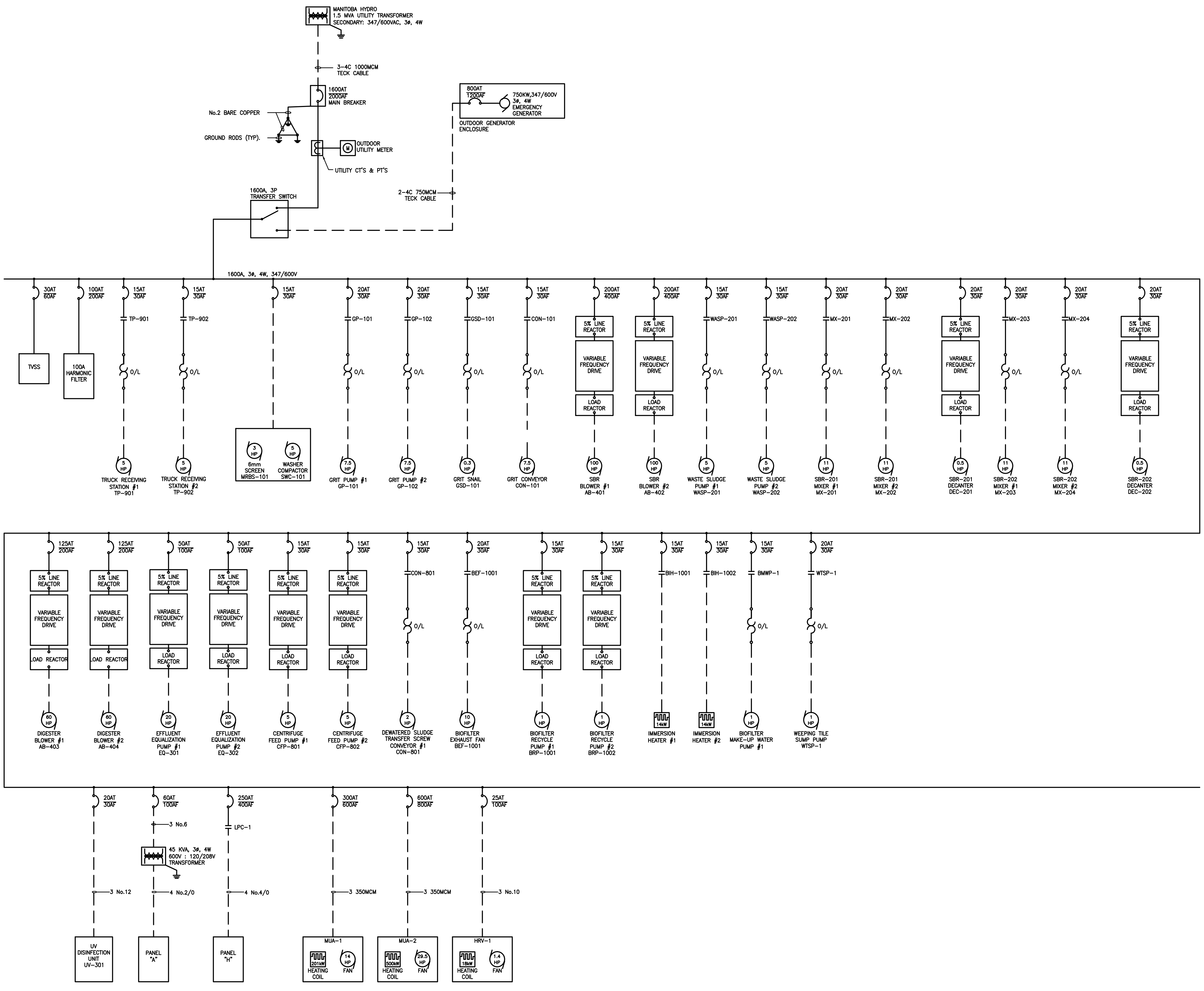

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Client/Project
CITY OF THOMPSON
WASTEWATER TREATMENT PLANT

UPGRADE / EXPANSION PROJECT

Thompson, MB Canada

Title
ELECTRICAL
SINGLE LINE DIAGRAM

Project No.
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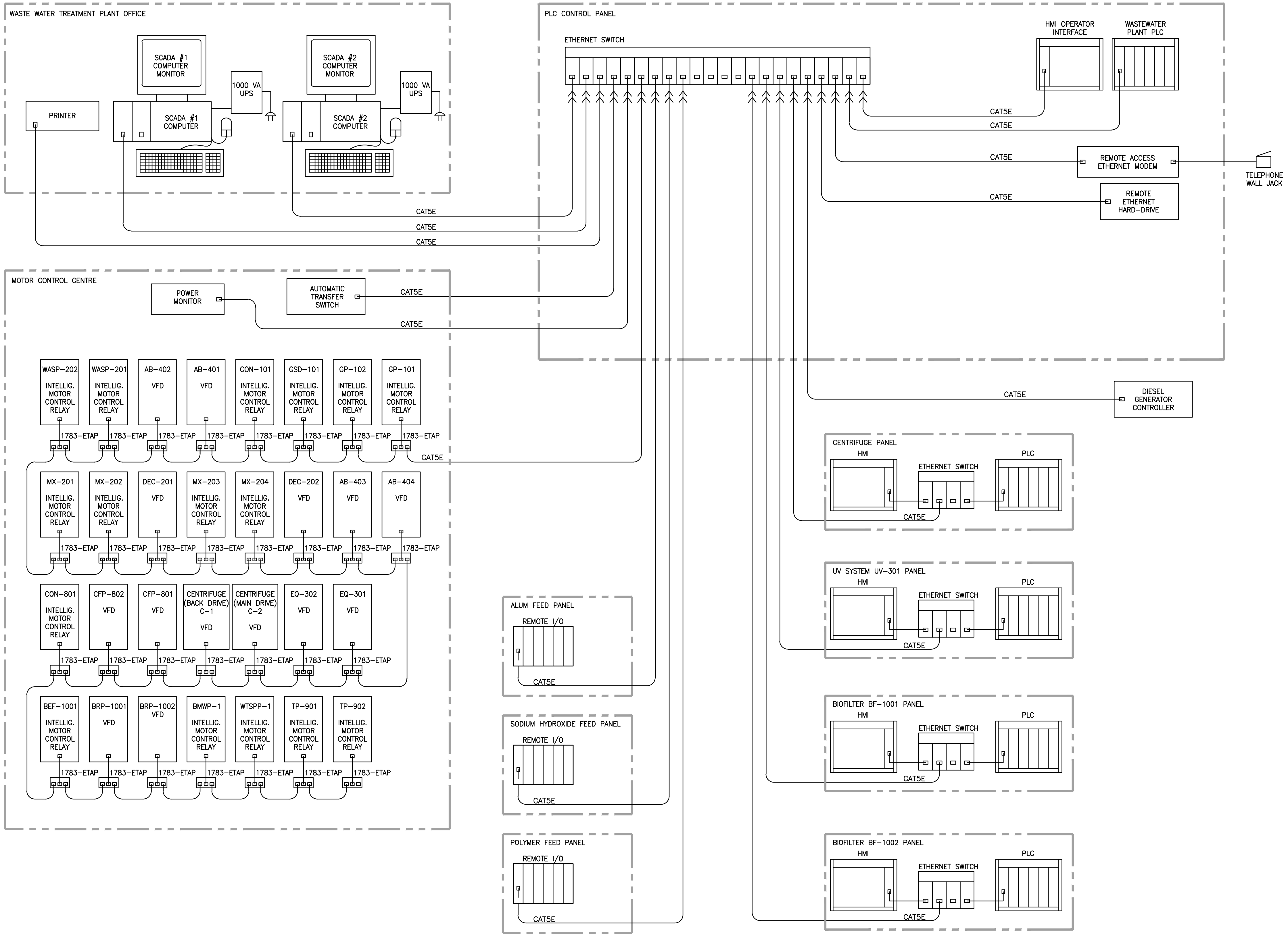

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Client/Project
CITY OF THOMPSON
WASTEWATER TREATMENT PLANT
UPGRADE / EXPANSION PROJECT

Thompson, MB Canada

Title
SCADA SYSTEM
ARCHITECTURE

Project No. 111214440
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APPENDIX C

Geotechnical Report

THE
NATIONAL
TESTING
LABORATORIES
LIMITED
Established in 1923

CELEBRATING
90 Years
1923 - 2013

GEOTECHNICAL INVESTIGATION AND FOUNDATION ENGINEERING REPORT FOR WASTEWATER TREATMENT PLANT UPGRADE AND EXPANSION THOMPSON, MANITOBA

Prepared for
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Prepared by
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October 31, 2013

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1.0 SUMMARY

The National Testing Laboratories Limited was retained to undertake a geotechnical investigation and provide recommendations for the Wastewater Treatment Plant (WWTP) Upgrade and Expansion project in Thompson, Manitoba. It is our understanding that the project will include a treatment plant, an office building adjacent to the treatment plant, pavement areas and a new forcemain. Nine testholes were drilled at the WWTP project site and ten testholes were drilled along the proposed alignment for the forcemain on August 12, 13 and 14, 2013. The geotechnical investigation revealed a typical soil profile of topsoil, clay fill, clay and sand to the depths explored in the testholes. Based on the soil and groundwater conditions encountered at the testhole locations, the tanks for the treatment plant may be supported on a raft slab and the adjacent office building may be supported on cast-in-place concrete friction piles.

2.0 TERMS OF REFERENCE

The scope of work for this project was outlined in our proposals dated June 19, 2013 for the WWTP and July 10 for the forcemain. Saibal Basu of Stantec provided authorization to proceed with the geotechnical investigation for the WWTP on July 9 and for the forcemain on August 2, 2013.

3.0 PROJECT SITE AND PROPOSED CONSTRUCTION

The project site for the WWTP is located at the north end of Nelson Road adjacent to the existing WWTP. It is our understanding that the project will include a treatment plant, an office building adjacent to the treatment plant, pavement areas and a new forcemain. The pavement areas will be located adjacent to the proposed WWTP. The project site for the WWTP is currently used as a snow dump during the winter months and a waste disposal facility for construction debris. The proposed alignment for the forcemain runs along Nelson Road, Princeton Drive and Weir Road. Photographs taken of the project site at the time of the field drilling program are provided in Appendix A.

It is our understanding the proposed wastewater treatment process will be based on three-tank Sequencing Batch Reactor (SBR) technology with sludge digesters. Each SBR tank is approximately 13 m wide by 50 m long, and either 4 m or 6 m deep (not including the top slab and the bottom slab). It was reported that the SBR and digester tanks will project approximately 0.6 m above the ground level. The preferred foundation system for the SBR and digester tanks is a raft slab. The detailed design for the treatment plant and office building has not been completed and therefore foundation loads are currently unknown. A general site plan for the WWTP is shown on the Testhole Location Plan provided in Appendix B.

4.0 GEOTECHNICAL INVESTIGATION

4.1 Testhole Drilling and Soil Sampling

The subsurface drilling and sampling program was conducted on August 12, 13 and 14, 2013. Drilling services were provided by Maple Leaf Drilling Ltd. under the supervision of our geotechnical field personnel. Nineteen testholes were drilled using a track-mounted drill rig equipped with 125 mm solid stem augers. A Stantec surveyor identified the locations of the testholes for the wastewater treatment plant and the forcemain. The testhole locations are shown on the Testhole Location Plans provided in Appendix B. The depths of the testholes for the site investigation are summarized in the following table.

Table 1 - Field Drilling Program

WWTP Site		**Forcemain**	
Testhole no.	**Testhole Depth (m)**	**Testhole no.**	**Testhole Depth (m)**
TH01	3.0	TH11	3.8
TH02	3.0	TH12	3.8
TH03	15.7	TH13	3.8
TH04	15.2	TH14	3.8
TH05	15.2	TH15	3.8
TH06	7.6	TH16	2.1
TH07	15.2	TH17	3.8
TH08	15.2	TH18	3.8
TH09	15.2	TH19	3.8
TH10	3.8		

Representative soil samples were obtained directly from the augers at depth intervals ranging from 0.3 to 1.5 m. Standard penetration tests were conducted in Testholes TH03, TH07 and TH08. Six undisturbed soil samples were recovered using thin walled Shelby tubes from Testhole TH03. Soil samples recovered from the testholes were examined for evidence of permafrost and no ice crystals or ice lenses were observed in the soil samples. Soil temperatures were checked with an infrared thermometer and were found to range from 1° to 16°C. A monitoring well was installed in Testhole TH06. The monitoring well was slotted between a depth of 0.9 m and 7.6 m and was installed to a depth of 7.6 m. Upon completion of drilling, the testholes were examined for evidence of sloughing and groundwater seepage. The soil samples were visually classified in the field and returned to our soils laboratory for additional examination and testing. The testholes were backfilled with the auger cuttings upon completion of the field drilling program. Excess soil cuttings were left at the testhole locations on the project site.

4.2 Laboratory Testing

Soil samples recovered from the testholes were tested for water content and shear strength and the test results are shown on the testhole logs provided in Appendix C. Selected soil samples were tested for particle size (ASTM D422), Atterberg limits (ASTM D4318) and unconfined compressive strength (ASTM D2166). The test data for particle size, Atterberg limits and unconfined compressive strength are summarized in the following tables.

Table 2 - Particle Size and Atterberg Limits Test Data

Testhole no.	Sample Depth (m)	Soil Type	Particle Size				Atterberg Limits		
			Gravel (%) 75 to 4.75 mm	Sand (%) <4.75 to 0.075mm	Silt (%) <0.075 to 0.005 mm	Clay (%) <0.005 mm	Liquid Limit	Plastic Limit	Plasticity Index
TH03	0.9	Clay	0	0.8	1.0	98.2	77	26	51
TH03	2.3	Clay	0.1	0.6	3.6	95.7	57	22	35
TH06	6.1	Clay	0	0.2	8.3	91.5	43	20	23

Table 3 - Unconfined Compressive Strength Data

Testhole no.	Sample Depth (m)	Soil Type	Unconfined Compressive Strength (kPa)
TH03	1.9	clay	48
TH03	3.5	clay	185
TH03	5.0	clay	176
TH03	6.5	clay	152
TH03	8.0	clay	123
TH03	9.5	clay	89

The laboratory test reports are provided in Appendix D.

5.0 SUBSURFACE CONDITIONS

5.1 Soil Profile

The typical soil stratigraphy at the site, as interpreted from the testhole logs, consists of topsoil, clay fill, clay and sand to the depths explored in the testholes. Silty clay was encountered in Testholes TH01, TH08, TH09 and TH13. Clayey silt was encountered in Testholes TH03, TH15, TH16 and TH17. Silt was encountered in Testholes TH05, TH07, TH08 and TH09.

Topsoil

Topsoil was encountered at the surface of Testholes TH10 to TH19. The thickness of the topsoil ranged from approximately 75 mm to 300 mm. Water contents of the topsoil ranged from 7 to 42%.

Clay Fill

Clay fill was encountered at the ground surface at the WWTP project site (Testholes TH01 to TH09) and below the topsoil in Testholes TH10, TH11, TH12, TH17 and TH19. The clay fill extended to depths ranging from 0.5 to 2.3 m in the testholes. The composition and consistency of the clay fill was variable at the testhole locations. The clay fill was brown, soft to firm, moist, and of medium plasticity with some fine to coarse sand, trace to some fine to coarse gravel, trace to some silt and trace to some organic material. Water contents of the clay fill ranged from 10 to 42%.

Clay

Clay was encountered below the clay fill and topsoil in the testholes. On the WWTP site, clay extended to the depths ranging from 2.6 to 11.4 m. Along the proposed alignment for the forcemain, clay typically extended to 3.8 m, the maximum depth explored in the testholes. The clay was brown to grey, firm to very stiff, moist, and of medium to high plasticity with some silt. Water contents of the clay ranged from 25 to 47%.

Silty Clay

Silty clay was encountered below the clay fill in Testholes TH01 and TH09 and below the clay in Testholes TH08 and TH13. The silty clay was encountered at depths ranging from 0.8 m to 2.5 m and extended to depths ranging from 1.4 to 6.9 m. The silty clay was tan to brown to grey, soft to firm, moist, and of medium to high plasticity. Water contents of the silty clay ranged from 22 to 32%.

Clayey Silt

On the WWTP site, clayey silt was encountered in Testholes TH03 at a depth of 11.3 and extended to a depth of 11.9 m Along the proposed alignment for the forcemain, clayey silt was encountered in Testholes TH15, TH16, and Testhole TH17 and extended to the depths explored in these testholes. The clayey silt was brown to grey, firm, moist, and of low to medium plasticity. Water contents of the clayey silt ranged from 21 to 33%.

Silt

Silt was encountered in Testholes TH05, TH07, TH08 and TH09 on the WWTP site. The silt was encountered at depths ranging from 6.8 to 11.1 m and extended to depths ranging from 7.9 to 12.3 m. The silt was tan to grey, soft to firm, moist and of low plasticity. Water contents of the silt ranged from 16 to 21%.

Sand

Sand was encountered in Testholes TH03, TH04, TH05, TH07, TH08 and TH09 on the WWTP site. The sand was encountered at depths ranging from 7.9 to 12.3 m and extended to the depths explored in the testholes. The sand was fine to medium grained, tan to brown to grey, compact, and moist. Water contents of the sand ranged from 4 to 31%.

5.2 Groundwater and Sloughing Conditions

No groundwater seepage or soil sloughing was observed in the testholes during the field drilling program except as noted in the following table.

Table 4 - Groundwater Conditions

Testhole no.	Groundwater Seepage	Groundwater Level
TH4	Heavy groundwater seepage at a depth of 1.2 m	Groundwater level at depth of 5.2 m upon completion of drilling
TH5	Minor groundwater seepage at a depth of 6.1 m	Groundwater level at depth of 15.2 m upon completion of drilling

Groundwater levels were checked in the monitoring well installed in Testhole TH06. The following table summarizes the groundwater levels at the monitoring well.

Table 5 - Groundwater Level in Monitoring Well (Testhole TH06)

Date	Depth to Groundwater
August 14	no water
August 15	7.56 m
September 9	2.59 m

It should be noted that only short-term seepage and sloughing conditions were observed in the testholes. Groundwater levels will normally fluctuate during the year and will be dependent on precipitation and surface drainage. Groundwater seepage and soil sloughing should be expected from the sand and permeable layers within the silty clay, clay and clay fill.

5.3 Permafrost

Minimum soil temperatures recorded at the testhole locations ranged from 1 to 6°C. Although no evidence of permafrost was observed in the soil samples recovered from the testholes, Thompson is located within the zone of discontinuous permafrost and consequently, isolated zones of permafrost may be present on the project site.

6.0 GEOTECHNICAL CONSIDERATIONS

Based on our current understanding of the project and the results of our geotechnical investigation, the primary geotechnical concerns are:

- Settlement of clay fill on WWTP site,
- Groundwater seepage from the clay layer on the WWTP site,
- Sloughing and groundwater seepage from the sand layer encountered below a depth of approximately 8 m on the WWTP site,
- Potential differential movement between the office building and the structure for the underground tanks,
- Risk of encountering bedrock at a shallow depth along the proposed alignment of the forcemain,
- Risk of encountering permafrost during excavation and foundation installation, and

- Long term settlement of structures and forcemain due to thaw degradation of permafrost.

These issues will be discussed in the following sections.

7.0 DESIGN RECOMMENDATIONS AND COMMENTS

7.1 Foundations

Based on the soil and groundwater conditions encountered at the testhole locations, the office building for the proposed WWTP may be supported on cast-in-place concrete friction piles and the underground tanks may be supported on a raft slab. The office building and the adjacent structure for the underground tanks will be supported on different foundation systems and consequently, measures must be taken to accommodate potential differential movement between the adjoining structures. A shallow foundation system is not recommended for the proposed office building due to variable soil conditions and low strength soils encountered at a shallow depth.

It is our understanding there are no plans to place a significant amount of fill on the project site. If more than 1 m of fill is to be placed on the site, we should be contacted to assess the potential for consolidation settlements and the impact on the foundation system due to placement of fill materials.

In accordance with the 2010 National Building Code of Canada (NBCC), the use of Limit States Design (LSD) is required for the design of buildings and their structural components including foundations. The limit states of LSD design are classified into two groups; the Ultimate Limit States (ULS) and the Serviceability Limit States (SLS).

The Ultimate Limit States case is primarily concerned with collapse mechanisms for the structure and hence, safety. For foundation design, ultimate limit states consist of:

- Exceeding the load-carrying capacity of the foundation
- Sliding
- Uplift
- Large deformation of foundation, leading to an ultimate limit state being induced in the superstructure or building
- Overturning, and
- Loss of overall stability

The factored resistance at the ULS is the ultimate geotechnical resistance multiplied by the appropriate resistance factor.

The Serviceability Limit State (SLS) case considers mechanisms that restrict or constrain the intended use or occupancy of the structure. They are typically associated with movements that interrupt or hinder the purpose of the structure. For foundation design, serviceability limit states can be categorized as:

- Excessive movements, and
- Unacceptable vibrations

The SLS case is addressed by determining the maximum available resistance to keep the foundation under service loads within tolerable limits as provided by the structural engineer. Unfactored permanent and transitory loads are used for calculating total deformation in non-cohesive soils. Unfactored permanent loads and appropriate portions of transitory loads are used for the initial and time-dependent final deformations of cohesive soils. Therefore, the foundation loads and serviceability tolerances have to be known to properly determine the SLS resistance values. In cases where tolerable movements are not provided by the structural engineer, the tolerable limit of total settlement for foundations subject to compression is assumed to be 25 mm.

7.1.1 Raft Slab

It is our understanding the proposed wastewater treatment process will be based on a three-tank Sequencing Batch Reactor (SBR) technology with sludge digesters. Each SBR tank will be approximately 13 m wide by 50 m long. Two options are being considered for the depth of the tanks, at 4 m and 6 m below existing grade. The existing effective vertical stress at a depth of 4 m and 6 m below grade is approximately 60 kPa and 80 kPa, respectively. A raft slab placed at a depth where the applied load is equal to or less than the existing effective vertical stress assures adequate bearing capacity and negligible settlement. A raft slab, constructed on firm clay, may be design based on the parameters in the following table.

Table 6 - Raft Slab Design Parameters

Depth below Existing Grade	Factored Bearing Resistance (ULS)	Serviceability Limit Pressure (SLS)
4 m	110 kPa	60 kPa
6 m	120 kPa	80 kPa

The modulus of subgrade reaction at a depth of 4 to 6 m is estimated be in the range from 13 to 27 MPa/m.

Construction equipment should not be allowed to travel directly on the foundation bearing surface. To minimize disturbance of the bearing surface, excavation with a flat bucket excavator is recommended at the foundation level. All loose and softened soil must be removed from the bearing surface. The clay subgrade has a high volume change potential and therefore, measures should be taken to prevent changes in soil moisture content at the foundation bearing surface. The bearing surface should not be exposed to excessive wetting or drying during construction. The magnitude of foundation movement related to volume change is difficult to predict but is estimated to be in the range of 15 to 25 mm. It is recommended that the foundation bearing surface be inspected and approved by qualified geotechnical personnel upon completion of excavation. Placement of a 75 mm thick concrete mud slab on the bearing surface upon completion of excavation is recommended to minimize moisture content changes and disturbance of the clay subgrade. If construction takes place during freezing weather, measures must be taken to prevent frost penetration beneath the foundation bearing surface. Frost heave of the subgrade soil will occur if it is exposed to freezing temperatures.

Potential uplift of the tanks should be checked, particularly during construction when foundation loads will be less than the design loads. The buoyancy pressure at a depth of 4 m and 6 m will be approximately 40 kPa and 60 kPa, respectively, with the water table assumed at the ground surface.

7.1.2 Cast-in-Place Concrete Friction Piles

Cast-in-place concrete friction piles are suitable for light to moderate foundation loads and may be designed based on the shaft resistance values shown in the following table.

Table 7 - Geotechnical Shaft Resistance for Cast-in-Place Concrete Friction Piles

Depth Interval below Existing Grade	Factored Geotechnical Shaft Resistance at ULS
0 to 1.5 m	0 kPa
1.5 to 6.0 m	21 kPa
6.0 to 11.0 m	14 kPa

The shaft resistance is based on the soil conditions encountered in Testholes TH01, TH03, TH04 and TH06 drilled at the proposed location for the office building. For friction piles, less than 15 mm of settlement is required to mobilize skin friction and consequently, the SLS case does not govern pile design.

Due to the presence of clay and clay fill at a shallow depth and the potential for soil drying and shrinkage near the ground surface, the frictional support should be excluded in the calculation of the pile capacity as follows.

- For piles beneath heated buildings (not perimeter piles), the depth to ignore for frictional support should be the greater of the upper 1.5 m below the adjacent ground surface or 1 m below the top of the pile.
- For perimeter or exterior piles, the depth to ignore for frictional support should be the greater of the upper 2.5 m below the adjacent ground surface or 1 m below the top of the pile.

The shaft resistance value is applied to the pile circumference within the clay stratum over the depth intervals indicated in the above table. The contribution from end bearing should be ignored in pile capacity calculations.

To avoid pile group effects, the minimum pile spacing should be three pile diameters, measured center to center. If pile spacing is less than three pile diameters, additional analyses will be required to evaluate the settlement and capacity of the pile group. Settlement calculation for a pile group is based on the foundation load and the consolidation properties of the soil below the base of the piles. The capacity of a pile group is reduced as the pile spacing is decreased.

Heavy groundwater seepage was observed in Testhole TH04 at a depth of 1.2 m within the clay fill, and in Testhole TH05 at a depth of 6.1 m within the clay. Pile holes should be poured with concrete as soon as they are drilled to minimize any potential problems related to soil sloughing and groundwater seepage. Temporary steel sleeves should be available in the event that groundwater seepage or sloughing of the pile holes is encountered during pile installation. Groundwater, if encountered in the pile holes, should be removed prior to concrete placement. Pile inspection by qualified geotechnical personnel should be provided during foundation construction to confirm that the piles are constructed in accordance with the project specifications.

It is recommended that the pile length not exceed 11 m from existing grade to reduce the risk of encountering sand during pile installation. A minimum void space of 150 mm should be provided beneath all structural elements to accommodate potential heave of the high plasticity clay and clay fill.

7.2 Tank Foundation Walls

Below grade walls should be designed to resist lateral earth pressures based on the following formula:

$$P = K_o (\gamma D + q)$$

where
P = lateral earth pressure at depth D, kPa
K_o = At rest earth pressure coefficient
γ = soil unit weight
q = live load surcharge within distance D, kPa

The above expression assumes the below grade walls will be drained and there will be no buildup of hydrostatic pressure on the walls, and a permanent horizontal surfaced will be utilized behind the wall. To prevent the buildup of hydrostatic pressure on the below grade walls, backfill behind retaining structures should consist of free draining granular material. The granular zone adjacent to the walls should be at least 0.9 m wide and be connected to a drainage system at the base of the wall. Clay or silt should not be used to backfill the foundation walls because these soils are not considered to be sufficiently free draining.

Table 8 - Lateral Earth Pressure Design Parameters

Soil Type	Soil Unit Weight	At Rest Lateral Earth Pressure Coefficient, K_O
Clay fill	17 kN/m³	0.70
Granular fill	21 kN/m³	0.48

In order to use the earth pressure coefficients for the granular fill material, the granular backfill must be placed within a wedge defined by the back of the wall and a line extending from the base of the wall at 45°. If a smaller wedge is used, the earth pressure coefficients of the material outside the backfill wedge must be used for lateral pressure design calculations. A factor of safety of 2.0 should be used to assess stability with respect to overturning.

7.3 Soil-Supported Floor Slab

Due to the presence of high plasticity clay at the project site, the potential exists for heave of a soil-supported slab. Soil moisture contents will typically increase after construction which causes swelling of clay soils. The magnitude of heave for soil-supported floor slabs is typically in the range of 25 to 70 mm but can be as high as 100 mm. Heave is generally higher on sites where leaking water supply or sewer lines, removal of vegetation, or poor drainage leads to increased moisture contents in the clay soil after construction. Based on the soil conditions encountered on the project site, the maximum heave of a soil-supported slab is estimated to be in the range of 25 to 50 mm. To minimize potential heave of a soil-supported floor slab, measures must be taken to prevent drying of the subgrade soils during construction.

Due to the variable consistency and composition of the clay fill encountered at a shallow depth, the clay fill is unsuitable as a subgrade soil for a soil-supported floor slab and must be removed prior to placement of granular fill materials. Construction of the floor slab should proceed as follows:

- Remove clay fill and weak subgrade soils to expose underlying clay or silty clay.
- Proof roll exposed subgrade to identify unsuitable subgrade soils
- Excavate low strength soils identified during proof rolling and replace with granular sub-base material
- Place and compact granular sub-base to the design elevation for the underside of the granular base course
- Place and compact granular base course

The minimum thickness of granular base course beneath the concrete floor slab should be 150 mm. All granular fill materials should be placed in 150 mm thick lifts and compacted to at least 100% of Standard Proctor Density.

The granular base course and sub-base materials for floor slab construction should comply with the requirements for Manitoba Infrastructure and Transportation Class A and Class C

Base Course respectively. The requirements for the granular fill materials are shown in the following table.

Table 9 - Granular Fill Requirements for Floor Slab

Sieve Size	Base Course	Sub-Base
37.5 mm		100%
25 mm		85 to 100%
19 mm	100%	—
16 mm	80 to 100%	—
4.75 mm	45 to 70%	25 to 80%
2.00 mm	25 to 55%	—
425	15 to 30%	15 to 40%
75	8 to 15%	8 to 18%
Crush content	35% min.	15% min.
Shale content	12% max.	15% max.
LA abrasion	35% max.	40% max.

Sieve analysis and compaction testing of the granular fill materials should be conducted to ensure the materials and compaction comply with the design specifications.

If the potential movements associated with volume change of the high plasticity clay are unacceptable, a structural floor system is recommended. A structural floor should be provided with a minimum 150 mm void space between the soil and the underside of the slab to accommodate potential heave of the underlying clay.

7.4 Forcemain

Based upon the testholes drilled along the proposed alignment for the forcemain, excavation for the forcemain will encounter clay fill, clay, silty clay and clayey silt. Testhole TH16 reached power auger refusal at a depth of 2.1 m on suspected bedrock. Although no coring was conducted during our site investigation to confirm the presence of bedrock, blasting may be required to remove bedrock along the forcemain alignment. Excavation within the clayey silt will be difficult due to the potential for sloughing within this soil layer.

7.5 Frost Penetration

The depth of frost penetration is dependent upon the rate of heat loss from the ground surface. The depth and type of backfill materials, trench geometry and the type of native soils all play a role in frost penetration into the ground where the underground services are buried. Besides the thermal properties of the soil, frost penetration is dependent upon climatic variables such as solar radiation, snow cover, wind and air temperature. Water service pipes backfilled with granular materials are especially prone to freezing because of high thermal diffusivity and low moisture content of the backfill materials. Frost penetration depths within the native soils on the project site are expected to be in the range of 2.5 to 3.0 m. Frost penetration depths will be greater for granular materials that are typically used to backfill underground services.

7.6 Excavations

Temporary excavations will be required for construction of the SBR tanks and the installation of the forcemain. The stability of temporary excavations is a function of several factors, including the total time the excavation is exposed, moisture conditions, soil type, soil consistency and the contractor’s operations. As a guideline for construction of the SBR tanks, open excavations to a maximum depth of 3 m may be sloped at a gradient of 1 horizontal to 1 vertical or less in the clay. It is anticipated that excavations for the forcemain will be undertaken using a shoring system due to the limited space for sloped excavations along the proposed alignment.

On September 9, 2013, the groundwater level was measured at a depth of 2.6 m in the monitoring well installed in Testhole TH06. Groundwater seepage and soil sloughing should be expected from the clay fill, clay and silty clay during excavation for the raft slab. The introduction of excessive moisture will often result in unstable excavation conditions. The design of excavation slopes or shoring must recognize the presence of water-bearing layers that will be encountered. Water within the excavation should be collected in a sump and pumped from the excavation. Excavated slopes should be protected from wetting and weathering by suitable temporary covering. Surface drainage should ensure surface water is directed away from the excavation. All excavation works must comply with the Province of Manitoba Workplace Safety and Health Act and Guidelines for Excavation Work. It is the responsibility of the contractor to retain the services of a professional engineer to design a suitable shoring system or establish safe side slopes for excavations.

7.7 Pavements

It is our understanding that pavement areas will be constructed adjacent to the proposed WWTP. The testholes revealed a typical soil profile of clay fill, clay and silty clay near the ground surface. Based on Testholes TH01 and TH02 drilled in the vicinity of the proposed pavement area, the thickness of clay fill is expected to range from 0.8 to 1.5 m. The clay fill is considered unacceptable subgrade for the construction of the pavement areas and must be removed prior to construction of the pavement section. Subgrade preparation and placement of granular fill for the pavement areas should be completed as follows:

- Remove clay fill and weak subgrade soils to expose underlying clay or silty clay.
- Proof roll the subgrade soil to identify unsuitable soils
- Excavate low strength soils identified during proof rolling and replace with granular sub-base material

- Place and compact granular sub-base to the design elevation for the underside of the granular base course
- Place and compact granular base course

Inspection of the subgrade by qualified geotechnical personnel is recommended during subgrade preparation.

The minimum pavement sections recommended for the WWTP project site are shown in the following table.

Table 10 - Asphalt Pavement Sections

Material	Light Duty Pavement	Heavy Duty Pavement
Asphaltic Concrete	65 mm	100 mm
Base Course	100 mm	100 mm
Sub-base	250 mm	350 mm

The light duty pavement section should be used where traffic loading will consist of passenger vehicles and light duty trucks. In areas where the pavement will be subjected to heavier traffic loads, the heavy duty pavement section is recommended.

Preparation of the subgrade and pavement construction should comply with the Manitoba Infrastructure and Transportation Standard Construction Specifications nos. 700 and 900. The granular base and sub-base materials should comply with the requirements for Manitoba Infrastructure and Transportation Class A and Class C Base Course respectively. The requirements for the granular fill materials are shown in Table 9 of section 7.3 of this report.

Sieve analysis and compaction testing of the base course and sub-base materials should be conducted to ensure that the materials and compaction comply with the design specifications. For the hot mix asphaltic concrete, compaction testing and Marshall analysis of the paving mix during construction should be undertaken. This will confirm that the asphaltic concrete has been supplied and installed in accordance with the project specifications.

8.0 FOUNDATION CONCRETE

The clay soils in Thompson contain sulphates that will cause deterioration of concrete. The class of exposure for concrete in contact with clay soil in the Thompson area is considered to be severe (S-2 in CSA A23.1-09 Table 3). The requirements for concrete exposed to severe sulphate attack are provided in the following table.

Table 11 - Mix Requirements for Foundation Concrete

Parameter	Design Requirement
Class of exposure	S-2
Compressive strength	32 MPa at 56 days
Air content	4 to 7%
Water-to-cementing materials ratio	0.45 max.
Cement	Type HS or HSb

Concrete in contact with the native soils should meet the above requirements.

9.0 DRAINAGE

All roof downspouts should be directed away from the WWTP building and the ground surface around the building should be graded to promote drainage away from the foundation and therefore minimize the risk of water accumulation and potential soil swelling. Final site grading should ensure that all surface runoff is directed away from the building using a minimum gradient of 2%. To compensate for potential settlement of backfill materials adjacent to the building, the grade should be increased to 10% for the first 2 m from the building. A drainage layer adjacent to the foundation wall and a weeping tile drainage system at the base of the tank foundation wall should be provided to prevent the buildup of hydrostatic pressure on below grade walls.

10.0 DESIGN REVIEW, CONSTRUCTION MONITORING AND TESTING SERVICES

The National Testing Laboratories Limited should be retained to review the foundation plans and specifications for conformance with the intent of our recommendations. During construction, The National Testing Laboratories Limited should provide field observation and testing to check that the site preparation, excavation and foundation installation conform to the intent of these recommendations, project plans, and specifications. We recommend that a representative from our firm be involved with the following tasks:

- Inspection of foundation installation
- Inspection of subgrade soils for floor slab and pavement areas
- Field density tests
- Concrete testing
- Testing of the bituminous paving mix

The purpose of the foundation and subgrade inspection services would be to provide The National Testing Laboratories Limited the opportunity to observe the soil conditions encountered during construction, evaluate the applicability of the recommendations presented in this report to the soil conditions encountered, and recommend appropriate changes in design or construction procedures if conditions differ from those described herein. The purpose of the field density tests is to confirm the fill materials have been compacted to the specified density. The purpose of the concrete and bituminous mix testing is to ensure these materials comply with the specification requirements.

11.0 CLOSURE

Professional judgments and recommendations are presented in this report. They are based partly on an evaluation of the technical information gathered during our site investigation and partly on our general experience with subsurface conditions in the area. We do not guarantee the performance of the project in any respect other than that our engineering work and judgment rendered meet the standards and care of our profession. The testholes may not represent potentially unfavourable subsurface conditions between testholes. If during construction soil conditions are encountered that vary from those discussed in this report, we should be notified immediately in order that we may evaluate effects, if any, on the foundation performance. The recommendations presented in this report are applicable only to this specific site. These data should not be used for other purposes.

We appreciate the opportunity to assist you in this project. Please call me if you have any questions regarding this report.

Prepared by	Reviewed by
German Gl.	Don Flatt
German Leal, P.Eng. Project Manager, Geotechnical Engineering	Don Flatt, M. Eng., P.Eng. Senior Geotechnical Engineer

APEGM
Certificate of Authorization
The National Testing Laboratories Limited
No. 690 Date: October 31, 2013

PROVINCE OF MANITOBA
D.G. FLATT
Member
5062
REGISTERED PROFESSIONAL ENGINEER

APPENDIX A

SITE PHOTOGRAPHS

Photo 1 - Concrete debris on the WWTP project site

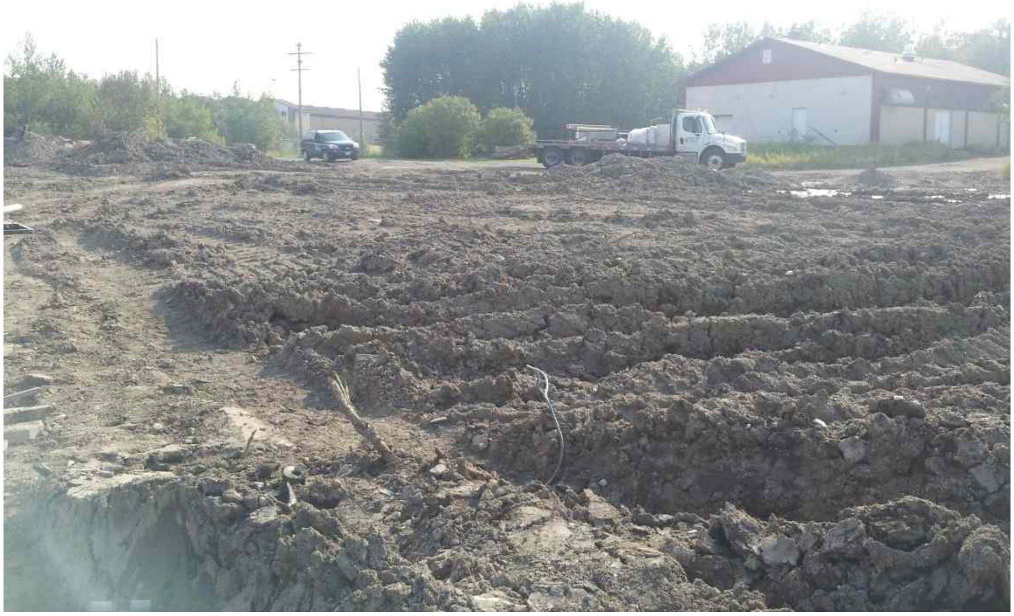


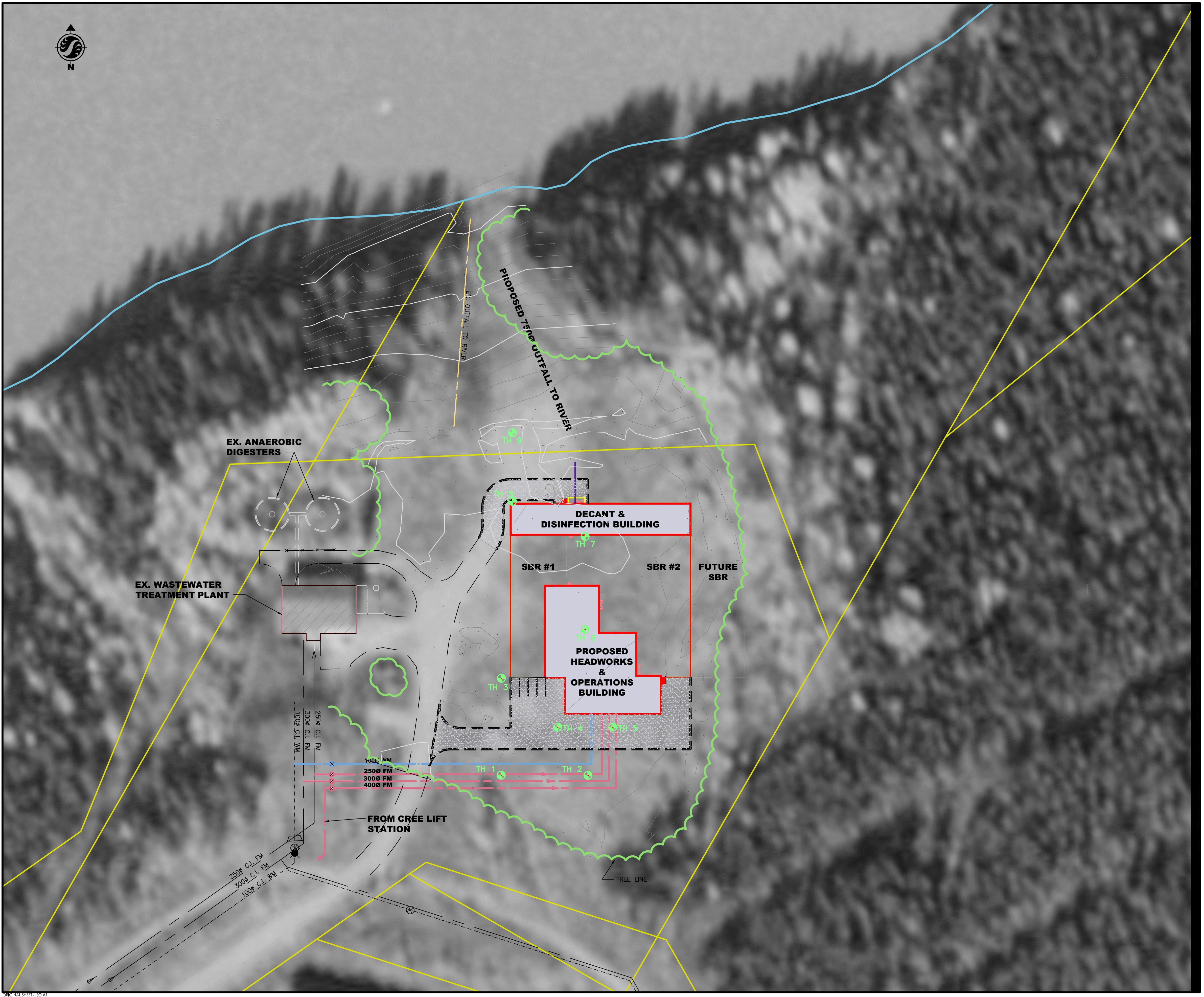
Photo 2 - Clay fill exposed at the surface of the WWTP project site

Photo 3 - Installation of monitoring well in Testhole TH06 on WWTP project site

Photo 4 - Testhole TH11 drilled along proposed alignment for forcemain

APPENDIX B

TESTHOLE LOCATION PLANS



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2013/10/30 10:01 AM By: Ramnarace, Kesh

ORIGINAL SHEET - ISO A1
00/000

Stantec
905 Waverley Street
Winnipeg, MB Canada
Tel. 204.489.5900
www.stantec.com

Consultants

Legend

Notes

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

	Dwn.	Chkd.	Dsgn.	YY.MM.DD
File Name: 14440c-101.dwg	KR	SAB	JB	2013.10.23

Permit-Seal

Client/Project
CITY OF THOMPSON
WASTEWATER TREATMENT PLANT

UPGRADE PROJECT

Thompson, MB Canada

Title

SITE PLAN

Project No.
111214440

Scale
1:125

Drawing No.
C-101

Sheet
of

Revision
0

1 SITE PLAN
1:10000

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2013/10/29 2:11 PM By: Ramnarace, Kesh

ORIGINAL SHEET - ANSI B

October 2013
111214440

Stantec

905 WAVERLEY ST.
Winnipeg, MB Canada
www.stantec.com

Legend

● TEST HOLE

Notes

Client/Project

THE CITY OF THOMPSON AND THE MANITOBA WATER SERVICES BOARD
THE CITY OF THOMPSON
WASTEWATER TREATMENT PLANT UPGRADE

Figure No.

1.0

Title

TEST HOLE LOCATION
SITE PLAN

APPENDIX C

TESTHOLE LOGS

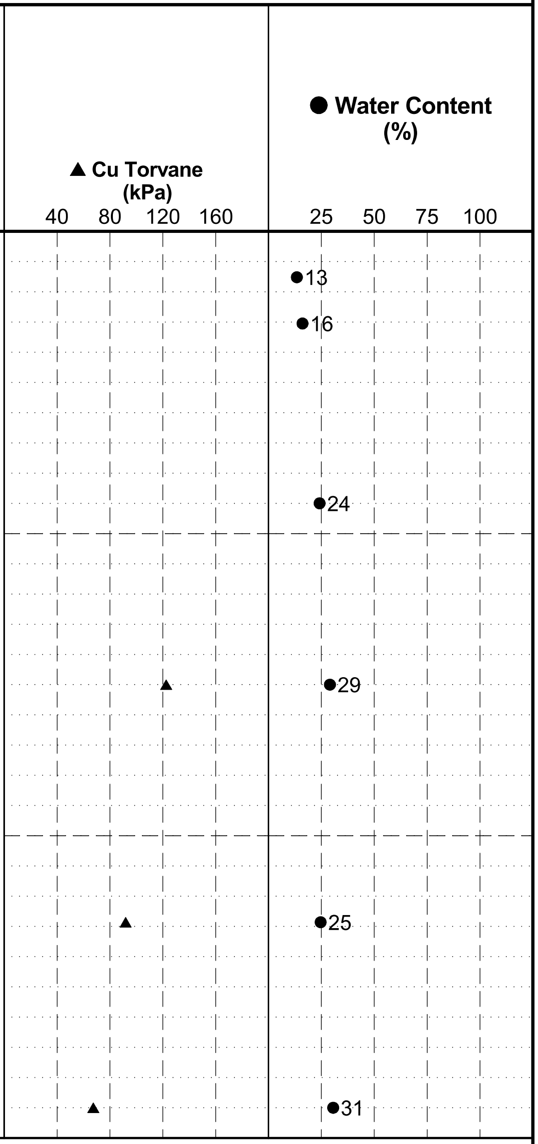
TESTHOLE TH01

THE NATIONAL TESTING LABORATORIES LIMITED
Established in 1923

Project Name: Wastewater Treatment Plant Upgrade and Expansion
Project Location: Thompson, Manitoba
Client: Stantec
Drilling Contractor: Maple Leaf Drilling Ltd.
Drilling Method: 125 mm Solid Stem Auger
UTM Coordinates: 14U 573250.1 m E, 6178715.9 m N

Date Drilled: August 12, 2013
Depth of Testhole: 3.0 m
Logged by: Sothea Bun
Reviewed by: German Leal
Testhole Elevation: 206.2 m

Elevation (m)	Symbol	Description	Sample Type
205.4		**Clay Fill** - brown, soft, moist, medium plasticity - trace organic material - some fine to coarse sand - trace fine gravel	BS BS
204.8		**Silty Clay** - brown, firm, moist, medium plasticity	BS
203.2		**Clay** - brown, stiff, moist, high plasticity - some silt below 2.1 m	BS BS BS BS



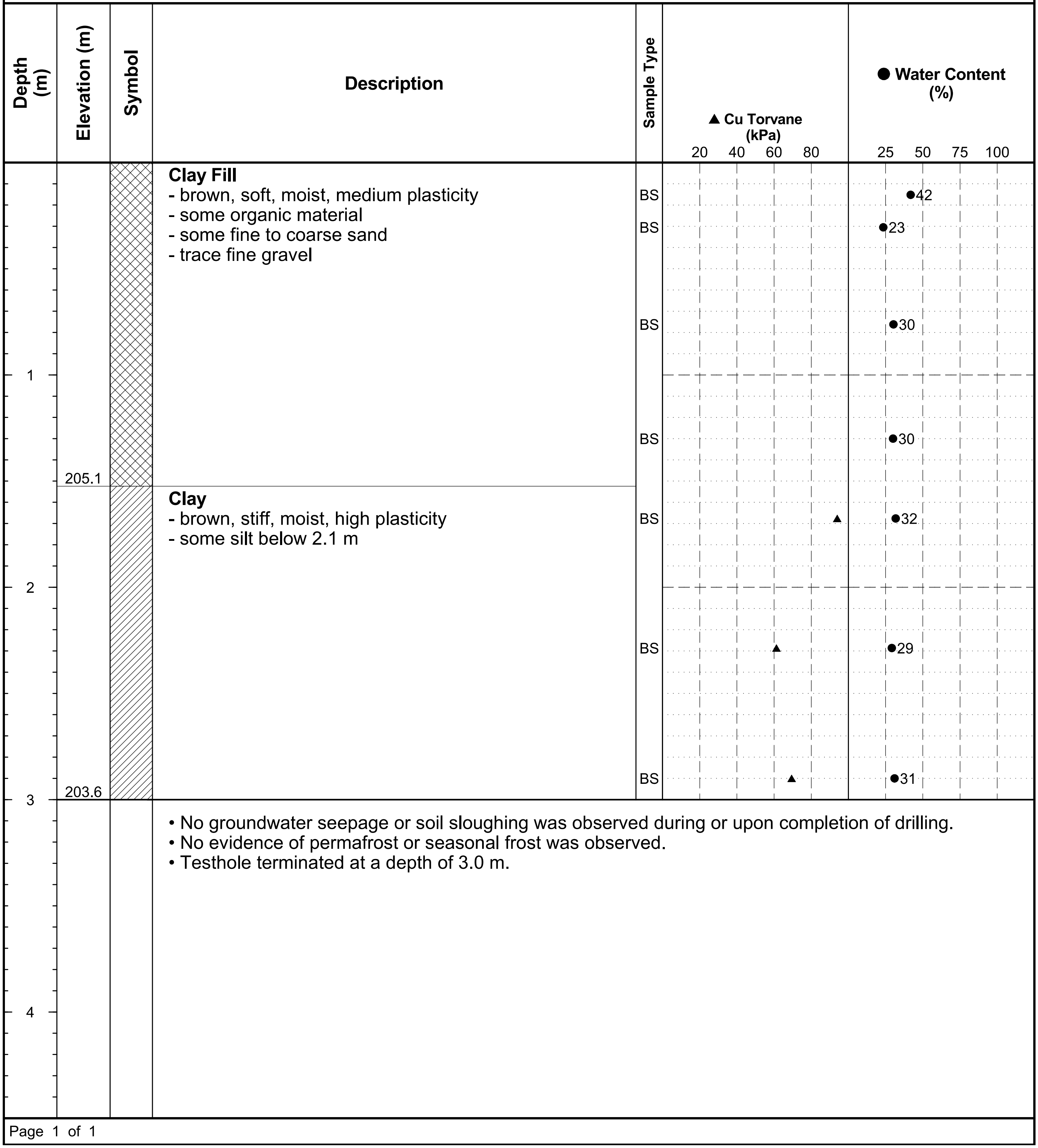
Depth (m): 1, 2, 3, 4

- No groundwater seepage or soil sloughing was observed during or upon completion of drilling.
- No evidence of permafrost or seasonal frost was observed.
- Testhole terminated at a depth of 3.0 m.

TESTHOLE TH02

Project Name: Wastewater Treatment Plant Upgrade and Expansion
Project Location: Thompson, Manitoba
Client: Stantec
Drilling Contractor: Maple Leaf Drilling Ltd.
Drilling Method: 125 mm Solid Stem Auger
UTM Coordinates: 14U 573274.8 m E, 6178714.4 m N

Date Drilled: August 12, 2013
Depth of Testhole: 3.0 m
Logged by: Sothea Bun
Reviewed by: German Leal
Testhole Elevation: 206.6 m



Clay Fill
- brown, soft, moist, medium plasticity
- some organic material
- some fine to coarse sand
- trace fine gravel

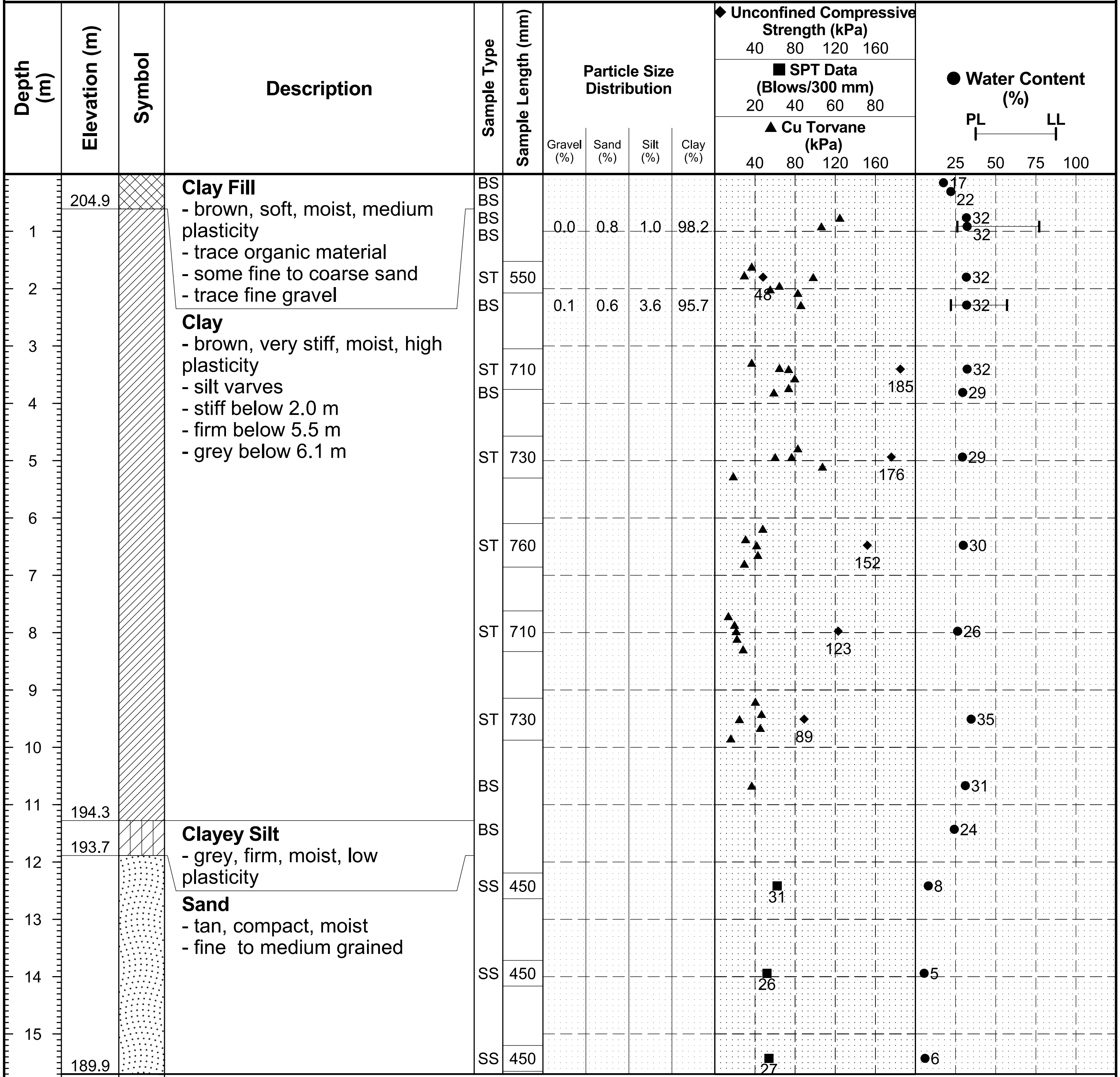
Clay
- brown, stiff, moist, high plasticity
- some silt below 2.1 m

- No groundwater seepage or soil sloughing was observed during or upon completion of drilling.
- No evidence of permafrost or seasonal frost was observed.
- Testhole terminated at a depth of 3.0 m.

TESTHOLE TH03

Project Name: Wastewater Treatment Plant Upgrade and Expansion
Project Location: Thompson, Manitoba
Client: Stantec
Drilling Contractor: Maple Leaf Drilling Ltd.
Drilling Method: 125 mm Solid Stem Auger
UTM Coordinates: 14U 573251.7 m E, 6178743.4 m N

Date Drilled: August 13, 2013
Depth of Testhole: 15.7 m
Logged by: Sothea Bun
Reviewed by: German Leal
Testhole Elevation: 205.6 m



Clay Fill
- brown, soft, moist, medium plasticity
- trace organic material
- some fine to coarse sand
- trace fine gravel

Clay
- brown, very stiff, moist, high plasticity
- silt varves
- stiff below 2.0 m
- firm below 5.5 m
- grey below 6.1 m

Clayey Silt
- grey, firm, moist, low plasticity

Sand
- tan, compact, moist
- fine to medium grained

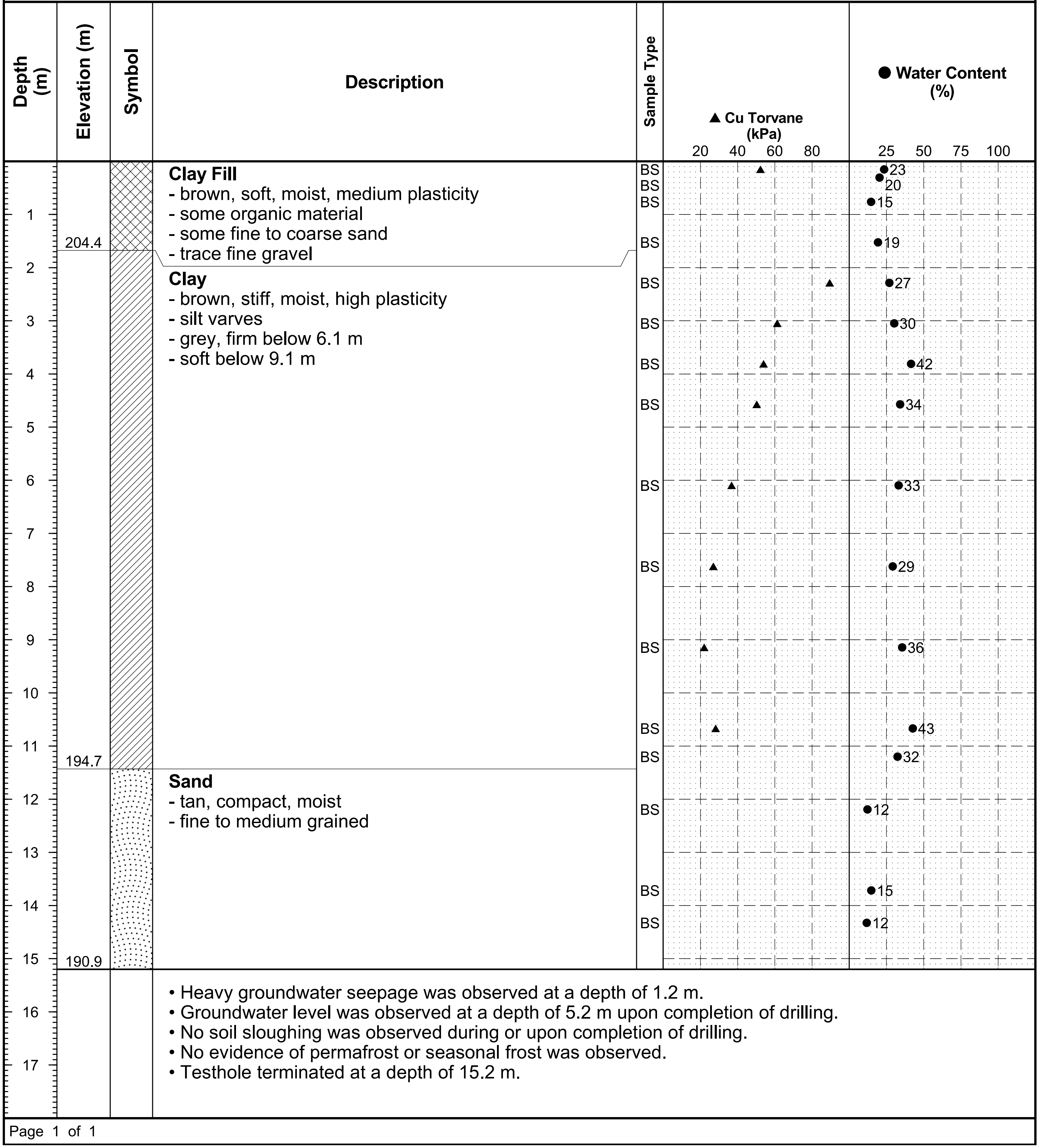
- No groundwater seepage or soil sloughing was observed during or upon completion of drilling.
- No evidence of permafrost or seasonal frost was observed.
- Testhole terminated at a depth of 15.7 m.

TESTHOLE TH04

THE NATIONAL TESTING LABORATORIES LIMITED
Established in 1923

Project Name: Wastewater Treatment Plant Upgrade and Expansion
Project Location: Thompson, Manitoba
Client: Stantec
Drilling Contractor: Maple Leaf Drilling Ltd.
Drilling Method: 125 mm Solid Stem Auger
UTM Coordinates: 14U 573266.9 m E, 6178728.6 m N

Date Drilled: August 13, 2013
Depth of Testhole: 15.2 m
Logged by: Sothea Bun
Reviewed by: German Leal
Testhole Elevation: 206.1 m



Clay Fill
- brown, soft, moist, medium plasticity
- some organic material
- some fine to coarse sand
- trace fine gravel

Clay
- brown, stiff, moist, high plasticity
- silt varves
- grey, firm below 6.1 m
- soft below 9.1 m

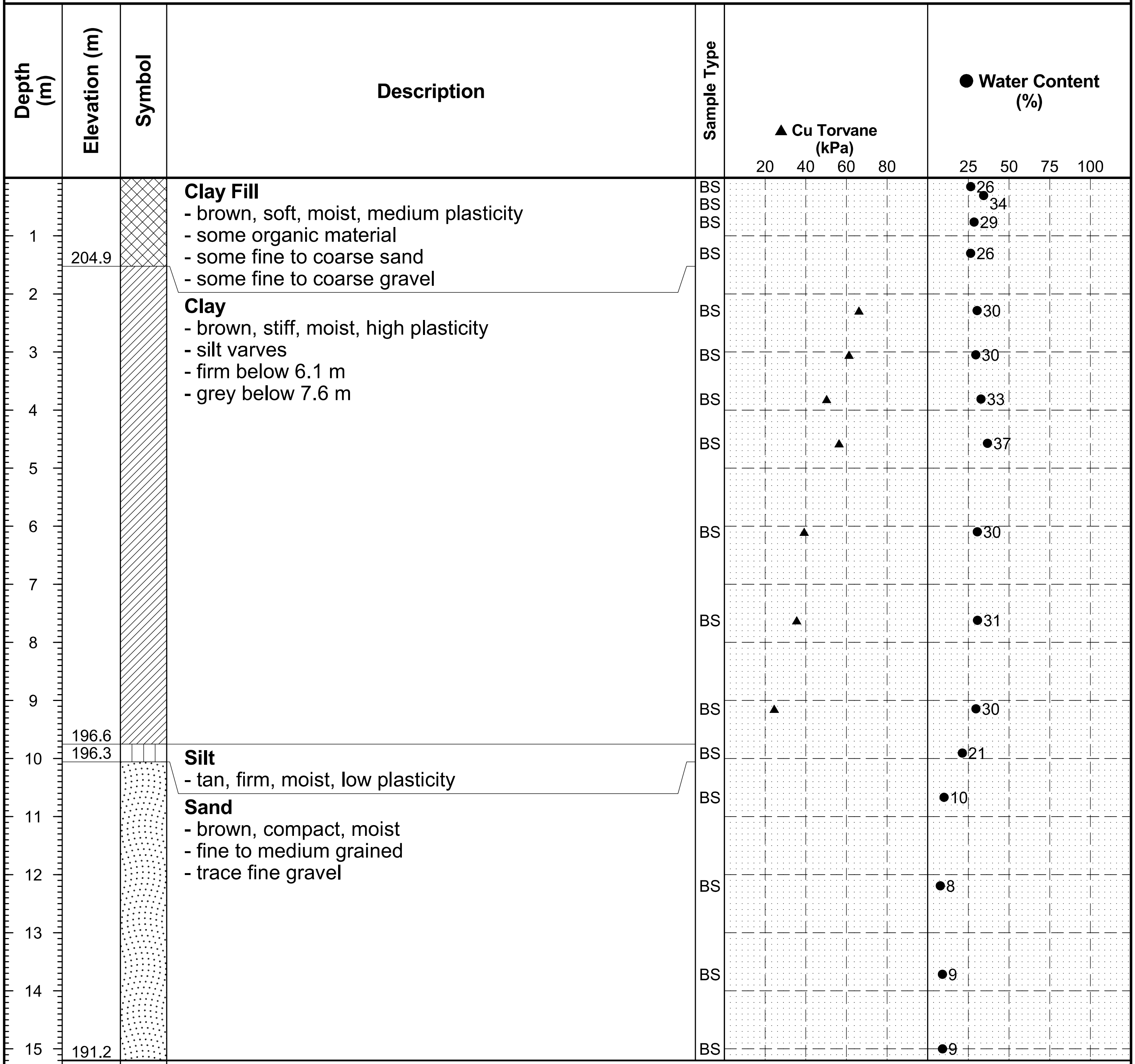
Sand
- tan, compact, moist
- fine to medium grained

- Heavy groundwater seepage was observed at a depth of 1.2 m.
- Groundwater level was observed at a depth of 5.2 m upon completion of drilling.
- No soil sloughing was observed during or upon completion of drilling.
- No evidence of permafrost or seasonal frost was observed.
- Testhole terminated at a depth of 15.2 m.

TESTHOLE TH05

Project Name: Wastewater Treatment Plant Upgrade and Expansion
Project Location: Thompson, Manitoba
Client: Stantec
Drilling Contractor: Maple Leaf Drilling Ltd.
Drilling Method: 125 mm Solid Stem Auger
UTM Coordinates: 14U 573282.6 m E, 6178727.8 m N

Date Drilled: August 13, 2013
Depth of Testhole: 15.2 m
Logged by: Sothea Bun
Reviewed by: German Leal
Testhole Elevation: 206.4 m



Clay Fill
- brown, soft, moist, medium plasticity
- some organic material
- some fine to coarse sand
- some fine to coarse gravel

Clay
- brown, stiff, moist, high plasticity
- silt varves
- firm below 6.1 m
- grey below 7.6 m

Silt
- tan, firm, moist, low plasticity

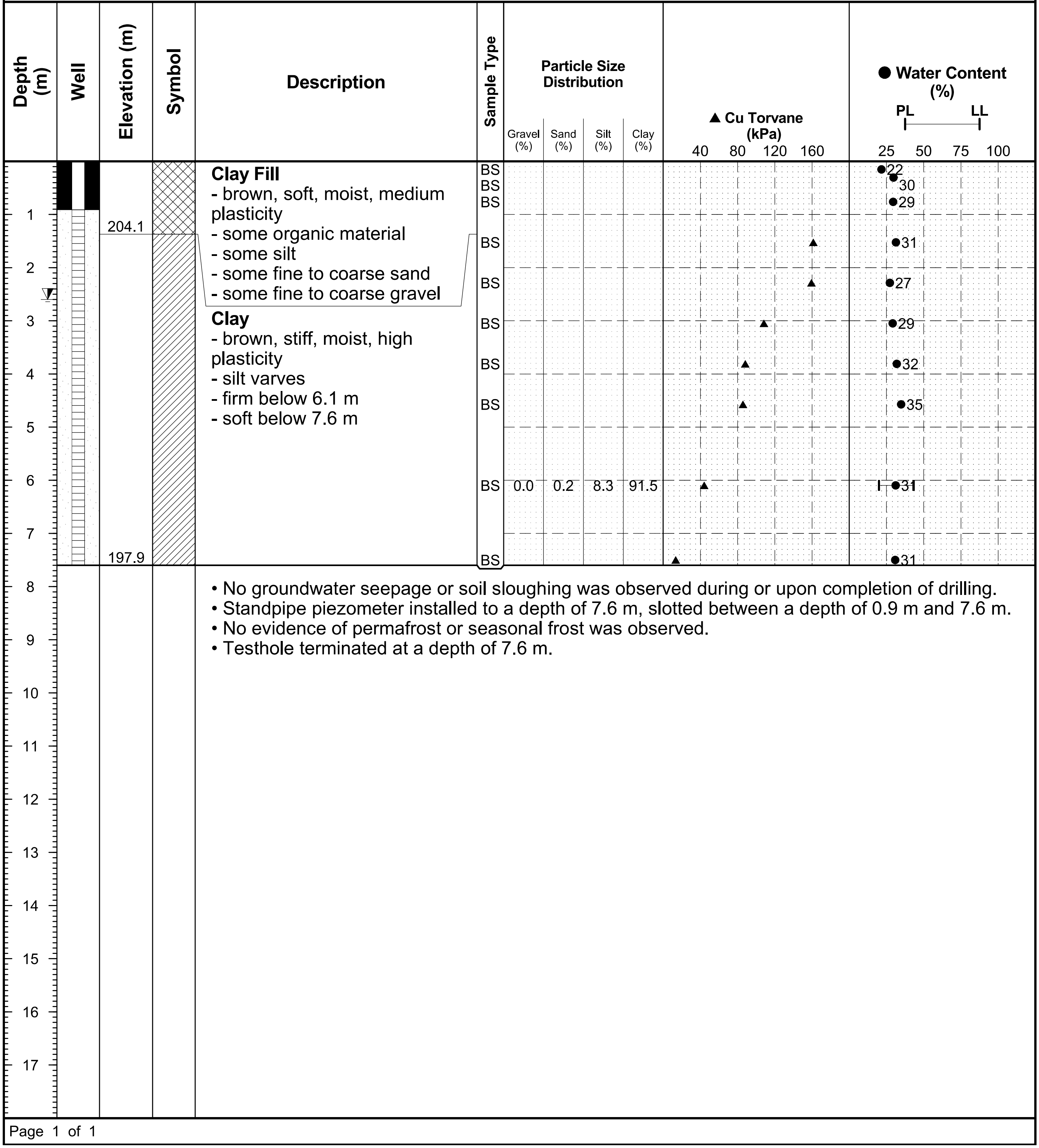
Sand
- brown, compact, moist
- fine to medium grained
- trace fine gravel

- Minor groundwater seepage was observed at a depth of 6.1 m.
- Groundwater level was observed at a depth of 15.2 m upon completion of drilling.
- No soil sloughing was observed during or upon completion of drilling.
- No evidence of permafrost or seasonal frost was observed.
- Testhole terminated at a depth of 15.2 m.

TESTHOLE TH06

Project Name: Wastewater Treatment Plant Upgrade and Expansion
Project Location: Thompson, Manitoba
Client: Stantec
Drilling Contractor: Maple Leaf Drilling Ltd.
Drilling Method: 125 mm Solid Stem Auger
UTM Coordinates: 14U 573276.2 m E, 6178756.0 m N

Date Drilled: August 13, 2013
Depth of Testhole: 7.6 m
Logged by: Sothea Bun
Reviewed by: German Leal
Testhole Elevation: 205.5 m



Clay Fill
- brown, soft, moist, medium plasticity
- some organic material
- some silt
- some fine to coarse sand
- some fine to coarse gravel

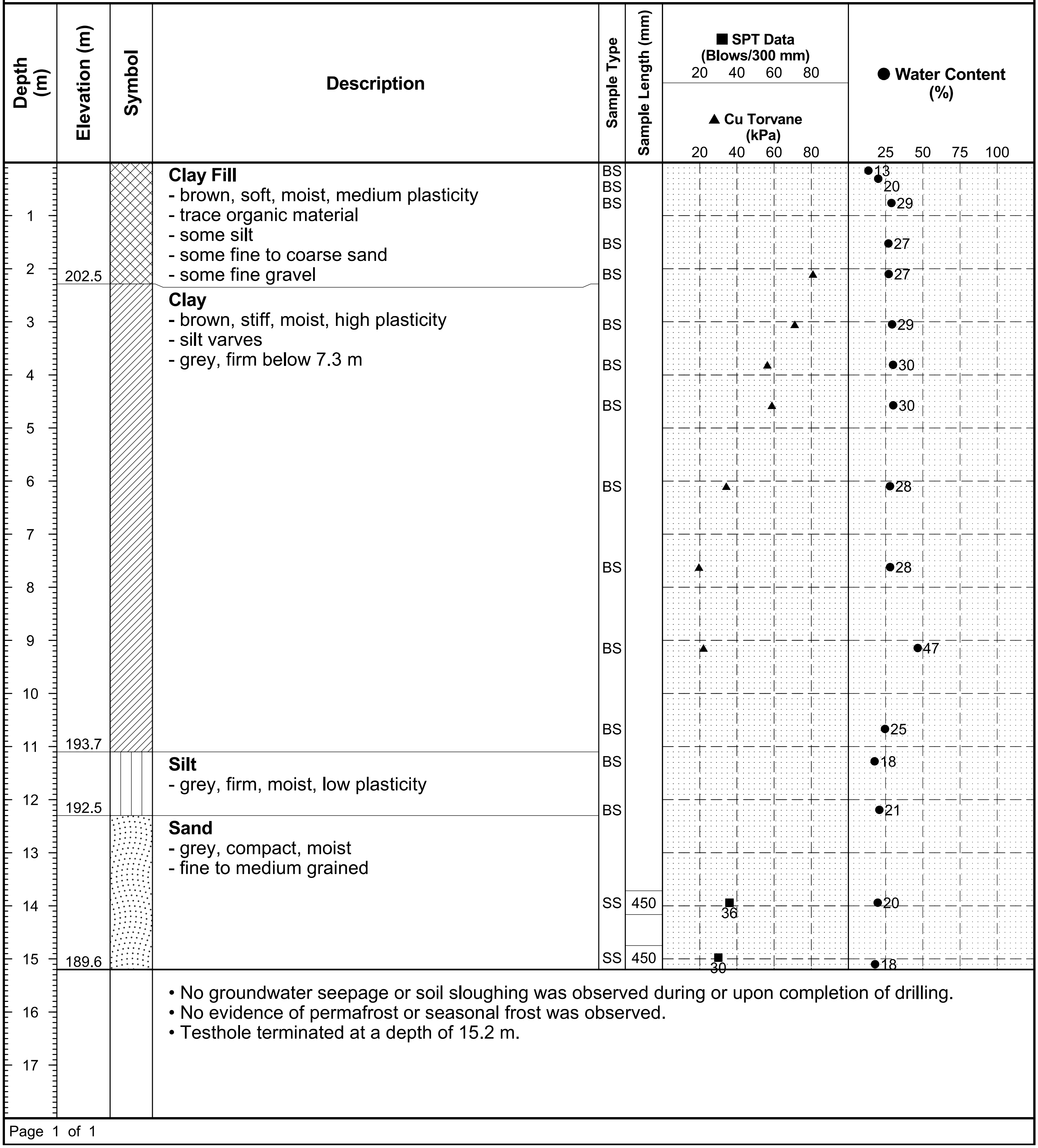
Clay
- brown, stiff, moist, high plasticity
- silt varves
- firm below 6.1 m
- soft below 7.6 m

- No groundwater seepage or soil sloughing was observed during or upon completion of drilling.
- Standpipe piezometer installed to a depth of 7.6 m, slotted between a depth of 0.9 m and 7.6 m.
- No evidence of permafrost or seasonal frost was observed.
- Testhole terminated at a depth of 7.6 m.

TESTHOLE TH07

Project Name: Wastewater Treatment Plant Upgrade and Expansion
Project Location: Thompson, Manitoba
Client: Stantec
Drilling Contractor: Maple Leaf Drilling Ltd.
Drilling Method: 125 mm Solid Stem Auger
UTM Coordinates: 14U 573277.7 m E, 6178782.5 m N

Date Drilled: August 13, 2013
Depth of Testhole: 15.2 m
Logged by: Sothea Bun
Reviewed by: German Leal
Testhole Elevation: 204.8 m



Clay Fill
- brown, soft, moist, medium plasticity
- trace organic material
- some silt
- some fine to coarse sand
- some fine gravel

Clay
- brown, stiff, moist, high plasticity
- silt varves
- grey, firm below 7.3 m

Silt
- grey, firm, moist, low plasticity

Sand
- grey, compact, moist
- fine to medium grained

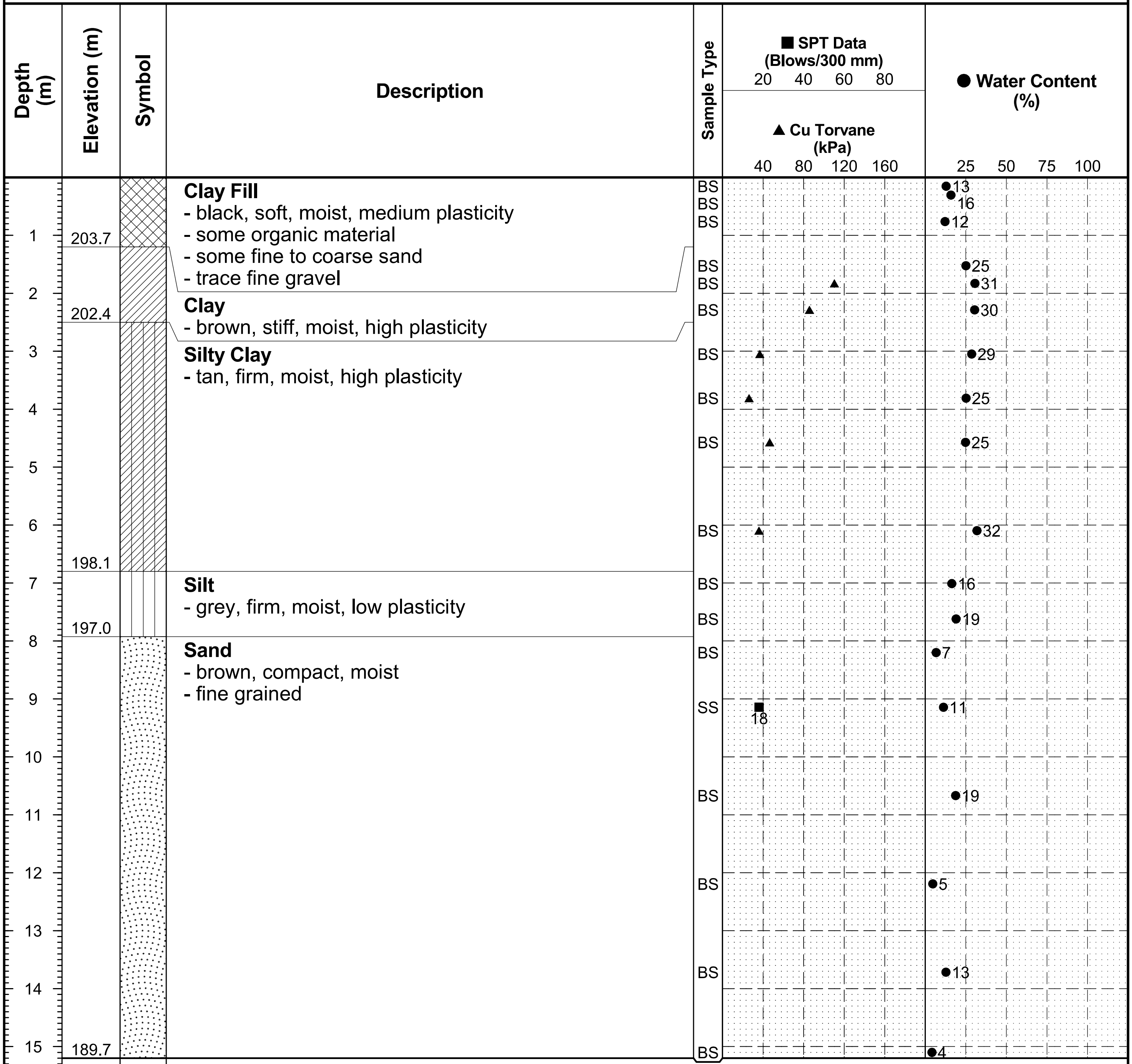
- No groundwater seepage or soil sloughing was observed during or upon completion of drilling.
- No evidence of permafrost or seasonal frost was observed.
- Testhole terminated at a depth of 15.2 m.

TESTHOLE TH08

THE NATIONAL TESTING LABORATORIES LIMITED
Established in 1923

Project Name: Wastewater Treatment Plant Upgrade and Expansion
Project Location: Thompson, Manitoba
Client: Stantec
Drilling Contractor: Maple Leaf Drilling Ltd.
Drilling Method: 125 mm Solid Stem Auger
UTM Coordinates: 14U 573257.5 m E, 6178793.6 m N

Date Drilled: August 13, 2013
Depth of Testhole: 15.2 m
Logged by: Sothea Bun
Reviewed by: German Leal
Testhole Elevation: 204.9 m



Clay Fill
- black, soft, moist, medium plasticity
- some organic material
- some fine to coarse sand
- trace fine gravel

Clay
- brown, stiff, moist, high plasticity

Silty Clay
- tan, firm, moist, high plasticity

Silt
- grey, firm, moist, low plasticity

Sand
- brown, compact, moist
- fine grained

- No groundwater seepage or soil sloughing was observed during or upon completion of drilling.
- No evidence of permafrost or seasonal frost was observed.
- Testhole terminated at a depth of 15.2 m.

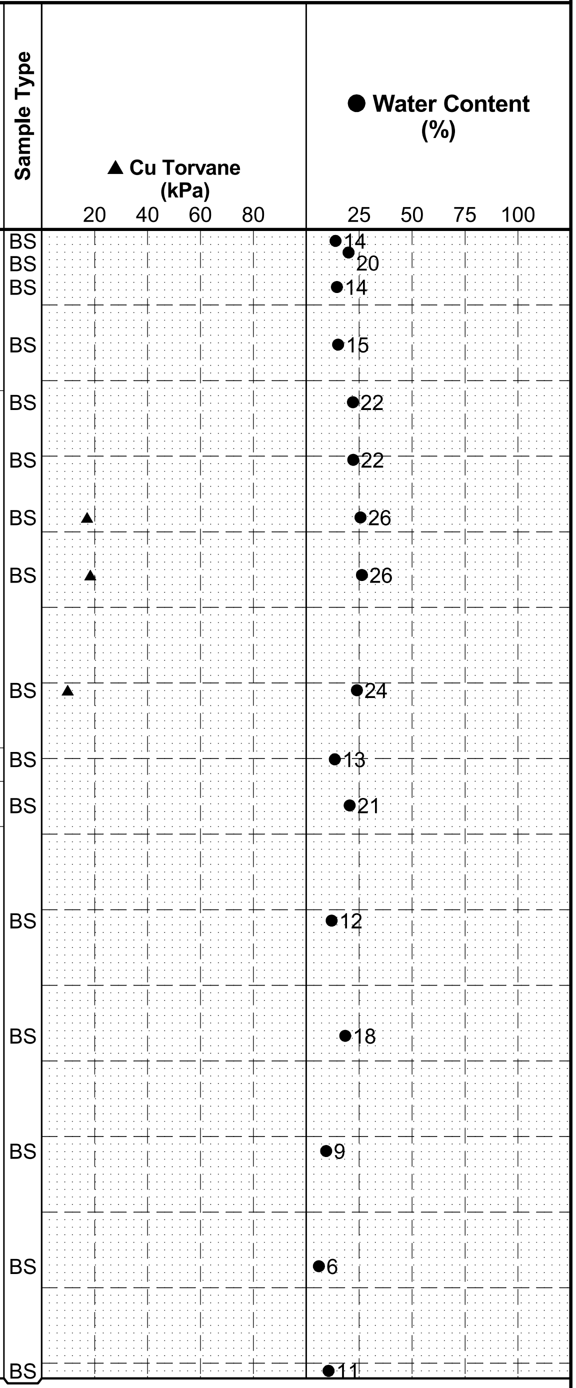
TESTHOLE TH09

THE NATIONAL TESTING LABORATORIES LIMITED
Established in 1923

Project Name: Wastewater Treatment Plant Upgrade and Expansion
Project Location: Thompson, Manitoba
Client: Stantec
Drilling Contractor: Maple Leaf Drilling Ltd.
Drilling Method: 125 mm Solid Stem Auger
UTM Coordinates: 14U 573258.5 m E, 6178813.1 m N

Date Drilled: August 14, 2013
Depth of Testhole: 15.2 m
Logged by: Sothea Bun
Reviewed by: German Leal
Testhole Elevation: 204.7 m

Depth (m)	Elevation (m)	Description
0 – 2.1	202.6	**Clay Fill** - brown, soft, moist, medium plasticity - trace organic material - some fine to coarse sand - trace fine gravel
2.1 – 6.8	197.9	**Silty Clay** - tan, firm, moist, high plasticity - soft below 3.8 m
6.8 – 7.3	197.4	**Sand** - tan, compact, moist
7.3 – 7.9	196.8	**Silt** - tan, soft, moist, low plasticity
7.9 – 15.2	189.5	**Sand** - tan, compact, moist - fine grained - clay inclusions at a depth of 10.4 m - fine to coarse grained below 14.3 m

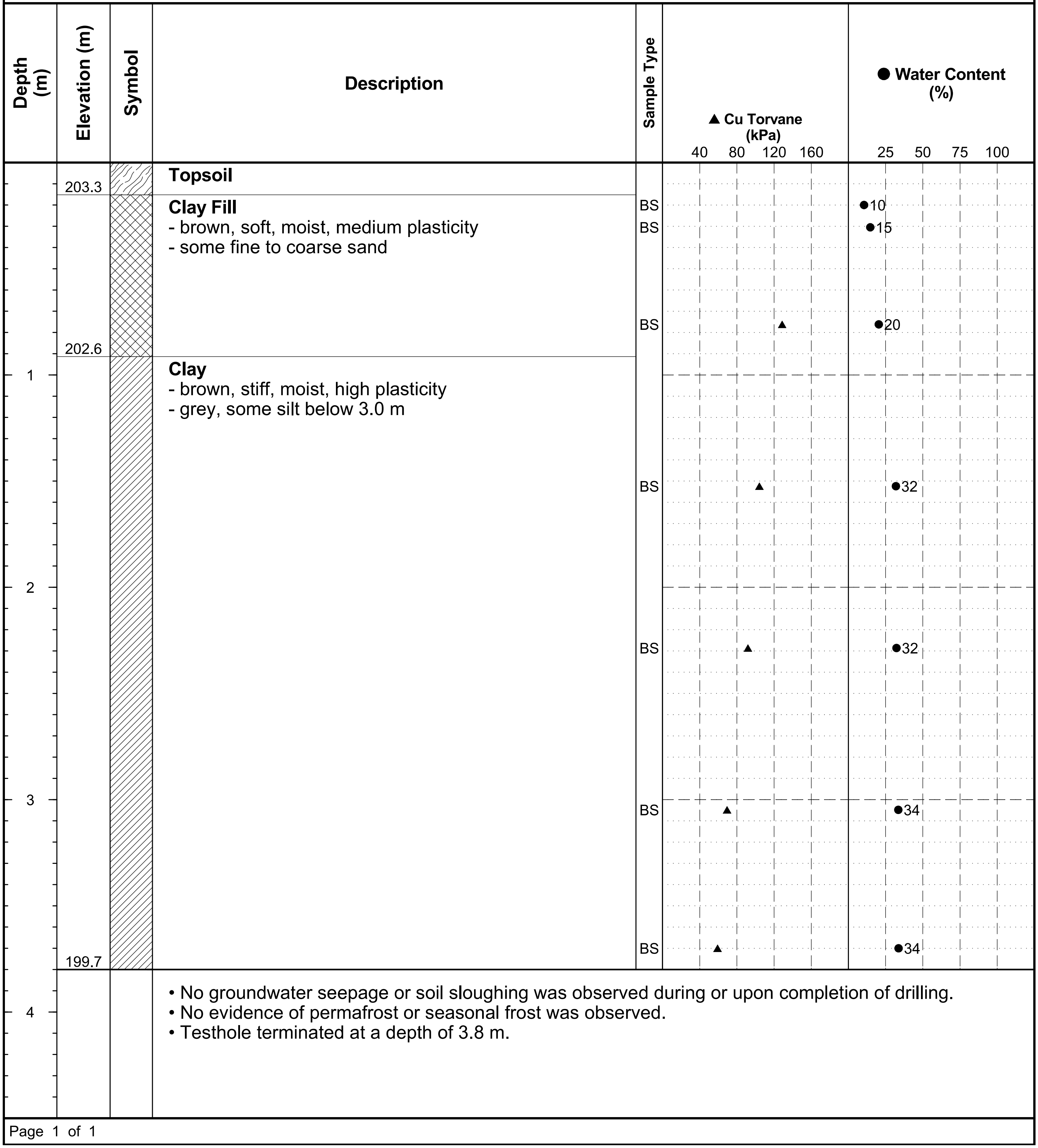


- No groundwater seepage or soil sloughing was observed during or upon completion of drilling.
- No evidence of permafrost or seasonal frost was observed.
- Testhole terminated at a depth of 15.2 m.

TESTHOLE TH10

Project Name: Wastewater Treatment Plant Upgrade and Expansion
Project Location: Thompson, Manitoba
Client: Stantec
Drilling Contractor: Maple Leaf Drilling Ltd.
Drilling Method: 125 mm Solid Stem Auger
UTM Coordinates: 14U 572965.9 m E, 6178530.3 m N

Date Drilled: August 14, 2013
Depth of Testhole: 3.8 m
Logged by: Sothea Bun
Reviewed by: German Leal
Testhole Elevation: 203.5 m



Topsoil

Clay Fill
- brown, soft, moist, medium plasticity
- some fine to coarse sand

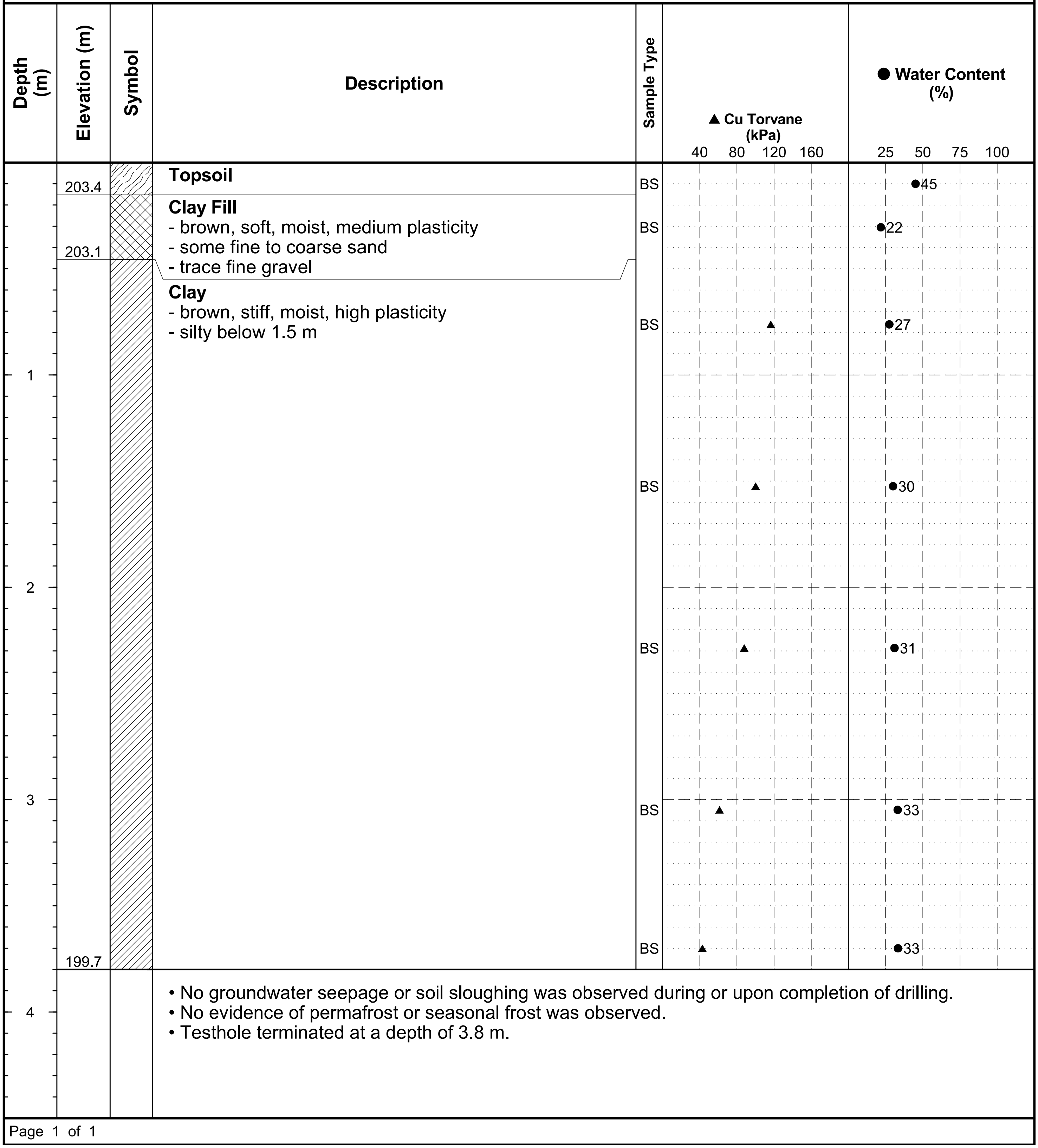
Clay
- brown, stiff, moist, high plasticity
- grey, some silt below 3.0 m

- No groundwater seepage or soil sloughing was observed during or upon completion of drilling.
- No evidence of permafrost or seasonal frost was observed.
- Testhole terminated at a depth of 3.8 m.

TESTHOLE TH11

Project Name: Wastewater Treatment Plant Upgrade and Expansion
Project Location: Thompson, Manitoba
Client: Stantec
Drilling Contractor: Maple Leaf Drilling Ltd.
Drilling Method: 125 mm Solid Stem Auger
UTM Coordinates: 14U 572883.6 m E, 6178391.8 m N

Date Drilled: August 14, 2013
Depth of Testhole: 3.8 m
Logged by: Sothea Bun
Reviewed by: German Leal
Testhole Elevation: 203.5 m



Topsoil

Clay Fill
- brown, soft, moist, medium plasticity
- some fine to coarse sand
- trace fine gravel

Clay
- brown, stiff, moist, high plasticity
- silty below 1.5 m

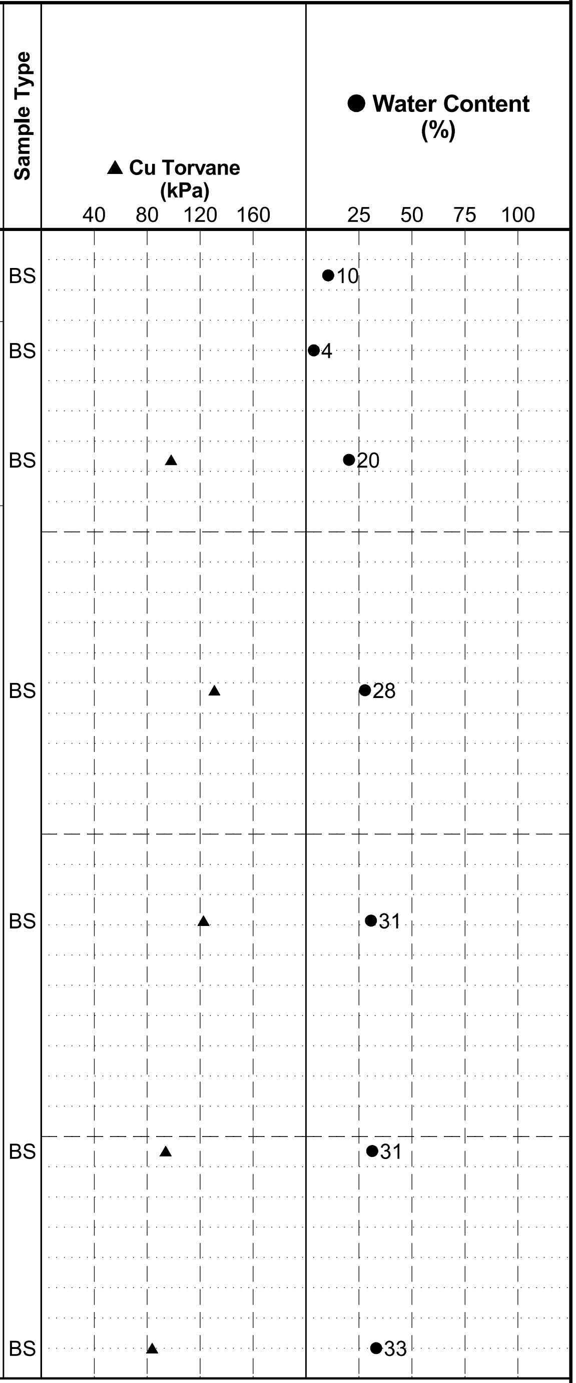
- No groundwater seepage or soil sloughing was observed during or upon completion of drilling.
- No evidence of permafrost or seasonal frost was observed.
- Testhole terminated at a depth of 3.8 m.

TESTHOLE TH12

Project Name: Wastewater Treatment Plant Upgrade and Expansion
Project Location: Thompson, Manitoba
Client: Stantec
Drilling Contractor: Maple Leaf Drilling Ltd.
Drilling Method: 125 mm Solid Stem Auger
UTM Coordinates: 14U 572801.3 m E, 6178281.2 m N

Date Drilled: August 14, 2013
Depth of Testhole: 3.8 m
Logged by: Sothea Bun
Reviewed by: German Leal
Testhole Elevation: 205.1 m

Depth (m)	Elevation (m)	Symbol	Description
	204.8		**Topsoil**
	204.2		**Clay Fill** - brown, firm, moist, medium plasticity - some fine to coarse sand - trace fine gravel
1 2 3	201.3		**Clay** - brown, stiff, moist, high plasticity - some silt below 2.3 m
4			• No groundwater seepage or soil sloughing was observed during or upon completion of drilling. • No evidence of permafrost or seasonal frost was observed. • Testhole terminated at a depth of 3.8 m.

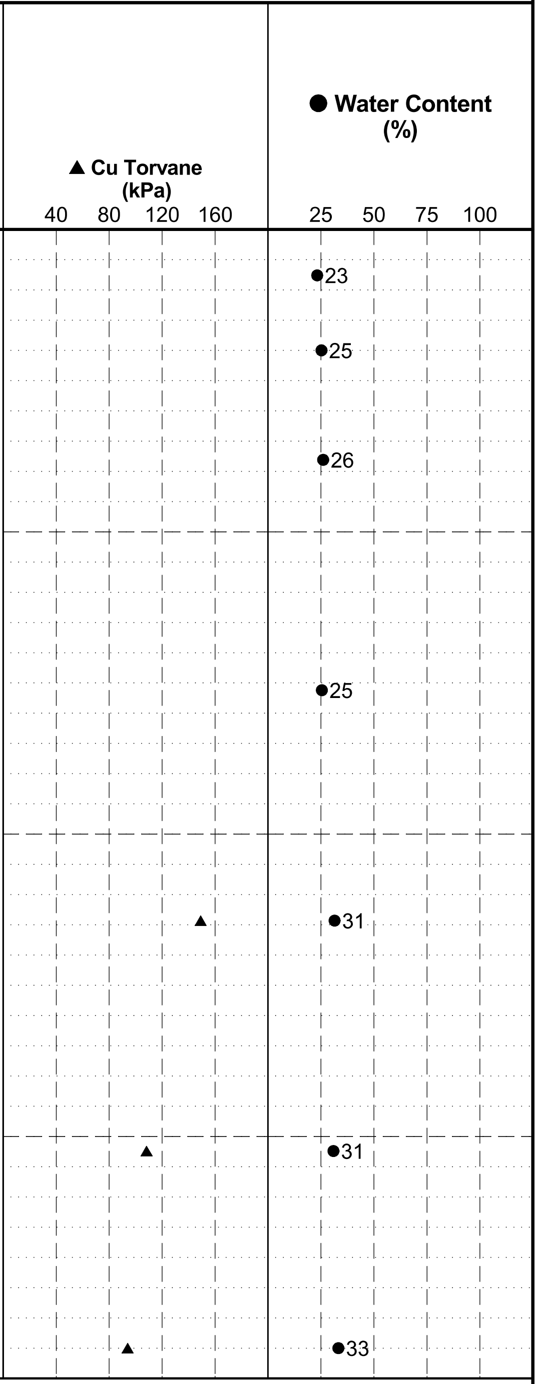


TESTHOLE TH13

Project Name: Wastewater Treatment Plant Upgrade and Expansion
Project Location: Thompson, Manitoba
Client: Stantec
Drilling Contractor: Maple Leaf Drilling Ltd.
Drilling Method: 125 mm Solid Stem Auger
UTM Coordinates: 14U 572881.5 m E, 6178130.6 m N

Date Drilled: August 14, 2013
Depth of Testhole: 3.8 m
Logged by: Sothea Bun
Reviewed by: German Leal
Testhole Elevation: 207.5 m

Depth (m)	Elevation (m)	Symbol	Description	Sample Type
	207.2	▒	**Topsoil**	BS
1	206.1	▨	**Clay** - brown, firm, moist, medium plasticity - trace organic material	BS BS
	205.8	▥	**Silty Clay** - grey, firm, moist, medium plasticity	BS
2 3	203.7	▨	**Clay** - brown, firm, moist, high plasticity - some silt below 3.0 m	BS BS BS
4			• No groundwater seepage or soil sloughing was observed during or upon completion of drilling. • No evidence of permafrost or seasonal frost was observed. • Testhole terminated at a depth of 3.8 m.	



Page 1 of 1

TESTHOLE TH14

THE NATIONAL TESTING LABORATORIES LIMITED
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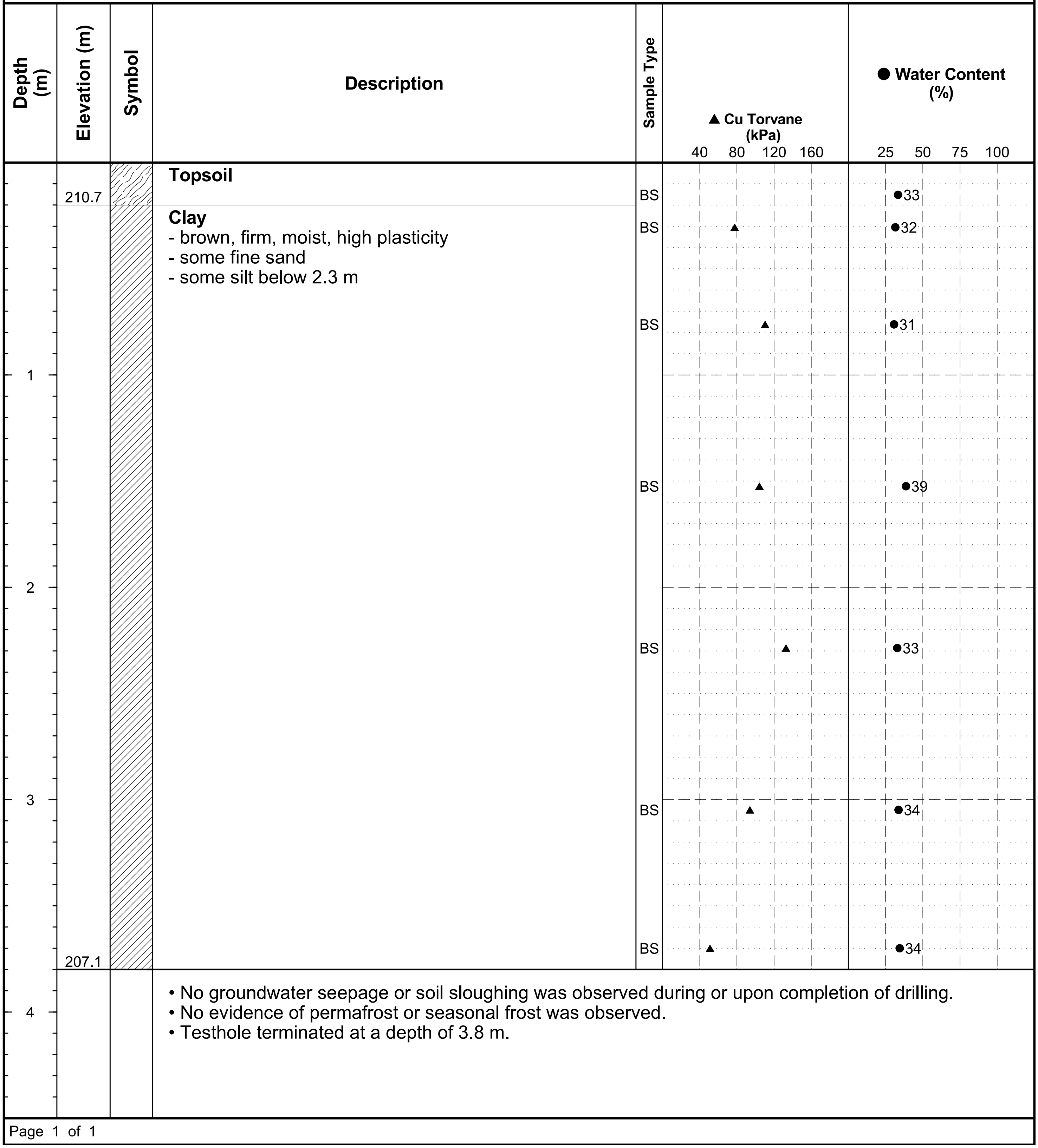
Project Name: Wastewater Treatment Plant Upgrade and Expansion
Project Location: Thompson, Manitoba
Client: Stantec
Drilling Contractor: Maple Leaf Drilling Ltd.
Drilling Method: 125 mm Solid Stem Auger
UTM Coordinates: 14U 572782.6 m E, 6177926.0 m N

Date Drilled: August 14, 2013
Depth of Testhole: 3.8 m
Logged by: Sothea Bun
Reviewed by: German Leal
Testhole Elevation: 210.9 m



Topsoil

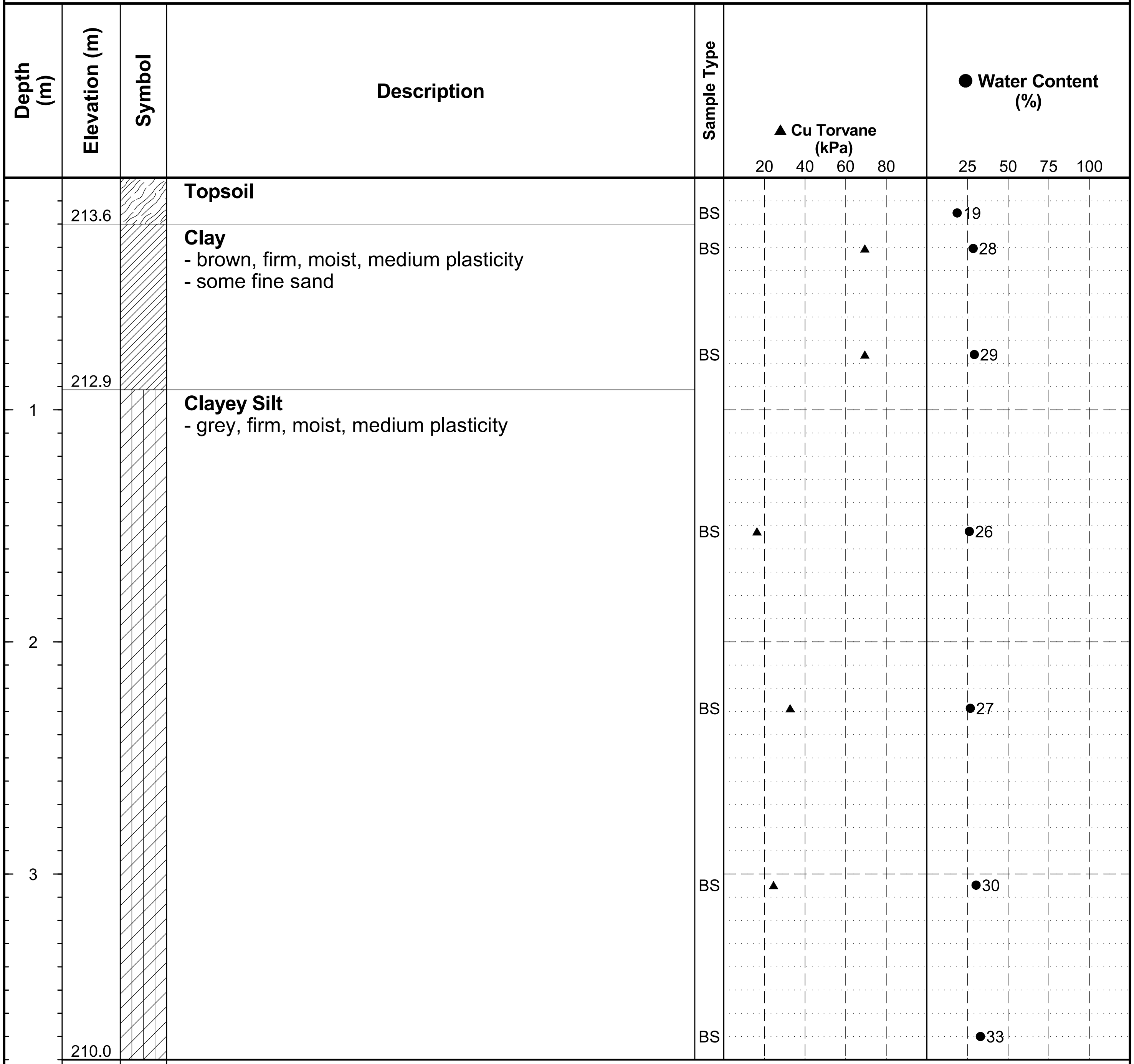
Clay
- brown, firm, moist, high plasticity
- some fine sand
- some silt below 2.3 m

- No groundwater seepage or soil sloughing was observed during or upon completion of drilling.
- No evidence of permafrost or seasonal frost was observed.
- Testhole terminated at a depth of 3.8 m.

TESTHOLE TH15

Project Name: Wastewater Treatment Plant Upgrade and Expansion
Project Location: Thompson, Manitoba
Client: Stantec
Drilling Contractor: Maple Leaf Drilling Ltd.
Drilling Method: 125 mm Solid Stem Auger
UTM Coordinates: 14U 572648.3 m E, 6177720.4 m N

Date Drilled: August 14, 2013
Depth of Testhole: 3.8 m
Logged by: Sothea Bun
Reviewed by: German Leal
Testhole Elevation: 213.8 m



Topsoil

Clay
- brown, firm, moist, medium plasticity
- some fine sand

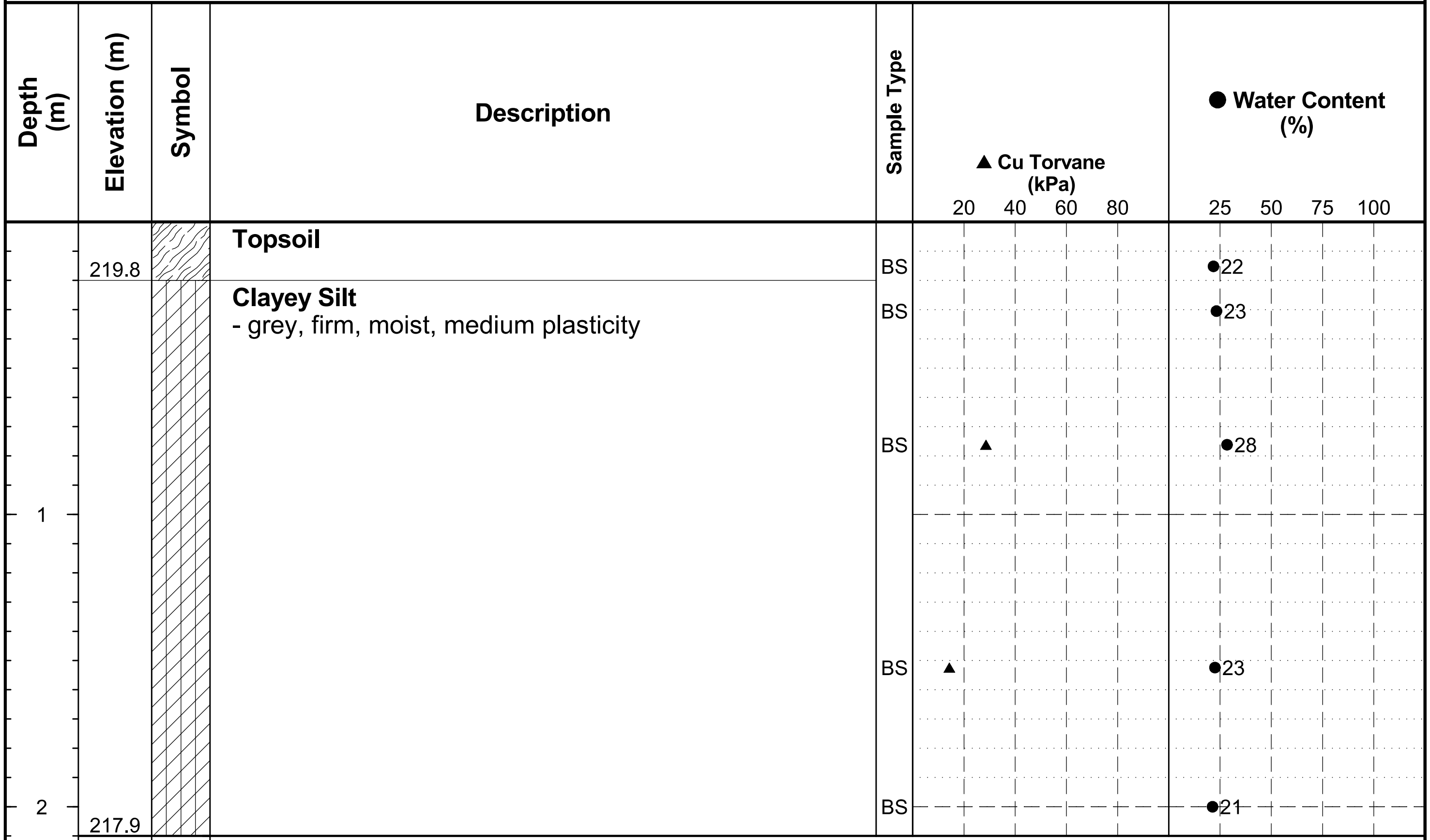
Clayey Silt
- grey, firm, moist, medium plasticity

- No groundwater seepage or soil sloughing was observed during or upon completion of drilling.
- No evidence of permafrost or seasonal frost was observed.
- Testhole terminated at a depth of 3.8 m.

TESTHOLE TH16

Project Name: Wastewater Treatment Plant Upgrade and Expansion
Project Location: Thompson, Manitoba
Client: Stantec
Drilling Contractor: Maple Leaf Drilling Ltd.
Drilling Method: 125 mm Solid Stem Auger
UTM Coordinates: 14U 572514.2 m E, 6177507.6 m N

Date Drilled: August 14, 2013
Depth of Testhole: 2.1 m
Logged by: Sothea Bun
Reviewed by: German Leal
Testhole Elevation: 220.0 m



Topsoil

Clayey Silt
- grey, firm, moist, medium plasticity

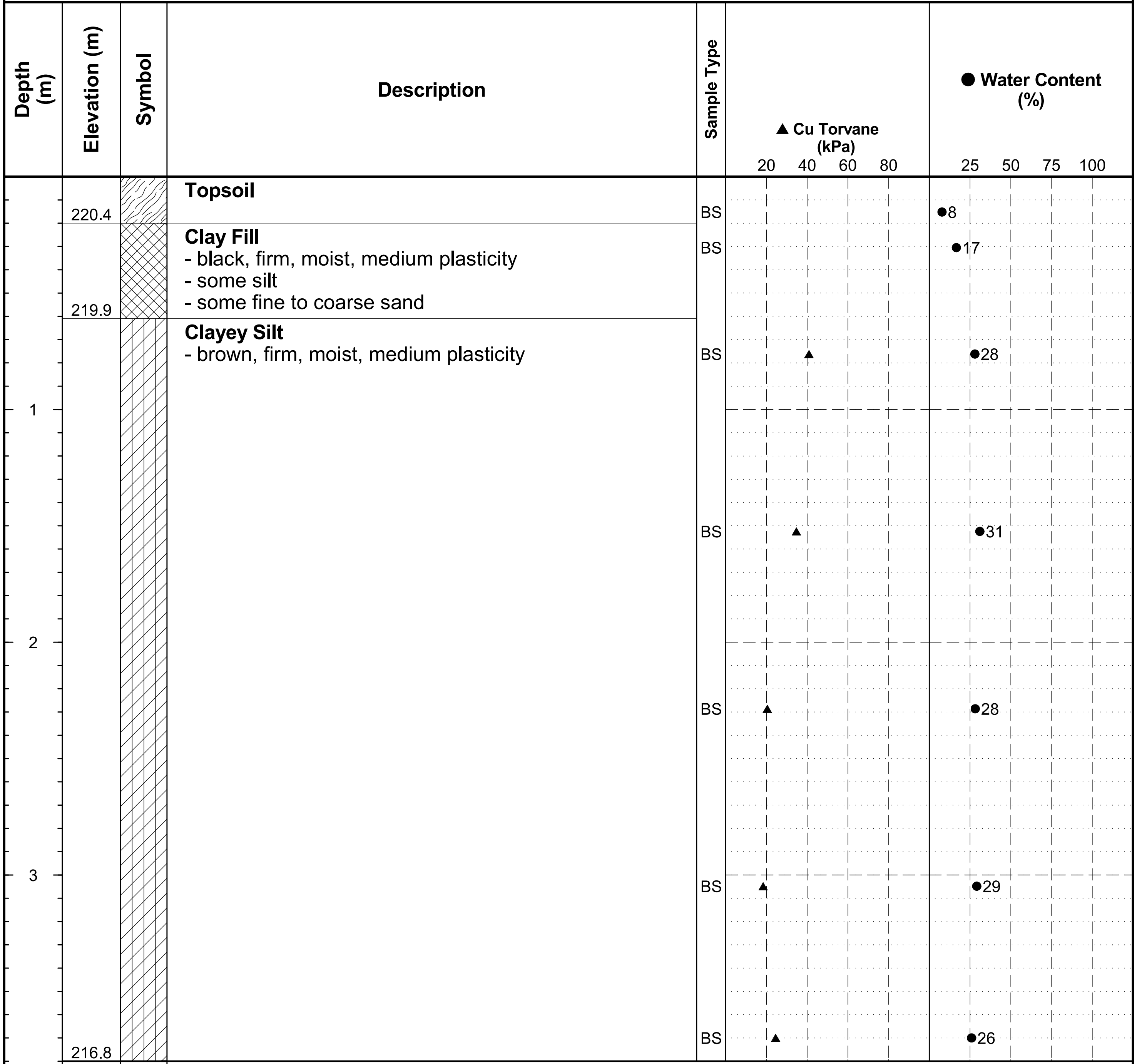
- No groundwater seepage or soil sloughing was observed during or upon completion of drilling.
- No evidence of permafrost or seasonal frost was observed.
- Auger refusal at a depth of 2.1 m on suspected bedrock.

TESTHOLE TH17

Project Name: Wastewater Treatment Plant Upgrade and Expansion
Project Location: Thompson, Manitoba
Client: Stantec
Drilling Contractor: Maple Leaf Drilling Ltd.
Drilling Method: 125 mm Solid Stem Auger
UTM Coordinates: 14U 572236.3 m E, 6177173.6 m N

Date Drilled: August 14, 2013
Depth of Testhole: 3.8 m
Logged by: Sothea Bun
Reviewed by: German Leal
Testhole Elevation: 220.6 m

Elevation (m)	Description	Sample Type	● Water Content (%)
220.4	**Topsoil**	BS	8
219.9	**Clay Fill** - black, firm, moist, medium plasticity - some silt - some fine to coarse sand	BS	17
216.8	**Clayey Silt** - brown, firm, moist, medium plasticity	BS BS BS BS BS	28 31 28 29 26



- No groundwater seepage or soil sloughing was observed during or upon completion of drilling.
- No evidence of permafrost or seasonal frost was observed.
- Testhole terminated at a depth of 3.8 m.

TESTHOLE TH18

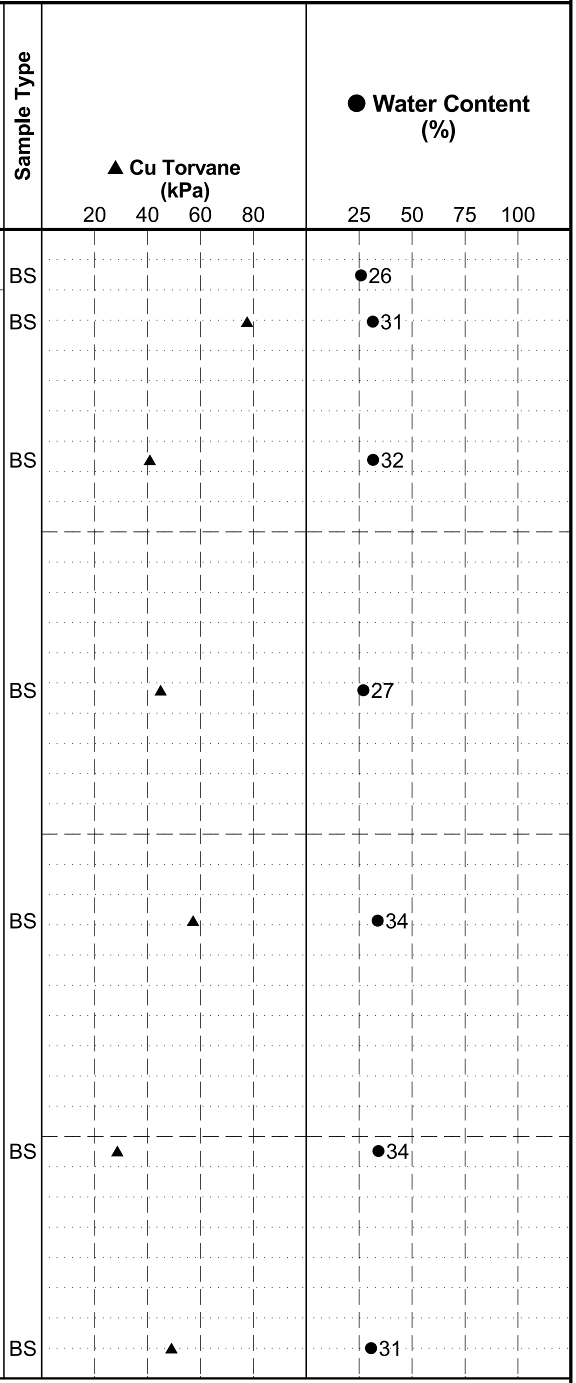
THE NATIONAL TESTING LABORATORIES LIMITED
Established in 1923

Project Name: Wastewater Treatment Plant Upgrade and Expansion
Project Location: Thompson, Manitoba
Client: Stantec
Drilling Contractor: Maple Leaf Drilling Ltd.
Drilling Method: 125 mm Solid Stem Auger
UTM Coordinates: 14U 571637.3 m E, 6176631.6 m N

Date Drilled: August 14, 2013
Depth of Testhole: 3.8 m
Logged by: Sothea Bun
Reviewed by: German Leal
Testhole Elevation: 212.0 m

Depth (m)	Elevation (m)	Symbol	Description
	211.8	▨	**Topsoil**
	208.2	▨	**Clay** - brown, stiff, moist, high plasticity - grey, some silt below 0.8 m

Depth (m): 1, 2, 3, 4



- No groundwater seepage or soil sloughing was observed during or upon completion of drilling.
- No evidence of permafrost or seasonal frost was observed.
- Testhole terminated at a depth of 3.8 m.

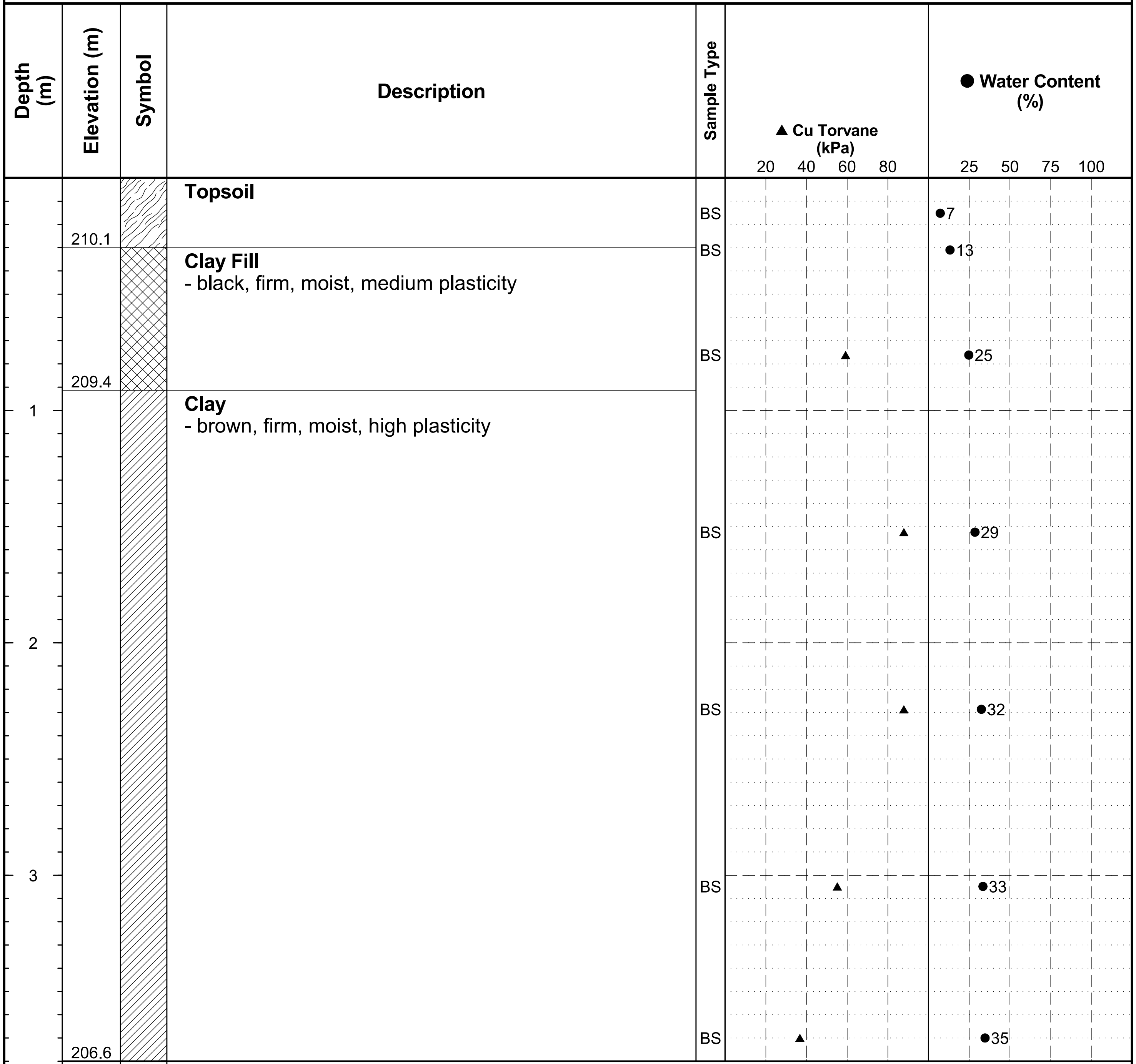
TESTHOLE TH19

THE NATIONAL TESTING LABORATORIES LIMITED
Established in 1923

Project Name: Wastewater Treatment Plant Upgrade and Expansion
Project Location: Thompson, Manitoba
Client: Stantec
Drilling Contractor: Maple Leaf Drilling Ltd.
Drilling Method: 125 mm Solid Stem Auger
UTM Coordinates: 14U 570978.7 m E, 6176979.6 m N

Date Drilled: August 14, 2013
Depth of Testhole: 3.8 m
Logged by: Sothea Bun
Reviewed by: German Leal
Testhole Elevation: 210.4 m

Elevation (m)	Description
210.1	**Topsoil**
209.4	**Clay Fill** - black, firm, moist, medium plasticity
206.6	**Clay** - brown, firm, moist, high plasticity



- No groundwater seepage or soil sloughing was observed during or upon completion of drilling.
- No evidence of permafrost or seasonal frost was observed.
- Testhole terminated at a depth of 3.8 m.

APPENDIX D

LABORATORY TEST REPORTS

THE NATIONAL TESTING LABORATORIES LIMITED
Established in 1923

PARTICLE SIZE ANALYSIS
ASTM D422

Stantec
905 Waverley St.
Winnipeg, MB
R3T 5P4

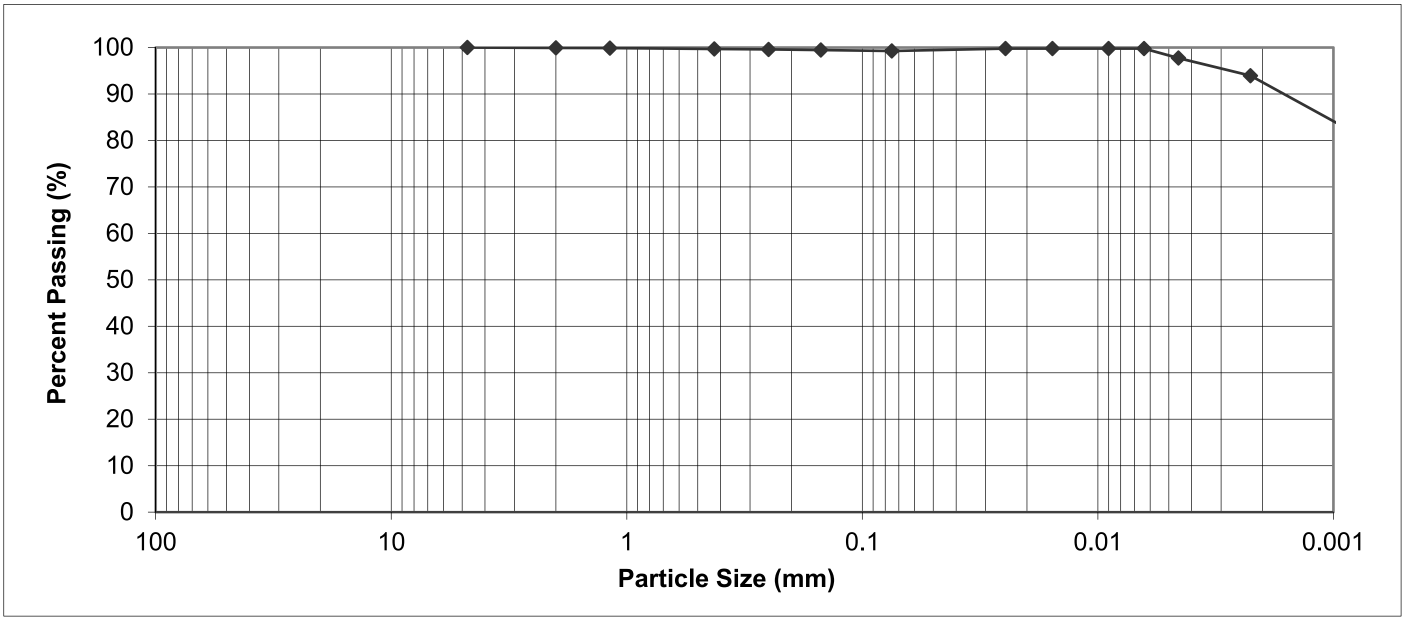
PROJECT: Wastewater Treatment Plant
Upgrade and Expansion
Thompson, Manitoba

Attention: Saibal Basu

PROJECT NO.: STA-1339

SAMPLED BY: Sothea Bun
SAMPLE ID: TH3 @ 0.9 m

DATE RECEIVED: August 15, 2013
TESTED BY: Sothea Bun



PARTICLE SIZE	PERCENT PASSING
37.50 mm	100.0
25.00 mm	100.0
19.00 mm	100.0
16.00 mm	100.0
12.50 mm	100.0
9.50 mm	100.0
4.75 mm	100.0
2.00 mm	99.9

PARTICLE SIZE	PERCENT PASSING
1.18 mm	99.9
0.425 mm	99.7
0.250 mm	99.6
0.150 mm	99.5
0.075 mm	99.2
0.005 mm	98.2
0.002 mm	91.9
0.001 mm	83.9

Gravel, % 75 to 4.75 mm	Sand, %			Silt, % <0.075 to 0.005 mm	Clay, % <0.005 mm	Colloids, % < 0.001 mm
	Coarse <4.75 to 2.0 mm	Medium <2.0 to 0.425 mm	Fine <0.425 to 0.075 mm			
0.0	0.1	0.2	0.5	1.0	98.2	83.9

August 27, 2013

REVIEWED BY: German E. Leal, B.Sc., P. Eng.

THE
NATIONAL
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Established in 1923

PARTICLE SIZE ANALYSIS
ASTM D422

Stantec
905 Waverley St.
Winnipeg, MB
R3T 5P4

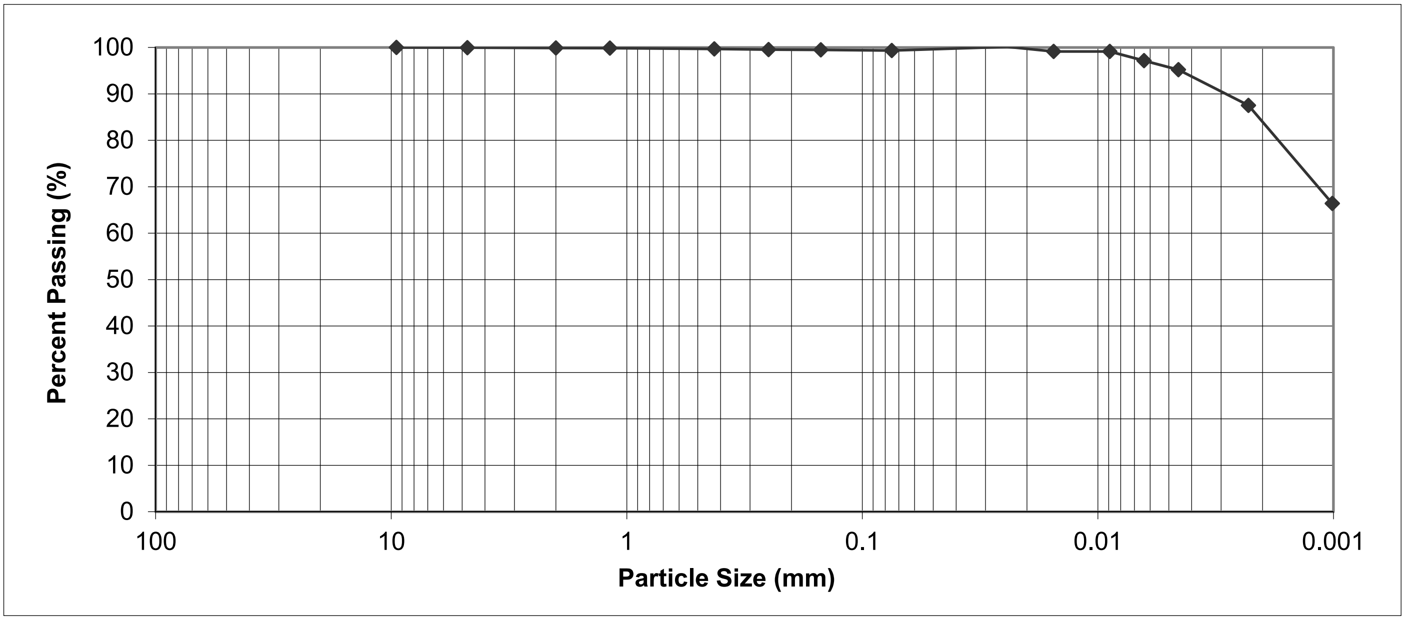
PROJECT: Wastewater Treatment Plant
Upgrade and Expansion
Thompson, Manitoba

Attention: Saibal Basu

PROJECT NO.: STA-1339

SAMPLED BY: Sothea Bun
SAMPLE ID: TH3 @ 2.3 m

DATE RECEIVED: August 15, 2013
TESTED BY: Sothea Bun



PARTICLE SIZE	PERCENT PASSING
37.50 mm	100.0
25.00 mm	100.0
19.00 mm	100.0
16.00 mm	100.0
12.50 mm	100.0
9.50 mm	100.0
4.75 mm	99.9
2.00 mm	99.9

PARTICLE SIZE	PERCENT PASSING
1.18 mm	99.8
0.425 mm	99.7
0.250 mm	99.5
0.150 mm	99.5
0.075 mm	99.3
0.005 mm	95.7
0.002 mm	82.6
0.001 mm	NT*

Gravel, % 75 to 4.75 mm	Sand, %			Silt, % <0.075 to 0.005 mm	Clay, % <0.005 mm	Colloids, % < 0.001 mm
	Coarse <4.75 to 2.0 mm	Medium <2.0 to 0.425 mm	Fine <0.425 to 0.075 mm			
0.1	0.0	0.2	0.4	3.6	95.7	NT*

NT* Sample not tested for colloids

August 27, 2013

REVIEWED BY: German E. Leal, B.Sc., P. Eng.

THE NATIONAL TESTING LABORATORIES LIMITED
Established in 1923

PARTICLE SIZE ANALYSIS
ASTM D422

Stantec
905 Waverley St.
Winnipeg, MB
R3T 5P4

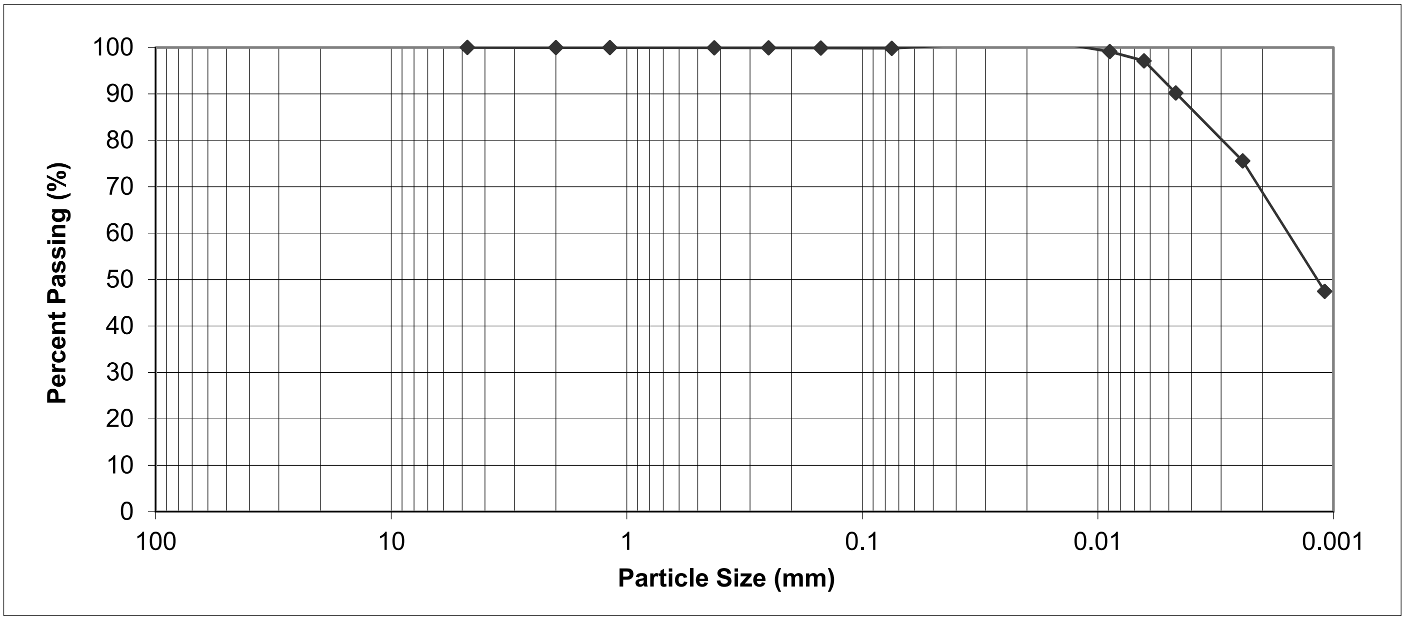
PROJECT: Wastewater Treatment Plant
Upgrade and Expansion
Thompson, Manitoba

Attention: Saibal Basu

PROJECT NO.: STA-1339

SAMPLED BY: Sothea Bun
SAMPLE ID: TH6 @ 6.1 m

DATE RECEIVED: August 15, 2013
TESTED BY: Sothea Bun



PARTICLE SIZE	PERCENT PASSING
37.50 mm	100.0
25.00 mm	100.0
19.00 mm	100.0
16.00 mm	100.0
12.50 mm	100.0
9.50 mm	100.0
4.75 mm	100.0
2.00 mm	100.0

PARTICLE SIZE	PERCENT PASSING
1.18 mm	100.0
0.425 mm	99.9
0.250 mm	99.9
0.150 mm	99.9
0.075 mm	99.8
0.005 mm	91.5
0.002 mm	66.5
0.001 mm	NT*

Gravel, % 75 to 4.75 mm	Sand, %			Silt, % <0.075 to 0.005 mm	Clay, % <0.005 mm	Colloids, % < 0.001 mm
	Coarse <4.75 to 2.0 mm	Medium <2.0 to 0.425 mm	Fine <0.425 to 0.075 mm			
0.0	0.0	0.1	0.1	8.3	91.5	NT*

NT* Sample not tested for colloids

August 27, 2013

REVIEWED BY: German E. Leal, B.Sc., P. Eng.

THE
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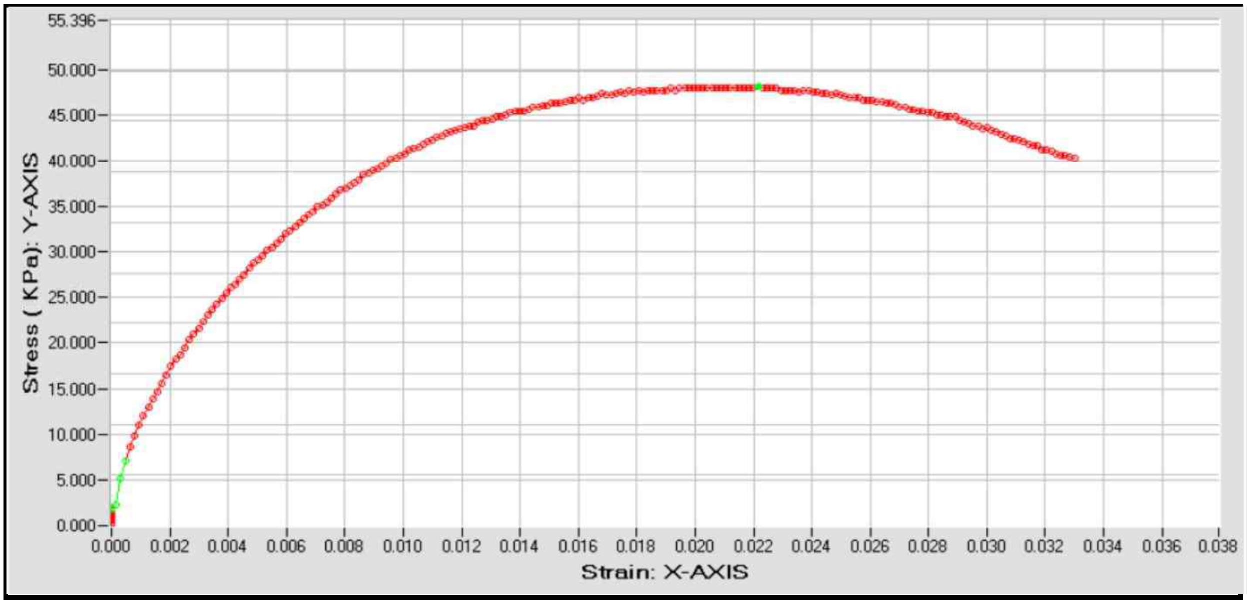
UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOIL (ASTM D2166)

Stantec
905 Waverley Street
Winnipeg, MB
R3T 5P4

PROJECT:	Wastewater Treatment Plant Upgrade and Expansion Thompson, Manitoba
Attention:	Saibal Basu
PROJECT NO.:	STA-1339
SAMPLED BY:	Sothea Bun
TESTHOLE No.:	TH3
SAMPLE DEPTH:	1.9 m
DATE RECEIVED:	August 15, 2013
TESTED BY:	Sothea Bun

Soil Description: brown, firm, moist, medium plasticity clay
silty



Failure Description: Bulge on top of sample

Diameter (mm):	72.90
Height (mm):	161.69
Height/Diameter ratio:	2.22
Sample Weight (g):	1290.28
Moisture Content (%):	30.6
Wet Unit Weight, kN/m³:	18.74
Dry Unit Weight, kN/m³:	14.34
Void ratio:	0.88
Saturation (%)	95.80
Unconfined Compressive Strength (kPa):	48
Strain at Failure (%):	2.21

REVIEWED BY: German E. Leal, B.Sc., P. Eng.

September 3, 2013

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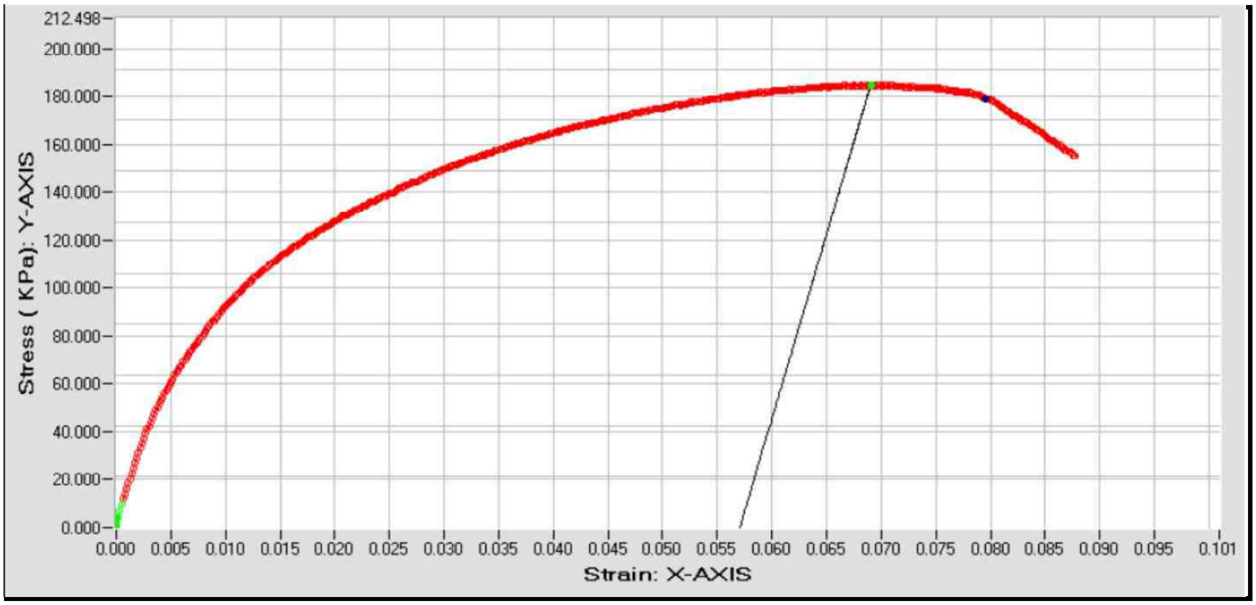
Established in 1923

UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOIL (ASTM D2166)

Stantec
905 Waverley Street
Winnipeg, MB
R3T 5P4

Attention:	Saibal Basu	PROJECT:	Wastewater Treatment Plant Upgrade and Expansion Thompson, Manitoba
		PROJECT NO.:	STA-1339
SAMPLED BY:	Sothea Bun	DATE RECEIVED:	August 15, 2013
TESTHOLE No.:	TH3	TESTED BY:	Sothea Bun
SAMPLE DEPTH:	3.5 m		

Soil Description: brown, stiff, moist, high plasticity clay
silty



Failure Description: Bulge on top of sample

Diameter (mm):	72.65
Height (mm):	161.48
Height/Diameter ratio:	2.22
Sample Weight (g):	1283.67
Moisture Content (%):	32.5
Wet Unit Weight, kN/m³:	18.79
Dry Unit Weight, kN/m³:	14.18
Void ratio:	0.90
Saturation (%)	99.32
Unconfined Compressive Strength (kPa):	185
Strain at Failure (%):	6.92

REVIEWED BY: German E. Leal, B.Sc., P. Eng.

September 3, 2013

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UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOIL (ASTM D2166)

Stantec
905 Waverley Street
Winnipeg, MB
R3T 5P4

PROJECT: Wastewater Treatment Plant
Upgrade and Expansion
Thompson, Manitoba

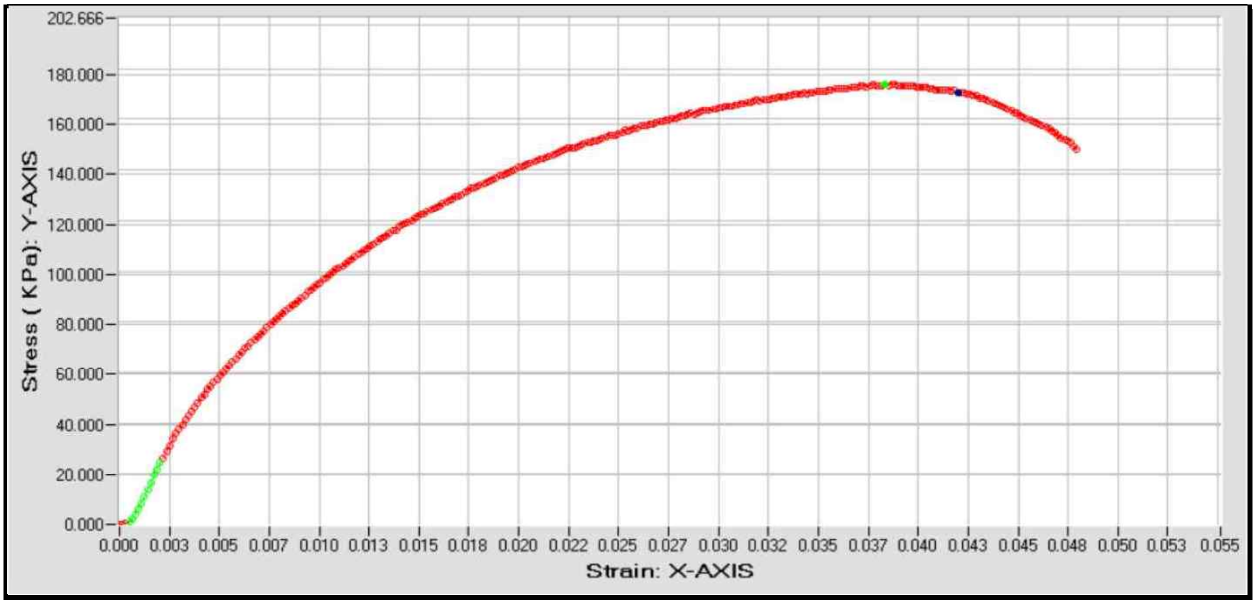
Attention: Saibal Basu

PROJECT NO.: STA-1339

SAMPLED BY: Sothea Bun
TESTHOLE No.: TH3
SAMPLE DEPTH: 5.0 m

DATE RECEIVED: August 15, 2013
TESTED BY: Sothea Bun

Soil Description: grey, firm, moist, high plasticity
some silt



Failure Description: Bulge on top of sample

Diameter (mm):	72.51
Height (mm):	161.58
Height/Diameter ratio:	2.23
Sample Weight (g):	1300.11
Moisture Content (%):	28.5
Wet Unit Weight, kN/m³:	19.10
Dry Unit Weight, kN/m³:	14.86
Void ratio:	0.81
Saturation (%)	96.42
Unconfined Compressive Strength (kPa):	176
Strain at Failure (%):	3.84

REVIEWED BY: German E. Leal, B.Sc., P. Eng.

September 3, 2013

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UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOIL (ASTM D2166)

Stantec
905 Waverley Street
Winnipeg, MB
R3T 5P4

PROJECT: Wastewater Treatment Plant
Upgrade and Expansion
Thompson, Manitoba

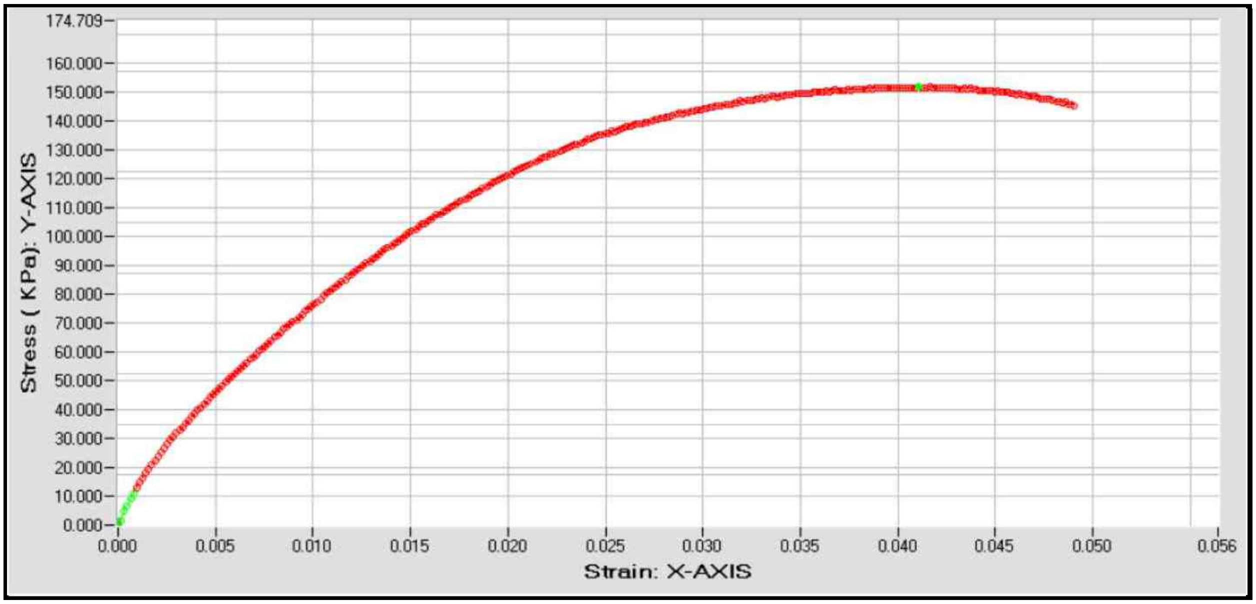
Attention: Saibal Basu

PROJECT NO.: STA-1339

SAMPLED BY: Sothea Bun
TESTHOLE No.: TH3
SAMPLE DEPTH: 6.5 m

DATE RECEIVED: August 15, 2013
TESTED BY: Sothea Bun

Soil Description: grey, firm, moist, high plasticity
some silt



Failure Description: Bulge at the bottom of sample

Diameter (mm):	72.27
Height (mm):	161.55
Height/Diameter ratio:	2.24
Sample Weight (g):	1262.53
Moisture Content (%):	30.9
Wet Unit Weight, kN/m³:	18.67
Dry Unit Weight, kN/m³:	14.26
Void ratio:	0.89
Saturation (%)	95.51
Unconfined Compressive Strength (kPa):	152
Strain at Failure (%):	4.10

REVIEWED BY: German E. Leal, B.Sc., P. Eng.

September 3, 2013

THE NATIONAL TESTING LABORATORIES LIMITED
Established in 1923

UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOIL (ASTM D2166)

Stantec
905 Waverley Street
Winnipeg, MB
R3T 5P4

PROJECT: Wastewater Treatment Plant Upgrade and Expansion Thompson, Manitoba

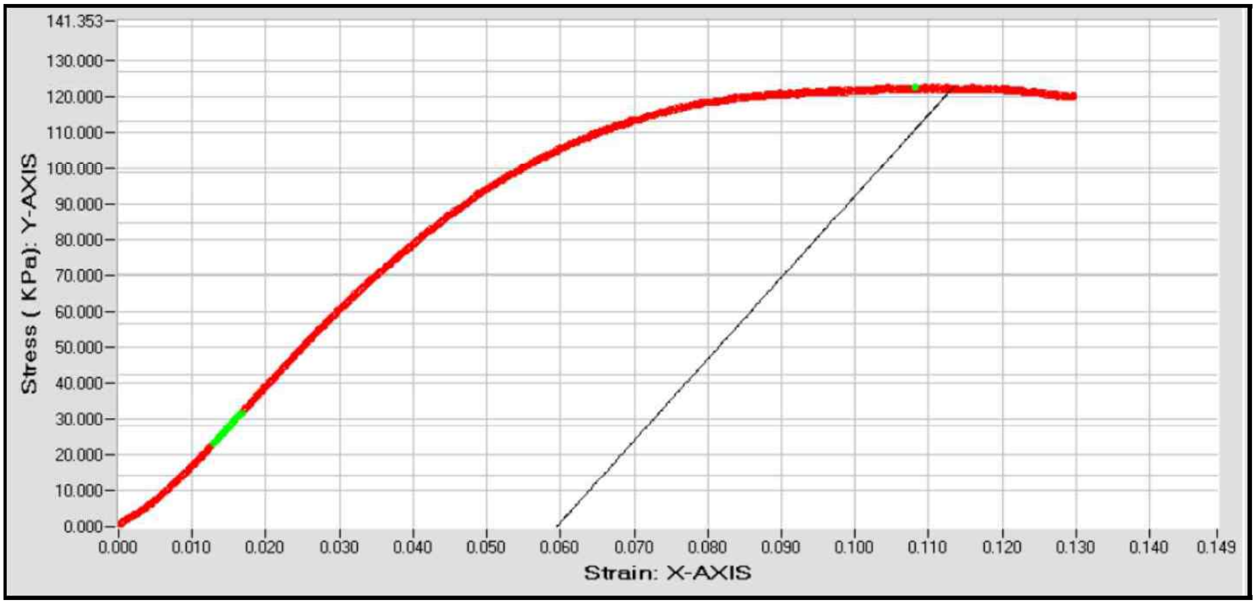
Attention: Saibal Basu

PROJECT NO.: STA-1339

SAMPLED BY: Sothea Bun
TESTHOLE No.: TH3
SAMPLE DEPTH: 8.0 m

DATE RECEIVED: August 15, 2013
TESTED BY: Sothea Bun

Soil Description: grey, firm, moist, low plasticity clayey silt



Failure Description: Bulge at top of sample

Diameter (mm):	72.03
Height (mm):	160.57
Height/Diameter ratio:	2.23
Sample Weight (g):	1268.97
Moisture Content (%):	30.3
Wet Unit Weight, kN/m³:	19.01
Dry Unit Weight, kN/m³:	14.59
Void ratio:	0.85
Saturation (%)	98.28
Unconfined Compressive Strength (kPa):	123
Strain at Failure (%):	10.82

REVIEWED BY: German E. Leal, B.Sc., P. Eng.

September 3, 2013

THE NATIONAL TESTING LABORATORIES LIMITED
Established in 1923

UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOIL (ASTM D2166)

Stantec
905 Waverley Street
Winnipeg, MB
R3T 5P4

PROJECT: Wastewater Treatment Plant
Upgrade and Expansion
Thompson, Manitoba

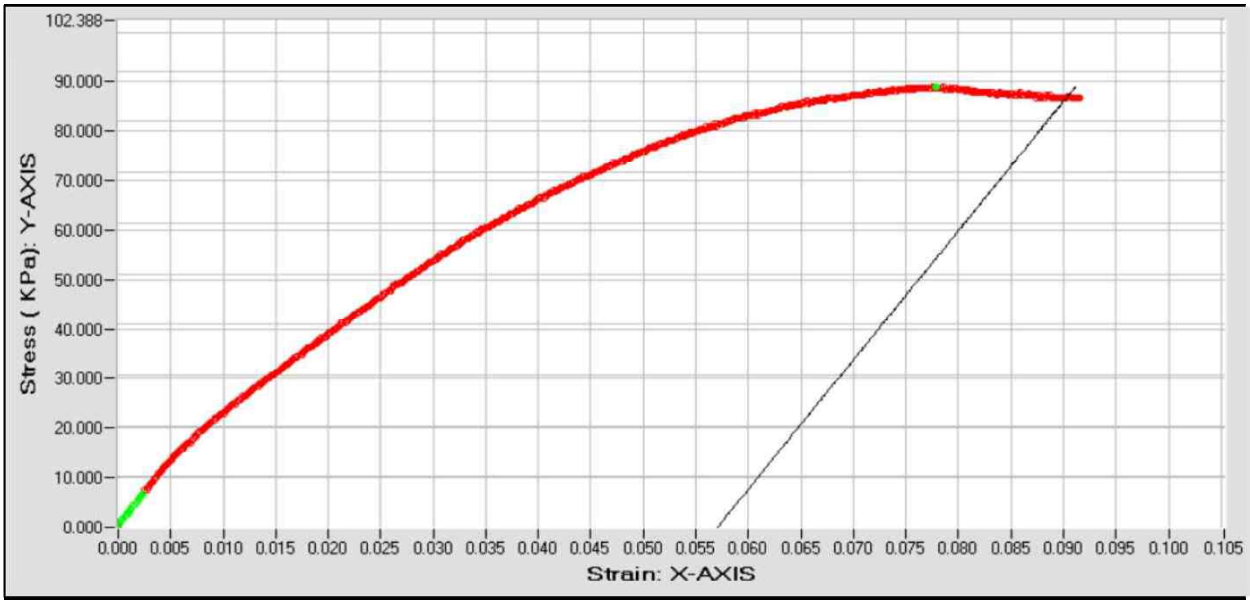
Attention: Saibal Basu

PROJECT NO.: STA-1339

SAMPLED BY: Sothea Bun
TESTHOLE No.: TH3
SAMPLE DEPTH: 9.5 m

DATE RECEIVED: August 15, 2013
TESTED BY: Sothea Bun

Soil Description: grey, firm, moist, low plasticity clayey silt



Failure Description: Slicken sided at top of sample

Diameter (mm):	72.75
Height (mm):	160.06
Height/Diameter ratio:	2.20
Sample Weight (g):	1258.73
Moisture Content (%):	29.1
Wet Unit Weight, kN/m³:	18.54
Dry Unit Weight, kN/m³:	14.36
Void ratio:	0.88
Saturation (%)	91.27
Unconfined Compressive Strength (kPa):	89
Strain at Failure (%):	7.79

REVIEWED BY: German E. Leal, B.Sc., P. Eng.

September 3, 2013

APPENDIX D

Opinion of Probable Costs Breakdown

City of Thompson Wastewater Treatment Plant
Functional Design
Design Flow = 7,200 cm/d
Opinion of Probable Cost (Class D)

Item	Description	Unit	Quantity	Unit Price	Supply	Install	Total
A	Headworks						
1	Substructure (Basement / Grit & Screen Channels)	c.m.	498	$2,500	$1,245,000	Included	$1,245,000
2	Superstructure (Headworks Room)	s.m.	273	$2,000	$546,000	Included	$546,000
3	Multiple Rake Bar Screen	l.s.	1	$200,000	$200,000	$80,000	$280,000
4	Washer / Compactor	l.s.	1	$60,000	$60,000	$30,000	$90,000
5	Static Bar Screen	l.s.	1	$5,000	$5,000	$5,000	$10,000
6	High Rate Grit Removal Process	l.s.	1	$370,000	$370,000	$111,000	$481,000
7	Grit Pumps	ea	2	$18,000	$36,000	$18,000	$54,000
8	Conveyor	l.s.	1	$50,000	$50,000	$25,000	$75,000
9	Process piping, valves, gates	l.s.	1	$250,000	$250,000	Included	$250,000
10	Miscellaneous Metals	l.s.	1	$170,000	$170,000	Included	$170,000
B	Truck Haul Receiving Station						
1	Substructure	c.m.	20	$2,500	$50,000	Included	$50,000
2	Receving manhole, piping and associated works	l.s.	1	$50,000	$50,000	Included	$50,000
3	Pumps	ea	2	$10,000	$20,000	$8,000.0	$28,000
4	Process Mechanical	l.s.	1	$60,000	$60,000	Included	$60,000
5	Miscellaneous Metals	l.s.	1	$5,000	$5,000	Included	$5,000
C	Secondary Process						
1	Substructure (SBR's / EQ / Chemical Rm))	c.m.	2609	$2,500	$6,523,000	Included	$6,523,000
2	Superstructure (Decant Rm / Blower Rm / Chemical Rm)	s.m.	704	$2,000	$1,408,000	Included	$1,408,000
3	Pre-Cast Cover (SBR / EQ)	s.m.	1206	$525	$633,150	Included	$633,150
4	SBR Process	l.s.	1	$580,000	$580,000	$290,000	$870,000
5	EQ Pumps	ea	2	$50,000	$100,000	$50,000	$150,000
6	High Efficiency Blowers	ea	2	$110,000	$220,000	$88,000	$308,000
7	Process Piping and Valves	l.s.	1	$350,000	$350,000	Included	$350,000
8	Alum Feed System	l.s.	1	$75,000	$75,000	$30,000	$105,000
9	Sodium Hydroxide Feed System	l.s.	1	$75,000	$75,000	$30,000	$105,000
10	Miscellaneous Metals	l.s.	1	$125,000	$125,000	Included	$125,000
D	Effluent Disinfection						
1	Superstructure (UV Room)	s.m.	185	$2,000	$370,000	Included	$370,000
2	UV Channel	c.m.	22	$3,000	$66,000	Included	$66,000
3	UV Process	l.s.	1	$212,000	$212,000	$84,800	$297,000
4	Miscellaneous Metals	l.s.	1	$30,000	$30,000	Included	$30,000
E	Solids Handling						
1	Substructure (Sludge Holding Tanks / Dewatering & Bin Rm)	c.m.	418	$2,500	$1,045,000	Included	$1,045,000
2	Superstructure (Dewatering Room / Bin Rm)	s.m.	132	$2,000	$264,000	Included	$264,000
3	Pre-Cast Cover (SHT)	s.m.	225	$525	$118,125	Included	$119,000
4	Aerobic Digestion Process	l.s.	1	$135,000	$135,000	$54,000.0	$189,000
5	Centrifuge Feed Pumps	ea	2	$24,000	$48,000	$24,000.0	$72,000
6	Centrifuge (c/w polymer feed system & conveyor)	ea	1	$252,000	$252,000	$100,800.0	$353,000
7	Process Piping and Valves	l.s.	1	$150,000	$150,000	Included	$150,000
8	Sludge Bin	l.s.	1	$10,000	$10,000	Included	$10,000
9	Miscellaneous Metals	l.s.	1	$20,000	$20,000	Included	$20,000
F	Operations Building						
1	Substructure (Vestibule / Workshop)	c.m.	87	$2,500	$217,500	Included	$217,500
2	Superstructure (Storage Rm / Elec Rm / Lab / Meeting Rm/ Office / Workshop / Vestibule)	s.m.	331	$2,000	$662,000	Included	$662,000
G	Building Mechanical (HVAC & Domestic Water / Plumbing)	l.s	1	$1,100,000	$1,100,000	Included	$1,100,000
H	Odor Control	l.s.	2	$200,000	$400,000	$200,000	$600,000
I	Site Works						
1	Excavation and Backfill	c.m.	16874	$15	$253,000	Included	$253,000
2	Roads and Parking	s.m.	1130	$65	$73,000	Included	$73,000
3	Ex. Influent Forcemain Extension (300 mm dia & 250 mm dia)	l.m.	206	$400	$82,400	Included	$83,000
4	Ex. Watermain Extension (100 mm dia)	l.m.	99	$200	$19,800	Included	$20,000
5	Effluent Outfall (750 mm dia.)	l.m.	150	$1,700	$255,000	Included	$255,000
6	Outfall Structure and Miscellaneous Work	l.s.	1	$100,000	$100,000	Included	$100,000
7	Topsoil and Sedding	s.m.	8100	$8	$64,800	Included	$64,800
J	Decommissioning						
1	Existing WWTP	l.s.	1	$175,000	$175,000	Included	$175,000
2	Existing Aerated Lagoon and Associated Infrastructure	l.s.	1	$250,000	$250,000	Included	$250,000
K	Diversion of Sewage From Cree Lift Station to WWTP						
1	Lift Station Upgrades	l.s.	1	$150,000	$150,000	Included	$150,000
2	New Forcemain to WWTP	l.m.	4150	$400	$1,660,000	Included	$1,660,000
L	Subtotal A						**$22,620,000**
M	Electrical/ I & C/SCADA	l.s.	1				$3,000,000
N	General Conditions	%	10				$2,262,000
O	Subtotal B (J +K + L)						**$27,882,000**
P	Engineering	%	11				$3,067,000
Q	Contingency	%	10				$2,788,000
R	Estimation Allowance	%	10				$2,788,000
S	Total						**$36,500,000**

APPENDIX B
Certificate of Title

Cert. No. 112646

MANITOBA

Certificate of Title

UNDER "THE REAL PROPERTY ACT."

The Local Government District of Mystery Lake

is now seized of an estate in fee simple in possession sub

such encumbrances, liens and interests as are notified by men

dum underwritten (or endorsed hereon) in all that piece or p

of land known and described as follows,

Block Lettered "C": which Block is shown bordered Pink on a Plan of Survey of part of Township Seventy-Eight in Range Three West of the Principal Meridian in Manitoba at Thompson, filed in the Neepawa Land Titles Office as Deposit Plan #465

E[illegible] THEREOUT: ALL MINES AND MINERALS TOGE-
HER WITH THE RIGHT TO ENTER, LOCATE, PROSPECT
MINE FOR AND REMOVE MINERALS, AND ALL OTHER EST-
ATES, RIGHTS AND INTERESTS RESERVED TO THE CROWN
UNDER THE CROWN LANDS ACT.

IN WITNESS WHEREOF I have hereunto signed my name and affixed my Seal of office this Second day of June One thousand nine hundred and Sixty-one

Signed in the presence of

E.H. Burns

D.J. Levenuk

District Registrar

for N

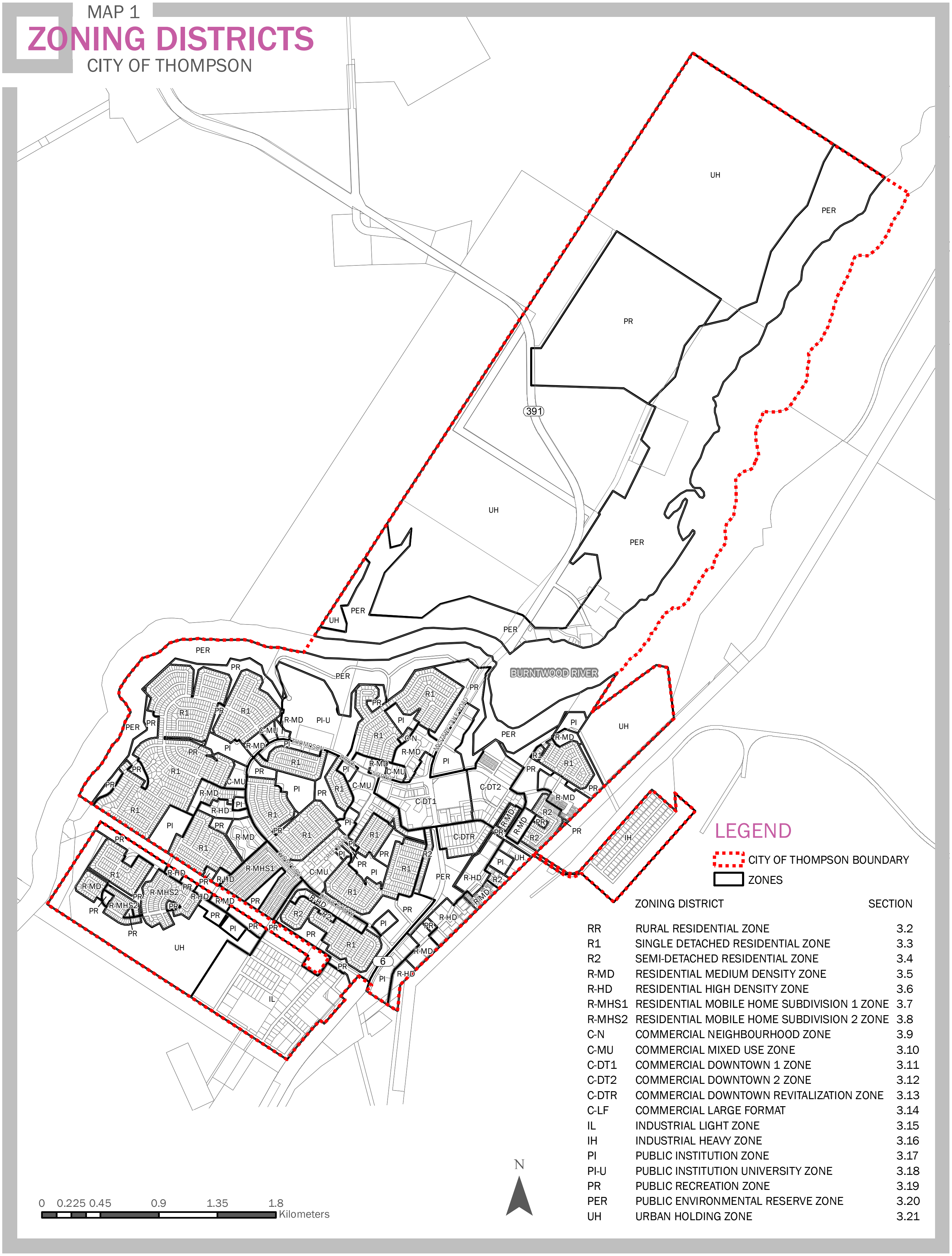
Any subsisting lease or agreement for a lease for a period not exceeding three years, where there is actual occupation of
d thereunder.
Any drainage levy or mechanics' lien affecting the land
Any order of attachment, judgment or order for the payment of money against the registered owner of the land, registered
he date of the certificate of title, and which has been maintained in force under the provisions of any Act of the province
g thereto.
Any certificate of lis pendens issued out of a court in the province and registered since the date of the certificate of title.
Any right of expropriation by statute
The title of a person adversely in actual occupation of and rightly entitled to the land at the time it was brought under the
nd who continues in such occupation.
Caveats affecting the land registered since the date of the certificate, and
Any town planning scheme or by-law authorized under "The Town Planning Act" or under the provisions of the charter of
ty and any by-law passed by any municipal corporation under "The Municipal Act" or the charter of any city relating to
ential areas or zoning.
ublic highways embraced in the description of the land included in a certificate shall be deemed to be excluded unless the
ertificate is t the Crown or a municipality.

APPENDIX C
Zoning Map

MAP 1

ZONING DISTRICTS

CITY OF THOMPSON



LEGEND

CITY OF THOMPSON BOUNDARY

ZONES

	ZONING DISTRICT	SECTION
RR	RURAL RESIDENTIAL ZONE	3.2
R1	SINGLE DETACHED RESIDENTIAL ZONE	3.3
R2	SEMI-DETACHED RESIDENTIAL ZONE	3.4
R-MD	RESIDENTIAL MEDIUM DENSITY ZONE	3.5
R-HD	RESIDENTIAL HIGH DENSITY ZONE	3.6
R-MHS1	RESIDENTIAL MOBILE HOME SUBDIVISION 1 ZONE	3.7
R-MHS2	RESIDENTIAL MOBILE HOME SUBDIVISION 2 ZONE	3.8
C-N	COMMERCIAL NEIGHBOURHOOD ZONE	3.9
C-MU	COMMERCIAL MIXED USE ZONE	3.10
C-DT1	COMMERCIAL DOWNTOWN 1 ZONE	3.11
C-DT2	COMMERCIAL DOWNTOWN 2 ZONE	3.12
C-DTR	COMMERCIAL DOWNTOWN REVITALIZATION ZONE	3.13
C-LF	COMMERCIAL LARGE FORMAT	3.14
IL	INDUSTRIAL LIGHT ZONE	3.15
IH	INDUSTRIAL HEAVY ZONE	3.16
PI	PUBLIC INSTITUTION ZONE	3.17
PI-U	PUBLIC INSTITUTION UNIVERSITY ZONE	3.18
PR	PUBLIC RECREATION ZONE	3.19
PER	PUBLIC ENVIRONMENTAL RESERVE ZONE	3.20
UH	URBAN HOLDING ZONE	3.21

APPENDIX D
Public Open House Information


CITY OF THOMPSON WASTEWATER TREATMENT PLANT UPGRADE/EXPANSION PROJECT
City of Thompson
EXISTING WASTEWATER TREATMENT INFRASTRUTURE
WWTP
AERATED LAGOON
WASTEWATER COLLECTION SYSTEM MODIFICATIONS
WASTEWATER TREATMENT PROCESS FLOW DIAGRAM


CITY OF THOMPSON WASTEWATER TREATMENT PLANT UPGRADE/EXPANSION PROJECT
City of Thompson
EXISTING WASTEWATER TREATMENT INFRASTRUTURE
WWTP
AERATED LAGOON
Commissioned in 1958
Handles 70% of the City flows
Provides Primary treatment only
No effluent disinfection provided
Final effluent to Burntwood River
Condition of concrete unknown
Requires major rehabilitation to meet current standards and codes
Facility reuse presents significant risks
PROPOSED

CITY OF THOMPSON WASTEWATER TREATMENT PLANT UPGRADE/EXPANSION PROJECT
WASTEWATER TREATMENT PLANT DESIGN CRITERIA
PROPOSED WASTEWATER TREATMENT PROCESS FLOW DIAGRAM
PROPOSED WASTEWATER COLLECTION SYSTEM MODIFICATIONS
City of Thompson
Stantec


WASTEWATER TREATMENT PLANT
DESIGN CRITERIA
PURPOSE ROOM


WASTEWATER TREATMENT PLANT DESIGN CRITERIA
City of Thompson
WASTEWATER TREATMENT PLANT FLOOR PLANS
LOWER LEVEL
PROJECT CONSTRUCTION COSTS
26A

Public Open House - Purposed Wastewater Treatment Facility

Public Open House Notice on the City's Website

City of Thompson

The Manitoba
Water Services Board

PURPOSE OF OPEN HOUSE

Welcome and Introduction

The City of Thompson welcomes you to this Open House to update the progress of the planning, design and future construction of a new Centralized Wastewater Treatment Plant for the City. Representatives from the City, Manitoba Water Services Board and Stantec Consulting are here today to answer your questions and concerns. Your feedback is very important and we would appreciate if you can fill up a comment sheet before you leave. We thank you for attending.

- Welcome and Introduction
- Project Background
- Existing Wastewater Treatment Infrastructure
- Proposed Wastewater Collection System Modifications
- Wastewater Treatment Process Flow Diagram
- Wastewater Treatment Plant – Design Criteria
- Wastewater Treatment Plant - Site Plan
- Wastewater Treatment Plant - Floor Plans
- Wastewater Treatment Plant - Building Elevations
- Project Construction Costs
- Environmental Licensing Process
- Preliminary Implementation Schedule/Next Steps

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City of Thompson

The Manitoba
Water Services Board

PROJECT BACKGROUND

- The City operates a primary WWTP which treats 70% of the City flows and an Aerated Lagoon that handles the remaining 30% of the City flows.
- Both facilities are dated, "do NOT meet" current guidelines and are difficult to upgrade.
- Stantec was retained to review the existing infrastructure and develop the most practical and cost effective option for a wastewater treatment infrastructure.
- Two options were reviewed during preliminary design which included upgrade/expansion of the existing treatment facilities vs. a new central WWTP at the Nelson Road site.
- Based on technical and financial analysis, the Project Team selected a "Central WWTP" option for a future WWTP based on utilizing a Sequencing Batch Reactor technology.
- This option was further developed during functional design and the work is being presented today for public input. When the proposed WWTP is commissioned, the existing treatment facilities will be decommissioned/demolished.
- Based on public input and comments from the City, the functional design report will be filed to Manitoba Conservation and Water Stewardship as a part of the Environmental Act Licencing Process

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CITY OF THOMPSON WASTEWATER TREATMENT PLANT UPGRADE/EXPANSION PROJECT

City of Thompson

The Manitoba
Water Services Board

EXISTING WASTEWATER TREATMENT INFRASTRUTURE

WWTP

AERATED LAGOON

- Commissioned in 1958
- Handles 70% of the City flows
- Provides Primary treatment only
- No effluent disinfection provided
- Final effluent to Burntwood River
- Condition of concrete unknown
- Requires major rehabilitation to meet current standards and codes
- Facility reuse presents significant risks

- Commissioned in 1970
- Handles 30% of the City flows
- Provides secondary treatment
- Chlorine disinfection is not effective
- Effluent route un-defined
- Significant sludge accumulation in cell
- 33% of aeration equipment is not functional
- Lack of track record of this technology to meet projected effluent criteria in cold climate like Thompson.

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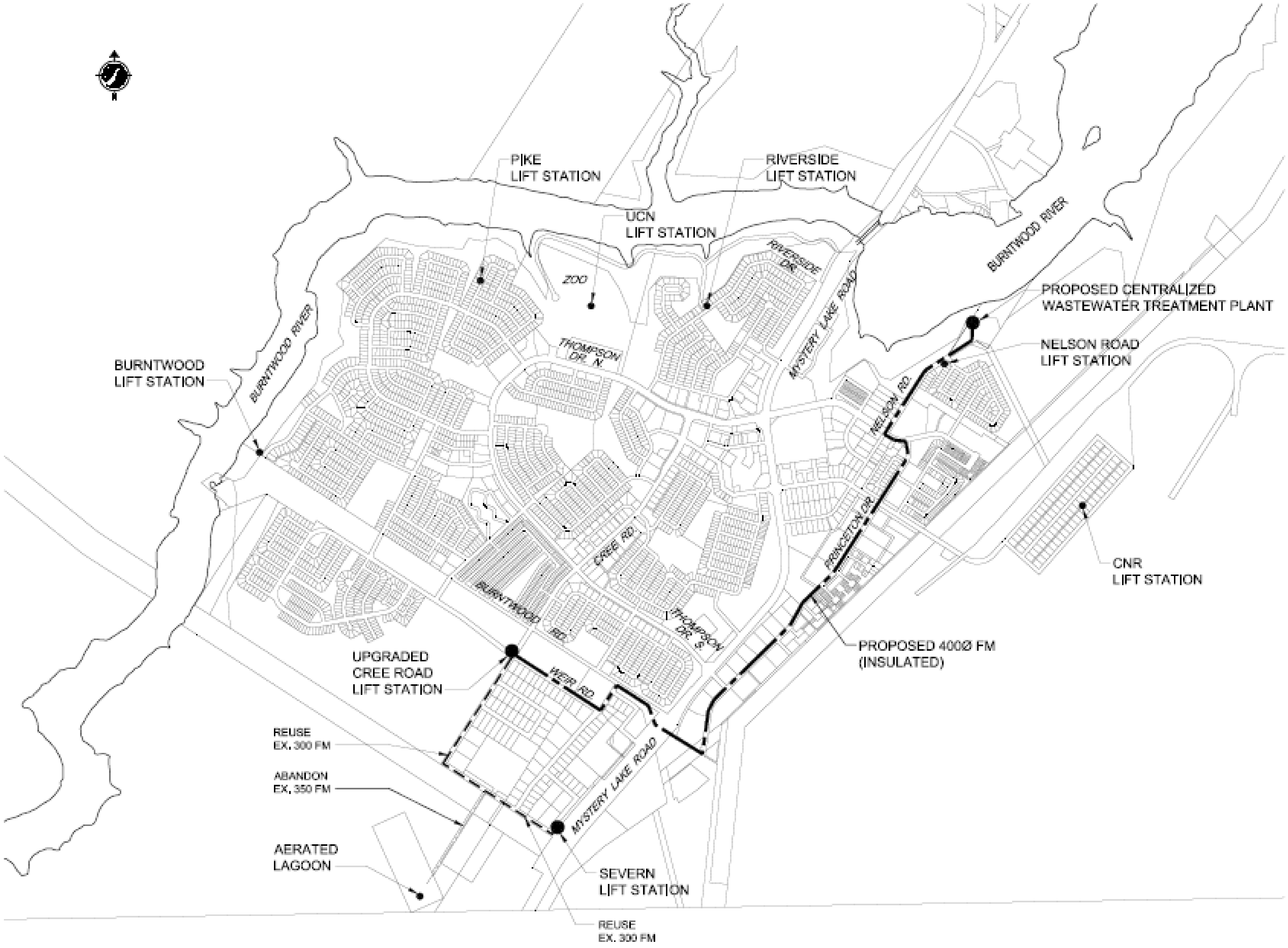
CITY OF THOMPSON WASTEWATER TREATMENT PLANT UPGRADE/EXPANSION PROJECT

The Manitoba
Water Services Board

PROPOSED WASTEWATER COLLECTION SYSTEM MODIFICATIONS



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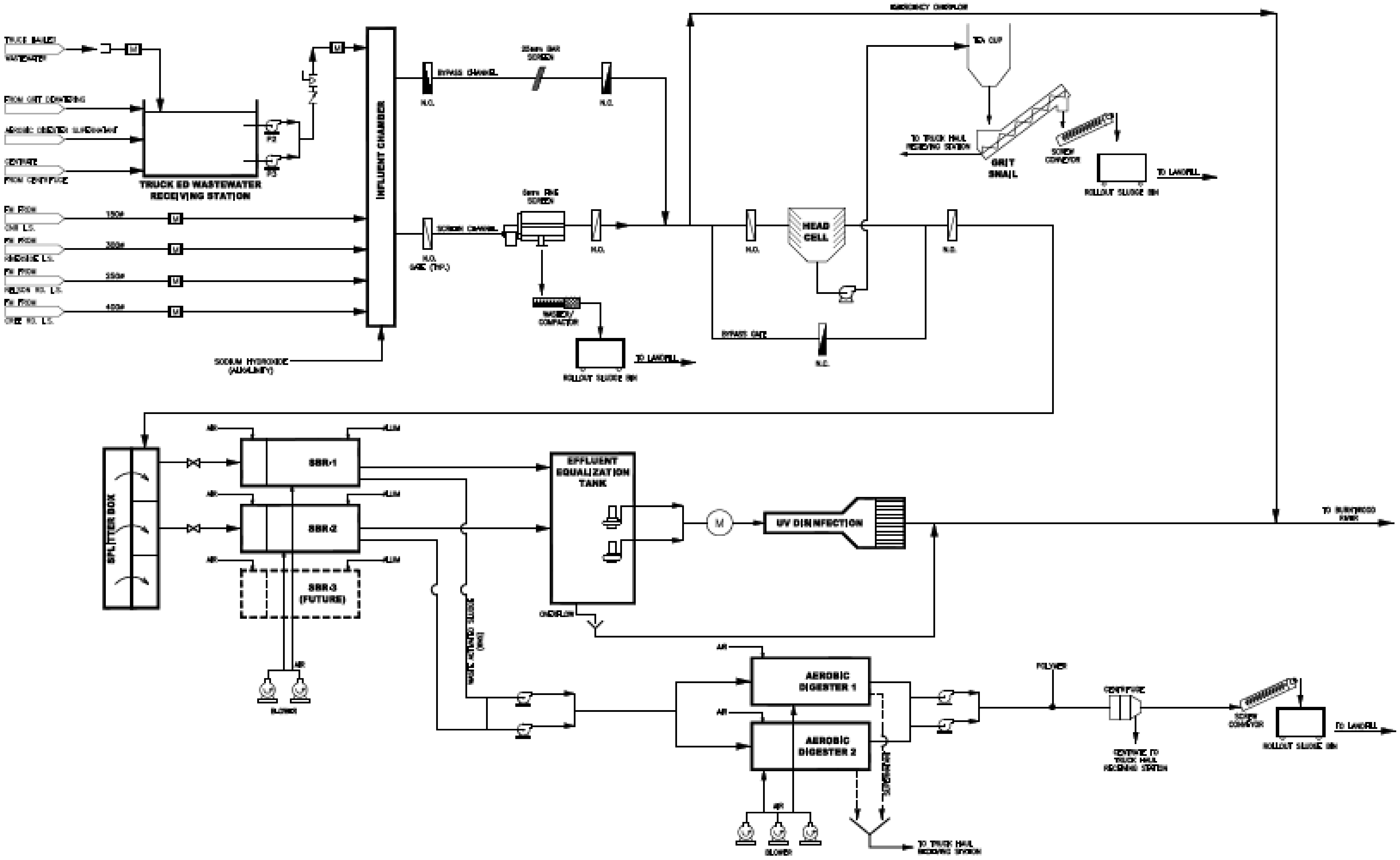
CITY OF THOMPSON WASTEWATER TREATMENT PLANT UPGRADE/EXPANSION PROJECT

City of Thompson

The Manitoba
Water Services Board

PROPOSED WASTEWATER TREATMENT PROCESS FLOW DIAGRAM



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CITY OF THOMPSON WASTEWATER TREATMENT PLANT UPGRADE/EXPANSION PROJECT

City of Thompson

The Manitoba Water Services Board

WASTEWATER TREATMENT PLANT DESIGN CRITERIA

Design Population: 15,000 (Year 2036)

Design Flows

• Annual Average Day Flow	6,000 m^3/d
• Maximum Month Flow	7,200 m^3/d (design basis)
• Maximum Day Flow	12,000 m^3/d
• Peak Hour Flow	324 L/s (1,167 m^3/h)

Influent Characteristics

• 5-day Biochemical Oxygen Demand (BOD$_5$):	140 mg/L (varies from 35 to 175 mg/L)
• Total Suspended Solids (TSS):	175 mg/L (varies from 59 to 269 mg/L)
• Ammonia- Nitrogen:	25 mg/L (varies from 14 to 37 mg/L)
• Total Kjeldhal Nitrogen (TKN):	38 mg/l (varies from 20 to 51 mg/L)
• Total Phosphorus (TP):	5.5 mg/L (varies from 2.7 to 7 mg/L)

Effluent Criteria (To be confirmed by Manitoba Conservation and Water Stewardship)

• cBOD$_5$:	≤ 25 mg/L
• TSS:	≤ 25 mg/L
• Ammonia- Nitrogen:	≤ 3 mg/L (Summer) and ≤ 5 mg/L (Winter)
• Total Nitrogen (TN):	≤ 15 ~ 25 mg/L (depending on the strength of raw wastewater)
• Total Phosphorus (TP):	≤ 1 mg/L
• Coliforms:	≤ 200 MPN/100 mL (Fecal) and ≤ 1500 MPN/100 mL (Total)

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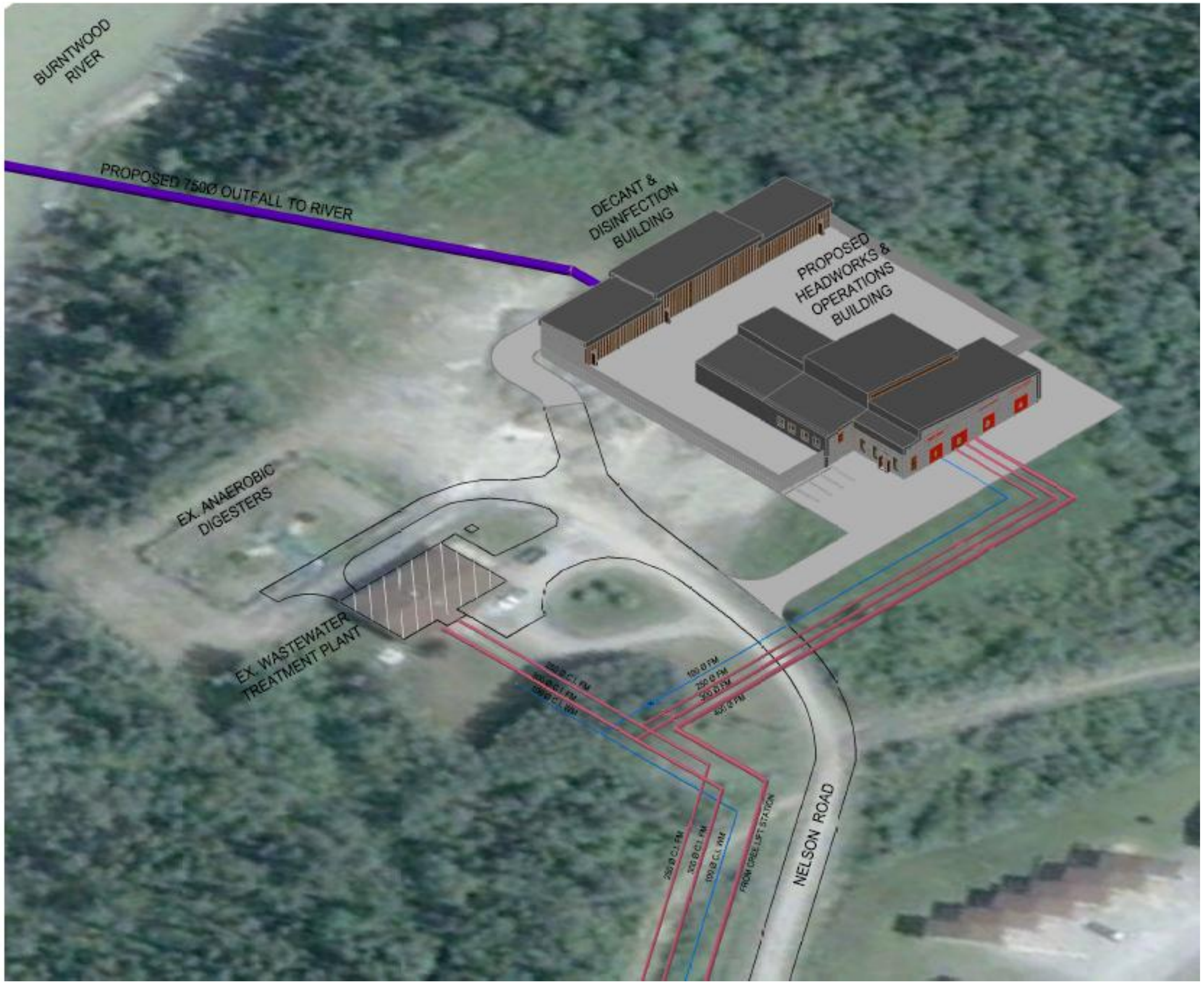
CITY OF THOMPSON WASTEWATER TREATMENT PLANT UPGRADE/EXPANSION PROJECT

City of Thompson

The Manitoba Water Services Board

WASTEWATER TREATMENT PLANT
SITE PLAN



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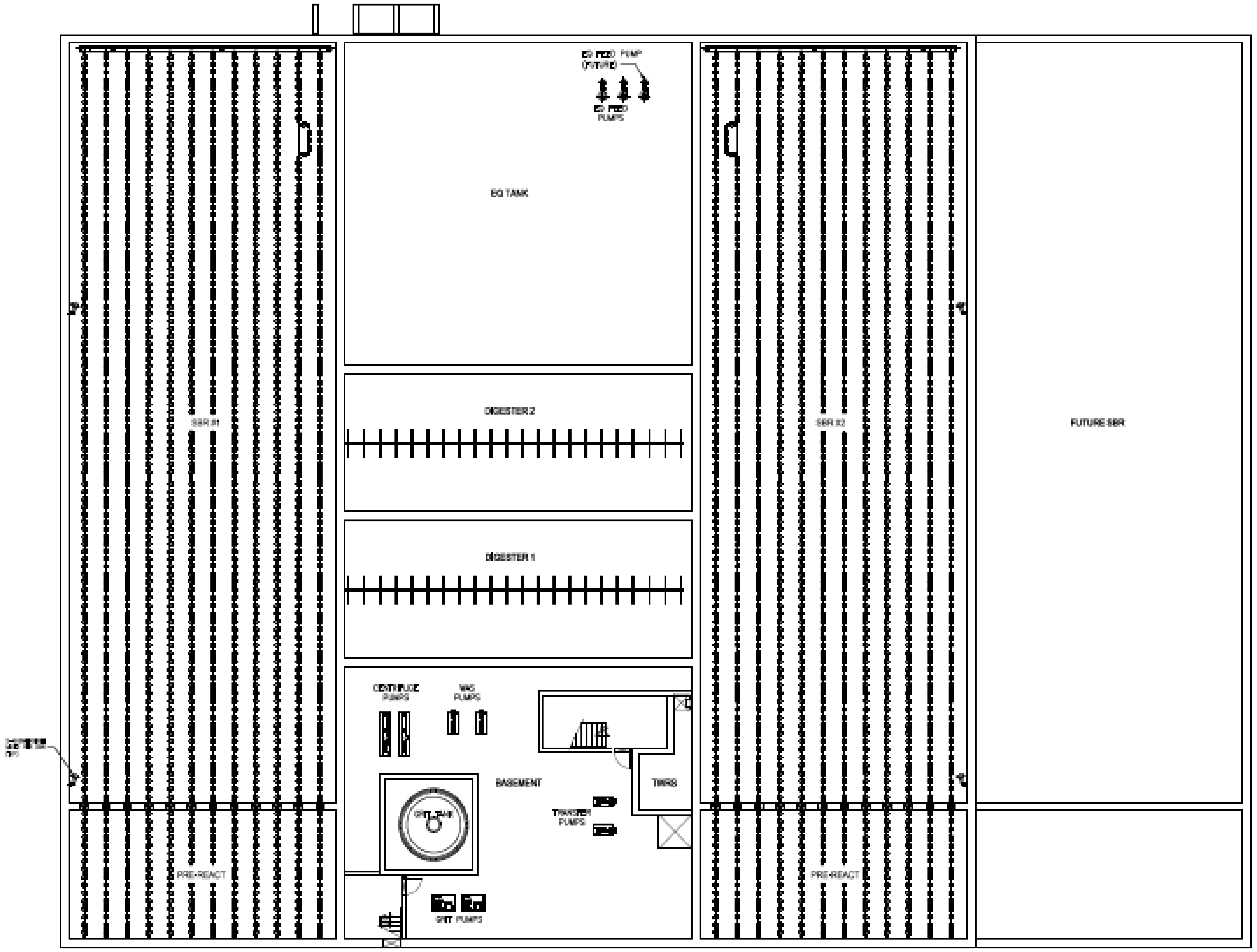
CITY OF THOMPSON WASTEWATER TREATMENT PLANT UPGRADE/EXPANSION PROJECT

City of Thompson

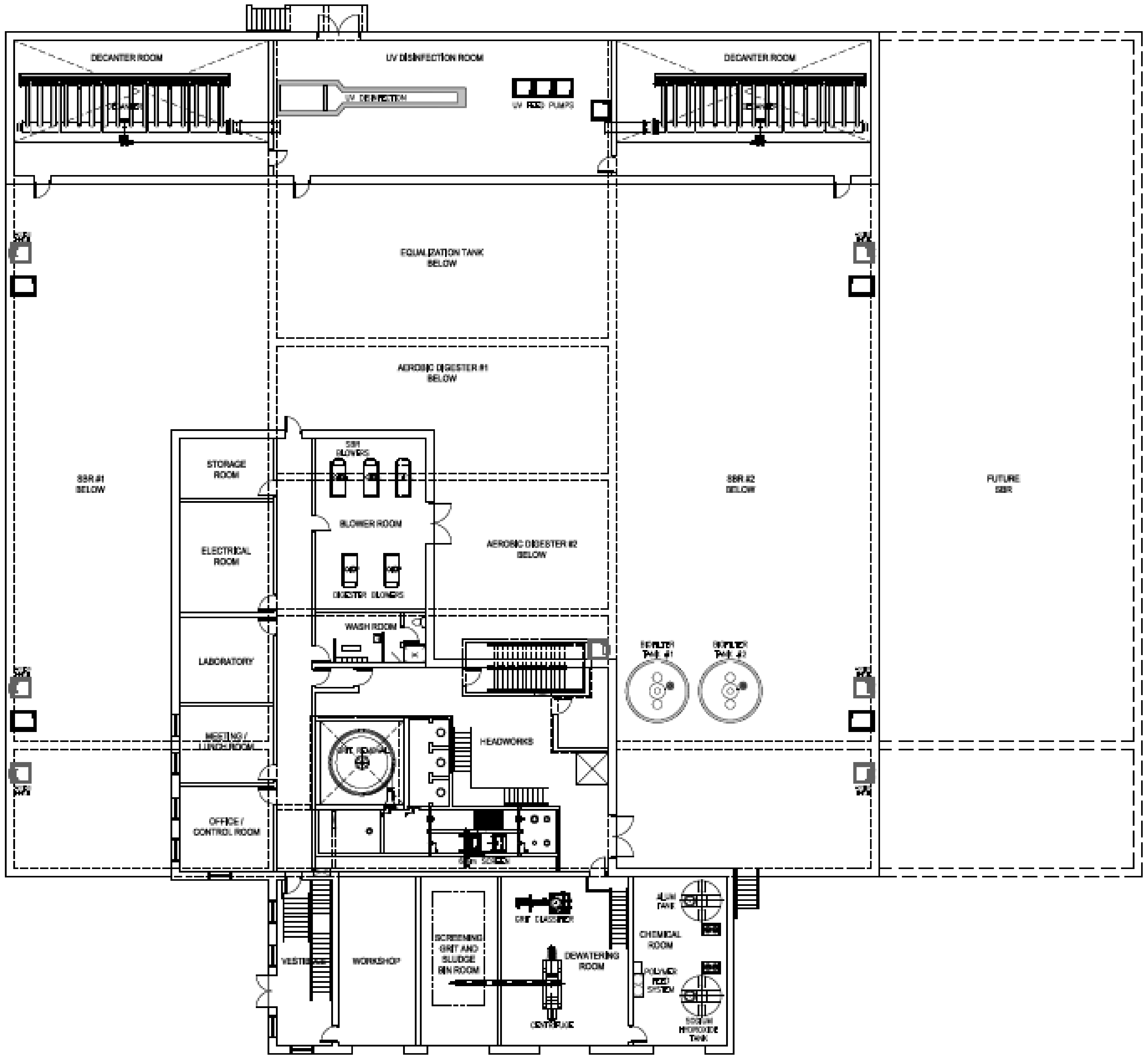
The Manitoba
Water Services Board

WASTEWATER TREATMENT PLANT
FLOOR PLANS

LOWER LEVEL



UPPER LEVEL



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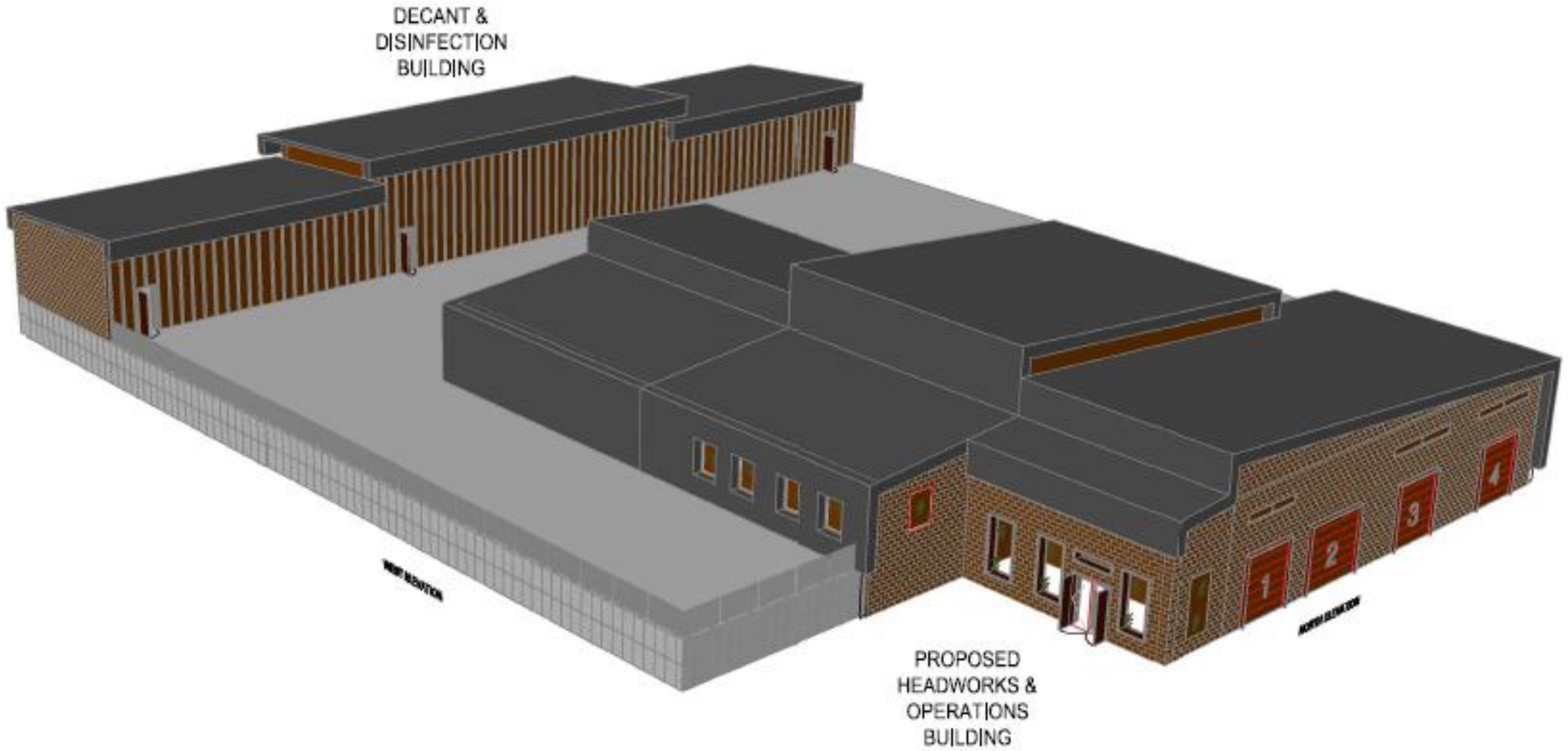
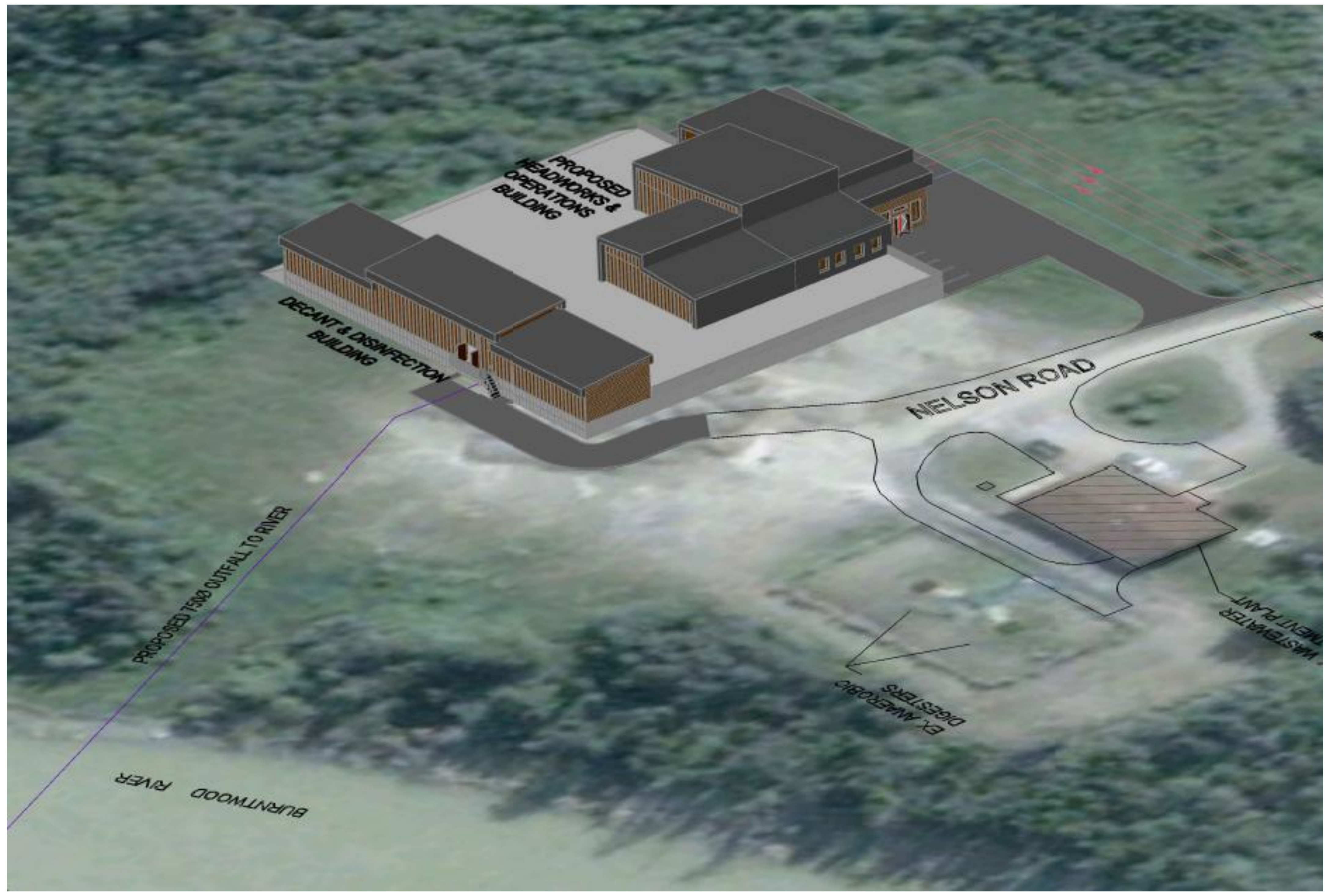
CITY OF THOMPSON WASTEWATER TREATMENT PLANT UPGRADE/EXPANSION PROJECT

City of Thompson

The Manitoba
Water Services Board

WASTEWATER TREATMENT PLANT
BUILDING ELEVATIONS





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City of Thompson

The Manitoba
Water Services Board

PROJECT CONSTRUCTION COSTS

Description	Total Amount
Headworks and Truckhaul receiving Station	$ 3,395,000
Secondary Process and UV Disinfection	$ 11,350,000
Solids Handling and Odour Control	$ 2,800,000
Operations Building	$ 875,000
Siteworks, Bldg. Mech., Decommissioning & Collection System	$ 4,180,000
Electrical, Instrumentation and General Conditions	$ 5,260,000
Engineering , Contingency and Estimating Allowance	$ 8,640,000
TOTAL CONSTRUCTION COST	**$ 36,500,000**

Stantec

City of Thompson

The Manitoba Water Services Board

ENVIRONMENTAL LICENSING PROCESS

1. Complete Functional Design of Treatment Facility
2. Submit Environment Act Proposal (EAP) to Manitoba Conservation
3. Opportunity for Public Input:
   a. Today's Open House
   b. Manitoba Conservation Will Advertise in Local Papers once the EAP has been received
4. Manitoba Conservation Circulates EAP to their Technical Advisory Committee for review by various government agencies
5. Comments of the Public and the Technical Advisory Committee are forwarded to the project proponent to respond
6. Proponent responses are returned to the government agency or private group or citizen that posed that particular question
7. Manitoba Conservation will then determine if any modifications are required to the functional design and whether or not the project can be issued an Environment Act License
8. Construction of the Wastewater Treatment Plant and associated infrastructure cannot proceed without an Environment Act License.

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City of Thompson

The Manitoba
Water Services Board

PRELIMINARY
IMPLEMENTATION SCHEDULE/NEXT STEPS

- Submit Functional Design and Environment Act Proposal to Manitoba Conservation – December 23, 2013
- Developing Project related Financial Plans
- Application for Infrastructure Funding
- Anticipated Receipt of Environment Act License – June/July, 2014
(Manitoba Conservation's licensing process typically takes 6 to 10 months for this type of project)
- Complete Detailed Design/Finalize Tender Package – November/December 2014
- Tender Project Construction Contract – February/March 2015
- Project Construction Period – May 2015 to December 2016
- Project Start-up and Commissioning – January/February 2017

City of Thompson Proposed Wastewater Treatment Plant Upgrade/Expansion
Public Open House
Multi-Purpose Room – TRCC, Thompson
27th November 2013
6 pm - 9 pm
Sign-in Sheet

	Name	Address	Phone Number	Email
1	John Burrows	76 Robinson Way.	778-8997	
2	Jim [illegible]	MULTI-CULTURAL CENTRE 79 MCGILL ST – COMMUNITY GARDENS 39 RIVERSIDE.	677-4588	jim@thompsoncitizen.net
3	Judy Kolada	108 Yale	677-3464	
4	Jeff Schultz	42 [illegible] - Bus 23 Selkirk - Work	677 1266	jeff.m.schultz@rbc.com
5	Tim Johnston	32 Hillside Cres	778-5511	
6	B [illegible]	119 Manasan	[illegible]1404	
7	Mark [illegible]	CBC RADIO	677-1682	north@cbc.ca
8	Dr. Peter Aarinola	41 Wuskwatim Bay	778-6434	Kofo.aarinola@yahoo.com
9	Kevin Carolino	63 Cambridge St.	677-5816	kevincarolino@yahoo.com
10	Paul Pritchard	31 Hillside	778-4350	pritch@mts.net
11	Raj Patel	44 Confederation	778-6114	rajrina@inbox.com
12	Ron Byer	24 STAGHORN DR.	677-2429	rBYER@MTS.NET
13				
14				
15				
16				
17				

City of Thompson Proposed Wastewater Treatment Plant Upgrade/Expansion
Public Open House
Multi-Purpose Room – TRCC, Thompson
November 27, 2013

Do you have any comments or suggestions regarding the proposed Wastewater Treatment Plant (WWTP)?

seze of Population, to small should be Built for. at least. 17,500

What aspects of the proposed WWTP interest you the most?

Do you have concerns with the proposed WWTP?

Are plans made for. use of sluged. eg Fertilizer

Would you like additional information regarding the proposed WWTP? Yes ☐ No ☑

If you answer "yes" please fill in the appropriate information:

What additional information are you interested in?

How would you like to be contacted? Mail ☐ Phone ☐ Email ☐

Please provide the necessary information:
Name: Ron BYER
Address: 24 STAGHORN DR.
Postal Code: R8N-1G5.
Phone Number: 677-2429.
Email Address: rbyer@MTS.NET

If you have additional comments or questions, please contact any of the following:

Ms. Carol Taylor
City of Thompson
City Hall
226 Mystery Lake Road
Thompson, MB, R8N 1S6
Ph: (204)-677-7923
Fax: (204)-677-7936
Email: ctaylor@thompson.ca

Mr. Saibal Basu, Ph.D,P.Eng.
Stantec Consulting Ltd.
Project Manager
905 Waverley Street
Winnipeg, MB R3T 5P4
Ph: (204) 488-5710
Fax: (204) 453-9012
Email: Saibal.basu@stantec.com

Thank You for Your Participation

City of Thompson

THE MANITOBA WATER SERVICES BOARD

Stantec

City of Thompson Proposed Wastewater Treatment Plant Upgrade/Expansion
Public Open House
Multi-Purpose Room – TRCC, Thompson
November 27, 2013

Do you have any comments or suggestions regarding the proposed Wastewater Treatment Plant (WWTP)?
Yes.

What aspects of the proposed WWTP interest you the most?
Waste to landfill. This is a great source of fertilizer for the Multicultural Centre Community Garden Project.

Do you have concerns with the proposed WWTP?
~~No~~ Yes. Designed capacity for 15000 people is too small. It should be greater than this in case of unexpected population/explosion increase of Thompson.

Would you like additional information regarding the proposed WWTP? Yes ☑ No ☐

If you answer "yes" please fill in the appropriate information:

What additional information are you interested in?
Capacity of the plant. Detailed engineering design/information on Environmental impact of the project.

How would you like to be contacted? Mail ☑ Phone ☐ Email ☑

Please provide the necessary information:
Name: DR. PETER AARINOLA, PhD, P.Eng.
Address: 41 WUSKWATIM BAY, THOMPSON
Postal Code: R8N 1V4 Phone Number: 204-778-6434
Email Address: kofo.aarinola@yahoo.com

If you have additional comments or questions, please contact any of the following:

Ms. Carol Taylor
City of Thompson
City Hall
226 Mystery Lake Road
Thompson, MB, R8N 1S6
Ph: (204)-677-7923
Fax: (204)-677-7936
Email: ctaylor@thompson.ca

Mr. Saibal Basu, Ph.D,P.Eng.
Stantec Consulting Ltd.
Project Manager
905 Waverley Street
Winnipeg, MB R3T 5P4
Ph: (204) 488-5710
Fax: (204) 453-9012
Email: Saibal.basu@stantec.com

Thank You for Your Participation

City of Thompson Proposed Wastewater Treatment Plant Upgrade/Expansion
Public Open House
Multi-Purpose Room – TRCC, Thompson
November 27, 2013

Do you have any comments or suggestions regarding the proposed Wastewater Treatment Plant (WWTP)?

I now understand that there is not enough sludge to warrant a milorganite type of commercial fertilizer plant.

What aspects of the proposed WWTP interest you the most?

We at the Multicultural society want to use the sludge from the decommissioned lagoon to use as fertilizer on hay fields under the Manitoba Hydro towers – NOT IN COMMUNITY GARDENS BUT IN HAYFIELDS.

Do you have concerns with the proposed WWTP?

That there will be enough capacity to handle BY 2017. 20,000 people also would not chlorine be more effective than ~~aeration~~ ultra violet light
in reducing

Would you like additional information regarding the proposed WWTP? Yes ☑ No ☐

Send to Dr. Peter Aarnola

If you answer "yes" please fill in the appropriate information:

What additional information are you interested in?

detailed engineering design sent to

How would you like to be contacted? Mail ☐ Phone ☐ Email ☑

Please provide the necessary information:
Name: JIM TOPPING (MULTI-CULTURAL CENTRE DIRECTOR FOR community gardens
Address: 39 RIVERSIDE – (CHAMBER OF COMMERCE
Postal Code:
Phone Number: WORK 677-4534
Email Address: jim@thompsoncitizen.net.

If you have additional comments or questions, please contact any of the following:

Ms. Carol Taylor
City of Thompson
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226 Mystery Lake Road
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Email: Saibal.basu@stantec.com

Thank You for Your Participation

City of Thompson Proposed Wastewater Treatment Plant Upgrade/Expansion
Public Open House
Multi-Purpose Room – TRCC, Thompson
November 27, 2013

Do you have any comments or suggestions regarding the proposed Wastewater Treatment Plant (WWTP)?

Yes. The sludge that the treatment plant generates would be perfect for reusing for the fields instead of ending-up in the landfill.

What aspects of the proposed WWTP interest you the most?

Modernization of the WWTP facility.

Do you have concerns with the proposed WWTP?

~~No~~ Yes, the design capacity is only for 15,000 people, whereas the present or current population is 13,000. Is there any chance that the designers ~~[illegible]~~ to could look at this?

Would you like additional information regarding the proposed WWTP? Yes ☐ No ☒

If you answer "yes" please fill in the appropriate information:

What additional information are you interested in?

How would you like to be contacted? Mail ☐ Phone ☐ Email ☐

Please provide the necessary information:
Name:
Address:
Postal Code: Phone Number:
Email Address:

If you have additional comments or questions, please contact any of the following:

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Thank You for Your Participation

City of Thompson Proposed Wastewater Treatment Plant Upgrade/Expansion
Public Open House
Multi-Purpose Room – TRCC, Thompson
November 27, 2013

Do you have any comments or suggestions regarding the proposed Wastewater Treatment Plant (WWTP)?

What aspects of the proposed WWTP interest you the most?
Location - Financial Plan

Do you have concerns with the proposed WWTP?

Would you like additional information regarding the proposed WWTP? Yes ☒ No ☐

If you answer "yes" please fill in the appropriate information:

What additional information are you interested in?
Financial Plan

How would you like to be contacted? Mail ☐ Phone ☐ Email ☒

Please provide the necessary information:
Name: Jeff Schultz (Royal Bank)
Address: 23 Selkirk Ave
Postal Code: Phone Number: 204 677 1266
Email Address: jeff.m.schultz@rbc.com

If you have additional comments or questions, please contact any of the following:

Ms. Carol Taylor
City of Thompson
City Hall
226 Mystery Lake Road
Thompson, MB, R8N 1S6
Ph: (204)-677-7923
Fax: (204)-677-7936
Email: ctaylor@thompson.ca

Mr. Saibal Basu, Ph.D,P.Eng.
Stantec Consulting Ltd.
Project Manager
905 Waverley Street
Winnipeg, MB R3T 5P4
Ph: (204) 488-5710
Fax: (204) 453-9012
Email: Saibal.basu@stantec.com

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City of Thompson
THE MANITOBA WATER SERVICES BOARD
Stantec

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November 27, 2013

Do you have any comments or suggestions regarding the proposed Wastewater Treatment Plant (WWTP)?

What aspects of the proposed WWTP interest you the most? The cost. – Raising the funding

Do you have concerns with the proposed WWTP? No – not knowledgeable in engineering

Would you like additional information regarding the proposed WWTP? Yes ☐ No ☐

If you answer "yes" please fill in the appropriate information:

What additional information are you interested in?

How would you like to be contacted? Mail ☐ Phone ☐ Email ☐

Please provide the necessary information:
Name: John Hada – will be informed through the City.
Address:
Postal Code: Phone Number:
Email Address:

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November 27, 2013

Do you have any comments or suggestions regarding the proposed Wastewater Treatment Plant (WWTP)?

What aspects of the proposed WWTP interest you the most?
New Technology.

Do you have concerns with the proposed WWTP?
Costs What is happening w/the waste.

Would you like additional information regarding the proposed WWTP? Yes ☑ No ☐

If you answer "yes" please fill in the appropriate information:

What additional information are you interested in?
Time Line of Costs.

How would you like to be contacted? Mail ☑ Phone ☐ Email ☐

Please provide the necessary information:
Name: John Burrows
Address: 76 Robinson Way
Postal Code: R8N 0M1 Phone Number:
Email Address: JNB1953@yahoo.ca

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