The Manitoba Water Services Board

Grand Beach Provincial Park Lagoon Upgrade Project - Environment Act Proposal

Prepared by:

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December, 2016

Project Number: 60430713

Environment Act Proposal Form

Manitoba
Sustainable Development

Name of the development: Grand Beach Provincial Park Lagoon Upgrade Project - Enironment Act Proposal	
Type of development per Classes of Development Regulation (Manitoba Regulation 164/88): Class 2	
Legal name of the applicant: Sustainable Development, Parks and Protected Spaces	
Mailing address of the applicant: Box 53, 200 Saulteaux Cres. Contact Person: J.P. Perreault City: Winnipeg Province: Manitoba Postal Code: R3J 3W3 Phone Number: 204-981-3805 Fax: 204-945-0012 email:	
Location of the development: Contact Person: J.P. Perreault Street Address: Grand Beach Provincial Park Legal Description: Lagoon: 20-18-7 EPM City/Town: Grand Beach Province: Manitoba Postal Code: R3J 3W3 Phone Number: 204-726-6080 Fax: 204-726-7196 email:	
Name of proponent contact person for purposes of the environmental assessment: Somia Sadiq, B.Env., EP, MCIP, RPP	
Phone: 204-477-5381 Fax: 204-284-2040	Mailing address: 99 Commerce Drive Winnipeg, Manitoba R3P 0Y7
Email address: somia.sadiq@aecom.com	
Webpage address:	
Date: December 8, 2016	Signature of proponent, or corporate principal of corporate proponent: Printed name: JP Perreault

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)

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Class 2 Developments $7,500
Class 3 Developments:
Transportation and Transmission Lines ..$10,000
Water Developments $60,000
Energy and Mining.....$120,000

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

For more information:
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2	1	The Manitoba Water Services Board

Revision History

Revision #	Date	Revised By:	Revision Description
1	December 2016	K. Cusitar	Final

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December 16, 2016

Ms. Tracey Braun, M.Sc.
Director, Environmental Assessment and Licensing
Department of Sustainable Development
123 Main Street
Ste. 160 Union Station
Winnipeg, Manitoba R3C 1A5

Dear Ms. Braun:

Project No: 60430713

Regarding: Grand Beach Provincial Park Lagoon Upgrade Project - Environment Act Proposal

Please find enclosed four hard copies and one electronic copy of the *Environment Act* Proposal form and supporting information to obtain approval for Grand Beach Provincial Park Lagoon Upgrade Project. We understand that the proposed project is a Class 2 Development as per the *Classes of Development Regulation.* In accordance with the Classes of Development Regulation Fee, please find enclosed the *Environment Act* Proposal Form and a cheque for the application fee of $7,500. We trust that the information on the form and the attached supporting information are sufficient.

Should you have any questions regarding the project or the attached information, please do not hesitate to contact Somia Sadiq directly at 204-928-8494.

Sincerely,
AECOM Canada Ltd.

Somia Sadiq, B.Env.Sc., EP, MCIP, RPP
Manitoba Lead, Impact Assessment & Permitting

KC:SS:
Encl. Application Fee
cc: The Manitoba Water Services Board

Quality Information

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Somia Sadiq, B.Env.Sc., EP, MCIP, RPP
Environmental Lead

Executive Summary

This *Environment Act* Proposal report contains the information described in Conservation and Water Stewardship's Information Bulletin "*Environment Act Proposal Report Guidelines*" and "*Alterations to Developments with Environment Act Licences*". The existing Grand Beach Provincial Park Lagoon requires upgrading as it has been leaking since it was constructed in 1976. To date, the Lagoon has not discharged treated effluent.

The existing Grand Beach Provincial Park Lagoon ("Lagoon") was constructed in 1976 as a three-cell Lagoon. Due to inadequate clay liners, the Lagoon has never been discharged since construction. The Lagoon was originally designed to discharge to a drainage ditch, which drains into the Grand Beach Natural Lagoon, which eventually drains directly into Lake Winnipeg. The existing two operating cells consist of a primary cell which receives wastewater from the Grand Beach Campground via forcemain and a lift station. Hauled waste is also trucked from cabins at the Grand Beach town site. The existing secondary Lagoon cell provides additional storage. The existing Lagoon cells are too small to provide sufficient surface area required for the organic treatment level required to meet Manitoba Water Quality Standards, Objectives, and Guidelines Regulation (MWQSOG).

The proposed project includes the following components:

- 1 Primary Cell with a floor area of 30,794 m^2;
- 2 Secondary Cells with floor areas of 9,745 m^2 and 8,244 m^2;
- Interconnecting pipe and level control structure;
- Connection to existing Campground lift station;
- 350 m of forcemain from the Campground lift station;
- Truck dump facility;
- Effluent discharge ditch;
- 100 m of road upgrading; and
- Transfer of wastewater and sludge from the existing Lagoon cells into the newly constructed secondary Lagoon cell.

The current licence stipulates that the Lagoon shall be discharged once a year in the fall, between September 15th and November 1st. The proposed upgraded lagoon has been sized to optimize the footprint of the site while fully utilizing the existing facility. The lagoon is anticipated to have high organic loading resulting from the flows from the campground and septage from the truck dump facility requiring an oversized primary cell. The hydraulic storage includes 24,000 m^3 in the primary cell and 30,600 m^3 in the secondary cells for the total required hydraulic storage. A staged discharge (2 discharges per year) is required to maintain the required level of treatment without also significantly oversizing the secondary cell. Therefore, in lieu of significantly oversizing the secondary cell two discharge events are proposed, once in early June (before peak park use coinciding with the end of the school year) and in fall (as stipulated in the existing Clean Environment Commission Order No. 634).

Environmental effects for the proposed project have been assessed as follows:

Topography

Construction of the proposed project will result in minor changes to topography due to the size of the area that requires clearing. The area of the proposed primary cell is located within a typical aspen forest that will require approximately 70,000 m^2 of clearing. The area of the existing Lagoon and the proposed primary cell are located approximately 60 m from the Campground Access Road through a heavily forested area; not visible from the Campground Access Road or the adjacent Trans Canada Trail also located approximately 60 m away.

Air and Noise

Although dust is not anticipated to be a major concern at the Project Site, with the implementation of measures such as limiting material stockpile heights, keeping disturbed/exposed areas to a minimum, and using dust suppression if required, the effects of dust is assessed to be negligible.

Only a slight odour was observed during the site visit once on the berm of the Lagoon; not while on the Lagoon access road or on the Trans Canada Trail. During the desludging of the existing Lagoon cells, the slurry will be pumped into the new secondary cell and will be partially filled with water to completely cover all of the remaining sludge and wastewater. There may be some sludge that will require to be removed from the existing Wastewater Treatment Plant (WWTP) during decommissioning. It is anticipated that decommissioning will occur during the fall, outside of the camping season.

This approach is expected to limit odours and impacts produced from the wastewater and sludge slurry. Desludging will also occur during the fall, outside of the camping season, and will take approximately five days to complete. Based on the separation distance between the Project Site and the closest receptors, and the time of year for the desludging to occur, any residual impact due to odour is assessed to be negligible.

With respect to exhaust emissions, it is anticipated that a maximum of 10 construction vehicles will access the Lagoon site via the Campground Access Road. Construction along the Causeway Road is anticipated to be limited to one or two horizontal directional drilling rigs and a maximum of five other construction vehicles. With the implementation of measures such as maintaining vehicles and equipment in proper working order and vehicle idling kept to a minimum, the effects of exhaust emissions is assessed to be negligible.

Noise levels at the Project Site during construction are not expected to be high enough to cause significant disturbance in the Project Area. With the implementation of measures such as providing hearing protection to workers as required and properly maintaining vehicles and equipment are expected to mitigate potential adverse effects. During operation, sources of noise include maintenance vehicles and activities along with hauler trucks arriving to the site approximately five times per year. Therefore, the effect of noise is assessed to be minor.

Greenhouse Gas Emissions

With respect to greenhouse gas (GHG) emissions, the proposed primary and secondary cells will be 1.5 m in depth and therefore produce negligible quantities of methane. Also, vehicle emissions associated with sludge removal and maintenance are anticipated to negligibly contribute to local GHG concentrations. Therefore, the effect of odour is assessed to be negligible.

Soil

With respect to soil compaction, mixing, and erosion during construction, the implementation of mitigation measures identified in this assessment is anticipated to mitigate any potential soil compaction/mixing and erosion effects. Therefore, it is anticipated that the residual effect on soil will be negligible.

Groundwater

The proposed project does not require undertaking of any activities that may affect groundwater in the area.

Surface Water and Aquatic Resources

The new Lagoon system will meet the following effluent criteria (prescribed under Manitoba Water Quality Standards, Objectives, and Guidelines):

- $CBOD_5$ - 25 mg/L;
- Total Suspended Solids (TSS); excluding algae solids - 25 mg/L;
- Total Coliform - 1500 CFU per 100 mL;
- Fecal Coliform - 200 CFU per 100 mL;
- Un-ionized ammonia - 1.25 mg/L expressed as nitrogen (N), at 15°C ± 1°C; and
- Total Phosphorus - 1 mg/L.

With the above criteria as the target for key parameters, the quality of the effluent that will be discharged to Lake Winnipeg is anticipated to improve and meet current environmental standards. The existing Lagoon has never been discharged since it was constructed approximately 40 years ago. Based on the topography in the area of the existing Lagoon (as shown in **Figure 02**), the land gently slopes towards the Grand Beach Natural Lagoon area. It is therefore anticipated that the effluent in the Lagoon may have seeped through the existing clay liner and followed the natural topography in the area towards the Grand Beach Natural Lagoon. With the proposed twice per year discharge, the quantity of effluent will remain the same, just discharged twice per year instead of once per year.

All construction works will be located approximately 100 m away from the Grand Beach Natural Lagoon; with the exception of clearing and grading of the existing effluent drainage ditch. With the implementation of measures such as installing silt fences, limiting material stockpile heights, keeping disturbed/exposed areas to a minimum, and using dust suppression if required, the effects of dust is assessed to be negligible.

In regards to potential flooding at the Project Site due to high water levels of Lake Winnipeg; the closest lagoon cells to the lake are the existing lagoon cells and with a berm elevation of 2.9 m above the record highest water level of the lake, it is anticipated that the berm will provide the necessary protection from any potential future high water levels of the lake/flooding.

In regards to water movement from the natural lagoon to Lake Winnipeg, it is anticipated that the higher levels of water flow between the natural lagoon and Lake Winnipeg will occur in spring during the winter run off and in the fall when higher levels of north-easterly winds occur. As the new Lagoon will discharge twice pre year, once in early June and once in the fall, it is anticipated that the discharge time will coincide with the higher water levels in the natural lagoon area; therefore the effluent from the new Lagoon is not anticipated to have a significant adverse effect on water quality in natural lagoon and Lake Winnipeg.

Protected and Other Flora Species

The location of the primary lagoon cell will require approximately 70,000 m^2 of vegetation clearing. A construction lay-down area will also be required for the proposed project and is anticipated to be located near the truck dump of the existing Lagoon. Vegetation clearing and grading will also be required within the existing effluent drainage ditch. Construction along the Causeway Road is anticipated to be limited to one or two horizontal directional drilling rigs. With the implementation of the mitigation measures identified in this assessment, the effect of vegetation clearing is assessed to be minor.

Protected and Other Fauna Species

With respect to protected species, there is the potential that some may be found within the Project Area, however, the likelihood of protected species at the existing Lagoon site is anticipated to be low. Also, the habitat encountered at the Project Site is very common for this area and therefore the loss of critical habitat due to the proposed project is not anticipated. The Project Site is located in an area which is frequented by disturbances including road traffic along the Campground Access Road and the regular use of the Trans Canada Trail by the public. Due to these regular disturbances, it is anticipated that wildlife in the area is accustomed to such disturbances. Also, construction along the Causeway Road is anticipated to be limited to one or two horizontal directional drilling rigs. Noise during construction will be a short-term disturbance and will subside thereafter. With implementation of the mitigation

measures identified in this report, the expected residual effects as a result of noise, dust deposition, and vegetation clearing on wildlife is anticipated to be minor to moderate at the Project Site.

Protected Areas

With respect to protected areas, the closest protected area is located approximately 11 km east from the Project Site; therefore, no effects on protected areas are anticipated from the construction and operation of the proposed project.

Heritage Resources

The Heritage Resources Branch (HRB) indicated that the potential to impact significant heritage resources was low for the Lagoon site and therefore the Branch has no concerns with the proposed project. A second updated screening request was submitted to HRB on May 6, 2016 that included the proposed lift station and forcemain; to date a response from HRB has not been received by AECOM.

Aesthetics

During construction, good housekeeping practices will be implemented at the Project Site including inspecting the Project Site on a regular basis for loose waste and debris and storing waste and debris in proper bins prior to removal from the site. There is approximately 60 m of heavily forested area between the Campground Access Road and the new primary Lagoon cell providing a visual screen during both construction and operation. The existing Lagoon site also has a heavily treed area between it and the Campground Access Road and is also gated and not accessible by the public. The new primary Lagoon cell will be fenced and will have a gate to limit public access. The existing WWTP is not directly visible from Provincial Highway No. 12. It is bordered by a smaller forested area approximately 15 m in depth from the Provincial Highway No. 12. Therefore, the overall impact on aesthetics as a result of the proposed project is assessed to be reversible and insignificant.

Public Engagement

On August 29, 2015 and September 9, 2015, public Open Houses were held by Parks and Natural Areas, with attendance by AECOM to provide an opportunity to convey information about the proposed upgrades at the Lagoon and gather any feedback people may have. At the time of these Open House events, it was stated on the Open House Story Boards that “the upgraded wastewater lagoon will provide 365 day storage by annually discharging in the fall”.

In general, the concerns that were discussed during the Open Houses were: increased user fee to the cabin owners, and the natural flow between the Grand Beach Natural Lagoon and Lake Winnipeg; that the channel requires dredging to improve flow. The positive feedback during the Open Houses included that the attendees agree that the new Lagoon upgrade will improve the water quality in the Grand Beach Natural Lagoon and Lake Winnipeg and attendees were also pleased to see the future decommissioning of the existing wastewater treatment plant.

This *Environment Act* Proposal report will be made available on Sustainable Development’s Public Registry for public review and comment for 30 days.

Conclusion Summary

Considering the implementation of the proposed mitigation measures, design features, existing and proposed environmental licence conditions and the social and ecological context of each environmental component, the cumulative residual environmental effects of the proposed Lagoon replacement project are expected to be negligible to moderate in magnitude. The measures described to mitigate the risk of occurrence of accidents and

malfunctions are deemed to be appropriate in mitigating such risks. Therefore, it is our opinion that based on the available information and documented assumptions, the overall potential adverse effects of the proposed project will range from negligible to moderate and insignificant.

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1. Introduction

Grand Beach Provincial Park ('Park") is located at the southeast end of Lake Winnipeg with a 3 km stretch of beach with fine silica sand and rolling dunes. Grand Beach is separated into two areas; West Beach and East Beach by a natural lagoon (Grand Beach Natural Lagoon). The Grand Beach Campground ("Campground") is located at East Beach and the town site is located at West Beach. Some of the West Beach wastewater is treated by an existing package treatment plant (WWTP), while the Campground (East Beach) is serviced by the Lagoon. The Grand Beach Lagoon ("Lagoon") is located east of the Grand Beach Natural Lagoon and is located approximately 60 m west of the Trans Canada Trail.

1.1 Project Overview

The existing Grand Beach Provincial Park Lagoon ("Lagoon") was constructed in 1976 as a three-cell Lagoon. Due to inadequate clay liners, the Lagoon has never been discharged since construction. The Lagoon was originally designed to discharge to a drainage ditch, which drains into the Grand Beach Natural Lagoon, which eventually drains into Lake Winnipeg. The existing two operating cells consist of a primary cell which receives wastewater from the Grand Beach Campground (Campground) which has 408 basic and electrical campsites and several modern washroom and shower facilities via forcemain and a lift station. Hauled waste is also trucked from approximately 414 cabins at the Grand Beach town site. The existing secondary Lagoon cell provides additional storage. The existing Lagoon cells are too small to provide sufficient surface area required for the organic treatment level required to meet Manitoba Water Quality Standards, Objectives, and Guidelines Regulation (MWQSOG)

Figure 01 shows the general location of the project site and **Figure 02** shows the layout of the existing Lagoon. **Figure 03** shows the location of the Lagoon upgrade being proposed, in relation to the existing lagoon.

The West Beach WWTP currently provides seasonal treatment for the cottage community and commercial customers in the Grand Beach town site. This plant was sized to treat wastewater produced from the cabins, Beach Safety Building, the two Pavilions, the Parks office, six washroom facilities, and one shower building. However, due to the high cost of connection to the sewage system, 80% of the cabins installed individual holding tanks, which are pumped out and trucked directly to the Lagoon.

This resulted in the overall loading to the WWTP being lower than expected and it being subjected to high "shock" loads on the weekends. Parks has experienced ongoing difficulties in managing the biological treatment process at the plant and as a result after completion of the Lagoon Upgrades, the WWTP is planned be decommissioned in subsequent phases. Wastewater from the WWTP will be transferred directly to the Lagoon via a new forcemain using a new West Beach lift station.

Figure 04 shows the existing layout of WWTP along with the proposed lift station and associated piping to the proposed Lagoon upgrade.

This *Environment Act* Proposal Report has been prepared by AECOM Canada Ltd. ("AECOM") on behalf of the Manitoba Water Services Board ("MWSB") in accordance with the Department of Sustainable Development's (DSD) Information Bulletin, "Environment Act Proposal Report Guidelines", and AECOM's professional experience with other similar projects. This report documents the activities associated with the replacement of the existing Lagoon, potential environmental effects, and proposed mitigation measures. The report is submitted along with the *Environment Act* Proposal Form for consideration by DSD.

1.2 Regulatory Framework

The existing lagoon facility operates under Clean Environment Commission Order No. 634 issued November 17, 1976. The following limitations and/or restrictions are outlined in the Order:

- The lagoon will be operated in a manner to minimize odours and prevent contamination of groundwater;
- The organic loading of the primary cell five-day biochemical oxygen demand (BOD_5) will not exceed 50 lbs/acre/day;
- Effluent limits include:
  - BOD5 < 30 mg/L;
  - Total coliform < 1500 per 100 mL of sample as indicated by the MPN index.
- No discharge is permitted between November 1st and September 15th of the following year; and
- The lagoon cells must be lined with an impervious liner before January 1, 1978.

The proposed lagoon replacement is considered a Class 2 Development under the *Classes of Development Regulation* and as described in Section 11 of Manitoba's *Environment Act*. The proposed lagoon replacement is not listed on the *Regulations* Designating *Physical Activities* under the *Canadian Environmental Assessment Act*, *2012*, and as such, no federal environmental assessment requirements are anticipated. Since the project will not involve any disturbance to adjacent waterbodies, a Request for Review or subsequent permitting from the Department of Fisheries and Oceans is not required.

2. Project Description

The following section provides information regarding the proposed Lagoon upgrade and the decommissioning of the existing Grand Beach Wastewater Treatment Plant (WWTP) along with information regarding the new lift station and forcemain to the proposed Lagoon upgrade.

2.1 Lagoon Upgrade

The proposed project includes the following components:

- 1 Primary Cell with a floor area of 30,794 m^2;
- 2 Secondary Cells with floor areas of 9,745 m^2 and 8,244 m^2;
- Interconnecting pipe and level control structure;
- Connection to existing Campground lift station;
- 150 m of forcemain from the Campground lift station;
- Truck dump facility;
- Effluent discharge ditch;
- 100 m of road upgrading; and
- Transferring the wastewater and sludge from the existing Lagoon cells into the newly constructed secondary Lagoon cell.

The current licence stipulates that the Lagoon shall be discharged once a year in the fall, between September 15th and November 1st. The proposed sizing of the secondary cell of the Lagoon (30,600 m^3) as outlined in the *Grand Beach Provincial Park Lagoon Preliminary Design Repor*t (**Appendix A**) will only have enough capacity to allow the lagoon to operate utilizing twice a year discharge. Twice a year discharge is necessary to avoid operation issues associated with lagoon in seasonal communities with high organic and low hydraulic loadings. Therefore, it is being proposed to have two discharge events, once in early June (before the school year ends) and once in fall (as stipulated in the existing Clean Environment Commission Order No. 634).

The following sections provide an overview of the existing Lagoon and the proposed Lagoon replacement. Additional design details are provided in the *Grand Beach Provincial Park Lagoon Preliminary Design Repor*t, which can be found in **Appendix A**.

2.1.1 Existing Wastewater Lagoon

The Grand Beach Provincial Park Lagoon was constructed in 1976 as a three-cell lagoon. At the time, only two cells were built. Construction on the third cell was initiated but never completed. The third cell is visible on site and the interconnecting piping between the existing cells is in place. The current site is constrained on multiple sides by the Wetland area, Trans Canada Trail, proximity to the Campground, and the East Gate Road to the Campground. As a result of these constraints the ability to expand on the current site while still incorporation the existing works into the new design is limited in size.

The two existing operating cells consist of a primary cell which receives wastewater from the Campground via forcemain and through a lift station. Hauled waste is also trucked to the Lagoon from the Cabins. The secondary cell provides additional storage. Both existing Lagoon cells are approximately 73 m by 80 m in size and occupy a total area of approximately 12,000 m^2. The third incomplete cell is approximately 110 m by 110 m in size.

The Lagoon was originally designed to discharge to a drainage ditch, which drains into the Grand Beach Natural Lagoon, which eventually drains into Lake Winnipeg. However, due to inadequate clay liners, the Lagoon has never been discharged since its construction.

2.1.2 Current Flows – Campground

The Campground is open seven days a week for approximately 16 weeks per year. During the winter, the Campground is shut down and no waste is pumped to the Lagoon. Estimated wastewater flows are divided into type of site; washroom, laundry and shower facilities, and a campground office.

Table 1 provides the current estimated wastewater flow from the Campground.

Table 1: Current Estimated Wastewater Flow – Campground

Flow Components	Number of Units	Daily Volume per unit (L)	Total Flow (L/day)
Basic and Electrical Camp Sites	1,142 people [1]	70	79,968
Laundry Facilities [2]	8 machines	1,330	10,640
Hiking Trail Washrooms	5	33 [3]	165
Shower Facility [4]	20 stalls	Showerhead @ 7.5 L/min	51,408
Campground Office [1]	22 people	49	1,078
		Average Day Flow	**143,259**
		Total Flow (16 weeks operation)	**16,045,000**

Notes:

1. *Calculations are based on a full Campground with 3.5 people per site. This number includes all 408 campsites and assumes 80% occupancy throughout the camping season.*
2. *Laundry Facility – There are currently eight washing machines operating at the central Concession Facility. It is assumed that when the Campground is full, each machine is capable of running 7 loads/day at 190 litres per load.*
3. *Assuming 1000L per month is pumped from each of the five washroom; these washrooms are expected to get limited use in general.*
4. *Shower Facility – A low flow shower head on the market today ranges from 6.0 L/min – 9.4 L/min. The 20 shower facility is assumed to have installed shower heads of 7.5 L/min. Calculations assumed that 75% of campsite occupant showered once a day for 8 minutes.*

2.1.3 Current Flows – Cabins

Of the 517 cabins at the Grand Beach town site, approximately 80% (i.e., 414 cabins) truck their waste to the Lagoon. The remaining cabins do not contain a wastewater system and therefore use the public washroom facilities in the West Beach area. Waste from the West Beach public washroom facilities is pumped to the Wastewater Treatment Plant (WWTP) located on West Beach.

The cabin area operates year round and wastewater from the holding tanks is trucked to the existing Lagoon throughout the year.

It is estimated that the Lagoon accepts one 4,500 L holding tank per month per cabin during the main operation season of April to November. This value is conservative and likely accounts for lower than average use during the early and late fall and higher than average use during July and August. During the winter months (December to March), it is estimated that only a quarter of the cabins are operating and pumping-out their holding tanks, on average once a month. **Table 2** provides the current estimated wastewater flow from the cabins.

Table 2: Current Estimated Wastewater Flow – Grand Beach Cabins

Flow Components	Number of Cabins	Number of Months	Daily Volume per unit (L)	Total Annual Flow (L)
April to November	414	8	4,500	14,904,000
December to March	104	4	4,500	1,872,000
			Total Annual Flow	**16,776,000**

2.1.4 Current Flows - Septage

Waste is also collected from several sites through the Park via a septage truck. The following sites send septage to the lagoon and **Table 3** provides the flow details.

- The East Gate consists of two permanent residences, which have been empty for the past two years, and 13 seasonal cabins for Park staff;
  - All facilities are connected to a septic field with septage being pumped out once a year and trucked to the Lagoon;
- The Beach Safety Facility, Pavilion 1, and Pavilion 2 are all located on the West Beach. A gravity sewer system connects all three buildings to the West Beach WWTP;
  - Septage is pumped out only every second year;
- The West Beach WWTP has the solids pumped out once a year and trucked to the Lagoon;
- The Lift Station located at 3rd Street has the solids pumped out once a year and trucked to the Lagoon; and
- There are also several outhouses located around the West Beach that have the solids pumped out once a year and trucked to the Lagoon.

Table 3: Current Estimated Wastewater Flow – Grand Beach Septage

Septage Locations	Amount of Septage Hauled per year (L)
East Gate Residences and Staff Cabins	40,000
Beach Safety Facility, Pavilion 1 and 2 [1]	25,000
Lift Station	5,000
Outhouses	5,000
Total Annual Septage	**75,000**

Notes: 1. Parks stated that 50,000L is pumped out every second year. Flow is estimated on half the flow being pumped out each year.

All of the septage locations are pumped out in the fall, once the Campground is closed for the year. No other known septage is hauled to the Lagoon.

2.1.5 Current Total Annual Flow

The total annual flow to the Lagoon is the sum of the summer flow from the Campground, the year round flow from the cabins, septage, and infiltration. Infiltration has been estimated by the Park operators to be 100 L/d throughout the year. Annual flows are summarized in **Table 4**.

Table 4: Current Estimated Wastewater Flow – Grand Beach Septage

Unit	Total Flow (L)
Campground	16,045,000
Cabins	16,776,000
Septage	75,000
Infiltration	36,500
Total Annual Flow	**32,932,500**

2.1.6 Projected Wastewater Flows

This section outlines the future flows for the campground, cabins, hauled in septage, and flows from the West Beach Wastewater Treatment Plant. These projected flows were used in developing the design criteria as outlined in Section 2.3.

2.1.6.1 Future Flow – Campground

The design of the Lagoon replacement was based on future projected flows. The Grand Beach operating staff have indicated that in the future, a maximum of 50 existing campsites may be converted to full-service sites. There are no known additional water or wastewater expansions for the next 20 years. Projected future wastewater flows are outlined in **Table 5**.

Table 5: Projected Future Flow – Campground

Flow Components	Number of Units	Daily Volume per unit (L)	Total Flow (L/day)
Conversion of 50 existing sites to Electrical and Water Sites	140 people	70	9,800
Basic and Electrical Camp Sites	1,002 people [2]	70	70,168
Laundry Facilities [3]	8 machines	1,330	10,640
Hiking Trail Washrooms	5	33 [4]	165
Shower Facility [5]	20 stalls	Showerhead @ 7.5 L/min	51,408
Campground Office [1]	22 people	49	1,078
		Average Day Flow	**143,259**
		Total Flow (16 weeks operation)	**16,045,000**

Notes:

1. *Campsite Flows – The numbers used in Table 5 for daily wastewater flows per campground office worker are derived from the Manitoba Minimum Expected Volume of Sewage Per Day Typical Wastewater Flow Rates, July 2010, published by Manitoba Conservation (http://www.gov.mb.ca/conservation/envprograms/wastewater/pdf/mb_min_sewage_vol_july_2010%20xls.pdf)*
2. *Calculations are based on a full Campground with 3.5 people per site. This number includes 408 campsites minus 50 site which are converted to water and electrical serviced campsites for a total of 358 campsites. It has been assumed that the Campground is 80% occupied throughout the 16 weeks of operation*
3. *Laundry Facility – There are eight washing machines operating at the central Concession Facility. It is assumed that when the campground is full, each machine is capable of running 7 loads/day at 190 litres per load.*
4. *Assuming 1000L per month is pumped from each of the five washrooms, these washrooms are expected to get limited use in general.*
5. *Shower Facility – A low flow shower head on the market today ranges from 6.0L/min – 9.4 L/min. The current 16 shower facility is assumed to have installed shower heads of 7.5 L/min. Calculations assumed that 75% of campsite occupant showered once a day for 8 minutes.*

2.1.6.2 Future Flow - Cabins

The projected annual flow from the cabin area at West Beach is 16,776,000 L. No expansions are planned for this area.

2.1.6.3 Future Flow - Septage

The projected annual volume of septage hauled to the Lagoon is projected to be 75,000 L. This volume is not expected to increase.

2.1.6.4 Future Flow – West Beach Wastewater Treatment Plant

The design treatment capacity of the West Beach WWTP is 340 m^3/day of domestic wastewater. The plant is treating an average of 16,700,000 L per year (115,000 L/day) of wastewater from mid-May to mid-October. This average flow per year was calculated from the wastewater flow records from 2007 to 2010.

2.1.6.5 Projected Total Annual Flow

The total annual projected flow for the new Lagoon is the sum of the summer flow from the Campground, the year round flow from the cabins, septage, the West Beach WWTP, and infiltration (assumed to be consistent at 100 L/d). The annual project flows are summarized in Table **6**.

Table 6: Projected Future Flow – Total Annual Flows

Unit	Total Flow (L)
Campground	16,045,000
Cabins	16,776,000
Septage	75,000
West Beach WWTP	16,700,000
Infiltration	36,500
Total Annual Flow	**49,632,500**

2.2 Design Criteria – Lagoon Replacement

The Lagoon replacement was sized to treat the projected organic and hydraulic wastewater loads. Organic loading was estimated based on biochemical oxygen demand BOD load. To account for the seasonal fluctuations in BOD load throughout the year, the design is based on the average BOD load for the busiest six months of the year (AECOM, 2015).

The new secondary Lagoon cell was sized based on the hydraulic storage required for storage of the remaining waste for the period between discharges. Treated waste will be stored in half of the new primary cell and the entire new secondary cell until the annual discharge periods (early June and fall).

The surface area required for treatment in the primary cell is calculated in **Table 7.**

Table 7: Organic Loading

Surface Area Calculations	Units
Average Daily BOD load from April to September	195.57 kg/day
Loading (Provincial Requirements)	56 kg BOD/ha/day
Required surface area (Average Daily BOD / Loading)	3.5 ha

Sizing for the new primary cell is provided in **Table 8**.

Table 8: Primary Cell Size

Primary Cell Size	Units
Volume (entire cell)	49,400 m^3
Storage Volume (bottom 0.75 m of cell)	24,000 m^3
Surface Area (not including 1 m freeboard)	35,150 m^2

As the new secondary cell is being constructed out of the existing operating cells and the existing incomplete cell, the elevation will be maintained at 1.5 m in depth. The total liquid depth of the secondary cell will be 1.5 m with an additional 1 m of freeboard. The bottom 0.3 m of the cell will contain the sludge blanket. Based on a twice per year discharge, the volume required for the secondary cell is summarized in **Table 9**.

Table 9: Secondary Cell Size

Secondary Cell Size	Units
Sludge Blanket Volume (volume below pipe invert)	5,400 m^3
Total Storage Volume required	25,200 m^3
Total Volume of the Secondary Cell	30,600 m^3

2.2.1 Phosphorus Removal

The Manitoba Water Quality Standards, Objectives, and Guidelines (MWQSOG's, 2011) include an effluent phosphorus limit of less than 1 mg/L for all new, expanding or modified wastewater treatment facilities including lagoons and mechanical systems. Two methods of phosphorus removal were investigated (AECOM, 2015); a Phosphex ™ System and alum dosing (a form of chemical precipitation). It was determined that alum dosing was the preferred method for the proposed project.

Chemical precipitation is a commonly used method of removing phosphorus from wastewater by the addition of a coagulant or the salts of multivalent metal ions such as calcium, aluminum and iron. Alum or hydrated aluminum is most commonly used to precipitate phosphates from wastewater lagoons. The dosage rate required is a function of the required phosphorus removal; as the concentration of phosphorus decreases, the efficiency of the metal salt decreases. Dosage is generally determined on the basis of bench-scale testing.

2.3 Lagoon Construction

The existing two operating cells will remain in operation throughout the construction of the new primary cell.

A new primary cell will be constructed to the east of the existing lagoon cells. The Trans Canada Trail, located approximately 60 m to the east of the existing lagoon, will be preserved and disruption kept to a minimum, with the new primary cell being situated approximately 75 m east of the trail. Interconnection pipes will be run under the Trans Canada Trail and a 40 m to 70 m wide tree buffer will be left intact between the trail and Lagoon cells.

The third existing (currently incomplete) cell will be converted into a portion of the new secondary cell, maintaining the current 1.5 m operating depth. Upon completion of the new primary cell, all wastewater flows will be redirected to the new primary cell and the existing operating cells will be reconstructed to form an additional secondary cell. The interior dike between the two existing operating cells will be removed to form one new larger cell (**Figure 03**).

Once fully constructed, the existing discharge ditch on the north side of the Lagoon site will be used for the annual discharge. Some clearing and possible grading will be required within this ditch, as it has had limited use since it was constructed almost 40 years ago. Effluent will flow through this ditch to the Grand Beach Natural Lagoon area and from there into Lake Winnipeg.

A geosynthetic liner will be installed on a 150 mm thick layer of compacted bedding sand. The bedding sand layer will be placed over a 300 mm thick granular dewatering and degassing system. This system will allow for the release of groundwater seepage and gas that might accumulate under the liner. Clean crushed limestone of 50 mm maximum size will be used for the drainage layer. A protective sand layer at least 300 mm thick, as required by Sustainable Development will be installed above the liner. The exterior and interior dikes will be constructed with a 4:1 slope and rip-rap will be placed on the dike slopes to mitigate for erosion.

Perimeter ditching will be incorporated around the Lagoon to collect and direct surface water away from the lagoon dikes in order to prevent the instability of the dikes due to excess moisture.

A fence will be built at the toe of the dike on both the new primary cell and surrounding the entire secondary cell. This fence will provide security for each lagoon cell separately while not interfering with the Trans Canada Trail located between the two cells.

2.3.1 Interconnection Pipes

The ground elevation of the new primary cell is higher than the secondary cell allowing waste to be transferred between the cells by gravity, however not significant enough to allow the pipe to be buried below the frost line at the new primary cell. Therefore a siphon style interconnection pipe will be installed to prevent the pipes from freezing in the winter.

2.3.2 Effluent Ditch

Treated effluent from the Lagoon will be discharged twice a year through an existing effluent ditch which runs west from the Lagoon to the Grand Beach Natural Lagoon. The effluent will leave the Lagoon through the discharge ditch on the north side of the Lagoon site; travel through the Grand Beach Natural Lagoon and from there flow into Lake Winnipeg.

2.3.3 New Access Road

An access road will be constructed to access the new primary cell. The road will enter the site directly off the main Park Road (Campground Access Road) and allow access for the truck dump area. The new access road will be 7 m wide (including shoulders) with 300 mm of 50 mm crushed rock. The road will be surfaced with 150 mm of 20 mm crushed rock. Drainage ditches will be provided to maintain drainage away from the roadway.

2.3.4 Truck Dump

A truck dump will be located at the Lagoon site. It will consist of a 30 m by 16 m gravel pad and a 3 m wide concrete swale which will direct the sewage into the Lagoon's new primary cell. The Lagoon fence will transition from the toe of slope to the top of slope in this area. A gate will be constructed with steel bars for the lower half which will allow sewage to pass through, permitting dumping without requiring the gate to be opened. The truck dump will accept holding tank waste and septage from holding tanks and ejector systems throughout the Park.

2.4 Lagoon Cell Reconstruction Plan

Reconstruction of the existing operating Lagoon cells will be required once the construction of the new primary cell is complete. The reconstruction will involve dewatering the existing Lagoon cells and disposing of the remaining sludge in these cells. Sewage sludge may be a solid, semi-solid or liquid residue that settles to the bottom of the wastewater lagoon during treatment. It consists of approximately 90-99% water and an accumulation of settled solids. Sludge also contains significant amounts of nitrogen and phosphorus and to a lesser degree some quantities of heavy metals such as zinc and copper.

2.4.1 Desludging of Existing Cells

Wastewater from the existing operating cells will be transferred into the new secondary cell. This will be done by mixing the wastewater in the existing cells into a slurry and pumping it over the interconnecting berms into the completed new secondary cell. The secondary cell will then be partially filled with water to completely cover all the sludge and wastewater transferred into the cell. This approach is expected to limit odours produced from the wastewater and sludge slurry.

2.4.2 Upgrading of Operating Lagoon Cells

Once the new primary cell is operational the existing Lagoon cells will be cleaned out, the interior dike will be removed, and the existing two cells will be converted into one larger cell forming a portion of the new secondary cell.

In summary, the Lagoon reconstruction plan will consist of the following steps:

- Mixing all wastewater and sludge present in the existing operating cells into a slurry;
- Pumping the completely mixed slurry over the interconnecting berms into the completed new secondary cell;
- Additional water will be pumped into this secondary cell to cover the wastewater and sludge slurry.
- Removing the internal dikes between the two existing operating cells;
- Removing contaminated soil from the interior berms and bottom of cells after testing for either treatment (i.e. dewatering) and/or disposal off-site to an approved facility;
- Removing and/ or recovering of all infrastructure works such as valves, pipes, etc.;
- Disposing of waste materials such as scrap steel, wood, etc. at the nearest landfill;
- Grading and sloping the lagoon site in accordance with the new cell design;
- Installing new valves and interconnection pipes between secondary cells; and
- Lining Lagoon cells with synthetic liners and sand before initiating operation.

2.5 Wastewater Treatment Plant

The following sections provide an overview of the existing WWTP and the proposed lift station and forcemain. Additional design details are provided in the Grand Beach Provincial Park Lift Station and Forcemain Preliminary Design Report located in **Appendix B**.

2.5.1 Current Flows

The WWTP operates seasonally during the summer months starting May 15 and ending October 31. During the winter months, when the WWTP is not operational, influent wastewater is stored in the equalization tank until the next start-up in the spring.

2.5.2 Winter Flow

Current operation practices of the WWTP are to shut down the plant and draw down the equalization tank in preparation for the winter months. Once the shutdown procedures have taken place, any inflow from the wastewater sewer, from either infiltration or flow from the Parks Office, is stored until spring start-up for duration of approximately 190 days.

The equalization tank is 11 m by 11 m by 3 m with a sloped bottom to a sump and is located upstream of the WWTP. It has an active storage depth of approximately 2.14 m above the sump. The storage volume of the tank has been estimated to be 260 m^3. It was determined that the volume of wastewater collected equates to an inflow rate of 0.07 L/s or 1,100 L/day.

2.5.3 Summer Flow

Summer flow rates were analyzed as part of the Preliminary Design Report as either low season (before the end of June and after the first week in September) season, and high season (July and August). Additional increases in flow were noted around Civic and Statutory holidays. A summary of the average flow rates are provided below in **Table 10**.

Table 10: Seasonal Wastewater Rates – Grand Beach WWTP

Season	Dates	Average Day Flow (L/s)
Low Season	May & June September	1.8
High Season	July & August	3.2
Holidays	Civic Holiday	3.4

2.5.4 Projected Future Flows

According to the Preliminary Design Report, project stakeholders have indicated there are no anticipated expansions planned of the cabin area or public beach facilities; therefore, both winter and summer flows are projected to remain approximately the same. Future repairs or upgrading of existing waste water sewers in the park could help to reduce infiltration.

2.6 Design Criteria – Lift Station and Forcemain

2.6.1 Winter Sewage Flow Rates

It is anticipated that the flow rates identified in Section 2.5.2 will not increase, and may be reduced over the life cycle of the lift station and forcemain through regular maintenance and infrastructure renewal.

2.6.2 Summer Sewage Flow Rates

As noted in Section 2.5.3, there are wide variations in flow coming from the West Beach collection system depending on the season and the activities occurring in the Park. For this design, the average day flow rate experienced during the summer high season was used for sizing. The sizing of the lift station and forcemain uses a peaking factor of 4.0 which is based on the Ontario Ministry of Environment ("MOE") Design Guidelines for Sewage Works (2008). Based on the selected peaking factor and the average day flow rate during the high season, the peak flow rate is noted in **Table 11**.

Table 11: Peak Flow Determination

Average Day Flow (L/s)	Peaking Factor	Peak Day Flow (L/s)
3.2	4.0	12.8

2.7 Lift Station and Forcemain Construction

The proposed final layout of the site involves the construction of a new wastewater lift station and forcemain to the upgraded Lagoon. Wastewater from the Townsite will continue to flow by gravity sewer to the site of the current WWTP. During summer operations the wastewater will be diverted to the proposed lift station where it will be conveyed via forcemain to the proposed upgraded Lagoon site. In winter, the lift station will be shut down and

prepared for winter by removing the pumps and diverting the wastewater into the equalization tank, where it will be stored until start-up in the spring.

2.7.1 Forcemain

Forcemains can be installed by open trench or trenchless methods depending on soil conditions encountered. The preferred method of installation will be by trenchless methods to reduce disturbance to the ground and park users.

Two options for the forcemain alignment were reviewed as part of the Lift Station and Forcemain Preliminary Design Report (**Appendix B**). Option 1 is to utilize Causeway Road and Option 2 is to utilize the beach front. It was determined that Causeway Road has better access, does not travel along ecologically sensitive area, and the surface conditions along the route do not have the same stability concerns as was indicated along the beach front. The proposed alignment is provided in **Figure 04**.

It is anticipated that the forcemain will be installed by horizontal directional drilling methods. Installation by these methods will reduce ground disturbance in the Park as well as help to facilitate working through wet or marshy areas. Construction methods and requirements are to follow the MWSB Standard Construction Specifications.

The forcemain should be installed at the minimum depth of cover required (2.75 m from ground surface to top of pipe). Additional details are provided in the Lift Station and Forcemain Preliminary Design Report in **Appendix B**.

2.7.2 Lift Station

Static head difference between the lift station and the lagoon discharge is approximately 9.3 m, with approximately 4,000 m of forcemain required.

Pumps were selected based on the following criteria:

- Design peak inflow of 12.8 L/s.
- Static head as listed above, 9.3 m.
- Minor losses in the Pumping Station piping (1 pump discharge, 2-90 degree bends, 1 gate valve, 1 check valve, 2 tees with side outlet).
- Friction losses in 3 m of 100 mm Cast Iron Pumping Station piping (C=100).
- Minor losses in forcemain (2-90 bends, 1 discharge/expansion at the gravity connection).
- Friction losses in the 250 mm forcemain (C=110) with length as listed above.
- 250 mm pump discharge desirable, 100 mm throughlet required.

The resultant design condition is a pumping rate of 22.5 L/s at a total system head of 16.1 m. Subject to further evaluation during the detailed design stage, the selected pumps were Flygt 3127 SH with 146 mm impellers and a 8.2 kW (11 hp) power input.

2.8 Equalization Tank

2.8.1 Current Condition

The equalization tank (EQ Tank) was originally constructed in 1979 and has undergone limited maintenance or rehabilitation over its nearly 40 years in operation. No inspection has been completed as part of the Lift Station and Forcemain Preliminary Design Report of the structural components of the tank itself including the concrete roof, cast in place walls and floor, and the integrity of the original waterproofing material applied to the walls.

2.8.2 Future Use

According to the Lift Station and Forcemain Preliminary Design Report, the EQ Tank is to remain in service to maintain the current practice of storing inflow during the winter. Due to the low flow rates, it may not be feasible to operate the lift station and forcemain during the winter months due to freezing and residence time concerns. However, due to the age of the tank and its unknown structural condition, its use will remain as an offline storage facility in the winter only. The use as offline storage only will allow for needed inspections, maintenance, and potentially repairs to be undertaken. By making the EQ Tank offline storage, the risks of costly repairs can be reduced by not having the EQ Tank as an integral part of the system.

Modifications necessary to re-purpose the EQ Tank for the proposed lift station installation include:

- Modifications and repair to the existing trash basket systems.
- New gravity outlet to be installed by coring a hole in the wall of the existing structure and making a water tight connection.
- Overflow pipe to the lake to be abandoned and capped off.

The following repairs and maintenance are required for the EQ Tank in order for its continued use include:

- Clean and de-sludge.
- Conduct a structural assessment of the integrity of the tank structure.
- Inspect the integrity of the tank liner for infiltration or exfiltration.
- Reconfiguration of the trash basket system.

2.9 Decommissioning of the Existing WWTP

The existing WWTP building and structure will be decommissioned, demolished and removed. A detailed decommissioning plan will be developed during the detailed design phase. If there is any remaining sludge within the existing WWTP, procedures outline in the *Grand Beach Provincial Park Lagoon, Preliminary Design Report* (Section 9) will be followed. It is anticipated that the existing WWTP may contain approximately 10,000 to 12,000 gallons of sludge.

2.10 Schedule

The project schedule for the Lagoon replacement project is based on the following milestones:

- File the *Environment Act* proposal for review by the Department of Sustainable Development (DSD) in late 2016
- Lagoon Design and Construction:
  - Detailed Design to be completed in 2016.
  - Construction expected to occur in 2017.
- Forcemain and Lift Station:
  - Detailed Design, tender and construction of the forcemain and lift station from the WWTP to proceed such that construction will occur during 2018.
- Decommissioning of the WWTP to occur after construction and commissioning of the lift station and forcemain in 2019 - 2020.

2.11 Funding

The project funding will be provided through Parks and Protected Spaces Branch, Sustainable Development (Manitoba).

3. Scope of the Assessment

To assess the potential environmental impact of the proposed Lagoon replacement, spatial and temporal boundaries were defined as follows:

3.1 Temporal Boundaries

The temporal boundaries of the assessment are divided as follows:

- **Construction Phase:** Construction April 2017 to November 2018;
- **Operation Phase:** December 2018 into the future; and
- **Decommissioning Phase:** This refers to the eventual decommissioning of the Lagoon replacement, and all associated infrastructure that is being proposed in this document. There are currently no plans to decommission the Lagoon in the foreseeable future. However, when the Project Site needs to be decommissioned at some point in the future, a site decommissioning plan will be filed with appropriate regulators prior to decommissioning. Therefore, effects associated with decommissioning have not been assessed as a part of this environmental assessment.

3.2 Spatial Boundaries

Spatial boundaries used for the assessment are described below. Where specifically noted, the boundaries may be adjusted to suit the Environmental Component (EC) or Social Component (SC) affected.

- **Project Site:** includes all areas subject to direct disturbance as a result of the project;
- **Project Area:** is a 3 km radius surrounding the Project Site, intended to account for the potential effects of the Project immediately outside of the Project Site. The majority of the information used to describe the existing environment is focused on the Project Area; and
- **Project Region:** is a 10 km radius beyond the Project Site, intended to account for the maximum spatial extent of potential impacts of the Project.

The Project Area and Project Region are shown in **Figure 05** and **Figure 06**, respectively.

3.3 Environmental and Social Components

This environmental assessment considers changes to the environment caused by the project, as well as any consequential socio-economic implications. The Environmental Components (ECs) and Social Components (SCs) were selected following the guidance provided in DSD, "*Environment Act* Proposal Report Guidelines". SCs include components of the socio-economic environment that may be affected by a change in the environment as a result of the project.

The potential interaction between project components and ECs and SCs are identified in **Table 12**. Potential interactions were identified based on the professional judgement of the assessor combined with anticipated implementation of standard environmentally responsible construction techniques and operating procedures in the course of project construction, operation and closure. Potential interactions identified in **Table 12** are assessed in Section 5. Mitigation measures and residual effects are also described in Section 5.14.

Table 12: Identification of Potential Environmental/Social Component Interactions with the Projec

	Environmental Components								Social Components [1]		
	Topography	Air and Noise	Climate	Soil	Surface Water & Aquatic Resources	Groundwater	Vegetation	Wildlife	Protected Areas (Land Use)	Heritage Resources	Aesthetics
Construction Phase											
Clearing and grubbing		X	X	X			X	X			X
Transportation and stockpiling of materials and equipment	X	X	X	X				X			X
New lagoon construction (primary and secondary cells)	X	X	X	X			X	X			X
Construction of new access road to primary lagoon cell	X	X	X	X			X	X			X
Decommission existing lagoon		X	X	X							
Sludge removal and dewatering from existing lagoon		X	X	X							
Construct new secondary lagoon cell		X	X	X							
Lift Station construction		X	X	X							X
Forcemain installation (vis horizontal directional drilling methods)		X	X	X			X	X			X
EQ Tank repairs and maintenance		X	X								
Decommission existing WWTP		X	X	X							X
Waste disposal		X	X	X							X
Site restoration		X	X	X							X
Operation Phase											
Maintenance		X	X								
Discharging effluent					X						

Notes:
X = identified interaction
1. only indirect interactions with SCs as a result of an direct project/EC interactions were considered

4. Existing Environment

The existing Lagoon site is located approximately 115 m east of the Grand Beach Natural Lagoon and approximately 60 m west of the Trans Canada Trail. The new secondary Lagoon cell is located immediately south of the existing Lagoon, incorporating the original unfinished southern Lagoon cell.

To accommodate the required treatment and storage volume, the Lagoon will also be expanded to the east. Land for a new primary Lagoon cell is located approximately 75 m east of the Trans Canada Trail. To connect the new primary cell to the new secondary cells, interconnection pipes will be run under the Trans Canada Trail. The Lagoon system will discharge into the existing discharge ditch on the north side of the Lagoon site, allowing effluent to flow into the Grand Beach Natural Lagoon area and eventually into Lake Winnipeg. Site photographs from the June 21, 2015 Lagoon site visit are provided in **Appendix C**.

The existing WWTP is located along Highway No. 12, approximately 550 m south of the West Beach. The proposed lift station will be constructed within the area of the existing WWTP in an area that appears to have been cleared of natural vegetation. The proposed forcemain will be installed via horizontal direction drilling methods along Highway No. 12 and then through the forested area south of the proposed primary cell located approximately 350 m east of the Trans Canada Trail.

The following sections provide information regarding the existing environment within the study area. Information was gathered via desktop review and a site visit of the Lagoon on June 21, 2015.

4.1 Physical Environment

4.1.1 Climate

The closest meteorological station to the Project Site is the Gimli meteorological station that measures temperature, precipitation, and wind speed and direction. Gimli and Grand Beach areas have similar land use. **Table 13** shows the monthly climate normal data relevant to the Project Area.

Table 13: Climate Data for Gimli, Manitoba (1971-2000)
Latitude 50°38'N, Longitude 97°01'W, Elevation 222.80 m

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Daily Average Temperature (°C)	-18.2	-14.8	-7.3	2.7	10.6	16.1	19.2	17.5	11.6	4.8	-5.2	-15.4	1.8	D
Precipitation (mm)	22.2	17.3	30.0	30.0	49.8	94.1	69.7	64.2	66.7	38.3	27.6	22.5	532.5	D
Average Wind Speed (km/h)	11.8	11.4	12.1	12.5	12.6	12.6	11.1	11.4	13.2	13.9	13.1	12.1	12.3	D
Most Frequent Wind Direction	NW	NW	NW	N	N	SE	W	W	W	S	S	S	NW	D

Notes:
Data obtained from Environment Canada, Gimli meteorological station (2015).
``D": at least 15 years

The Project Area falls within the Lake of the Woods Ecoregion. Climate in the Lake of the Woods Ecoregion is characterized by short, warm summers and long, cold winters. The mean annual air temperature ranges from 1.9 to

2.3°C with an average growing season of about 180 growing days. The mean annual precipitation for the ecoregion is approximately 540 to 650 mm and is highest in the growing season. The average yearly soil moisture deficit ranges from 45 to 95 mm (Smith *et al*., 1998). The area receives 532 mm of precipitation per year, with 407.8 mm as rainfall and 148.1 mm as snow (Environment Canada, 2015). The annual daily average temperature at the Gimli meteorological station was1.8 °C, ranging from -18°C (January) to 19°C (July). Extreme temperatures range from -41°C to 37.5°C (**Table 14**).

Table 14: Other Weather Parameter for Gimli, Manitoba

Parameter	Value
Extreme Maximum Temperature (°C)	37.5 (Aug 4, 1983)
Extreme Minimum Temperature (°C)	-41.2 (Jan. 20, 1982)
Extreme Daily Rainfall (mm)	104.8 (Jun. 12, 1989)
Extreme Daily Snowfall (cm)	31.4 (Nov. 8, 1986)

Notes: Data obtained from Environment Canada, Gimli meteorological station (2015).

4.1.2 Topography

The Project Region is located within the Stead Ecodistrict. The topography of this region can be generally described as level to depressional with irregular hummocky morainal uplands near Lake Winnipeg (Smith, *et al.*, 1998). The topography of the Project Area varies from approximately 227 m above sea level (masl) and 218 masl (Natural Resources Canada, 1996).

4.1.3 Geology

The Lake of the Woods Ecoregion is underlain primarily by massive crystalline Archean rocks forming broad sloping uplands and lowlands. The Ecoregion also contains some prominent Palaeozoic limestone erosion remnants. (Smith *et al*, 1998)

The underlying geology in the Project Area is part of the Red River Formation consisting of mottled dolomitic limestone in part cherty and calcareous (Geological Survey of Canada, 1987).

4.1.4 Soils

According to the Soil of the Lac Du Bonnet Area soils report, the Project Site is located predominantly on gleyed grey wooded soils developed on fine to medium sand over strongly calcareous till. These soils are generally fine to medium textured imperfectly drained sands. Towards the northern portion of the existing lagoons, the soils may consist of orthic grey wooded soils that were developed on fine sand overlying clay loam to clay textured lacustrine or clay deposits. These soils are generally fine textured well-drained sands. West of the Project Site, the soils consist of peaty rego humuc gleysol soils formed from weakly to moderately calcareous lacustrine clays. These soils are generally poorly to imperfectly drained clays. For the most part, none of the soils are generally suited for agriculture due to low fertility, coarse textures, low in water-holding capacity and/or too wet for crop production. (Smith *et al.*, 1967)

Soil in the Project Site is considered to have severe limitations that restrict the range of crops or require special conservation practices or both (Class 4s). The soil limitations include one or more of the following; undesirable structure, low permeability, a restricted rooting zone because of soil characteristics, low natural fertility, low moisture-holding capacity, and/or salinity. (CLI, 1968)

On August 5th, 2010, a geotechnical investigation was completed at the existing Lagoon site. Based on a review of the geotechnical drill logs, the soil in the Project Site consisted of sandy topsoil to 300 mm below the ground

surface. Fill consisting of fine to medium grained sand containing traces of sand, gravel and clay, approximately 1.7 m to 2.3 m thick, was encountered beneath the topsoil. The fill layer was underlain by naturally deposited fine to coarse grained sand to the depth explored (approximately 5 m below the ground surface or to auger refusal).

4.1.5 Groundwater

According to the Groundwater Pollution Hazard Map for the Selkirk Area, the Grand Beach and Grand Marais areas are located in a Groundwater Pollution Hazard Area. However, it appears that the lagoon area is located just outside of the groundwater pollution hazard area. (Phimister, 1976)

According to the aquifer maps of southern Manitoba, groundwater is found in the Precambrian rock however finding water varies from area to area. Well yield generally ranged from 0.01 L/s to 0.5 L/s and water quality also varies from excellent to salty. (Rutulis, 1986a)

Shallow groundwater aquifers may also be found in the vicinity of the Project Region, within lenses of sand and gravel. The depth of the shallow groundwater aquifers ranges from a few metres to more than 100 m and typically produce well yields between 0.1 L/s and 10 L/s. Generally, groundwater quality within the shallow groundwater aquifers ranges from very poor to excellent (Rutulis, 1986b).

Three standpipe piezometers were installed during the geotechnical investigation at the existing lagoon site. Water levels were recorded on August 5, 2010 and August 29, 2010. Groundwater levels in August ranged from 0.4 m to 1.44 m below the ground surface. Based on the measured groundwater elevations in the piezometers, the groundwater appears to be flowing in a west/southwest direction in the area of the proposed lagoon.

4.1.5.1 Extent of Groundwater Use

A review of the Groundwater Information Network (2014) online mapping service was completed to determine the number and type of registered wells within a 1.6 km radius of the existing and proposed Lagoon. The search found a total of 14 registered wells. Of the 14 wells, seven were registered as domestic wells, and seven were registered as missing information. Of the wells registered as domestic wells, seven were registered for production use. According to the well logs, the domestic wells groundwater levels range from 0.2 m to 4.9 m below the ground surface.

Both the Grand Beach East and West areas are supplied by a separate public water system. Grand Beach East public water system obtains raw water from two 175 mm diameter wells located in two pumphouses. Pumphouse #1 was constructed around 1973 and pumphouse #2 was constructed around 1967. Water is supplied to 400 campsites, eight washrooms, and a shower facility. (The Manitoba Water Services Board, 2010)

Grand Beach West public water system obtains raw water from two groundwater wells located approximately 100 m east of the lake shore (NE-24-18-6-E). The well located inside the water treatment plant (WTP); constructed in the 1960's is the primary well and the well located outside the WTP is a back-up well. Water is supplied to the town site including 400 cabins, picnic area, main beach front washrooms, one hotel, six public washrooms, one community centre and the wastewater treatment facility (WWTF). (The Manitoba Water Services Board, 2010)

4.2 Hydrology

The Project Site is located within the Lake Winnipeg Watershed and is located approximately 130 m east of Lake Winnipeg. The Project Site is also part of the Marais Creek Watershed. Marais Creek flows north into the Grand Beach Natural Lagoon then into Lake Winnipeg where the water quality has been deteriorating over the past three decades (LWSB, 2006).

4.2.1 Lake Winnipeg Water Levels

In 1966 Manitoba Hydro decided to use Lake Winnipeg as a natural reservoir while developing hydroelectric power from the Nelson River at the northern portion of the lake. When the generating stations were completed in 1976, they regulated the water level of the lake between 216.7 and 217.9 meters above sea level (masl). Prior to this regulation, lake levels fluctuated between 216.4 and 218.8 masl, mainly from the natural variations of seasonal changes, precipitation and evaporation. The maximum water level prior to regulation reached 219.5 masl in 1974, whereas the lowest occurrence was in 1940 at a water level of 216.3 masl. With this regulation in place, these extreme values have been eliminated.

Due to the size of Lake Winnipeg, Manitoba Hydro uses eight gauge stations to average the water level. One of these stations is located at Victoria Beach, which is the closest station to the Project Site. A review of the historic water levels at Victoria Beach indicated that the water level reached a peak of 219.56 masl in 2010. This event was a result of a large wind storm that raised the water levels all over the southern basin of the lake with the highest reading at Victoria Beach.

4.2.2 Grand Beach Natural Lagoon

The Grand Beach Natural Lagoon is located east of the Grand Beach East and West Beaches. This is a natural lagoon which is a common occurrence in many coastal dune areas. Other names for this natural formation are interdunal wetlands and interdunal swales. This natural lagoon area has fluctuating water levels affected by weather events and lake levels on Lake Winnipeg. During a hot summer, this area is virtually dry, whereas in the spring or wetter summers, standing water can be seen.

The channel to the natural lagoon area separates the East and West beaches, and the beach and sand dunes protect the natural lagoon area from the wind and wave action of Lake Winnipeg. This natural lagoon is an environment that is always changing due to the ecological processes surrounding it; lake levels, wind, and vegetation all have a significant part in sand dune generation and stabilization.

This channel provides a link for water movement between Lake Winnipeg and the natural lagoon area. The natural flow of water from the lagoon is to the north into Lake Winnipeg. However, prevailing winds play an important role in the creation of currents through the channel. Sustained north winds push large volumes of water south and temporarily raise the water level in the lagoon basin. As the winds change, the water levels between the channel and the lake reach equilibrium. Due to the nature of the wind, wave action, currents and sand dune formation, the channel between the natural lagoon and Lake Winnipeg is continually changing and reforming. Photos provided by Parks are located in **Appendix D**.

4.3 Aquatic Environment

AECOM has assumed that potential species found in Lake Winnipeg may also be located in the Grand Beach Natural Lagoon therefore approximately 60 species of fish inhabit Lake Winnipeg (**Table 15**) and/or its immediate tributaries. A number of these species (particularly Walleye and Lake Whitefish) support extensive commercial fisheries on Lake Winnipeg.

Table 15: Fish Species Inhabiting Lake Winnipeg and/or its Immediate Tributaries[1]

Family	Systematic Name	Common Name
Petromyzontidae	*Ichthyomyzon castaneus*	Chestnut Lamprey[2]
	I. unicuspis	Silver Lamprey
Acipenseridae	*Acipenser fulvescens*	Lake sturgeon
Hiodontidae	*Hiodon alosoides*	Goldeye
	H. tergisus	Mooneye
Cyprinidae	*Couesius plumbeus*	Lake Chub
	Cyprinus carpio	Common Carp
	Macrhybopsis storeriana	Silver Chub
	Margariscus margarita	Pearl Dace
	Notemigonus crysoleucas	Golden Shiner
	Notropis atherinoides	Emerald Shiner
	N. blennius	River Shiner
	N. heterolepis	Blacknose Shiner
	N. hudsonius	Spottail Shiner
	N. texanus	Weed Shiner
	N. volucellus	Mimic Shiner
	Phoxinus eos	Northern Redbelly Dace
	Phoxinus neogaeus	Finescale Dace
	Pimephales promelas	Fathead Minnow
	Platygobio gracilis	Flathead Chub
	Rhinichthys cataractae	Longnose Dace
	R. obtusus	Western Blacknose Dace
	Semotilus atromaculatus	Creek Chub
Catostomidae	*Carpiodes cyprinus*	Quillback
	Catostomus catostomus	Longnose Sucker
	C. commersoni	White Sucker
	Ictiobus cyprinellus	Bigmouth Buffalo
	Moxostoma anisurum	Silver Redhorse
Ictaluridae	*Ameiurus melas*	Black Bullhead
	A. nebulosus	Brown Bullhead
	Ictalurus punctatus	Channel Catfish
	Noturus gyrinus	Tadpole Madtom
Esocidae	*Esox lucius*	Northern Pike
Umbridae	*Umbra limi*	Central Mudminnow
Osmeridae	*Osmerus mordax*	Rainbow Smelt
Salmonidae	*Coregonus artedi*	Cisco
	C. clupeaformis	Lake Whitefish
	C. zenithicus	Shortjaw Cisco
	Salvelinus namaycush	Lake Trout
Percopsidae	*Percopsis omiscomaycus*	Troutperch
Gadidae	*Lota lota*	Burbot

Family	Systematic Name	Common Name
Gasterosteidae	*Culaea inconstans*	Brook Stickleback
	Pungitius pungitius	Ninespine Stickleback
Cottidae	*Cottus bairdi*	Mottled Sculpin
	C. cognatus	Slimy Sculpin
	C. ricei	Spoonhead Sculpin
Moronidae	*Morone chrysops*	White Bass
Centrarchidae	*Ambloplites rupestris*	Rock Bass
	Micropterus dolomieu	Smallmouth Bass
	Pomoxis nigromaculatus	Black Crappie
Moronidae	*Morone chrysops*	White Bass
Centrarchidae	*Ambloplites rupestris*	Rock Bass
	Micropterus dolomieu	Smallmouth Bass
	Pomoxis nigromaculatus	Black Crappie
Percidae	*Etheostoma exile*	Iowa Darter
	E. nigrum	Johnny Darter
	Perca flavescens	Yellow Perch
	Percina caprodes	Logperch
	P. maculata	Blackside Darter
	P. shumardi	River Darter
	Sander canadensis	Sauger
	S. vitreus	Walleye
Sciaenidae	*Aplodinotus grunniens*	Freshwater Drum

[1] *List compiled from Scott and Crossman (1998), Bulloch et al. (2002) and Stewart and Watkinson (2004). Other species may exist within the study area, but their presence has not been confirmed.*

[2] *The published distribution of the chestnut lamprey does not extend north of the south basin of Lake Winnipeg, but capture of a single specimen was reported in 2007 from Eight-Mile Channel, north of the lake (Earth Tech unpublished data).*

4.4 Terrestrial Environment

4.4.1 Flora

The Project Area lies within the Boreal Shield Ecoregion. The native vegetation of the Boreal Shield Ecoregion includes Jack Pine, Trembling Aspen, Paper Birch, White Spruce, Eastern White Cedar, Black Ash, Red Pine, Eastern White Pine and White Elm. On poorly to very poorly drained sites, in particular areas of shallow and deep peat, Black Spruce and/or tamarack dominate. (Smith *et al*. 1998)

A site visit of the Lagoon site was conducted on June 21, 2015. The existing Lagoon site consists of mowed grass with taller grasses and weeds along the shore of the lagoon cells. North of the existing Lagoon has been previously cleared but is now overgrown with taller grasses and some shrubs, which will need to be cleared prior to construction. Site photographs are provided in **Appendix C**.

The area for the proposed primary cell is a typical aspen forest with some taller grasses and shrubs. Some flowers were observed including a wild roses, Small Yellow Lady-slippers, wild Columbines, and Canada Anemone.

4.4.2 Fauna

Wildlife in the Boreal Shield Ecoregion includes moose, Black Bear, wolf, lynx and snowshoe hare. Birds include Ruffed Grouse, Hooded Merganser, Pileated Woodpecker, Bald Eagle, Turkey Vulture, Herring Gull and numerous waterfowl and songbird. (Smith *et al*. 1998)

During the site visit conducted at the Lagoon site on June 21, 2015, a woodpecker, deer, some butterflies, and a few other smaller birds were observed. Photographs taken during the site visit are provided in **Appendix C**.

4.5 Protected Areas

The closest protected area to the Project Site is the Catfish Creek Wildlife Management Area (WMA), located approximately 11 km east of the Project Site. Catfish Creek WMA is located on an end moraine or large deposit of sand and gravel. This WMA has one of the highest concentrations of neo-tropical migrant birds in North America. This area is also an important breeding ground and migration corridor for the northern forest owls. Other animals found in the area include moose, white-tailed deer, black bear, red fox, coyotes, mink, and wolves (Sustainable Development, Wildlife Branch, 2015a).

4.6 Protected Species

To identify species at risk that have the potential to occur in the Project Region, the Manitoba Conservation Data Centre (MB CDC), Occurrence of Species by Ecoregion was examined (Sustainable Development, 2013). The species listed on the MB CDC were cross-referenced with Schedule 1 of the Federal *Species at Risk Act* (SARA) (Government of Canada, 2015) and the *Manitoba Endangered Species Act* (MESA) (Sustainable Development, Wildlife Branch, 2015b) to determine the provincially listed rare or sensitive species with the ecoregion. Distribution maps and habitat requirements were examined to determine the likelihood of occurrence of federally and/or provincially listed species in the Project Region. The results of the annual surveys conducted by MB CDC were also examined to identify surveys for protected species in the vicinity of the Project Region; the most recent survey results available were from 2012 at the time of this assessment. No field surveys were conducted to confirm the presence of protected species for this Project.

Based on this search, there is potential for 15 listed species to occur in the Project Region (**Table 16**).

Table 16: Federally and Provincially Listed Species that May Occur in the Project Region

Species	SARA Status	MESA Status	Environmental Considerations	Likelihood of Occurrence in Project Region
Vertebrate Animal				
Whip-poor-will *Caprimulgus vociferus*	Threatened	Threatened	• Breeding preference in pine and oak based semi-open forests with clearings or forests that are regenerating. [1] • May feed in shrubby pastures or wetlands with perches.[1] • Overwinters in mixed coniferous-broadleaved forests. [1]	**High**: breeding resident range overlaps with Project Region.
Common Snapping Turtle *Chelydra serpentina serpentina*	Special Concern	Not Ranked	• Generally found in dry, open grasslands and breed primarily in temporary wetlands or edges of some permanent or semi-permanent wetlands. [1] • These shallow, clear pools are often found in imperfectly drained, sandy areas in grasslands, pastures, ditches or agricultural fields and range in size from large wetlands to small puddles. [1]	**High**: species range overlaps with Project Area, likely habitat within the Project Region.
Common Nighthawk *Chordeiles minor*	Threatened	Threatened	• In Manitoba, found south of the treeline and inhabits mixed and coniferous forests. [1] • Nests in a wide range of open, vegetation-free habitats including dunes, beaches, recently harvested forests, burnt-over areas, logged areas, rocky outcrops, rocky barrens, grasslands, pastures, peat bogs, marshes, lakeshores and river banks. [1]	**Moderate**: breeding habitat covers most of Manitoba.
Yellow Rail *Coturnicops noveboracensis*	Special Concern	Not Ranked	• Found in marshes dominated by sedges, true grasses and rushes with little to no standing water. [1] • Also found in damp fields and meadows, on floodplains of rivers and streams. [1]	**Moderate**: breeding range overlaps with Project Region.
Northern Leopard Frog *Lithobates pipiens*	Special Concern	Not Ranked	• Overwinter in well-oxygenated water bodies that do not freeze to the bottom, including streams, creeks, rivers, deep lakes and ponds. [1] • Breeds in pools, ponds, marshes, lakes and slow-moving streams and creeks that are typically located in an open area with abundant vegetation and no fish. [1] • Summer in moist upland meadows and native prairie, riparian areas and ponds. [1]	**High**: range of species overlaps with Project Area, likely habitat within the Project Region
Red-headed Woodpecker *Melanerpes erythrocephalus*	Threatened	Threatened	• Found in a variety of habitat including open oak and beech forests, grasslands, forest edges, orchards, pastures, riparian forests, roadsides, urban parks, golf courses, cemeteries, along beaver ponds and brooks. [1] • Nests are usually found in dead or dying trees but can also make nests in dead branches of live trees. [1]	**High**: species range overlaps with Project Region, likely habitat within the Project Region.
Golden-winged Warbler *Vermivora chrysoptera*	Threatened	Threatened	• Found in regeneration zones where young shrubs grow, surrounded by mature forest. [1] • Prefer public utility right-of-ways, the edges of fields, areas where logging has recently occurred, beaver ponds and burned-out or intermittently cultivated areas. [1] • Nests are built on the ground in areas of herbaceous plants and low bushes. [1]	**High**: breeding range overlaps with Project Region, possible breeding location identified within Project Region.

Species	SARA Status	MESA Status	Environmental Considerations	Likelihood of Occurrence in Project Region
Baird's Sparrow *Ammodramus bairdii*	Not Ranked	Endangered	• Found primarily in mixed grass prairies or in lightly grazed pastures. [2]	**Low:** possible breeding location identified in southwestern Manitoba.
Canada Warbler *Wilsonia canadensis*	Threatened	Endangered	• Found in a variety of forest types but is most abundant in wet, mixed deciduous-coniferous forest with a well-developed shrub layer. [1] • They are also found in riparian shrub forests on slopes, ravines and in old-growth forests with a high density of shrubs. [1] • Nests are built on or very close to the ground in dense ferns or fallen logs. [1]	**Moderate:** breeding range overlaps with Project Region.
Piping Plover *Charadrius melodus*	Endangered	Endangered	• Prefer nesting above the high-water mark on exposed sandy or gravelly beaches. [1] • On the prairies, nesting occurs on gravel shores of shallow, saline lakes and on sandy shores of larger prairie lakes and seeps provide foraging habitat. [1]	**High:** breeding range overlaps with Project Area, possible breeding location identified within Project Region.
Trumpeter Swan *Cygnus buccinator*	Not Ranked	Endangered	• Prefer beaver ponds for nesting sites and habitats such as freshwater and coastal estuarine wetlands and flooded agricultural land. [1]	**Low:** breeding range located further east of the Project Region.
Caribou *Rangifer tarandus caribou*	Threatened	Threatened	• Prefers mature and old growth coniferous forests that contain lichens during the winter months. [1] • These forested areas are generally associated with marshes, bogs, lakes and rivers. [1] • During the summer months, they occasionally feed in young stands, after fire or logging. [1]	**Low:** breeding range located further north of the Project Region.
Carmine Shiner *Notropis percobromus*	Threatened	Not Ranked	• Prefer clear, fast flowing larger streams and small rivers with clean gravel bottoms. [1] • They cannot tolerate turbid or silty water. [1]	**Low:** not known to be found in Lake Winnipeg. [3]
Olive-sided Flycatcher *Contopus cooperi*	Threatened	Not Ranked	• Mostly associated with open ranges with tall live trees or snags for perching including forest clearings, forest edge located near natural openings (ie. rivers or swamps) or human-made openings (ie. logged areas), burned forest or openings within old-growth forest stands. [1] • Nests are usually constructed in a conifer when arriving to Canada in mid-May. [1]	**High:** breeding range overlaps with Project Region, possible breeding location identified within Project Region.
Silver Chub *Macrhybopsis storeriana*	Special Concern	Not Ranked	• In Manitoba, found in large, moderate flowing rivers with a substrate of silt or sand. [1]	**High:** known to be found in the south basin of Lake Winnipeg. [3]

Sources:
1. Species at Risk Public Registry (Government of Canada, 2015).
2. Manitoba's Species at Risk – Baird's Sparrow (Sustainable Development, 2015c)
3. The Freshwater Fishes of Manitoba (Stewart, K.W. and D.A. Watkinson. 2004).

4.6.1 Migratory Birds

In the Lake of the Woods Ecoregion, waterfowl are common and are protected under Article I of the *Migratory Birds Convention Act*. The SARA bird species (rails, sparrows, plovers, swans, fly catchers, woodpeckers, and warblers) identified above are identified as long distance migrants. The nesting periods for these bird species occur between April 1 to September 1 of each year.

4.7 Heritage Resources

A screening request to the Heritage Resources Branch (HRB) was sent on June 29, 2015 for the Lagoon site to determine if there are any potential heritage resources that may be affected by the proposed development and if a Heritage Resources Impact Assessment (HRIA) is required. The Archaeological Unit of the HRB indicated that HRB has no concerns with the project at this time. A second updated screening request was submitted to HRB on May 6, 2016 that included the proposed lift station and forcemain; to date a response from HRB has not been received by AECOM. A copy of the correspondence is included in **Appendix E**.

4.8 Socio-Economic Environment

4.8.1 Land Use

Under the *Provincial Parks Act*, the Park is classified as a “Natural Park”. The purpose of the designation is to preserve areas representative of the Lake of the Woods portion of the Manitoba Lowlands Natural Region and to provide for a variety of recreational uses. Approximately 57% of the Park is categorized as Recreational Development (RD). Approximately 56% of the Park is categorized as Backcountry (B). The majority of the lands on the west half of the Park, including the Project Site, and an area immediately east of Lester Beach are categorized as RD, with the majority of the eastern portion of the park categorized as B. (Sustainable Development, Parks and Protected Spaces Branch, 1998). The protected area of the Park includes the entire Backcountry land use category which includes the forested uplands (representative of a moraine deposit) and the bog in the eastern portion of the Park (representative of deep basin deposits) (Sustainable Development, Parks and Protected Spaces Branch, 2002).

Within the Lake of the Woods Ecoregion, pulpwood extraction, paper product industry and local sawlog forestry are the dominant uses of resources. Water-oriented recreation including camping, cottaging, fishing and boating are common in the Ecoregion. Hunting and trapping make up a significant portion of the region’s land use and are of special significance to the First Nations and Metis. Agriculture is limited to lowlands along rivers and streams where drainage has been improved. Grains for livestock feed, oilseeds and hay crops are commonly grown in the Ecoregion (Smith *et al*. 1998).

4.8.2 Transportation

Vehicular access to the Park is provided by Highway No. 12, which runs east/west off of Highway No. 59. As the Park is located on Lake Winnipeg, boat access in summer and snowmobile access in winter is also available. Access within the Park is provided by local roads and trails. Historically, rail service provided transportation from the City of Winnipeg to the Park, as well as a few additional populated locations in the general area.

According to the 2014 Traffic Flow Map available from the Manitoba Infrastructure, Traffic Engineering Branch, the annual average daily traffic (AADT) along Highway No. 12 is 1,090 west of Highway No. 500, 1,030 east of Highway No. 500 and 360 south of Highway No. 12 along Highway No. 500. However, these AADT numbers likely include traffic travelling to Grand Marais, located south of Grand Beach.

It is anticipated that a maximum of 10 construction vehicles will access the Lagoon site via the Campground Access Road, therefore it is anticipated that the addition of approximately 10 vehicles will not significantly affect the local traffic. Construction along the Causeway Road is anticipated to be limited to one or two horizontal directional drilling rigs and a maximum of five other construction vehicles. All required safety signage and flag personnel will be in place.

4.8.3 Grand Beach Provincial Park Population

Within the Park, the Campground, located east of the Grand Beach Natural Lagoon, operates from mid-May to mid-October. Currently, the Campground has 408 campsites. Within the Campground, modern washrooms, laundry and shower facilities are available. In the Grand Beach town site, there are approximately 517 cabins, some of which are used year-round. Additional dwellings at the Park include two permanent residences at the East Gate and 13 seasonal cabins available for Park staff.

4.8.4 First Nations

The nearest First Nation Community to the Project Site is Sagkeeng First Nation located approximately 22 km northeast.

5. Environmental Effects Assessment and Mitigation Measures

5.1 Effects Assessment Methodology

This section contains the results of the environmental assessment.

Applying professional judgement and a thorough understanding of the components of the proposed project (outlined in Section 2 of this application) and the existing environment (as described in Section 4); AECOM determined the potential for physical and biological components to interact with project components as presented in **Table 12** (in Section 3 of this application). The assessment includes any effects on social components resulting from residual adverse environmental effects. Mitigation measures that have been incorporated into the proponent's proposed plan are taken into account, as well as the environmental protection practices included in the proponent's operation.

Environmental effects that may be caused as a result of accidents and malfunctions are discussed separately in Section 5.13. Definitions of the terms used to guide the effects assessment are provided in **Table 17**.

Table 17: Factors and Definitions Considered in Assessing Environmental Effects

Project Phase:	Refers to the phase of the project as construction, operation or decommissioning.
Potential Effect:	Classification of the type of effects possible during a specific project phase.
Magnitude of Effect:	Refers to the estimated percentage of population or resource that may be affected by activities associated with the construction, operation and decommissioning of the proposed project. Where possible and practical, the population or resource base has been defined in quantitative or ordinal terms (e.g., hectares of soil types, units of habitat). Magnitude of effect has been classified as either less than (<) 1%, 1% to 10%, or greater than (>) 10% of the population or resource base. Where the magnitude of an effect has been defined as virtually immeasurable and represents a non-significant change from background in the population or resource, the effect is considered negligible. An exception to this is in terms of potential human health effects where, for example health issues due to water-borne diseases amounting to 1% of the population being affected would still be considered major.
Direction of Effect:	Refers to whether an effect on a population or a resource is considered to have a positive, adverse or neutral effect.
Duration of Effect:	Refers to the time it takes a population or resource to recover from the effect. If quantitative information was lacking, duration was identified as short-term (<1 year), moderate term (1 to 10 years) and long term (>10 years).
Frequency of Activity:	Refers to the number of times an activity occurs over the project phase, and is identified as once, rare, intermittent, or continuous.
Scope of Effect:	Refers to the geographical area potentially affected by the effect and was rated as Project Site, Project Area or Project Region as defined in Section 4. Where possible, quantitative estimates of the resource affected by the effect were provided.
Degree of Reversibility:	Refers to the extent an adverse effect is reversible or irreversible over a 10-year period.
Residual Effect:	A qualitative assessment of the residual effect remaining after employing mitigation measures in reducing the magnitude and/or the duration of the identified effect on the environment.

Magnitude of Effect	Direction of Effect	Duration of Effect	Frequency of Effect	Scope of Effect	Degree of Reversibility of Effect
Negligible (immeasurable)	Positive	Short term (< 1 year)	Once	Project Site	Reversible
Minor (<1%)	Adverse	Moderate (1 to 10 years)	Rare	Project Area	Irreversible
Moderate (1 to 10%)	Neutral	Long term (>10 years)	Intermittent	Project Region	
Major (>10%)			Continuous		

5.2 Topography

Sources of changes to site topography include activities such as clearing, grading, excavating or stockpiling materials. The area of the proposed primary cell is located within a typical aspen forest that will require approximately 70,000 m^2 of clearing. The existing Lagoon and the proposed primary cell are located approximately 60 m from the Campground Access Road through a heavily forested area; not visible from the Campground Access Road or the Trans Canada Trail also located approximately 60 m away. Perimeter ditching around the primary cell will be completed to allow surface water to flow away from the lagoon cell. Following project construction, disturbed areas at the Project Site subject to surface water erosion will be re-vegetated with similar species in the area to minimize the effects of soil erosion.

The perimeter ditching will represent a permanent change in the topography; however, this change is not assessed to be adverse as the change can be reversed. Therefore, overall changes to topography during construction of the proposed project are anticipated to result in minor residual effects.

5.3 Air Quality and Noise

5.3.1 Dust

Sources of dust include activities such as clearing, grading, excavating, vehicle movement, the reconstruction of the existing Lagoon cells, and stockpiling of materials. Air quality may be affected by dust and particulates with subsequent effects on human health (including respiratory issues) and vegetation (dust deposition). Dust occurs primarily during summer and fall, with greater likelihood for an increase in dust during dry and windy conditions.

Vehicles commuting to and from the Project Site will utilize the paved Campground Access Road followed by either the existing gravel access road to the existing Lagoon site and/or the new gravel access road to the proposed primary cell. Since these access roads are sheltered by dense vegetation, the impact of dust on the Campground Access Road will be minimal.

During the decommissioning of the existing WWTP, dust may be generated from construction equipment movement at the site along with the physical removal of structures. Dust generation is anticipated to be minimal during directional drilling.

Although dust is not anticipated to be a major concern, to further manage potential effects due to dust, the following mitigation measures will be implemented:

- Material stockpile heights will be limited;
- The disturbed/exposed areas will be kept to a minimum; and

- If required, dust suppression activities such as the use of approved dust control agents and/or water will be undertaken.

In our opinion, the mitigation measures proposed above are sufficient to mitigate any adverse effects due to dust during the construction and operation phases. Residual effects on air quality due to dust emissions are therefore assessed to be negligible.

5.3.2 Odour

During the site visit on June 21, 2015, only a slight odour was observed once at the lagoon cell (on the berm); not while on the Lagoon access road or on the Trans Canada Trail.

During the desludging of the existing Lagoon cells, wastewater will be mixed into a slurry and will be pumped over the interconnecting berms into the completed new secondary cell. The secondary cell will then be partially filled with water to completely cover all the sludge and wastewater transferred into the cell. This approach is expected to limit odours produced from the wastewater and sludge slurry. The desludging will occur during the fall, outside of the camping season, and will take approximately five days to complete.

There may be some sludge that will require to be removed from the existing WWTP during decommissioning. It is anticipated that decommissioning will occur during the fall, outside of the camping season.

The closest residential receptor is the Campground located approximately 150 m north of the Lagoon site through a heavily forested area. The closest residential receptor to the existing WWTP is located approximately 110 m southwest through two smaller forested areas (ranging in thickness between approximately 15 m and 20 m) and Provincial Highway No. 12. Due to these separation distances and the desludging to occur during the fall, outside of the camping season, the residual effects due to odour are anticipated to be negligible in the Project Area. If during construction odour becomes an issue for the neighbouring Campground or cottagers, the MWSB will work to try to alleviate these concerns. During operation, if odour becomes an issue for the neighbouring Campground or cottagers, Parks will work to try to alleviate these concerns. Based on the separation distance between the Project Site and the closest receptors, any residual impact due to odour is anticipated to be negligible.

5.3.3 Exhaust Emissions

During construction, exhaust emissions will be generated during the delivery of materials to the Project Site, construction equipment movement at the Project Site, and septage truck deliveries during operation. These emissions could decrease the quality of the air by increasing the local concentration of carbon monoxide, carbon dioxide, particulate matter, and nitrogen oxides in the air with potential for subsequent effects on human health. During construction, a maximum of 10 construction vehicles will access the Lagoon site via the Campground Access Road, which will be temporary. Construction along the Causeway Road is anticipated to be limited to one or two horizontal directional drilling rigs and a maximum of five other construction vehicles. During operation, it is anticipated that septage will be trucked to the Lagoon approximately five times per year from locations identified in Section 2.1.3.

The following mitigation measures will be implemented to manage these construction-related exhaust emissions:

- Vehicles and equipment will be properly maintained; and
- Vehicle idling will be kept to a minimum.

With the implementation of the mitigation measures proposed above, any adverse residual impact due to exhaust emissions during construction is anticipated to be negligible.

5.3.4 Noise

An increase in noise levels at the Project Site could potentially affect people and wildlife in the surrounding area. Potential effects of noise on wildlife are discussed in Section 5.9.

Sources of noise during construction would be typical of heavy equipment such as graders, excavators, loaders, compactors, directional drill rigs, and haulage trucks. General construction activities are anticipated to generate intermittent noise over the construction period; approximately eight months of construction for the Lagoon site. It is anticipated that the construction of the new lift station will be approximately two months and one month for the installation of the forcemain. The closest residential receptors to the Lagoon site would be the Campground located approximately 150 m away. The closest residential receptor to the existing WWTP is located approximately 110 m southwest through two smaller forested areas (ranging in thickness between approximately 15 m and 20 m) and Provincial Highway No. 12. Signage will be provided for usage in the Campground to inform users of construction activities along with a contact number to use to report any complaints.

During the operation phase, sources of noise include maintenance vehicles and activities (anticipated to be typical of lawn equipment, trucks, and small hand held tools) along with the septage haulers trucks approximately five times per year.

Some additional measures to mitigate noise are:

- Vehicle and equipment will be properly maintained; and
- Provide hearing protection to workers as required.

The mitigation measures listed above are judged to be sufficient to mitigate any potential noise related effects at the Project Site. Therefore, residual effects from noise are assessed to be minor.

5.4 Climate

5.4.1 Greenhouse Gas Emissions

Wastewater treatment can generate methane; a potent greenhouse gas (GHG). GHGs trap heat in the atmosphere and are the leading cause of climate change. Methane is the second most abundant GHG emitted by human activities after carbon dioxide.

The proposed primary and secondary lagoon cell will be 1.5 m deep. According to the Intergovernmental Panel on Climate Change (IPCC), lagoons less than 1 m in depth generally provide aerobic conditions and negligible quantities of methane are generated. Lagoons deeper than 2-3 m, however, can produce significant amounts of methane (IPCC, 2006). As the lagoon will be less than 2 m in depth, significant methane emissions are not anticipated.

The vehicle emissions associated with sludge removal and maintenance are not expected to significantly contribute to local GHG concentrations.

5.5 Soil

5.5.1 Soil Compaction and Mixing

As a result of incidental vehicle and equipment movement, along with grading, excavations, and stockpiling of materials at the Project Site during construction, there is the potential to cause soil compaction and mixing of soil horizons which may change the soil structure. Soil compaction also has the potential to change surface drainage patterns and reduce flora growth.

To reduce potential soil compaction and mixing of soil horizons at the Project Site, the following mitigation measures will be implemented:

- Construction equipment and vehicle movements will be limited to designated roads/pathways within and around work areas;
- Construction activities during periods of extensive precipitation/runoff will be limited;
- Disturbed/exposed areas will be kept to a minimum with site restoration occurring as soon as practical where required;
- Topsoil will be stripped and stockpiled on the Project Site for use in site restoration; and
- The contractor will be responsible for the appropriate repair of any areas where equipment has compacted soils with the repairs including appropriate grading and site restoration.

In our opinion, the mitigation measures proposed above are sufficient to mitigate potential adverse effects due to soil compaction and mixing during the construction, operation, and decommissioning phases. Residual effects on soils are therefore assessed to be negligible.

5.5.2 Soil Erosion

Soil may be lost during the construction phase due to erosion as runoff from wind and precipitation. Conditions favourable for erosion have the potential to occur during clearing, grading, excavation, stockpiling, site restoration, and movement of equipment at the Project Site. Erosion of soil and material stockpiles due to wind has the potential to cause subsequent effects on air quality (dust and particular matter) and vegetation (dust deposition).

To mitigate potential soil erosion effects, mitigation measures described in Section 5.3.1 will be implemented. In our opinion, the mitigation measures proposed are sufficient to mitigate any adverse effects due to soil erosion during the construction, operation, and decommissioning phases. Residual effects on air quality due to soil erosion are therefore assessed to be negligible.

5.6 Groundwater

As indicated in Section 4.1.5.1, a review of the Groundwater Information Network (2014) online mapping tool was completed and 14 registered groundwater wells we found to be within 1.6 km (1 mile) radius of the Project Site. Also, Grand Beach East and West have separate water supply systems to service the area. The proposed project does not require undertaking any activities that may affect groundwater in the area.

5.7 Surface Water and Aquatic Resources

Since effluent from the lagoon will be discharged into the Grand Beach Natural Lagoon, which eventually flows into Lake Winnipeg, the proposed project could potentially impact surface water quality in Lake Winnipeg.

The Lagoon currently operates under the Clean Environment Commission (CEC) Order No. 634 (issued November 7, 1976). Due to inadequate clay liners, the Lagoon has never been discharged since construction (almost 40 years).

With the proposed upgrade of the existing Lagoon, the new Lagoon system will meet the following effluent criteria (prescribed under Manitoba Water Quality Standards, Objectives, and Guidelines):

- $CBOD_5$ - 25 mg/L;
- Total Suspended Solids (TSS); excluding algae solids - 25 mg/L;
- Total Coliform - 1500 CFU per 100 mL;
- Fecal Coliform - 200 CFU per 100 mL;
- Un-ionized ammonia - 1.25 mg/L expressed as nitrogen (N), at 15°C ± 1°C; and

- Total Phosphorus - 1 mg/L.

With the above criteria as the target for key parameters, the quality of the effluent that will be discharged to Lake Winnipeg is anticipated to improve. The existing Lagoon has never been discharged since it was constructed approximately 40 years ago. Based on the topography in the area of the existing Lagoon (as shown in **Figure 02**), it gently slopes towards the Grand Beach Natural Lagoon area. It is therefore anticipated that the effluent in the Lagoon may have seeped through the existing clay liner and followed the natural topography in the area towards the Grand Beach Natural Lagoon. With the proposed twice per year discharge, the quantity of effluent will remain the same, just discharged twice per year instead of once per year.

Soil may be lost during the construction phase due to erosion as runoff from wind and precipitation and could potentially affect surface water quality and aquatic resources. Vegetation clearing and grading will also be required within the existing effluent drainage ditch. Conditions favourable for erosion could occur during clearing, grading, excavation, stockpiling, site restoration, and movement of equipment at the Project Site. The majority of construction will occur approximately 100 m east of the Grand Beach Natural Lagoon through a heavily forested area. Silt fences will be employed to minimize sediment transport where appropriate. Also, the mitigation measures identified in Section 5.5.2 will be implemented.

In our opinion, the mitigation measures proposed are sufficient to mitigate any adverse effects due to soil erosion and subsequent transport and deposition of eroded material during the construction phase. Residual effects on surface water and aquatic resources are therefore assessed to be negligible.

Some concerns regarding the water level of Lake Winnipeg and how it may potentially affect the existing and proposed Lagoon came up during the design of the Lagoon. As indicated in Section 4.2.1, water levels in Lake Winnipeg are regulated by Manitoba Hydro with a regulated water level between 216.7 masl and 217.9 masl. The maximum water level prior to the regulation reached 219.5 masl in 1974. There are eight gauge stations located around the lake and the station located at Victoria Beach is the closest to the Project Site. A review of the historic water levels at Victoria Beach indicated that the water level reached a peak of 219.56 masl in 2010. This event was a result of a large wind storm that raised the water levels all over the south basin of the lake, and Victoria Beach was the highest.

According to the Preliminary Design Report, the elevations of the berms of the existing lagoon cells are 222.5 masl and the berm elevation of the new primary lagoon cell is 223.35 masl. The closest lagoon cells to the lake are the existing lagoon cells and with a berm elevation of 2.9 m above the record highest water level of the lake, it is anticipated that the berm will provide the necessary protection from any potential future high water levels of the lake.

The channel between the Grand Beach East and West Beaches provide a link for water movement between Lake Winnipeg and the Grand Beach Natural Lagoon. The natural flow of water is a northwards flow from the lagoon into Lake Winnipeg. However, prevailing winds play an important role in creating currents through this natural channel. Sustained north winds push large volumes of water south and temporarily raise the water level in the natural lagoon basin. As the winds change, the water levels between the channel and the Lake reach equilibrium. Also, during a hot summer, this area is virtually dry, whereas in the spring or wetter summers, standing water exists.

While water levels vary significantly throughout the year and between years, there is evidence of continual water flow between the natural lagoon and Lake Winnipeg. It is anticipated that the higher levels of water flow between the natural lagoon and Lake Winnipeg will occur in spring during the winter run off and in the fall when higher levels resulting from north-easterly winds occur. As the new Lagoon will discharge twice pre year, once in early June and once in the fall, it is anticipated that the discharge time will coincide with the higher water levels in the natural lagoon area; therefore the effluent from the new Lagoon is not anticipated to have a significant adverse effect on water quality in natural lagoon and Lake Winnipeg. Photographs provided by Parks are located in **Appendix D**.

5.8 Protected and Other Flora Species

As described in Section 4.6, there are no protected vascular plant species located at the Project Site.

Clearing and dust from construction activities are potential sources of effects on flora. The location of the primary Lagoon cell will require approximately 70,000 m^2 of vegetation clearing. Some minor clearing will also be required along the interconnection pipe between the new primary Lagoon cell and the secondary cell. A construction lay-down area will also be required for the proposed project and is anticipated to be located near the existing truck dump area (north of the existing Lagoon). Some minor clearing may be required in this area and once construction is complete, this area will then be tied into the existing access road. Vegetation clearing and grading will also be required within the existing effluent drainage ditch.

Construction along the Causeway Road is anticipated to be limited to one or two horizontal directional drilling rigs and a maximum of five other construction vehicles.

To minimize the amount of disturbance to vegetation at the Project Site, the disturbed/exposed areas will be kept to a minimum with site restoration occurring as soon as practical following construction. While not anticipated, if any areas outside of the fenced Lagoon are cleared, restoration will include the planting of trees. Any areas within the fenced Lagoon that are disturbed along within the area of the interconnection pipe will be restored upon completion of construction and will include the addition of topsoil and re-seeding along the berms and ditches.

With these measures implemented, the residual effects on flora are assessed to be minor.

5.9 Protected and Other Fauna Species

Clearing (loss of habitat) and noise (disturbance) are potential sources of effects on fauna.

As indicated in Section 4.6, there is the potential that the Common Snapping Turtle, Northern Leopard Frog, Piping Plover, and Silver Chub may be found in the Project Area. The Whip-poor-will, Red-headed Woodpecker, Yellow Rail, Golden-winged Warbler, Canada Warbler, and Olive-sided Flycatcher may be found within the Project Region. The Yellow Rail, Piping Plover, Olive-sided Flycatcher, Red-headed Woodpecker, Golden-winger Warbler, and Canada Warbler are protected and are included in Article I of the *Migratory Birds Convention Act* as long distance migrants. As indicated in Section 4.6.1, the nesting periods for the potential bird species found in the Project Region is between April 1 to September 1 of each year. Any clearing must occur outside of this nesting window.

During the site visit conducted on June 21, 2015, a woodpecker, deer, some butterflies, and a few other smaller birds were observed at the Project Site.

The area of the existing Lagoon has been previously disturbed therefore the likelihood of protected species in the area is anticipated to be low. Also, the habitat encountered at the Project Site is very common for this area and therefore the loss of critical habitat due to the proposed project is not anticipated.

As indicated in Section 5.8, vegetation clearing will be required in the area of the proposed primary lagoon cell (approximately 70,000 m^2), the area north of the existing lagoon (taller grasses and some shrubs), and within the existing effluent drainage ditch. It is anticipated that the construction laydown area will be located near the existing truck dump (north of the existing Lagoon) with some minor clearing anticipated and once construction is complete, this area will then be tied into the existing access road. Site restoration will include the addition of topsoil and re-seeding along the berms and ditches. While not anticipated, if any areas outside of the fenced Lagoon are cleared, restoration will include the planting of trees. With the implementation of the mitigation measures identified in Section 5.8, the residual effect due to clearing (habitat loss) is assessed to be minor.

Construction along the Causeway Road is anticipated to be limited to one or two horizontal directional drilling rigs and a maximum of five other construction vehicles.

The Project Site is located in an area which is frequented by disturbances including road traffic along the Campground Access Road and the regular use of the Trans Canada Trail by the public. Due to these regular disturbances, it is anticipated that wildlife in the area is accustomed to such disturbances. Noise during construction will a short-term disturbance and will subside thereafter. Effects due to noise during construction will be mitigated with the implementation of the mitigation measures identified in Section 5.3.3.

With the implementation of the mitigation measures identified above, the expected residual effects as a result of noise, dust deposition, and vegetation clearing on wildlife is anticipated to minor to moderate at the Project Site.

5.10 Protected Areas

The construction and operation of the proposed project is not anticipated to affect nearby protected areas. Based on the distance to the Project Site as indicated in Section 4.5, no effects on protected areas are anticipated from the construction and operation of the proposed project.

5.11 Heritage Resources

As part of this assessment, a screening request was submitted to the Heritage Resources Branch (HRB) to determine if there are any potential heritage resources that may be affected by the Lagoon expansion. HRB indicated that the potential to impact significant heritage resources was low and therefore the Branch had no concerns with the project (**Appendix D**). A second updated screening request was submitted to HRB on May 6, 2016 that included the proposed lift station and forcemain; to date a response from HRB has not been received by AECOM. Once AECOM receives a response, it will be forwarded to MWSB and DSD.

However, if artifacts, historical features or skeletal remains are encountered during construction, work activities will stop immediately around the affected area with the find reported to the site supervisor. A qualified archaeologist will investigate and assess the find prior to the continuation of work. If skeletal remains are encountered during construction activities, the find will be immediately reported to the site supervisor and the RCMP.

5.12 Aesthetics

The aesthetics of the Project Site are anticipated to temporarily change during the construction phase. An area of approximately 70,000 m^2 will required to be cleared for the new primary Lagoon cell. There is approximately 60 m of heavily forested area between the Campground Access Road and the new primary Lagoon cell providing a visual buffer during both construction and operation. The existing Lagoon site also has a heavily treed area between the site and the Campground Access Road. The existing Lagoon site is gated and not accessible by the public. The new primary Lagoon cell will also be fenced and will have a gate to limit public access. Neither the existing Lagoon site nor the proposed Lagoon cells will be visible from the Trans Canada Trail due to the area being heavily treed.

The existing WWTP is not directly visible from Provincial Highway No. 12. It is bordered by a smaller forested area approximately 15 in depth from the Provincial Highway No. 12.

To maintain a clean, aesthetically pleasing Project Site, the following mitigation measures will be implemented:

- The Project Site will be inspected for loose waste and debris in order to maintain a clean area on a regular basis; and
- Waste and debris will be stored in bins and removed on a regular basis from the Project Site.

With the implementation of the above mitigation measures and the heavily forested area between the Campground Access Road and the Project Site, the overall impact on aesthetics as a result of the proposed project is assessed to be reversible and insignificant.

5.13 Health and Safety

Exposure to fuels, moving vehicles, construction equipment and pinch points could all negatively impact worker health and safety. In Manitoba, worker protection is provided through legislated standards, procedures and training under the *Workplace Safety and Health Act*. All contractors will be subject to site specific environmental, health and safety orientation for the construction phase of the proposed project.

The health and safety program will generally include the following:

- All construction will be carried out in accordance with the Workplace Safety and Health Act to minimize health and safety effects;
- Contractors will adhere to the requirements of applicable health and safety legislation and the site specific safety plan developed by the prime contractor or contractor as appropriate; and
- All workers will wear appropriate PPE at all times, including hearing protection as required.

Construction signage will be in place for the safety of the cottagers/campers and the public who use the Trans Canada Trail. The public will not be permitted access to the Project Site as it will be fenced with a gate during both construction and operation.

The new primary Lagoon cell will be completely fenced along with the new secondary cell Lagoon site to prevent public access and signage will be posted.

With the above provisions in place, we do not expect health and safety as a result of the proposed upgrade, to be of any concern.

5.14 Accidents and Malfunctions

To prevent accidents and malfunctions, all phases of the proposed project will be conducted in accordance with applicable regulatory requirements. The following sections provide additional details on precautionary measures that are proposed to minimize the risk of occurrence for accidents and malfunctions.

5.14.1 Spills

During construction and operation, there is potential for environmental effects due to fuel spills and/or leaks. Accidents (including transportation accidents) could also result in the accidental release of hazardous materials and/or equipment/vehicle fluids and fuels. A number of potential environmental concerns are also associated with the accidental release of chemicals and fuels resulting from improper storage and handling procedures. Spills can affect soil, vegetation, groundwater quality, air quality, and can potentially threaten human health and safety. Activities that may cause a spill are anticipated to occur rarely over the short term during the construction phase of the proposed project. Spills are expected to be predominantly contained to the Project Site. The magnitude of the spill effects are anticipated to range from negligible to moderate depending on the severity of a spill.

To prevent spills from occurring during project activities, the following procedures will be employed:

- All potentially hazardous products (if required on-site) will be stored in a pre-designated, safe and secure product storage area(s) in accordance with applicable legislation;

- Storage and disposal of liquid wastes and filters from equipment maintenance, and any residual material from spill clean-up will be contained in an environmentally safe manner and in accordance with any existing regulations;
- Storage sites (equipment storage, hazardous product storage, etc.) will be inspected periodically for compliance with requirements;
- Service and minor repairs of equipment performed on-site will be performed by trained personnel in appropriate areas;
- Vehicles and equipment will be maintained to minimize leaks. Regular inspections of hydraulic and fuel systems on equipment/machinery will be completed on a routine basis. When detected, leaks will be repaired immediately by trained personnel;
- Any used oils or other hazardous liquids will be collected and disposed of according to provincial requirements;
- Appropriate type and size of spill kits are available on-site; and
- On-site construction staff will be trained in how to deal with spills and clean-up procedures, including review of applicable Spill Response Plans and knowledge of how to properly deploy site spill kit materials; which will be readily accessible at the site at all times.

Adherence to standard environmental management practices will minimize the risks of accidental spills and adverse effects. This includes regular equipment inspection and maintenance to minimize the risk of fuel spills. In the event of an accidental spill, a regulatory report will be made to Environment Canada and DSD. Following a spill, measures will be taken immediately with a spill kit or suitable alternative to prevent migration of the spilled material. Recovery measures will be implemented as necessary in consultation with the appropriate provincial authorities. Following initial response, a remediation program will be undertaken if necessary with contaminated material appropriately managed (in accordance with federal and provincial regulations).

With the implementation of the above mitigation measures as necessary and assuming the implementation of safe work practices, the risk of spills is considered to be appropriately mitigated.

5.14.2 **Fire/Explosions**

During construction and operation there exists the potential for fires at the Project Site involving mechanical equipment and fuels. Effects related to fires include, but are not limited to, harm to on-site personnel, equipment, and the potential release of contaminants and hazardous materials.

All precautions necessary will be taken to prevent fire hazards at the Project Site; these include, but are not limited to:

- All flammable waste will be removed on a regular basis and disposed of at an appropriate disposal site;
- Appropriate fire extinguisher(s) are available on the Project Site. Such equipment will comply with and be maintained to, the manufacturers' standards;
- All on-site fire prevention/response equipment is checked on a routine basis, in accordance with local fire safety regulations, to ensure the equipment is in proper working order at all times; and
- Greasy or oily rags or materials subject to spontaneous combustion are deposited and stored in appropriate receptacles. This material will be removed from the Project Site on a regular basis and be disposed of at an appropriate waste disposal facility.

With these mitigation measures employed and assuming the implementation of typical safe work practices, the risk of fires and explosions is considered to be appropriately mitigated.

6. Public Engagement

On August 29, 2015 and September 9, 2015, public Open Houses were held by Parks and Protected Spaces Branch, with attendance by AECOM, to provide an opportunity to convey information about the proposed upgrades at the Lagoon and gather any feedback people may have. At the time of these Open House events, it was stated on the Open House Story Boards that “the upgraded wastewater lagoon will provide 365 day storage by annually discharging in the fall”.

To inform the public of these events, an advertisement was placed in the following local papers;

- Winnipeg Free Press (Saturday August 8, 2015);
- Beausejour Clipper (August 10 to August 14, 2015);
- The Selkirk Record (August 10 to August 14, 2015);
- The Selkirk Journal (August 10 to August 14, 2015); and
- Grand Beach Cottage Association Monthly Newsletter.

The proposed project was also discussed during the Grand Beach Cottagers Association Annual General Meeting (AGM) on August 2, 2015. Information regarding the project along with the display boards, comment sheet, and the open house dates was also provided on the Parks and Natural Areas website under the Public Consultations section.

The first Open House was held in Grand Beach at the Grand Beach Community Club located at 6 Grand Beach Road. A total of 45 attendees signed the sign-in sheet.

The second Open House was held at the Garden City Canad Inns located at 2100 McPhillips Street in Winnipeg. A total of 11 attendees signed the sign-in sheet.

Comment sheets were provided during the Open Houses where the attendees could sit and fill out the form. A copy of the presentation story boards and comment sheet from the Open Houses are included in **Appendix F.**

The main concern that was discussed during the Open Houses was about the increase in user fee for cabin owners. A representative from the finance department from Parks was available to discuss these concerns. During the Open Houses several people also mentioned concerns over water flow through the existing channel between the Grand Beach Natural Lagoon and Lake Winnipeg; that the channel requires dredging to improve flow.

Attendees agreed that the new Lagoon will improve the Grand Beach Natural Lagoon and Lake Winnipeg water quality. Attendees were also pleased to see the decommissioning of the existing wastewater treatment plant in the near future.

A total of three (3) comment sheets were received during these Open Houses. One of the general concerns from the comment sheets was regarding the restricted water flow from the Grand Beach Natural Lagoon to Lake Winnipeg via the channel between East and West Beaches; the channel has filled in with sand. Another noted concern was to take the wastewater treatment out of the Park and work with other stakeholders (i.e. RM of St. Clements and RM of Alexander) and use existing wastewater infrastructure of the RM of St. Clements. Lastly, there was concern about transparency in regards to the cost of the proposed project on cottagers.

As indicated in Section 5.7, the water levels vary significantly throughout the year and between years and there is evidence of continual water flow between the natural lagoon and Lake Winnipeg. It is anticipated that the higher levels of water flow between the natural lagoon and Lake Winnipeg will occur in spring during the winter run off and in the fall when higher stronger of north-easterly winds occur. It is anticipated that the discharge time will coincide

with the higher water levels in the natural lagoon area; therefore the effluent from the new Lagoon is not anticipated to have a significant adverse effect on water quality in natural lagoon and Lake Winnipeg.

This *Environment Act* Proposal report will be made available on Sustainable Development's Public Registry for public review and comment for 30 days.

7. Conclusions

The results of the effects assessment can be summarized as follows:

Topography

Construction of the proposed project will have minor changes to topography due to the size of the area that requires clearing. The area of the proposed primary cell is located within a typical aspen forest that will require approximately 70,000 m^2 of clearing. The area of the existing Lagoon and the proposed primary cell are located approximately 60 m from the Campground Access Road through a heavily forested area; not visible from the Campground Access Road or the Trans Canada Trail also located approximately 60 m away.

Air and Noise

Although dust is not anticipated to be a major concern at the Project Site, with the implementation of measures such as limiting material stockpile heights, keeping disturbed/exposed areas to a minimum, and using dust suppression if required, the effects of dust is assessed to be negligible.

Only a slight odour was observed during the site visit once on the berm of the Lagoon; not while on the Lagoon access road or on the Trans Canada Trail. During the desludging of the existing Lagoon cells, the slurry will be pumped into the new secondary cell and will be partially filled with water to completely cover all of the sludge and wastewater. There may be some sludge that will require to be removed from the existing WWTP during decommissioning. It is anticipated that decommissioning will occur during the fall, outside of the camping season.

This approach is expected to limit odours produced from the wastewater and sludge slurry. Desludging will also occur during the fall, outside of the camping season, and will take approximately five days to complete. Based on the separation distance between the Project Site and the closest receptors, and the time of year for the desludging to occur, any residual impact due to odour is assessed to be negligible.

With respect to exhaust emissions, it is anticipated that a maximum of 10 construction vehicles will access the Lagoon site via the Campground Access Road. Construction along the Causeway Road is anticipated to be limited to one or two horizontal directional drilling rigs and a maximum of five other construction vehicles. With the implementation of measures such as maintaining vehicles and equipment in proper working order and vehicle idling kept to a minimum, the effects of exhaust emissions is assessed to be negligible.

Noise levels at the Project Site during construction are not expected to be high enough to cause significant disturbance in the Project Area. With the implementation of measures such as providing hearing protection to workers as required and properly maintaining vehicles and equipment are expected to mitigate potential adverse effects. During operation, sources of noise include maintenance vehicles and activities along with hauler trucks arriving to the site approximately five times per year. Therefore, the effect of noise is assessed to be minor.

Greenhouse Gas Emissions

With respect to greenhouse gas (GHG) emissions, the proposed primary and secondary cells will be 1.5 m in depth and therefore produce negligible quantities of methane. Also, vehicle emissions associated with sludge removal and maintenance are anticipated negligibly contribute to local GHG concentrations. Therefore, the effect on GHG emissions is assessed to be negligible.

Soil

With respect to soil compaction, mixing, and erosion during construction, the implementation of mitigation measures identified in this assessment is anticipated to mitigate any potential soil compaction/mixing and erosion effects. Therefore, it is anticipated that the residual effect on soil is assessed to be negligible.

Groundwater

The proposed project does not require undertaking of any activities that may affect groundwater in the area.

Surface Water and Aquatic Resources

The new Lagoon system will meet the following effluent criteria (prescribed under Manitoba Water Quality Standards, Objectives, and Guidelines):

- CBOD5 - 25 mg/L;
- Total Suspended Solids (TSS); excluding algae solids - 25 mg/L;
- Total Coliform - 1500 CFU per 100 mL;
- Fecal Coliform - 200 CFU per 100 mL;
- Un-ionized ammonia - 1.25 mg/L expressed as nitrogen (N), at 15°C ± 1°C; and
- Total Phosphorus - 1 mg/L.

With the above criteria as the target for key parameters, the quality of the effluent that will be discharged to Lake Winnipeg is anticipated to improve. The existing Lagoon has never been discharged since it was constructed approximately 40 years ago. Based on the topography in the area of the existing Lagoon (as shown in **Figure 02**), the land gently slopes towards the Grand Beach Natural Lagoon area. It is therefore anticipated that the effluent in the Lagoon may have seeped through the existing clay liner and followed the natural topography in the area towards the Grand Beach Natural Lagoon. With the proposed twice per year discharge, the quantity of effluent will remain the same, just discharged twice per year instead of once per year.

All construction works will be located approximately 100 m away from the Grand Beach Natural Lagoon; with the exception of clearing and grading in the existing effluent drainage ditch. With the implementation of measures such as installing silt fences, limiting material stockpile heights, keeping disturbed/exposed areas to a minimum, and using dust suppression if required, the effects of dust is assessed to be negligible.

In regards to potential flooding at the Project Site due to high water levels of Lake Winnipeg; the closest lagoon cells to the lake are the existing lagoon cells and with a berm elevation of 2.9 m above the record highest water level of the lake, it is anticipated that the berm will provide the necessary protection from any potential future high water levels of the lake/flooding.

In regards to water movement from the natural lagoon to Lake Winnipeg, it is anticipated that the higher levels of water flow between the natural lagoon and Lake Winnipeg will occur in spring during the winter run off and in the fall when higher levels of north-easterly winds occur. As the new Lagoon will discharge twice pre year, once in early June and once in the fall, it is anticipated that the discharge time will coincide with the higher water levels in the natural lagoon area; therefore the effluent from the new Lagoon is not anticipated to have a significant adverse effect on water quality in natural lagoon and Lake Winnipeg

Protected and Other Flora Species

The location of the primary lagoon cell will require approximately 70,000 m^2 of vegetation clearing. A construction lay-down area will also be required for the proposed project and is anticipated to be located near the truck dump of the existing Lagoon. Vegetation clearing and grading will also be required within the existing effluent drainage ditch.

Construction along the Causeway Road is anticipated to be limited to one or two horizontal directional drilling rigs. With the implementation of the mitigation measures identified in this assessment, the effect of vegetation clearing is assessed to be minor.

Protected and Other Fauna Species

With respect to protected species, there is the potential that some may be found within the Project Area, however, the likelihood of protected species at the existing Lagoon site is anticipated to be low. Also, the habitat encountered at the Project Site is very common for this area and therefore the loss of critical habitat due to the proposed project is not anticipated. The Project Site is located in an area which is frequented by disturbances including road traffic along the Campground Access Road and the regular use of the Trans Canada Trail by the public. Due to these regular disturbances, it is anticipated that wildlife in the area is accustomed to such disturbances. Also, construction along the Causeway Road is anticipated to be limited to one or two horizontal directional drilling rigs. Noise during construction will be a short-term disturbance and will subside thereafter. With implementation of the mitigation measures identified in this report, the expected residual effects as a result of noise, dust deposition, and vegetation clearing on wildlife is anticipated to be minor to moderate at the Project Site.

Protected Areas

With respect to protected areas, the closest protected area is located approximately 11 km east from the Project Site, therefore no effects on protected areas are anticipated from the construction and operation of the proposed project.

Heritage Resources

The Heritage Resources Branch (HRB) indicated that the potential to impact significant heritage resources was low for the Lagoon site and therefore the Branch has no concerns with the proposed project. A second updated screening request was submitted to HRB on May 6, 2016 that included the proposed lift station and forcemain; to date a response from HRB has not been received by AECOM.

Aesthetics

During construction, good housekeeping practices will be implemented at the Project Site including inspecting the Project Site on a regular basis for loose waste and debris and storing waste and debris in proper bins prior to removal from the site. There is approximately 60 m of heavily forested area between the Campground Access Road and the new primary Lagoon cell providing a visual during both construction and operation. The existing Lagoon site is also has a heavily treed area between it and the Campground Access Road and is also gated and not accessible by the public. The new primary Lagoon cell will also be fenced and will have a gate to limit public access. The existing WWTP is not directly visible from Provincial Highway No. 12. It is bordered by a smaller forested area approximately 15 m in depth from the Provincial Highway No. 12. Therefore, the overall impact on aesthetics as a result of the proposed project is assessed to be reversible and insignificant.

Public Engagement

On August 29, 2015 and September 9, 2015, public Open Houses were held by Parks and Natural Areas, with attendance by AECOM to provide an opportunity to convey information about the proposed upgrades at the Lagoon and gather any feedback people may have. At the time of these Open House events, it was stated on the Open House Story Boards that “the upgraded wastewater lagoon will provide 365 day storage by annually discharging in the fall”.

In general, the concerns that were discussed during the Open Houses were: increased user fee to the cabin owners, and the natural flow between the Grand Beach Natural Lagoon and Lake Winnipeg; that the channel

requires dredging to improve flow. The positive feedback during the Open Houses included that the attendees agree that the new Lagoon upgrade will improve the water quality in the Grand Beach Natural Lagoon and Lake Winnipeg and attendees were also pleased to see the future decommissioning of the existing wastewater treatment plant.

This *Environment Act* Proposal report will be made available on Sustainable Development's Public Registry for public review and comment for 30 days.

Conclusion Summary

Considering the implementation of the proposed mitigation measures, design features, existing and proposed environmental licence conditions and the social and ecological context of each environmental component, the cumulative residual environmental effects of the proposed Lagoon replacement project are expected to be negligible to moderate in magnitude. The measures described to mitigate the risk of occurrence of accidents and malfunctions are deemed to be appropriate in mitigating such risks. Therefore, it is our opinion that based on the available information and documented assumptions, the overall potential adverse effects of the proposed project will range from negligible to moderate and insignificant.

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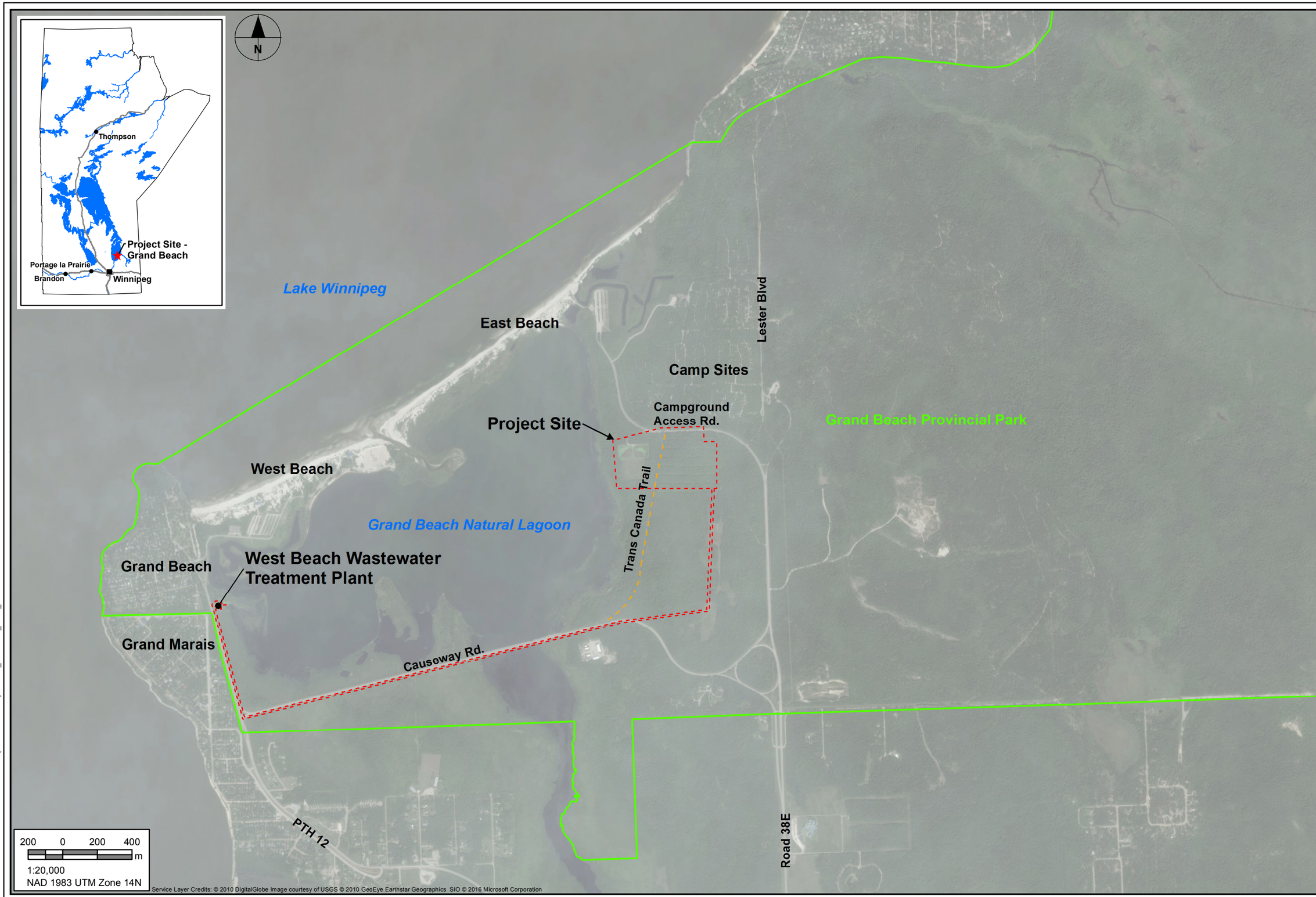
Figures



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Approved:

Checked:

Designer:

Project Management Initials:

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Figure: 01

Location Plan

Grand Beach Provincial Park Lagoon Upgrade Project - Environmental Act Proposal

The Manitoba Water Services Board

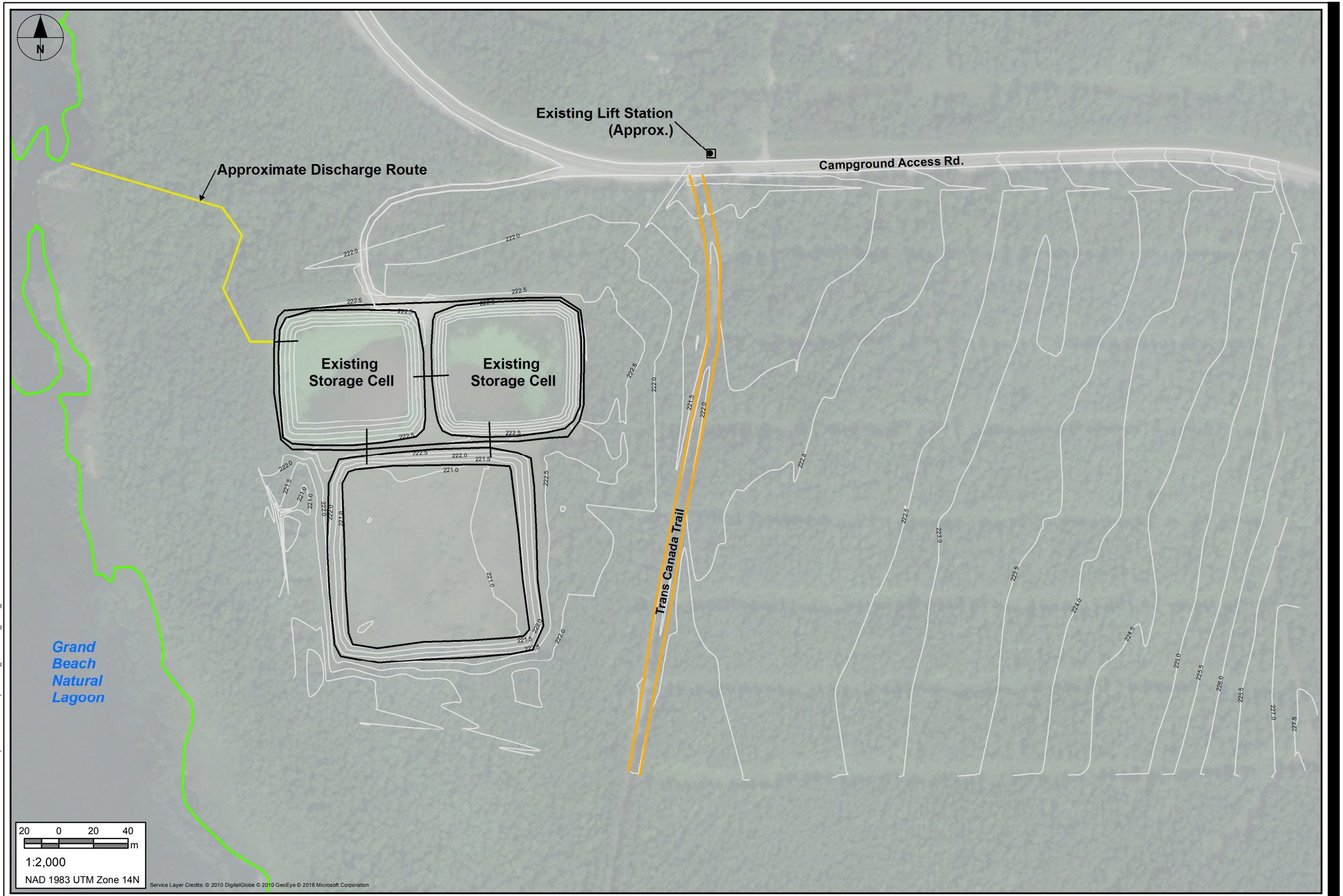

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Figure: 02

Site Plan - Existing Lagoon Site

Grand Beach Provincial Park Lagoon Upgrade Project - Environmental Act Proposal

The Manitoba Water Services Board

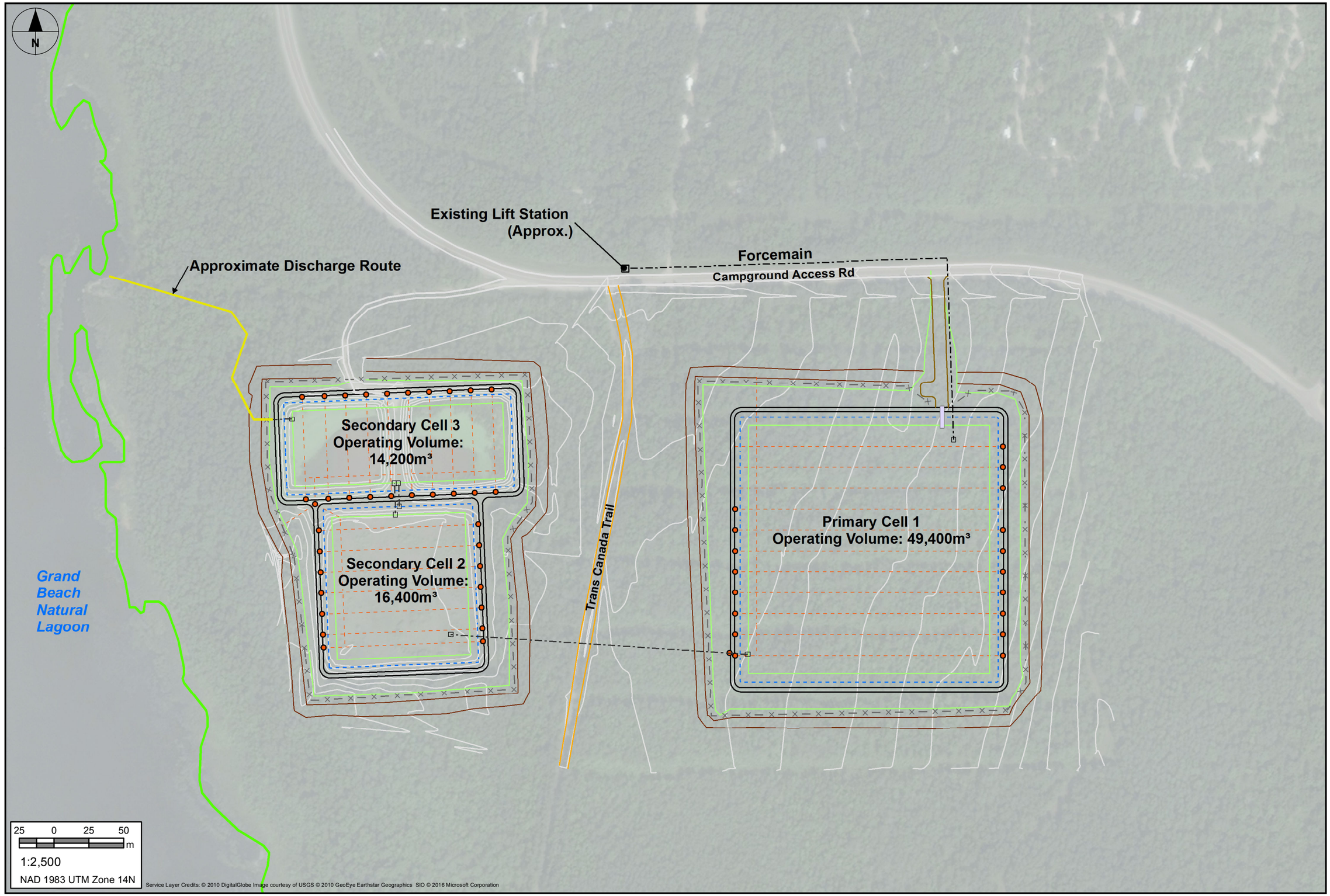

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Figure: 03

Site Plan - Proposed Lagoon Site

Grand Beach Provincial Park Lagoon Upgrade Project - Environmental Act Proposal

The Manitoba Water Services Board

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Designer:

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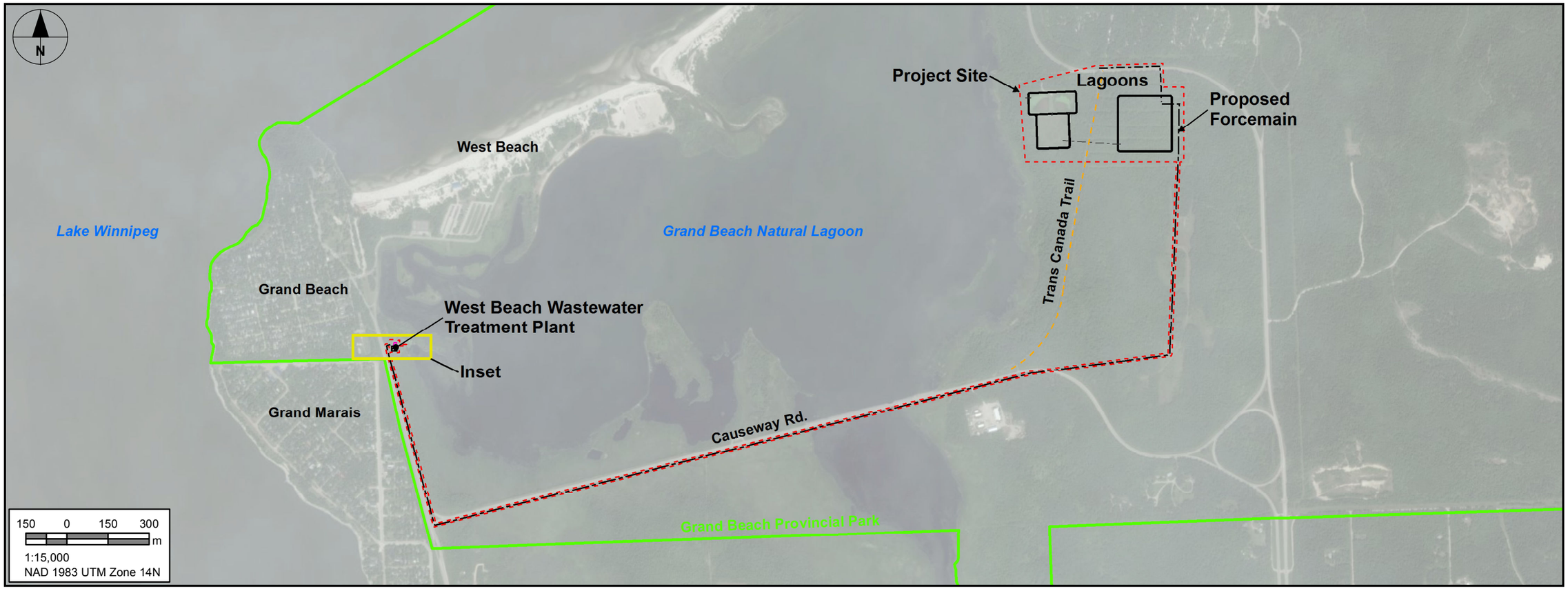

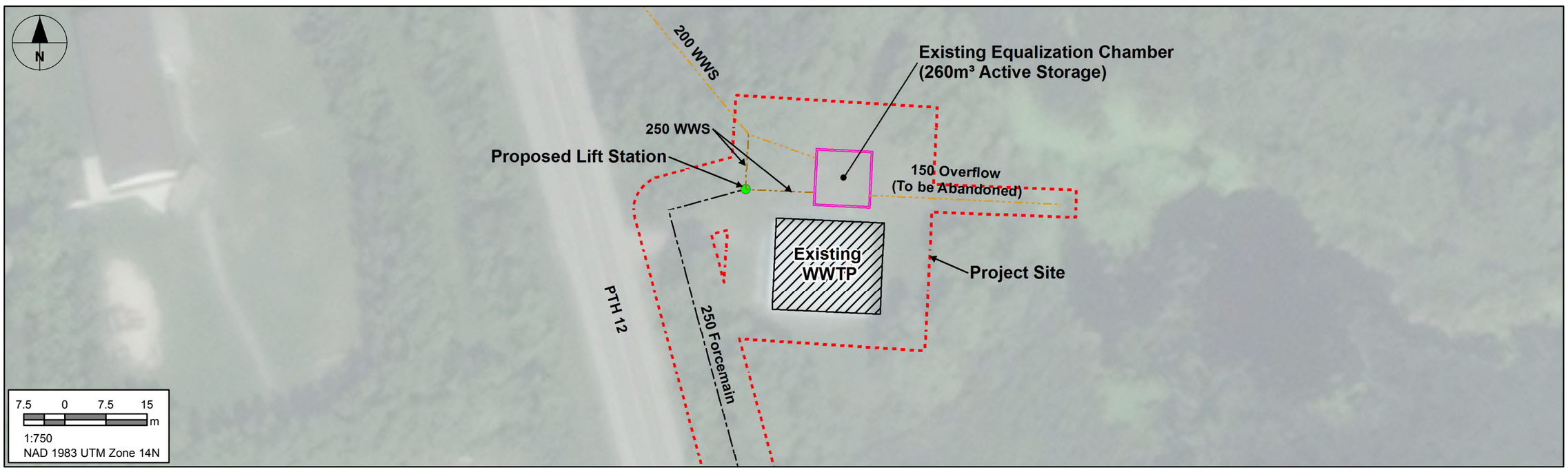

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Figure: 04

Site Plan - Proposed WWTP Site

Grand Beach Provincial Park Lagoon Upgrade Project - Environmental Act Proposal

The Manitoba Water Services Board

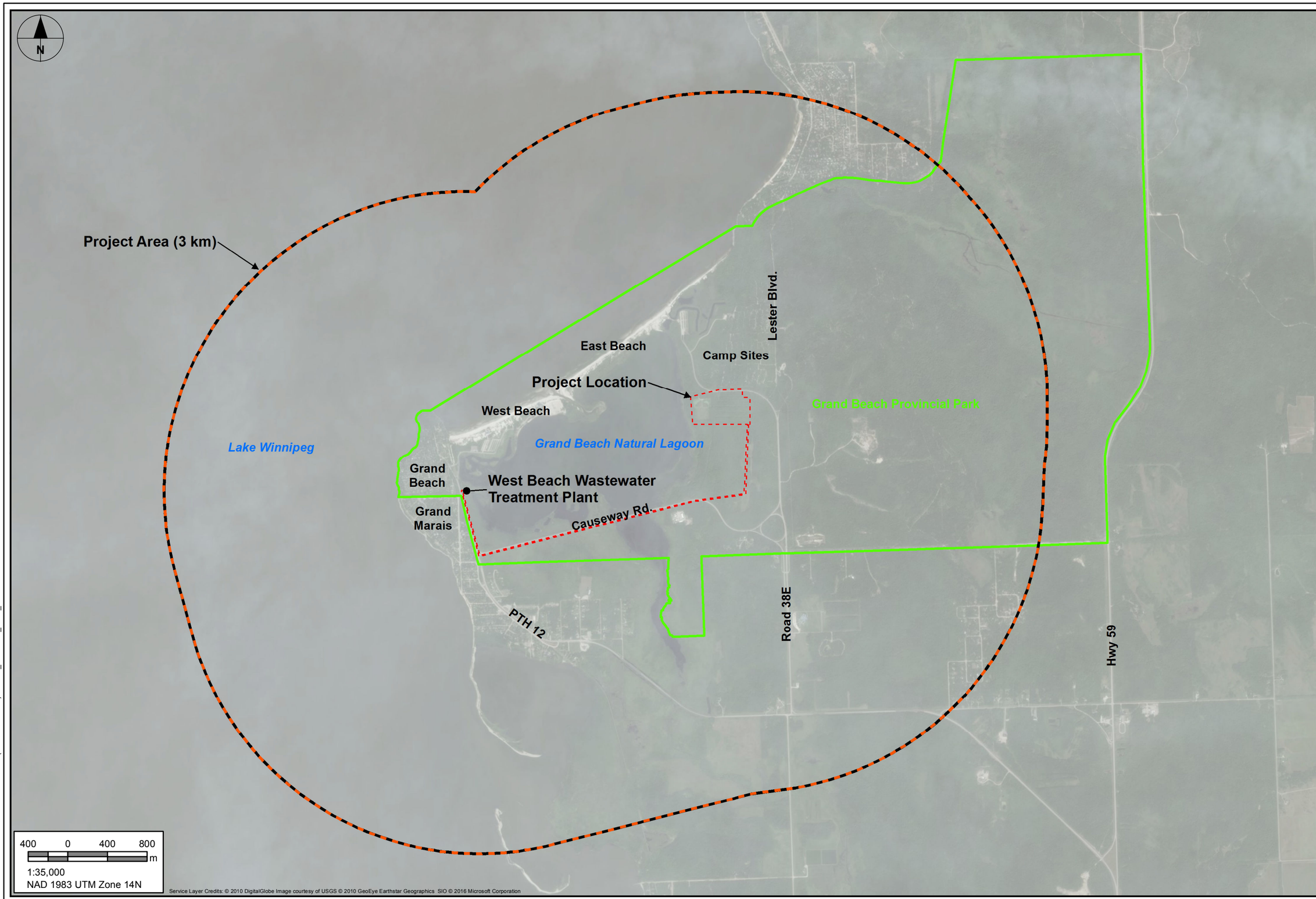

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Figure: 05

Project Area - 3 km Radius from the Project Site

Grand Beach Provincial Park Lagoon Upgrade Project - Environmental Act Proposal

The Manitoba Water Services Board

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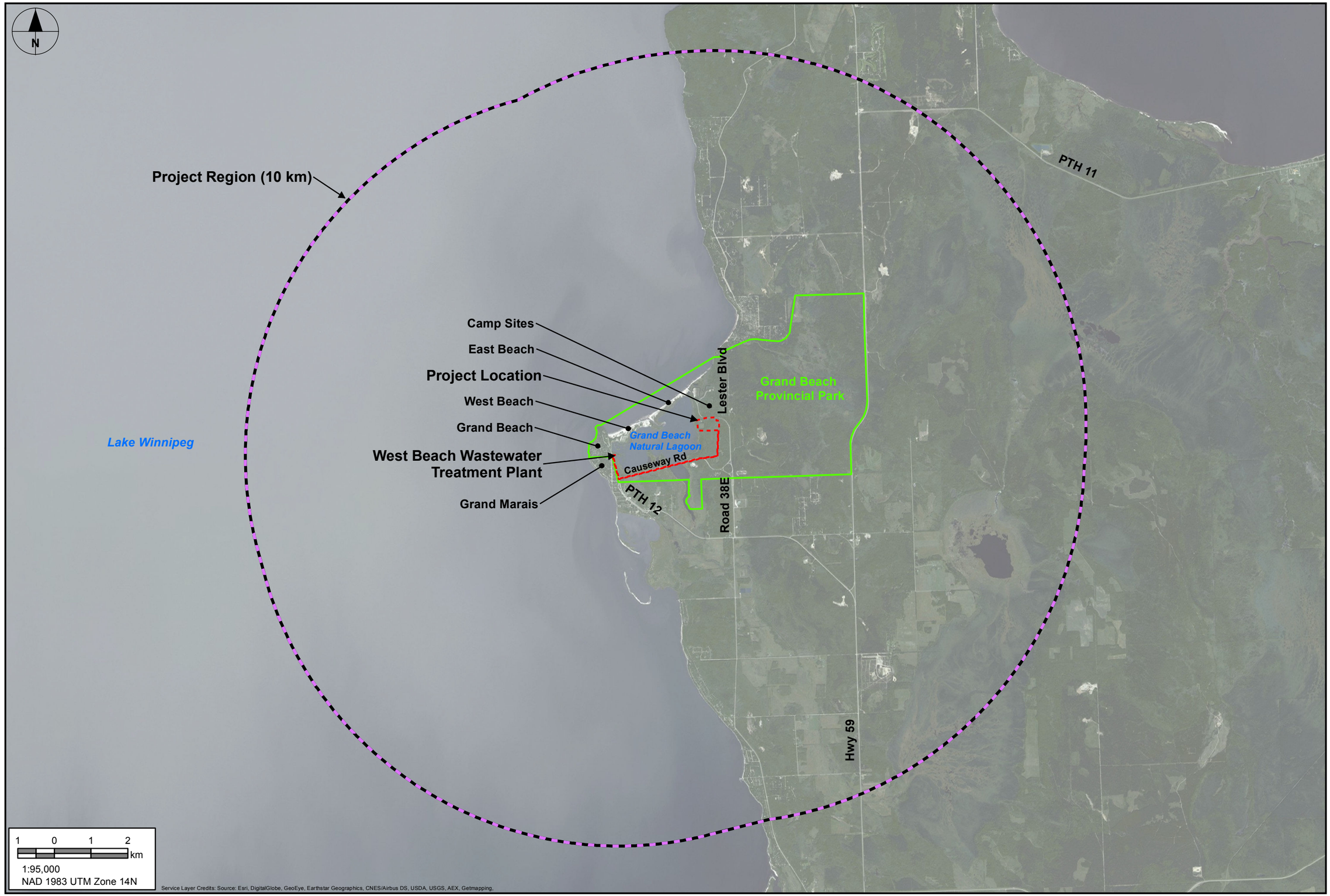

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Figure: 06

Project Region - 10 km Radius from Project Site

Grand Beach Provincial Park Lagoon Upgrade Project - Environmental Act Proposal

The Manitoba Water Services Board

Project Management Initials: Designer: Checked: Approved: ANSI B 279.4mm x 431.8mm

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Appendix A

Grand Beach Provincial Park Lagoon Preliminary Design Report

The Manitoba Water Services Board and
Manitoba Conservation

Grand Beach Provincial Park Lagoon Preliminary Design Report

Prepared by:

AECOM
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Project Number:

60430713

Date:

August 2015

Statement of Qualifications and Limitations

The attached Report (the "Report") has been prepared by AECOM Canada Ltd. ("Consultant") for the benefit of the client ("Client") in accordance with the agreement between Consultant and Client, including the scope of work detailed therein (the "Agreement").

The information, data, recommendations and conclusions contained in the Report (collectively, the "Information"):

- is subject to the scope, schedule, and other constraints and limitations in the Agreement and the qualifications contained in the Report (the "Limitations");
- represents Consultant's professional judgement in light of the Limitations and industry standards for the preparation of similar reports;
- may be based on information provided to Consultant which has not been independently verified;
- has not been updated since the date of issuance of the Report and its accuracy is limited to the time period and circumstances in which it was collected, processed, made or issued;
- must be read as a whole and sections thereof should not be read out of such context;
- was prepared for the specific purposes described in the Report and the Agreement; and
- in the case of subsurface, environmental or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time.

Consultant shall be entitled to rely upon the accuracy and completeness of information that was provided to it and has no obligation to update such information. Consultant accepts no responsibility for any events or circumstances that may have occurred since the date on which the Report was prepared and, in the case of subsurface, environmental or geotechnical conditions, is not responsible for any variability in such conditions, geographically or over time.

Consultant agrees that the Report represents its professional judgement as described above and that the Information has been prepared for the specific purpose and use described in the Report and the Agreement, but Consultant makes no other representations, or any guarantees or warranties whatsoever, whether express or implied, with respect to the Report, the Information or any part thereof.

Without in any way limiting the generality of the foregoing, any estimates or opinions regarding probable construction costs or construction schedule provided by Consultant represent Consultant's professional judgement in light of its experience and the knowledge and information available to it at the time of preparation. Since Consultant has no control over market or economic conditions, prices for construction labour, equipment or materials or bidding procedures, Consultant, its directors, officers and employees are not able to, nor do they, make any representations, warranties or guarantees whatsoever, whether express or implied, with respect to such estimates or opinions, or their variance from actual construction costs or schedules, and accept no responsibility for any loss or damage arising therefrom or in any way related thereto. Persons relying on such estimates or opinions do so at their own risk.

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This Statement of Qualifications and Limitations is attached to and forms part of the Report and any use of the Report is subject to the terms hereof.

AECOM: 2012-01-06

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August 12, 2015

Travis Parsons, P. Eng.
Chief Engineer
The Manitoba Water Services Board
2010 Currie Boulevard
Brandon MB, R7A 6Y9

Dear Mr. Parsons:

Project No: **60430713**

Regarding: **Grand Beach Provincial Park Lagoon Preliminary Design Report**

AECOM is pleased to submit the Final Grand Beach Provincial Park Lagoon Preliminary Design Report. The report incorporates comments received from the Manitoba Water Services Board and Manitoba Conservation on the draft report.

The Grand Beach Provincial Park Lagoon Preliminary Design Report include design criteria related to wastewater flows, lagoon layout and construction considerations. Preliminary drawings of the lagoon layout are also included.

We appreciate the assistance provided by the Manitoba Conservation and the Manitoba Water Services Board in preparing this report.

Sincerely,
AECOM Canada Ltd.

Eric Hutchison, P. Eng.
Senior Advisor
Eric.Hutchison@aecom.com
HB:td

Distribution List

# of Hard Copies	PDF Required	Association / Company Name
1	1	The Manitoba Water Services Board
2	1	Manitoba Conservation – Parks and Natural Areas

Revision Log

Revision #	Revised By	Date	Issue / Revision Description
0	H. Buhler	July 24,2015	Draft
1	H. Buhler	August 11, 2015	Final Report

AECOM Signatures

Report Prepared By:

Heather Buhler, P. Eng.
Project Manager

PROVINCE OF MANITOBA
H. A.
BUHLER
Member
25656
REGISTERED PROFESSIONAL ENGINEER

Report Reviewed By:

Eric Hutchinson, P. Eng.
Senior Advisor

Executive Summary

Manitoba Water Services Board (MWSB) retained AECOM to prepare the assessment, preliminary design and detailed design for the Grand Beach Provincial Park Lagoon. This facility is owned and operated by Manitoba Conservation. The existing lagoon is located south west of the campground and east of the Grand Beach Wetlands. It was constructed in 1976 as a three cell lagoon, although only two cells were completely constructed. Due to inadequate clay liners, the lagoon has never been discharged to Lake Winnipeg since constructed.

Wastewater is received by forcemain from the campground, which has 408 basic and electrical campsites, and several modern washroom and shower facilities. Hauled waste is trucked from approximately 414 cabins at the Grand Beach town site, while septage is trucked from several park staff cabins, beach pavilions, a lift station and outhouses. Including infiltration, and transferring of all wastewater from the existing West Beach Wastewater Treatment Plant, future projected flows for the new lagoon are 49.6 ML per year.

An expanded, properly lined lagoon is required to replace the existing lagoon. The proposed location of the new lagoon is positioned such that the existing lagoon cells will be re-used. The unfinished third cell, as well as the cells currently in use, will be retrofitted to become the new secondary cells. Locations south and east of the existing lagoon were studied as potential sites for the new primary cell, with the location east of the cell being determined as more appropriate. The existing Trans-Canada Trail and MTS underground lines will remain intact and will separate the new primary and secondary cells. Extensive tree buffers will be maintained between the trail and the lagoon cells.

A geosynthetic liner will be installed in both the primary and secondary cells with layers of bedding sand below and above. The liner will be placed over top of a dewatering and degassing system to allow for the release of groundwater and gas that may accumulate under the liner. The total volume of the primary cell will be 49,400 m^3, while the secondary cells will have a total volume of 30,600 m^3.

Improvements will also be required to re-route the forcemain from the campground to the new lagoon. A truck dump will be constructed at the new primary cell and both the primary cell and secondary cells will be completely fenced to prevent campers and animals from accessing the cells. In the future, the West Beach wastewater treatment plant will also be replaced with a lift station and forcemain to transfer all wastewater from the current treatment plant to the lagoon for treatment. Once the new West Beach lift station and forcemain are completed, the West Beach treatment plant will be decommissioned.

The new lagoon will discharge into the Grand Beach Wetland which drains into Lake Winnipeg, so it is expected that the lagoon's operating licence will have a phosphorus limit of 1 mg/L. Two options were studied for phosphorus removal, alum dosing and the Phosphex™ system. While both systems will remove phosphorus to discharge levels, the alum dosing option is recommended due to its simplicity, low life cycle costs, and ability for annual discharge instead of monthly.

Once the new primary cell is constructed and the existing third cell is retrofitted, the existing lagoon will be decommissioned and retrofitted. This will involve dewatering the lagoon, disposing of the remaining sludge, and then rebuilding the remaining secondary cell by removing the interior berm and installing a geosynthetic liner in the cell.

The project is expected to be tendered and awarded in March 2017 with construction starting in May 2017. Lagoon construction is scheduled to be completed by October 2017 with the desludging and reformation of the currently operating cells completed the following summer, 2018.

The environment act proposal is being prepared as a separate document. Public consultations are proposed for August and September, 2015.

Estimated capital costs for the new facultative lagoon and all associated piping, infrastructure and desludging of the operating lagoon cells are $5,028,000.00. The estimated capital cost is for the lagoon works only and does not include the future decommissioning of the West Beach wastewater treatment plant and construction of a new West Beach lift station and forcemain to the lagoon.

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1. Introduction

Grand Beach Provincial Park is located at the southeast end of Lake Winnipeg, and is reputed to have one of the best beaches in North America; the 3 km stretch of beach boasts fine silica sand and rolling dunes reaching up to 12 m high. Grand Beach is separated into two areas, West Beach and East Beach, by a natural Wetland. The campground is located at East Beach, while the town site is located at West Beach. Some of the West Beach wastewater is treated by an existing package treatment plant, while the East Beach is serviced by a lagoon.

In 2010, Manitoba Conservation – Parks and Natural Areas (Parks) authorized The Manitoba Water Services Board (MWSB) to hire a consultant to assess the existing Grand Beach lagoon and prepare a preliminary design report for any lagoon upgrades. MWSB retained AECOM to prepare the assessment and preliminary design for the Grand Beach Provincial Park Lagoon. AECOM submitted a draft preliminary design report in March 2010 for review. However, due to unexpected delays in the project this report was not finalized. In 2011, AECOM further completed an assessment of the existing wastewater treatment plant located on the West Beach.

In 2015, the MWSB retained AECOM to complete and update the preliminary design report for the Grand Beach wastewater lagoon. This updated report incorporates the campground wastewater flows, as well as the flows from the West Beach mechanical treatment plant, which will be transferred to the upgraded lagoon in the future.

2. Sources of Wastewater

The Grand Beach Provincial Park Campground operates seasonally from mid-May until mid-September and is located on the east side of the Grand Beach Wetland along the south east shore of Lake Winnipeg. The Grand Beach Campground offers over 408 campsites with a combination of electrical and basic camping opportunities; no full service sites are available. Several modern washrooms are located throughout the campground as well as a laundry and shower facility. All waste from these locations is pumped to the wastewater lagoon through the piped sewer system and the main lift station.

The Grand Beach lagoon also accepts wastewater hauled from approximately 80% of the 517 cottages in the West Beach Area and septage from 5 washrooms in the self-guided trail area to the east of the campground. No external septage haulers are allowed to dump in the Grand Beach lagoon.

The West Beach wastewater treatment plant (WWTP) provides seasonal treatment for the cottage community and commercial customers in the Grand Beach town site. The plant was sized to treat all the wastewater produced from the cabins, Beach Safety Building, two Pavilions, the Parks office, six washroom facilities and one shower building. However, due to the high cost of connection to the sewage system, 80% of the cabins installed individual holding tanks, which are pumped out and trucked directly to the East Beach lagoon. This resulted in the overall loading to the plant being lower than expected and the WWTP being subjected to high “shock” loads on the weekends. Parks has experienced ongoing difficulties in managing the biological treatment process at the plant and as a result after completion of the East Beach lagoon upgrades, the WWTP will be decommissioned. Wastewater from the WWTP will be transferred directly to the lagoon through a new West Beach lift station and forcemain.

3. Condition Assessment of Existing Lagoon

The Grand Beach Lagoon was constructed in 1976 as a three cell lagoon. Construction on the third cell was started but not completed possibly due to lack of funding. The third cell is visible on site and the piping from the two operation cells is in place, but it appears that no clay liner was ever actually constructed.

The two operating cells consist of a primary cell, which receives the wastewater from the campground through the lift station and from the septage haulers, and a secondary cell, which provides additional storage.

The Grand Beach Lagoon was designed to discharge to a drainage ditch and then into the Grand Beach Wetlands, which eventually drain directly into Lake Winnipeg. However, operators have stated that the lagoon has not been discharged in over 40 years, due to leakage in the lagoon liner.

Phosphorus removal will be included in the wastewater treatment for this lagoon due to its proximity to Lake Winnipeg. The current drainage route is insufficient to provide any nutrient uptake through the use of a trickle discharge or wetland system. As a result, it is expected that Manitoba Conservation will achieve phosphorus removal through the chemical addition of alum into the lagoon. Alum dosing is currently being used in other provincial parks for phosphorus removal; and is able to provide reliable phosphorus removal results.

The existing lagoon site is considered acceptable for expansion and relocation of the lagoon was not considered.

4. Current Flows

4.1 Campground

The Grand Beach Campground is open 7 days a week for approximately 16 weeks per year. During the winter the campground system is shut down and no wastewater is pumped to the lagoon.

Estimated wastewater flows are divided into type of site, washroom, laundry and shower facilities, and a campground office. From information published on various campground locations in Canada, each camper is expected to contribute 70 L of wastewater per day based on basic or electrical only campsites. Additional flow has been anticipated for shower usage in the 20 stall shower facility. **Table 1** summarizes the current estimated flows.

Table 1: Current Estimated Flow – Grand Beach Campground

Flow Components	Number of Units	Daily Volume per unit (L)	Total Flow (L/day)
Basic and Electrical Camp Sites	1142 people[1]	70	79,968
Laundry Facility[2]	8 machines	1330	10,640
Hiking Trail Washrooms	5	33[3]	165
Shower Facility[4]	20 stalls	Showerhead @ 7.5 L/min	51,408
Campground Office	22 people	49	1,078
Average Day Flow			**143,259**
Total Flow (16 weeks operation)			**16,045,000 L**

Notes:

1 *Calculations are based on a full campground with 3.5 people per site. This number includes all 408 campsites and assumes 80% occupancy throughout the camping season.*

2 *Laundry Facility – There are currently eight washing machines operating at the central Concession Facility. It is assumed that when the campground is full, each machine is capable of running 7 loads/day at 190 litres per load.*

3 *Assuming 1000L per month is pumped from each of the five washroom; these washrooms are expected to get limited use in general.*

4 *Shower Facility – A low flow shower head on the market today ranges from 6.0 L/min – 9.4 L/min. The 20 shower facility is assumed to have installed shower heads of 7.5 L/min. Calculations assumed that 75% of campsite occupant showered once a day for 8 minutes.*

The estimate wastewater flows, summarized in **Table 1**, were compared to the pump hours from the campground's main lift station to confirm estimates.

Table 2: Annual Campground Flows based on Lift Station Pump Hours from 2008 - 2014

Year	Total Pump Hours (hrs)	Annual Flow (L)
2008	2,240	18,847,457
2009	1,584	11,581,691
2010	2,279	21,643,856
2011	1,796	11,797,900
2012	1,302	11,828,655
2013	1,500	13,627,483
2014	1,540	13,990,883

A comparison of **Table 1** and **Table 2** reveal that the estimated flows are higher than the actual wastewater flows from the campground in the last 4 years. It is believed that this additional capacity in the lagoon upgrade will provide the park with a buffer for years when the campground occupation is higher than expected or additional unexpected flows are seen at the lagoon.

Based on the difference between the estimated campground wastewater flows, Table 1, and the current 2014 pump hours from the campground lift station, Parks should have capacity in the lagoon to add an additional 40 basic, electrical and/or electrical/water campsites in the future in addition to converting any existing basic sites to electrical or electrical/water campsites in the future, if desired. This number is based on the assumption that the infiltration and inflow in the campground wastewater collection system does not increase significantly and that no full service sites are added to the campground.

4.2 Cabins

Of the 517 cabins in the Grand Beach town site, approximately 80% or 414 cabins, truck their waste to the Grand Beach Lagoon. The remaining cabins contain no wastewater system and use the public washroom facilities in the West Beach Area. Waste from the West Beach public washroom facilities is pumped to the Wastewater Treatment Plant (WWTP) located on West Beach, and has no current effect on the Grand Beach lagoon.

The cabin area is operational year round and wastewater from the holding tanks is trucked to the lagoon throughout the year. It has been estimated that the lagoon accepts one 4,500 L holding tank per month per cabin during the main operating season of April to November. This conservative value should account for lower usage during the early and late fall and higher usage during July and August. During the winter months, December to March, it has been estimated that only a quarter of the cabins are still operating and will be pumping out their holding tanks once per month. **Table 3** summarizes the wastewater volume expected from the Cabins.

Table 3: Current Estimated Flow – Grand Beach Cabins

Flow Component	Number of Cabins	Number of Months	Daily Volume per unit (L)	Total Annual Flow (L)
April to November	414	8	4,500	14,904,000
December to March	104	4	4,500	1,872,000
Total Annual Flow				**16,776,000 L**

4.3 Septage

In addition to the Campground and Cabin waste there are several sites throughout the Park that truck septage to the lagoon. The following sites send septage to the lagoon; flows are detailed in **Table 4**:

- The East Gate consists of 2 permanent residences, which have been empty for the past two years, and 13 seasonal cabins for Park Staff. All facilities are connected to a septic field with septage being pumped out once a year and trucked to lagoon.
- The Beach Safety Facility, Pavilion 1 and 2 are all located on the West Beach. A gravity sewer system connects all three buildings to the West Beach WWTP. Septage is pumped out only every second year.
- The Lift Station located at 3rd and 3rd street has the solids pumped out once a year and trucked to the lagoon.
- There are also several outhouses located around the West Beach that have the solids pumped out once a year and trucked to the lagoon.

Table 4: Current Estimated Flow – Grand Beach Septage

Septage Locations	Amount of Septage Hauled per year (L)
East Gate Residences and Staff Cabins	40,000
Beach Safety Facility, Pavilion 1 and 2[1]	25,000
Lift Station	5,000
Outhouses	5,000
Total Annual Septage	**75,000**

Notes: 1. Parks stated that 50,000L is pumped out every second year. Flow is estimated on half the flow being pumped out each year.

All of the septage locations are pumped out in the fall, once the campground is closed for the year. No other known septage is hauled to the lagoon.

Total annual flow to the lagoon is the sum of the summer flow from the campground and the year round flow from the cabins, septage and infiltration. Infiltration has been estimated to be 100 L/d throughout the year based on a review of the lift station pump logs. Current annual flows are summarized in **Table 5**.

Table 5: Current Estimated Flow – Total Annual Flows

Unit	Total Flow (L)
Campground	16,045,000
Cabins	16,776,000
Septage	75,000
Infiltration	36,500
Total Annual Flow	**32,932,500**

5. Project Future Flows

5.1 Campground

Future projected flows will form the basis for the design of the upgraded lagoon. The Grand Beach operating staff has specified that in the future, at most 50 existing campsites may be converted to electrical & water service sites. No other water or wastewater expansions or upgrades are currently planned for the next twenty years. Projected future wastewater flows are outlined in **Table 6**.

Table 6: Projected Future Flow – Grand Beach Campground

Flow Components	Number of Units	Daily Volume per unit (L)	Total Flow (L/day)
Conversion of 50 existing sites to Electrical & Water Sites	140 people	70	9,800
Basic and Electrical Camp Sites	1,002 people[2]	70	70,168
Laundry Facility[3]	8 machines	1330	10,640
Hiking Trail Washrooms	5	33[4]	165
Shower Facility[5]	20 stalls	Showerhead @ 7.5 L/min	51,408
Campground Office/ person[1]	22	49	1,078
Average Day Flow			**143,259**
Total Flow (16 weeks operation)			**16,045,000 L**

Notes:

1. *Campsite Flows – The numbers used in **Table 6** for daily wastewater flows per campground office worker are derived from the Manitoba Minimum Expected Volume of Sewage Per Day Typical Wastewater Flow Rates, July 2010, published by Manitoba Conservation (http://www.gov.mb.ca/conservation/envprograms/wastewater/pdf/mb_min_sewage_vol_july_2010%20xls.pdf)*
2. *Calculations are based on a full campground with 3.5 people per site. This number includes 408 campsites minus 50 site which are converted to water and electrical serviced campsites for a total of 358 campsites. It has been assumed that the campground is 80% occupied throughout the 16 weeks of operation*
3. *Laundry Facility – There are eight washing machines operating at the central Concession Facility. It is assumed that when the campground is full, each machine is capable of running 7 loads/day at 190 litres per load.*
4. *Assuming 1000L per month is pumped from each of the five washrooms, these washrooms are expected to get limited use in general.*
5. *Shower Facility – A low flow shower head on the market today ranges from 6.0L/min – 9.4 L/min. The current 16 shower facility is assumed to have installed shower heads of 7.5 L/min. Calculations assumed that 75% of campsite occupant showered once a day for 8 minutes.*

5.2 Cabins

There is no expected expansion of the Cabin area at the West Beach; therefore, the annual flow is projected to remain consistent at 16,776,000 L.

5.3 Septage

There is no expected increase in the volume of septage hauled to the lagoon. Therefore, the annual flow is projected to remain consistent at 75,000 L.

5.4 West Beach Wastewater Treatment Plant

A detailed assessment of the West Beach WWTP was completed in December 2011. The package WWTP was constructed in 1979 with a design treatment capacity of 340 m^3/d of domestic wastewater. Wastewater flow records from 2007 to 2010 indicated that the plant is treating an average of 16,700,000L per year or 115,000 L/d from mid-May to mid-October. **Table 7** summarizes the average annual flows and average daily flows over the 4 year period.

Table 7: West Beach WWTP Historical Wastewater Flow 2007-2010

Year	Total Annual Flow (L)	Average Daily Flow (L/d)	Minimum Daily Flow (Ld)	Maximum Daily Flow (L/d)
2007	16,809,000	126,000z	10,000	316,000
2008	19,503,000	129,000	9,000	288,000
2009	16,052,000	106,000	21,000	247,000
2010	14,454,000	98,000	18,000	206,000
Average	**16,700,000**	**115,000**	**14,000**	**264,000**

Total annual flow to the lagoon is the sum of the summer flow from the campground, the year round flow from the Cabins, septage, the West Beach WWTP and Infiltration. Infiltration valves are estimated to be consistent at 100 L/d. Annual flows are summarized in **Table 8**.

Table 8: Projected Future Flow – Total Annual Flows

Unit	Total Flow (L)
Campground	16,045,000
Cabins	16,776,000
Septage	75,000
West Beach WWTP	16,700,000
Infiltration	36,500
Total Annual Flow	**49,632,500**

6. Design Criteria

The wastewater lagoon must be sized to treat the projected organic and hydraulic wastewater loads. Organic loading is estimated based on BOD load. As this is a seasonal location, the maximum population is only present during the two busiest months of the year, July and August. To account for the seasonal fluctuations in BOD load throughout the year, we recommend basing the design on the average BOD load for the busiest six months of the year. Manitoba Conservation guidelines limit the amount of organic loading to 56 kg BOD/ha/day assuming an influent BOD loading rate of 0.076 kg BOD/person/day. The key to a facultative lagoon's operation is oxygen production by photosynthetic algae and surface reaeration. The surface area of the primary cell is where the wastewater treatment occurs. Oxygen at the surface is utilized by the aerobic bacteria in stabilizing the organic material in the upper layer of waste. The bottom layer of the primary cell is considered storage, where anaerobic fermentation occurs.

The secondary cell is sized based on the hydraulic storage required to store the remaining waste throughout 365 days. Treated waste is stored in half of the primary cell and the entire secondary cell until the annual discharge period.

Table 9 illustrates the population distribution and BOD load throughout the year.

Table 9: Monthly BOD Load

Month	Campground[1]		Cabins[2]		Septage[3]		WWTP[4]		Total
	Population	BOD (kg/d)	Population	BOD (kg/d)	(L)	BOD (kg/d)	(L)	BOD (kg/d)	BOD (kg/d)
Jan	0	0	361.9	27.14	0		0		27.14
Feb	0	0	361.9	27.14	0		0		27.14
March	0	0	361.9	27.14	0		0		27.14
April	0	0	1447.6	108.57	0		0		108.57
May	456.96	34.27	1447.6	108.57	0		1,558,620	16.70	178.82
June	1142.4	85.68	1447.6	108.57	0		3,339,900	35.78	251.45
July	1142.4	85.68	1447.6	108.57	0		3,451,230	36.98	252.65
August	1142.4	85.68	1447.6	108.57	0		3,451,230	36.98	252.65
Sept	456.96	34.27	1447.6	108.57	75,000	17.50	3,339,900	35.78	215.40
Oct	0	0	1447.6	108.57	0		1,558,620	16.70	125.27
Nov	0	0	1447.6	108.57	0		0		108.57
Dec	0	0	361.9	27.14	0		0		27.14
Average Daily BOD load from May to October (kg/d)									**195.57**

Notes:

1 *Campsite Population – Based on an 80% occupied campground with 3.5 people per site from mid-May to mid-September.*

2 *Cabin Population – Based 3.5 people per Cabin and 408 cabins from April to November. Off season population is based on a ¼ of the cabins being open with 3.5 people per cabin from December to March.*

3 *Septage –.Septage is only hauled once a year in the fall, assuming that the total septage volume is hauled consistently throughout the 30 days in September.*

4 *WWTP flows are based on data from the plant from 2007-2010 and average BOD concentration of 150 mg/L.*

The surface area required for treatment in the primary cell is calculated in **Table 10.**

Table 10: Organic Loading

Surface Area Calculations	Units	
Average Daily BOD load from April to September	195.57	kg/day
Loading (Provincial Requirement)	56	kg BOD/ha/day
Required surface area (Average Daily BOD / Loading)	3.5	ha

From these calculations it is evident that the primary cell will require a minimum surface area of 3.5 ha. Using a liquid depth of 1.5 m, freeboard of 1 m, and a dike slope of 4:1 the lagoon cells are sized using the following equation:

$$V = (d/6) \times (A_t + A_b + 4\ A_m)$$

Where:

V = Volume
d = depth of the lagoon
A_t = Area of the top of the lagoon, $A_t = L \times W$
A_b = Area of the bottom of the lagoon, $A_b = (L - 2 \times ES \times d)\ (W - 2 \times SS \times d)$
A_m = Area of the midsection of the lagoon, $A_m = (L - ES \times d)(W - SS \times d)$
SS = slope of the sides of the lagoon
ES = slope of the ends of the lagoon
L = Length of the top of the lagoon
W = Width of the top of the lagoon

Using this equation the primary cell size is:

Table 11: Primary Cell Size

Primary Cell Size	Units
Volume (entire cell)	49,400 m^3
Storage Volume (bottom 0.75 m of cell)	24,000 m^3
Surface area (not including 1 m freeboard)	35,150 m^2

The footprint of the primary cell within the fenced area is approximately 53,450 m^2. The drainage ditch along the exterior of the fence extends out another 10 to 15 metres.

The secondary cell is used for hydraulic storage and reduction of ammonia. The existing CEC licence for this facility allows for discharge only between September 15th and November 1st. As only one discharge per year is permitted, 365 day storage is required. The total storage requirement is equal to the total amount of waste produced per year from the campground, cabins and WWTP, 49,633 m^3 (**Table 8**). The bottom 0.75 m of depth in the primary cell is considered storage, as it is too deep to provide the surface aeration required for treatment. The volume required for the secondary cell is calculated by the total storage required minus the storage volume in the bottom half of the primary cell. In addition to this volume the secondary cell must maintain a minimum depth of 300 mm on the bottom of the lagoon to prevent freezing of the pipes after discharge. Therefore, additional storage is required to maintain a minimum water level in the cell at all times.

Since the secondary cell is being constructed out of the existing operating cells and the existing incomplete cell, the elevation will be maintained at 1.5 m depth. The total liquid depth of the secondary

cell is 1.5 m with an additional 1 m freeboard. The bottom 0.3 m of the cells will contain the sludge blanket; this volume is in addition to the storage volume required. Based on one discharge per year the volume required for the secondary cell is summarized in **Table 12**:

Table 12 Secondary Cell Size

Secondary Cell Size	Units
Sludge Blanket Volume (volume at the pipes):	5,400 m^3
Total Storage volume required	25,200 m^3
Total Volume of the Secondary Cell	30,600 m^3

The secondary cell has a footprint of 38,260 m^2 which includes the area within the fence. The ditch that surrounds the fence varies significantly in width; however, the furthest the ditch extends beyond the fence is approximately 15 metres.

Preliminary lagoon layout drawings are included in **Appendix D**.

7. Phosphorus Removal

In 2011, Manitoba Conservation (Parks) requested that a new system be evaluated based on the potential for it to be installed at the Grand Beach lagoon. As phosphorus removal is rapidly becoming a requirement of operating licences for lagoons that discharge into Lake Winnipeg, Grand Beach was considered a potential candidate for a new phosphorus removal technology. The current standard method of reducing phosphorus levels in lagoons is through alum dosing of the secondary cell prior to discharge. The Phosphex™ system, by Agassiz Enviro-Systems Inc., is part of a new movement away from chemical dosing for phosphorus removal.

7.1 Phosphex™ System

Phosphex™ Filter Media

Phosphex™ is a new system that uses a waste by-product from steel production, Basic Oxygen Furnace (BOF) slag or other slag material, to remove phosphorus and arsenic from water. Treatment is through the flow of wastewater through a permeable bed or chamber containing the slag material. The slag material promotes the removal of water-born contaminants and pathogens to very low levels. The Phosphex™ system requires little to no electricity and recycles the waste material created by the steel industry. The supplier states that the Phosphex™ system is capable of removing 98% or more of dissolved phosphorus, the destruction of water borne pathogens, bacteria, and viruses, and is capable of removing many dissolved contaminants including arsenic, mercury, and uranium. The Phosphex™ system boasts the ability to decrease phosphorus levels to less than 0.15 mg/L.

The pH of wastewater discharged from the Phosphex™ system can range from 8-11, which can be a problem for the receiving wetland. Reducing the pH of the effluent can be completed by a carbon-dioxide injection system or a peat filter. Peat filters are the most cost effective system if there is a source of peat near the lagoon site. However, pH control from peat filters is notoriously uncontrollable. There is the potential for this filter to need regular replacement. As a result a CO_2 injection system is recommended. The system is relatively simple and provides reliable control of pH from the effluent.

The media for the Phosphex™ system requires a constant flow of water, so for systems that are continual discharge, this is not an issue. For intermittent flow, such as a seasonal campground, a float and pump configuration is required to ensure the media remains saturated. This system is ideal for a continuous discharge lagoon; however, these are extremely uncommon in Manitoba. A continuous discharge lagoon would be extremely difficult to install at Grand Beach Provincial Park due to regulatory and public concerns. A continuous discharge lagoon must also meet the same regulations set for a mechanical wastewater treatment plant, including an ammonia limit. To accommodate for the lack of continuous discharge at the proposed Grand Beach Lagoon, Agassiz has suggested doing a batch discharge from the lagoon. Essentially, water will continuously flow from the secondary cell into the Phosphex™ system, and from there, clean water flows into an additional small storage cell where it will stored for 30 days to allow for detailed testing of the water prior to monthly discharges. Agassiz feels that this batch system will alleviate any concerns about the water quality that is being discharged.

The Phosphex™ system is a very new system, with only one small-scale trail installation in Miami, Manitoba. The pilot test was constructed in late May 2009; the system was operated throughout the spring and fall of the 2010 season. No full scale testing has yet been completed.

For the Grand Beach lagoon system Agassiz has proposed to use one of the existing operating cells retrofitted to form part of the Phosphex™ system. This would require that the remaining operating cell and incomplete cell form the entire secondary cell and likely the floor elevation would need to be lowered to provide sufficient storage space. A preliminary drawing of how the system could function is provided in **Figure 1**.

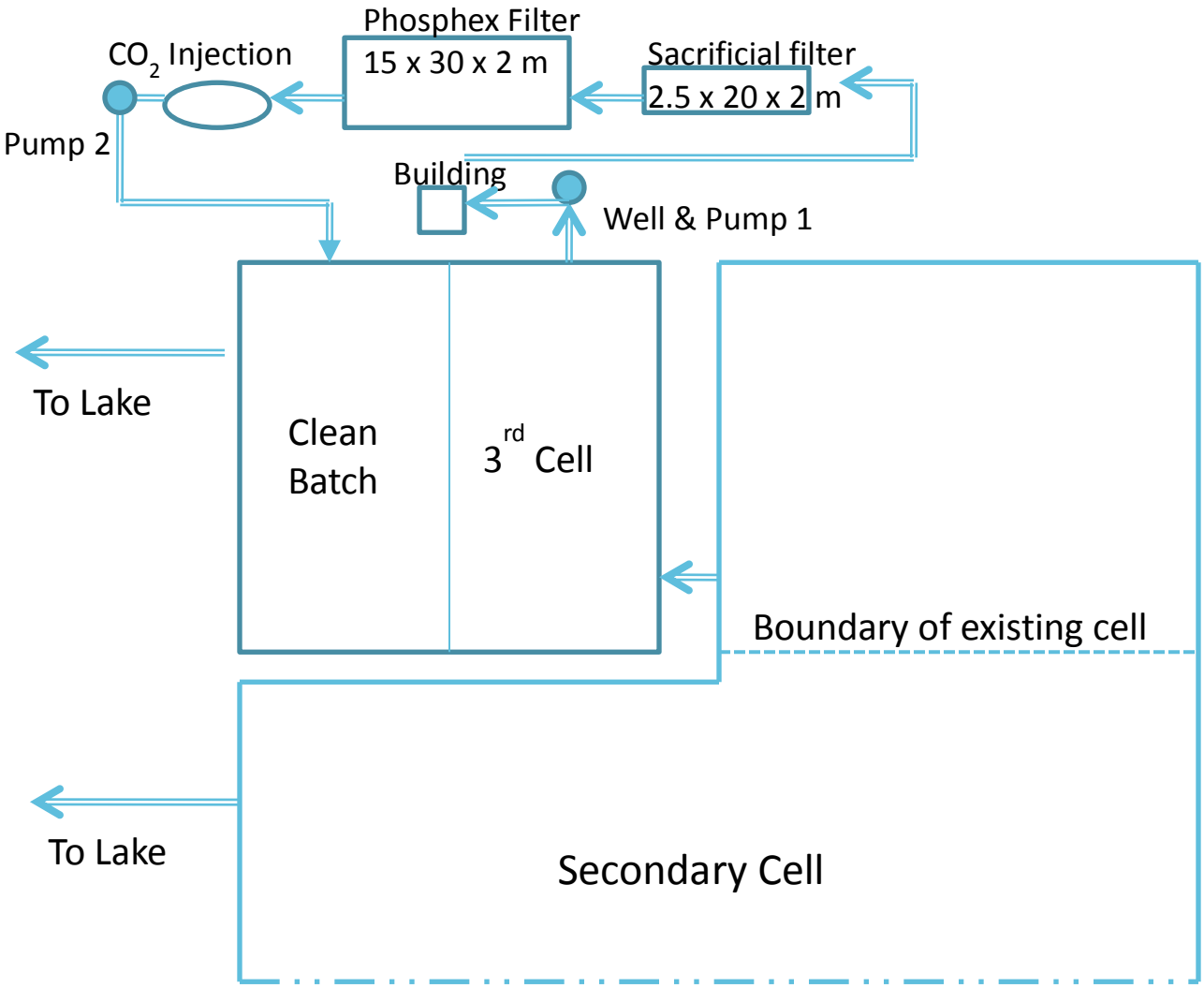


Figure 1: Proposed Phosphex™ Layout

The 3rd cell in **Figure 1** provides a buffer for the Phosphex™ filter while the primary is being transferred to the secondary. During this transfer process the liquid coming into the secondary cell will have a very high suspended solids content which can enter the Phosphex™ filter and clog it up. With a 3rd cell the valve between the 3rd cell and secondary cell can be closed and there is ample liquid in the 3rd cell for the Phosphex™ filter to continue to operate until the solids settle in the secondary cell. The cell is not a requirement but is recommended by the supplier for improved operation.

The sacrificial filter uses the same media as the main filter and is also used to protect the larger main filter from high levels of BOD. This filter will remove approximately 60% of the phosphorus and the majority of the coliforms in the effluent prior to entering the main filter. As a result this filter will require new media every year or two. The supplier estimates that approximately 50% of this media can be reconditioned through drying and crushing of old media to expose reactive surfaces. Reconditioning the media will reduce the cost of regular media replacement but increases time required by the operators. The use of a sacrificial filter will significantly extend the life of the larger and more expensive main filter.

The small building is used to house a small mechanical filter, which essentially does the same job as the sacrificial filter. With the use of the sacrificial filter, this mechanical filter may not be required. Excluding this system in the project would reduce the overall maintenance required at the lagoon by reducing the mechanical systems on site. The requirement for the mechanical filter is based on effluent quality, and so is uncertain until the lagoons are constructed. It is possible it will be originally installed and then removed if not required.

A bypass discharge would also be provided to allow for discharge directly from the secondary cell in the situation where the Phosphex™ system is not operating as designed.

The Phosphex™ filter life expectancy is ten years with relatively low O&M costs. Maintenance for small systems includes annual opening of the cover to inspect for crusts on the media, analysing the water for phosphorus levels and pH. Once phosphorus is no longer being removed effectively, the media can be replaced by disposal through a licensed non-hazardous waste handler and replaced with new media. The supplier estimates that approximately 75% of media can be reconditioned through drying and crushing of old media to expose reactive surfaces.

With a monthly batch system, the water will need to be sampled monthly prior to discharge. There is also some level of maintenance associated with the two small pumps, the CO_2 injection system and the sand or cloth filter that are required for the system. When compared to a mechanical treatment plant, this system has relatively low O&M costs, but compared to a standard facultative lagoon, the amount of operator attention required is significant.

7.2 Chemical Dosing

Chemical precipitation is a commonly used method of removing phosphorus from wastewater by the addition of a coagulant or the salts of multivalent metal ions such as calcium, aluminum and iron. Alum or hydrated aluminum is most commonly used to precipitate phosphates from wastewater lagoons. The dosage rate required is a function of the required phosphorus removal, as the concentration of phosphorus decreases the efficiency of the metal salt decreases. Dosage is generally determined on the basis of bench-scale testing.

The dosing process involves the chemical, commonly alum for lagoons, being added into the secondary cell by fairly basic means. The Birds Hill and Stephenfield Provincial Park lagoons both used alum dosing in the fall of 2010 to lower phosphorus levels prior to discharge. In both instances the alum was sprayed from a fire tanker with fire pump, hose and nozzle, onto the secondary cell water surface. One person drove the tractor pulling the fire tanker, one person controlled the pump, one person assisted with the fire hose, and one person directed the alum spray; a total of four operators were required. Once all of the alum was discharged onto the water surface, a small boat and motor with two people was driven around the secondary cell to mix the alum throughout the cell.

Alternatively, chemicals could be added directly through use of a small chemical pump to inject the chemicals into the propwash located at the stern of the boat, providing an even distribution throughout the cell.

Personal protective equipment is required for all operators during alum dosing includes Tyvek suits, facemasks, goggles and gloves. A first aid kit, complete with fresh water should always be nearby. Once all spraying is complete, all pumps, tanks, boat and motor and PPE need to be flushed with clean water, based on Parks procedures. Discharge of the lagoon can occur once the correct phosphorus results of <1mg/L are shown on the laboratory samples. This usually occurs 24 to 48 hours after alum dosing.

Chemical addition for the precipitation of phosphorous can result in increased sludge volume, specifically sludge with poor settling and dewatering characteristics. Precipitation with metals or salts can also depress the pH. If nitrification is required, additional alkalinity will be consumed and the pH will drop further. Sludge volumes have been known to increase by up to 40% through chemical precipitation of phosphorus. Along with larger sludge volumes comes the additional cost of sludge removal and disposal.

7.3 Cost Comparison

The cost comparison was prepared in 2011 and costs are for comparison purposes only. Costs included in this section have not been increased to 2015 dollars.

7.3.1 Option 1 - Phosphex™ System

The Phosphex™ system is expected to have a capital cost approximately $580,000. This budget is an installed price including material, labour and the following:

- Insulated 12'x12' accessories building
- Manitoba Hydro connection to a 200 Amp service
- Phosphex™ sacrificial filter, main filter, all pumps and associated plumbing
- CO_2 pH neutralizing system
- Two years operation and supervision not including sampling costs
- Training
- Two year warranty on mechanical components
- Five year warranty on main Phosphex™ filter

The only regular maintenance will be from the small pumps, mechanical filter, and regular water sampling. It is estimated that the cost for electricity for the pumps and the CO_2 system, will be approximately $800/annually. There is also the cost of media replacement every two years for the sacrificial filter and every ten years for the main filter. For a cost comparison the cost of replacing the sacrificial filter every two years has been estimated as an annual cost. **Table 13** details the estimated annual O&M costs for the Phosphex™ system. These costs include general maintenance of the lagoon including grass mowing, access road maintenance and sampling, in addition to the costs associated with the Phosphex™ system.

Table 13: Annual Estimated O&M Costs for the Phosphex™ System

#	Item	Unit	Quantity	Unit Price	Total Amount
1	Grass Mowing and General Maintenance	ls	1	$1,000.00	$1,000
2	Monthly Sample Collection and Analysis	ls	1	$2,000.00	$2,000
3	Lagoon Access Road Maintenance	ls	1	$1,000.00	$1,000
4	Valves and Maintenance	ls	1	$500.00	$500
5	Power	ls	1	$800.00	$800
6	Pumps & Mechanical Filter Maintenance	ls	1	$1,000.00	$1,000
7	Sacrificial Media Replacement (replaced every 2 yr)	ls	1	$1,250.00	$1,250
8	$C0_2$ for pH control	ls	1	$3,000.00	$3,000
9	Misc. Electrical/ Mechanical	ls	1	$1,000.00	$1,000
	Annual Operations & Maintenance Cost				**$11,550**

Note: 1 Cost for the sacrificial filter is estimated at $2500 every two years.

7.3.2 Option 1 – Alum Dosing

Alum dosing is likely the simplest method of reducing phosphorous levels to below 1 mg/L. The capital cost estimate includes the cost of a boat and motor, as a boat provides the most even distribution of alum with little additional cost or labour.

There are two common methods for determining the appropriate alum dosage. One method involves taking samples and determining the existing phosphorus concentration in the secondary cell and matching the reading with those on a precalculated chart. This chart lists the associated alum dosage which would be applied to the lagoon wastewater at the level of phosphorus concentration obtained in the sample. The other, more common method is for the operator to use past experiences of applying alum. Should conditions change, phosphorus levels increase or decrease, the operator will either add more or less alum to ensure continued compliance with phosphorus effluent guidelines. Alum dose rates can vary from 50 mg/L to 175 mg/L. Dosing greater than 175 mg/L has a less significant effect on phosphorus removal. After comparing dose rates used at Birds Hill and Stephenfield it was determined that a dose rate of 100 mg/L will be a good basis for cost comparisons.

The volume of the secondary cell is 30,396 m^3 or 30,396,000 L. At a dose rate of 100 mg/L of 3,039,600,000 mg or 3040 kg of alum is required. Both Stephenfield and Bird's Hill Park have their alum delivered by Border Chemicals and pay $275.00 per tonne of alum at 48.7% concentration, plus a delivery fee of $384.00 to the Grand Beach lagoon site. Calculations for cost determination of alum for the Grand Beach lagoon follow:

Specific Gravity of Alum: 1.335

3040 kg alum required

Alum is delivered at 48.7% concentration

3040 / 0.487 = 6,236 kg total

6,236 kg = 6.2 tonnes rounded up to 7 tonnes total

7 tonnes * $275.00 = $1,925

Table 14 details the annual O&M costs expected for lagoon operation, with alum dosing. These costs include general maintenance of the lagoon including grass mowing, access road maintenance and sampling, in addition to the costs associated with the alum dosing.

Table 14: Annual Estimated O&M Costs for Alum Dosing

#	Item	Unit	Quantity	Unit Price	Total Amount
1	Grass Mowing and General Maintenance	ls	1	$1,000.00	$1,000
2	Sample Collection and Analysis	ls	1	$500.00	$500
3	Lagoon Access Road Maintenance	ls	1	$1,000.00	$1,000
4	Valves and Maintenance	ls	1	$500.00	$500
5	Alum	tonnes	7	$275.00	$1,925
6	Alum Delivery	ls	1	$384.00	$384
Annual Operations & Maintenance Cost					**$5,309**

In order to dose the alum in the secondary cell a capital cost would be required to purchase a 16 ft aluminum or fibreglass boat. $10,000 has been allotted for the boat and motor purchase in the capital cost of the project.

Also, as alum dosing has been known to increase sludge volumes by 40%, we have allotted an amount for desludging the lagoon ever 10 years instead of every 20 years used for a traditional lagoon.

7.3.3 Cost Summary

The following cost estimates are preliminary estimates for concept comparison purposes only; estimates were prepared in 2010 dollars. **Table 15** summarizes the capital cost for each of the four options. Capital costs do not include the initial construction cost of the lagoon. Both options are based on the same size lagoon. The Phosphex™ supplier feels that if his system of batch discharges were utilized the lagoon size could be significantly decreased and would offset the capital cost of the filter installation. However, as the Phosphex™ system would be installed as an experimental system, the lagoon must be sized to operate effectively in the event the Phosphex™ system is unable to perform as designed.

Table 15: Summary of Capital Costs for Phosphorus Removal Options

#	Item	Option 1 - Phosphex™	Option 2 - Alum Dosing
1	Capital Cost[1]	$ 580,000.00	$ 10,000.00
2	Annual Operation & Maintenance	$ 158,100.00	$ 73,300.00
3	Lagoon Desludging	$ 22,800.00 [3]	$ 56,600.00 [2]
4	Media Replacement	$ 70,750.00 [4]	-
	Total 20 Year Life Cycle Cost	**$ 840,000.00**	**$ 140,000.00**

Notes:

1. *Capital costs do not include the overall cost of the lagoon construction, only the additional cost of each option.*
2. *With Alum Dosing desludging will be completed in year 10 & year 20*
   a. *Year 10 - $50,000 @ 0.676 = $33,800 in present day dollars*
   b. *Year 20 $50,000 @ 0.456 = $22,800 in present day dollars*
3. *No Alum Dosing desludging will be completed in year 20*
   a. *Year 20 - $50,000 @ 0.456 = $22,800 in present day dollars*
4. *Phosphex™ Media Replacement in year 10 & year 20*
   a. *Year 10 - $62,500 @ 0.676 = $42,250 in present day dollars*
   b. *Year 20 - $62,500 @ 0.456 = $28,500 in present day dollars*
5. *Discount rate of 4%*
6. *Cost estimate intended for comparison purposes only*

7.4 Recommendations

The Phosphex™ system has potential as an efficient system for phosphorus removal. Testing has shown the system is capable of lowering phosphorus levels to as low as 0.1 mg/L. However, the additional capital cost to construct the system, cost of the carbon dioxide system for pH control, and regular maintenance on the pumps and sand filter make this system significantly more expensive than simply dosing the effluent with alum to achieve a similar result. However, were phosphorus limits to be lowered to less than 1 mg/L, as seen in other jurisdictions; a system like the Phosphex™ system may be required, as chemical dosing is not likely to lower the phosphorus levels consistently below 1 mg/L.

At this point the Phosphex™ system is not recommended for the Grand Beach lagoon due to the requirement for discharging during the summer months into a highly recreational area and the addition maintenance and cost associated with the system.

8. Construction Considerations

8.1 Cell Location

The existing wastewater lagoon located in Grand Beach Provincial Park consists of a primary and secondary cell; both cells are approximately 73 x 80 m in size. A third cell was also constructed, but never completed, and is approximately 110 x 110 m in size. Measurements were taken at approximately the water surface along the dike. The operating depth of all the lagoon cells is 1.5 m.

Section 6 summarized the lagoon size calculation required to treat the wastewater produced from the campground, the cabin sites and the West Beach WWTP. The existing lagoon cells are too small to provide sufficient surface area required for the organic treatment level necessary to meet Provincial guidelines. However, it is desirable to make use of the existing infrastructure at the lagoon site. AECOM recommends that the existing two operating cells remain in operation throughout the construction of the new lagoon cells. A new primary cell will be constructed to the east of the existing lagoon. The Trans Canada Trail, located approximately 60 m to the east of the existing lagoon, will be left intact, with the new primary cell being situated approximately 75 m east of the trail. Interconnection pipes will be run under the Trans Canada Trail and a significant tree buffer will be left intact between the trail and lagoons cells. Thus the existing trail and MTS fibre optic cable that runs under the trail will not be affected by the construction of the new lagoon cell.

The third existing (incomplete) cell will be converted into a portion of the secondary cell, maintaining the current 1.5 m operating depth. Upon completion of the new primary cell, all wastewater flows will be redirected to the new primary cell and the existing operating cells will be decommissioned and reconstructed to form part of the secondary cell. The interior dike between the two operating cells will be removed, to form one larger cell. Drawings C-1002 and C-1003, **Appendix D**, show the layout for the lagoon cells.

When fully constructed, the existing discharge ditch on the north side of the lagoon site will be used for the annual discharge of the lagoon. Effluent would flow through this ditch to the Grand Beach Wetland area and from there into Lake Winnipeg.

8.2 Geotechnical Investigations

The geotechnical review of the existing lagoon site, final report completed in March 2011, found the soil to be mainly sandy. A thin layer of clay was located beneath the topsoil; this clay may have been a part of the original clay liner in the existing cells. The native sand was found to be generally silty with some amount of gravel and traces of clay.

The first phase of the study was completed in November 2010 and reviewed preliminary information around the existing lagoon cells. Groundwater and sloughing was observed in all the test holes to some degree. Ground water recordings were taken on August 5, 2010, immediately after drilling, and on August 29, 2010. Ground water levels were higher on August 29th, likely due to heavy rains in August, levels varied from 0.4 to 0.55 m below the ground surface.

A further geotechnical review was conducted in January 2011, in the location of the new primary cell. Fifteen test pits were dug in the footprint of the new primary cell. Clay was found in all but three pits dug, but in insufficient quantities for a clay liner. Two piezometers were installed to monitor ground water levels; conditions on January 27, 2011 were dry. On February 18, 2011 ground water levels were 3.5 m

and 3.05 m below ground level. The complete geotechnical review and soil logs can be found in **Appendix A**.

It is recommended that ground water levels should be measured again from the existing piezometers that were installed in 2011. This will provide additional confirmation of ground water levels in the lagoon site prior to construction. This will be completed as part of the detailed design phase of the project.

8.3 Lagoon Constriction Components

The geotechnical review of the site recommended installation of a geosynthetic liner on a 150 mm thick layer of compacted bedding sand. The bedding sand layer will be placed over 300 mm thick granular dewatering and degassing system. Clean crushed limestone of 50 mm maximum size will be used for the drainage layer. Geotextile will be used at the bottom and top of the drainage layer to provide separation and filtration. A protective sand layer at least 300 mm thick, as required by Manitoba Conservation, will be installed above the geomembrane. The exterior and interior dikes will be constructed with a 4:1 slope and rip-rap will be placed on the dike slopes to protect against erosion. Drawing C-1004, in **Appendix D**, illustrates a typical cross section of the lagoon liner and a typical cross section of the dewatering and degassing system.

A dewatering and degassing system will be installed under the lagoon liner to allow for the release of ground water seepage and gas that might accumulate under the liner.

Perimeter ditching will be incorporated around the lagoon to collect and direct surface water away from the lagoon dikes in order to prevent the stability of the dikes from being reduced by excess moisture.

A chain link fence will be located at the toe of the dike on both the primary cell and surrounding the entire secondary cell. These fences will provide security for each lagoon separately, while not interfering with the Trans Canada Trail that goes between the two cells.

8.4 Interconnection Pipes

The ground elevation of the primary cell is higher than that of the secondary cell allowing waste to be transferred between cells by gravity. However, the elevation difference is not significant enough to allow the pipe to be buried below the frost line at the primary cell. Due to this, a siphon style interconnection pipe will be installed between the two cells to allow waste to flow from the primary to secondary cell by gravity and prevent the pipes from freezing in the winter.

8.5 Effluent Ditch

Treated effluent from the lagoon will be discharged once a year through an existing effluent ditch which has an alignment running west from the lagoon to the Grand Beach Wetland. The effluent will leave the lagoon through the discharge ditch on the north side of the lagoon site; flow through the Grand Beach Wetland and from there flow into Lake Winnipeg.

8.6 Lift Station

The existing lift station is located north of the main Park Road near the campground. The existing lift station will require a detailed assessment to determine the condition of the lift station and the hydraulics

to pump waste to the new lagoon site. As the new forcemain from the lift station to the new primary cell will actually be shorter than the existing forcemain, it is not expected that the lift station will require significant upgrade. If the current lift station has adequate capacity to pump waste to the current lagoon it is expected to have capacity to pump to the new primary cell. However, a detailed assessment of the lift station will be required to confirm this operation.

8.7 New Access Road

An access road will be created to access the new primary cell. The road will enter the site directly off the main Park Road and allow access for the truck dump area. The new road travel surface will be 7.0 m wide (including shoulders) with 300 mm of 50 mm crushed rock. The road will be surfaced with 150 mm of 20 mm down crushed rock. Drainage ditches will be provided to maintain positive drainage away from the roadway.

8.8 Truck Dump

A truck dump will be located at the lagoon. It will consist of a 30 m x 16 m gravel pad and a 3.0 m wide concrete swale, which will direct the sewage into the lagoons primary cell. The lagoon fence will transition from the toe of slope to the top of slope in this area. A gate will be constructed with steel bars for the lower half which will allow sewage to pass through permitting dumping without requiring the gate to be opened. The truck dump will accept holding tank waste and septage from holding tanks and ejector systems throughout the Park.

9. Decommissioning Plan

Decommissioning of the operating lagoon cells will be required upon completion of construction of the new primary cell. Decommissioning will involve dewatering the lagoon and disposing of the remaining sludge remaining in the cell. Sewage sludge may be a solid, semi-solid or liquid residue that settles to the bottom of the wastewater lagoon during treatment. It consists of approximately 90-99% water and an accumulation of settled solids. Sludge also contains significant amounts of nitrogen and phosphorus and to a lesser degree some quantities of heavy metals, such as zinc and copper.

There are essentially two options for disposing of the remaining sludge in the lagoon; landfill or land application. Land application involves land applying the dewatered sludge to agricultural land for the purposed of providing nutrients to the soil.

9.1 Land Application of Sludge

The nitrogen and phosphorus in the sludge can be very useful in land application by improving the physical and chemical properties of the soils. But the same constituents in sludge that may benefit soil and crops can also produce detrimental effects when applied in excessive rates or under improper conditions.

Land application involves the dredging or pumping of all the sludge from the lagoon. The sludge must then be hauled to local agricultural land for application. This process required an additional permit at the cost of $5,000.

In addition to the permit there are restrictions placed on the land in regards to crops planted in the following year.

9.2 Landfilling Sludge

To dispose of wastewater sludge in a municipal landfill, it is required the landfill be rated at Class 1. The nearest landfill to Grand Beach Provincial Park that meets these requirements is located in St Clement, Manitoba.

The St. Clement Landfill is the nearest landfill to Grand Beach and is willing to accept the Grand Beach sludge as long as it is dewatered and has a slump factor. A slump factor is commonly used for measuring the water content in a substance. A cone shaped mould is placed on a sample of the sludge and tamped down. The mould is then carefully lifted vertically upwards, so as not to disturb the material. This subsidence of the material, after the removal of the cone, is termed as slump, and is measured to the nearest 5 mm. If the mixture collapses then the material is found to be too wet.

Dewatering the sludge will be completed with Geo Bags. Geo Bags are made of geo-textile fabric which is woven from heavy plastic threads. A common Geo-Bag size is 13 m in diameter and 60 m long. Geo bags provided by Assiniboine Injections Ltd. can hold approximately 700 m^3 of material when it is full. The fabric has small openings of 50 to 100 microns between the threads. The lagoon sludge can be directly pumped into the bag, which retains the solids and allows water to pass through the small openings. Over approximately a six month period, which is weather dependant, the retained material dewaters and can be hauled in dump trucks to a landfill.

9.3 Desludging of Existing Cells

Based on previous experiences with Geobags and dewatering of lagoon sludge, Parks would like to proceed with transferring all the wastewater from the existing operating cells into the newly upgraded secondary cell. The wastewater in the existing cells will be mixed into a slurry and pumped over the interconnecting berms into the completed secondary cell. It is recommended that the secondary cell then be partially filled with water to completely cover all the sludge and wastewater transferred into the cell. This procedure will assist in limiting odours produced from the wastewater and sludge slurry.

9.4 Upgrading of Operating Lagoon Cells

Wastewater generated by the Park is currently directed into a two cell lagoon located south west of the campground. The operating lagoon facility occupies an area of approximately 12,000 m^2. Once the new primary cell is operational, the existing lagoon cells will be cleaned out and upgraded for use as secondary cells. The operating cells will be cleaned out, the interior dike will be removed, and the two cells will be converted into one larger cell forming a portion of the new secondary cell.

In summary, the lagoon upgrades will consist of the following steps:

- Mixing all wastewater and sludge present in the operating cells into a slurry. Pumping the completely mixed slurry over the interconnecting berms into the completed secondary cell. Additional water will be pumped into the secondary cell to cover the wastewater and sludge slurry.
- Remove the internal dikes between the two existing operating cells. Contaminated soil from the interior berms and bottom of cells will be removed for treatment and disposal off site.
- Remove and/ or recover all infrastructure works such as valves, pipes, etc. Waste materials, such as scrap steel, wood, etc. should be disposed of at the nearest landfill.
- The lagoon site should be graded and sloped in accordance with the new cell design.
- Install new valves and interconnection pipes between secondary cells.
- Line lagoon cells with synthetic liners and put into operation.

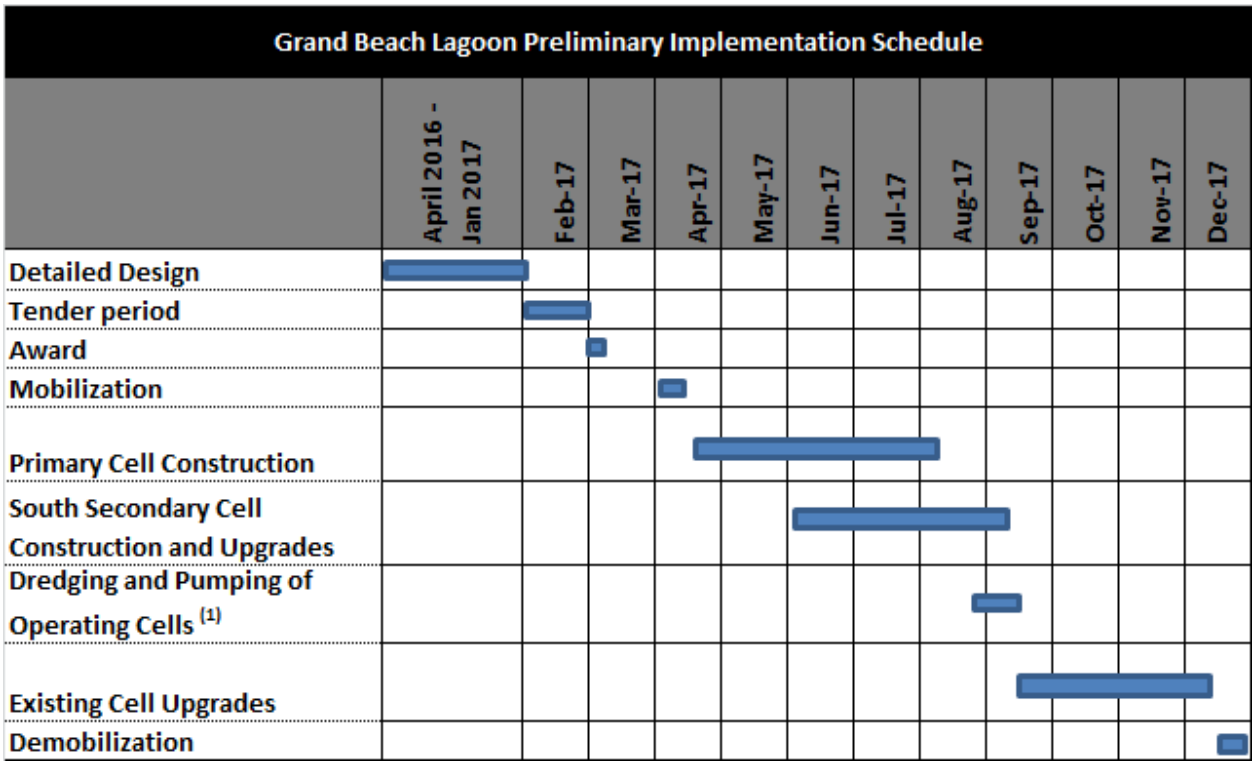
10. Schedule

The project schedule for the Grand Beach Lagoon is based on the following milestones:

- Environment Act Proposal will be submitted as a separate document. Public consultations are proposed for August and September, 2015. The Environment Act Licence will then be issued, likely in early 2016.
- Detailed Design of Lagoon upgrades to be completed in 2016.
- Lagoon construction expected to commence in April 2017. Construction schedule may be accelerated based on available funding.
- Completion date of November 2017.
- Detailed Design, tender and construction of the Forcemain and Lift Station from the West Beach WWTP to be completed from April 2018 - March 2019.
- Decommissioning of the West Beach WWTP to occur in 2019-2020

Table 16, below, shows a brief outline of the expected sequence of events throughout the design and construction of the new Grand Beach lagoon. A detailed schedule is included in **Appendix E**.

Table 16: Preliminary Schedule



Note:

1 May be advanced, refer to text above.

11. Recommendations and Capital Cost Estimate

11.1 General

This section provides a summary of recommendations and capital cost estimates for the project.

AECOM recommends construction of a facultative lagoon complete with a piped conveyance system connecting the campground to the new lagoon system. Wastewater from the future campground development would be trucked to the new lagoon. The piped conveyance system consists of a lift station, forcemain, and truck dump. Once the new infrastructure is in place, decommissioning of the existing lagoon can occur and the old lagoon site rehabilitated. The wastewater treatment plant will also ultimately be decommissioned and its wastewater flows directed to the new lagoon.

11.2 Scope of Work

The scope of the work is as follows:

- 1 Primary Cell with a floor area of 30,794 m^2
- 2 Secondary Cells with floor areas of 9,745 m^2 and 8,244 m^2
- Interconnecting pipe and level control structure
- Tie to existing campground lift station
- 350 m of forcemain from the campground lift station
- Truck dump facility
- Effluent discharge ditch
- 100 m of road upgrading
- Desludging of the operating lagoon cell
- Rework of desludged cells into Secondary cell

11.3 Costs

Capital Costs for the facultative lagoon at Grand Beach Provincial Park are summarized in **Table 17**. Detailed Cost estimate included in **Appendix B**.

Table 17: Preliminary Cost Estimate

Grand Beach Preliminary Costs Estimate			
A	Forcemain		$ 57,500.00
B	Roads		$ 55,830.00
C	Lagoon and Related Works		$ 3,172,510.00
D	Miscellaneous (includes mobilization, demobilization, insurance, material testing etc.)		$ 384,950.00
E	Desludging		$ 53,600.00
	Sub Total		**$ 3,724,390.00**
	Engineering	15%	$ 558,660.00
	Contingency Allowance	10%	$ 372,440.00
	MWSB Finance and Administration	10%	$ 372,440.00
	Total		**$ 5,027,930.00**

Appendix A

Geotechnical Investigation

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Memorandum

To	Eric Hutchison	Page	1
CC	Heather Buhler, Natalie Wilson, Faris Khalil, P.Eng.		
Subject	Proposed Expansion of Grand Beach Lagoon Site Feasibility – Phase 2		
From	Jeremy Fiebelkorn		
Date	March 4, 2011	Project Number	60159090 (402.1)

1. INTRODUCTION

The existing wastewater treatment facility in Grand Beach Provincial Park has reached its functional capacity and an upgrade/expansion is required. It is understood that seepage from the existing secondary cell is a concern and a repair or replacement of the existing clay liner may be required. No information related to the design or the construction of the existing facility is available. The size and location of the proposed expansion is to be finalized, however the intent is to use areas to the south and east of the existing lagoon. It is noted that the area immediately south of the existing facility had previously been prepared and excavated, and perimeter dykes had been constructed. No information related to the design or construction of these dykes is available.

The site feasibility investigation consisted of two Phases. Phase 1 was outlined in the memorandum dated November 15, 2010 titled "Proposed Expansion of Grand Beach Lagoon Site Feasibility". This memorandum summarizes the Phase 2 geotechnical investigation completed by AECOM at the site east of the existing facility. The purpose of the investigation is to assess the subsurface conditions and determine the suitability of the site for the proposed construction.

2. FIELD INVESTIGATION

Fifteen test pits (TP11-01 to11-15) were dug within the footprint of the proposed expansion lagoon to the east of the existing facility, three test pits (TP11-16 to 11-18) were dug outside the dykes of the previously prepared area to the south of the existing facility, and two standpipe piezometers were installed; one in TP11-13 and one in TP11-15. The approximate locations of the test pit are shown on the Test Hole and Monitoring Instrumentation Plan, Figure 01.

The test pits were excavated between January 25 and 27, 2011 by P & A Contracting Ltd. using a Case CX135 SR Excavator. The test pits were advanced to between 3 m and 4 m below grade or to excavator refusal depth, whichever occurs first. General site supervision and test pit logging was provided by AECOM personnel. Disturbed samples were collected at regular intervals and the soil samples were transported to AECOM's Materials Testing Laboratory in Winnipeg for further visual classification and laboratory testing. All test pits were backfilled upon completion.

The laboratory testing program consisted of the determination of moisture contents, Atterberg limits, hydrometer analyses, standard Proctor tests, and flexible wall permeability tests. Detailed logs have been prepared for each test pit to record the description and the relative position of the various soil strata, location of samples obtained, field and laboratory test results, and other pertinent information, and are provided with the standard Proctor results in Appendix A. Flexible wall permeability tests can run for an extended period of time, and as such results will be forwarded once the test is completed.

3. SUBSURFACE CONDITIONS

3.1 Soil Profile

The subsurface conditions encountered consist of a complex alluvial deposit overlying glacial till, with relatively large cobbles and boulders encountered at variable depths. In descending order the general soil profile is as follows:

- Topsoil
- Clay
- Sand
- Till

These soils are described as follows:

Topsoil

Topsoil less than 300 mm thick was encountered at the ground surface in all test holes. The topsoil was frozen at the time of the investigation.

Clay

Clay was encountered in all but three test pit locations (TP11-03, TP11-14 and TP11-17). The clay is highly variable in both silt and sand content, and as such the material properties are highly variable across the site. High plastic, silty clay was generally encountered in test pits excavated in the east side of the proposed expansion site. The material varied in thickness from approximately 450 mm to 2.1m. Moisture contents in the high plastic clay range from approximately 17 percent to 33 percent with an average value of 26 percent. Atterberg limits were determined for a representative sample, with measured liquid and plastic limits of 67.5 percent and 34 percent respectively.

Soils with reduced clay content and reduced plasticity were encountered in test pits excavated in the middle and west parts of the proposed site. These soils predominantly consist of intermediate plasticity silty clay, and mixtures of low to intermediate plasticity sand and clay. The intermediate plasticity silty clay contains variable amounts of sand, and varies in thickness from approximately 450 mm to 1.2 m. Moisture contents in this material range from approximately 14 percent to 26 percent with an average value of 19 percent. Atterberg limits were determined for representative samples, with liquid and plastic limits ranging from 28.5 to 30.7 percent and 11.9 to 18.7 percent respectively.

Sand

Sand was encountered at all locations across the proposed site. The sand contains variable amounts of gravel, silt and clay, and varies in thickness from approximately 150 mm to 2.3 m. West of the zone in which high plastic clay was encountered, the sand contains relatively high amounts of clay. Moving further west across the proposed site toward the existing facility, the clay content decreases and the sand becomes predominantly silty. Moisture contents in the sand are highly variable depending on the clay and silt content, and range from approximately 4 percent to 24 percent.

Till

Till was encountered in all test pit locations at variable depths. The till primarily consists of sand and gravel mixtures, and contains cobbles and boulders. Moisture contents in the till range from approximately 6 percent to 13 percent with an average value of 10 percent.

3.2 Groundwater Conditions

Seepage and sloughing was observed in most test pits at various depths. Details on seepage and sloughing are provided in the test pit logs. Two standpipe piezometers were installed to facilitate short term groundwater level measurements. A summary of the groundwater measurements is provided in Table 01. It should be noted that groundwater levels may fluctuate annually, from season to season or due to construction activities.

Table 01 – Summary of Groundwater Measurements

Piezometer	Date	Groundwater Elevation (m)
SP11-13	January 27, 2011 (immediately after drilling)	dry
	February 18, 2011 (22 days after installation)	222.9 (3.50 m below ground surface)
SP11-15	January 27, 2011 (immediately after drilling)	dry
	February 18, 2011 (22 days after installation)	218.5 (3.05m below ground surface)

4. GEOTECHNICAL CONCERNS AND RECOMMENDATIONS

4.1 Floor of the Proposed Facility

Soils of high hydraulic conductivity (sand and sand/gravel till) were encountered at or near the existing ground surface. Therefore, the site is considered feasible for a geosynthetic-lined or clay-lined sewage lagoon facility. A geosynthetic liner may be a more viable option if a suitable clay source within reasonable haul distance is not available. The clay encountered at the proposed site is highly variable in composition and properties, and as such selective borrowing under inspection and judgement of qualified geotechnical personnel would be required if the use of this material as a source for a clay liner is contemplated. Therefore, it is not recommended for use as a clay liner. A

clay borrow source investigation was beyond the scope of this investigation. Given the site is underlain by compact to dense granular material, the site preparation will likely be limited to the removal of any vegetation and topsoil, grading and proof-rolling the facility footprint.

If a geosynthetic liner is used, it should be placed on a 150 mm thick layer of compacted bedding sand. The bedding sand layer should be placed over a 300 mm thick granular drainage and gas relief layer. Clean, crushed limestone of 50 mm maximum size can be used for the drainage layer. Geotextile should be used at both the bottom and top of the drainage layer to provide separation and filtration. A protective sand layer at least 300 mm thick, or as recommended by the manufacturer, should be placed over the liner.

If a clay liner is used, the properties and thickness of the liner should be in compliance with provincial requirements (i.e., 1 m thick layer of compacted clay having a hydraulic conductivity of 1 x 10-9 m/s). The clay should be placed in layers not to exceed 300 mm in non-compacted thickness at a moisture content within 0 and +3 percent of the optimum moisture content, and compacted to at least 95 percent of the Standard Proctor maximum dry density (SPMDD). Depending on the design floor elevation, protection against uplift should be provided by using a granular drainage layer or by adjusting the floor elevation to provide factor of safety against uplift of not less than 1.5.

4.2 Dykes of the Proposed Facility

The encountered subsurface conditions should provide a suitable foundation for the proposed dykes. The native sand and till can be used to construct these dykes provided that additional measures are used to control seepage. These measures include the incorporation of a geosynthetic or clay liner on the interior face of the dykes and across the top of the dykes for at least 1 m. Dykes constructed using relatively clean sand and or till and not exceeding 3 m high can be designed with side slopes not steeper than 4H:1V. Unsuitable materials including but not limited to organics and silts should be removed prior to construction. Stability analysis will be required for heights greater than 3 m. Depending on the final floor elevation, there may be a need to perform additional investigation(s) to identify a borrow source in close proximity to the proposed site.

Erosion protection measures will be required on the slope surfaces of the proposed dykes. The exterior slopes can be protected using a 300 mm of topsoil and vegetation cover. The interior slopes will require a rip-rap protection layer. Further recommendation can be provided as part of the detailed design phase of the proposed facility.

Should you require any further assistance, please do not hesitate to contact the undersigned.

Respectfully submitted,

Jeremy Fiebelkorn, E.I.T.
Geotechnical Engineering
JF:dh

Reviewed by:

Faris Khalil, P.Eng.
Manager, Geotechnical Engineering

AECOM

Appendix A

Test Hole Logs and Test Results

AECOM Canada Ltd.

GENERAL STATEMENT

NORMAL VARIABILITY OF SUBSURFACE CONDITIONS

The scope of the investigation presented herein is limited to an investigation of the subsurface conditions as to suitability for the proposed project. This report has been prepared to aid in the evaluation of the site and to assist the engineer in the design of the facilities. Our description of the project represents our understanding of the significant aspects of the project relevant to the design and construction of earth work, foundations and similar. In the event of any changes in the basic design or location of the structures as outlined in this report or plan, we should be given the opportunity to review the changes and to modify or reaffirm in writing the conclusions and recommendations of this report.

The analysis and recommendations presented in this report are based on the data obtained from the borings and test pit excavations made at the locations indicated on the site plans and from other information discussed herein. This report is based on the assumption that the subsurface conditions everywhere are not significantly different from those disclosed by the borings and excavations. However, variations in soil conditions may exist between the excavations and, also, general groundwater levels and conditions may fluctuate from time to time. The nature and extent of the variations may not become evident until construction. If subsurface conditions differ from those encountered in the exploratory borings and excavations, are observed or encountered during construction, or appear to be present beneath or beyond excavations, we should be advised at once so that we can observe and review these conditions and reconsider our recommendations where necessary.

Since it is possible for conditions to vary from those assumed in the analysis and upon which our conclusions and recommendations are based, a contingency fund should be included in the construction budget to allow for the possibility of variations which may result in modification of the design and construction procedures.

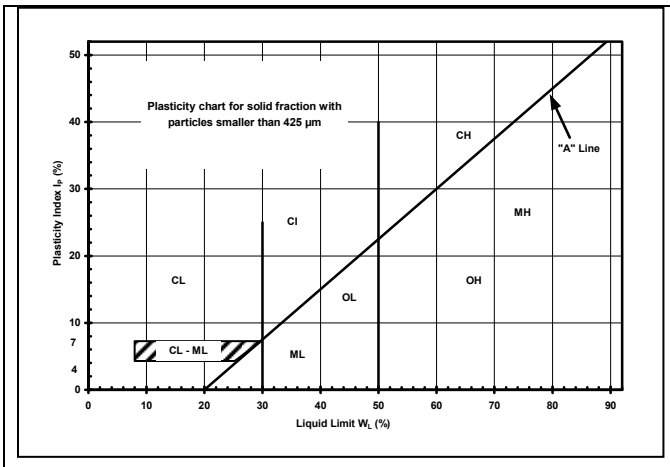
In order to observe compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated, we recommend that all construction operations dealing with earth work and the foundations be observed by an experienced soils engineer. We can be retained to provide these services for you during construction. In addition, we can be retained to review the plans and specifications that have been prepared to check for substantial conformance with the conclusions and recommendations contained in our report.

EXPLANATION OF FIELD & LABORATORY TEST DATA

Description				UMA Log Symbols	USCS Classification	Laboratory Classification Criteria			
						Fines (%)	Grading	Plasticity	Notes
COARSE GRAINED SOILS	GRAVELS (More than 50% of coarse fraction of gravel size)	CLEAN GRAVELS (Little or no fines)	Well graded gravels, sandy gravels, with little or no fines		GW	0-5	$C_U > 4$ $1 < C_C < 3$		Dual symbols if 5-12% fines. Dual symbols if above "A" line and $4<W_P<7$ $C_U = \frac{D_{60}}{D_{10}}$ $C_C = \frac{(D_{30})^2}{D_{10} x D_{60}}$
			Poorly graded gravels, sandy gravels, with little or no fines		GP	0-5	Not satisfying GW requirements		
		DIRTY GRAVELS (With some fines)	Silty gravels, silty sandy gravels		GM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey gravels, clayey sandy gravels		GC	> 12		Atterberg limits above "A" line or $W_P<7$	
	SANDS (More than 50% of coarse fraction of sand size)	CLEAN SANDS (Little or no fines)	Well graded sands, gravelly sands, with little or no fines		SW	0-5	$C_U > 6$ $1 < C_C < 3$		
			Poorly graded sands, gravelly sands, with little or no fines		SP	0-5	Not satisfying SW requirements		
		DIRTY SANDS (With some fines)	Silty sands, sand-silt mixtures		SM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey sands, sand-clay mixtures		SC	> 12		Atterberg limits above "A" line or $W_P<7$	
FINE GRAINED SOILS	SILTS (Below 'A' line negligible organic content)	$W_L<50$	Inorganic silts, silty or clayey fine sands, with slight plasticity		ML			Classification is Based upon Plasticity Chart	
		$W_L>50$	Inorganic silts of high plasticity		MH				
	CLAYS (Above 'A' line negligible organic content)	$W_L<30$	Inorganic clays, silty clays, sandy clays of low plasticity, lean clays		CL				
		$30<W_L<50$	Inorganic clays and silty clays of medium plasticity		CI				
		$W_L>50$	Inorganic clays of high plasticity, fat clays		CH				
	ORGANIC SILTS & CLAYS (Below 'A' line)	$W_L<50$	Organic silts and organic silty clays of low plasticity		OL				
		$W_L>50$	Organic clays of high plasticity		OH				
HIGHLY ORGAINIC SOILS			Peat and other highly organic soils		Pt	Von Post Classification Limit		Strong colour or odour, and often fibrous texture	

	Asphalt		Till		
	Concrete		Bedrock (Undifferentiated)		
	Fill		Bedrock (Limestone)		

When the above classification terms are used in this report or test hole logs, the designated fractions may be visually estimated and not measured.



FRACTION		SEIVE SIZE (mm)		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
		Passing	Retained	Percent	Identifier
Gravel	Coarse	76	19	35-50	and
	Fine	19	4.75		
Sand	Coarse	4.75	2.00	20-35	“y” or “ey” *
	Medium	2.00	0.425		
	Fine	0.425	0.075	10-20	some
Silt (non-plastic) or Clay (plastic)		< 0.075 mm		1-10	trace
* for example: gravelly, sandy clayey, silty					

Definition of Oversize Material

COBBLES: 76mm to 300mm diameter
BOULDERS: >300mm diameter

LEGEND OF SYMBOLS

Laboratory and field tests are identified as follows:

q_u - undrained shear strength (kPa) derived from unconfined compression testing.

T_v - undrained shear strength (kPa) measured using a torvane

pp - undrained shear strength (kPa) measured using a pocket penetrometer.

L_v - undrained shear strength (kPa) measured using a lab vane.

F_v - undrained shear strength (kPa) measured using a field vane.

γ - bulk unit weight (kN/m^3).

SPT - Standard Penetration Test. Recorded as number of blows (N) from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 51 mm O.D. Raymond type sampler 0.30 m into the soil.

DPPT - Drive Point Pentrometer Test. Recorded as number of blows from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 50 mm drive point 0.30 m into the soil.

w - moisture content (W_L, W_P)

The undrained shear strength (Su) of a cohesive soil can be related to its consistency as follows:

Su (kPa)	CONSISTENCY
<12	very soft
12 – 25	soft
25 – 50	medium or firm
50 – 100	stiff
100 – 200	very stiff
200	hard

The resistance (N) of a non-cohesive soil can be related to compactness condition as follows

N – BLOWS/0.30 m	COMPACTNESS
0 - 4	very loose
4 - 10	loose
10 - 30	compact
30 - 50	dense
50	very dense

PROJECT: Grand Beach Lagoon	CLIENT: The Manitoba Water Services Board	TESTHOLE NO: **TP11-01**
LOCATION: 5603869.578 m N 670318.107 m E		PROJECT NO.: 60159090
CONTRACTOR: P & A Contracting Ltd	METHOD: Case CX135SR Excavator	ELEVATION (m): 224.10

SAMPLE TYPE: GRAB, SHELBY TUBE, SPLIT SPOON, BULK, NO RECOVERY, CORE

PENETRATION TESTS: Becker; Dynamic Cone; SPT (Standard Pen Test) (Blows/300mm); Total Unit Wt (kN/m³); Plastic MC Liquid

UNDRAINED SHEAR STRENGTH: Torvane; QU; Lab Vane; Pocket Pen.; Field Vane (kPa)

DEPTH (m)	SOIL DESCRIPTION	SAMPLE #	SPT (N)	ELEVATION
0	TOPSOIL -black/brown, frozen	G1, G2		224
	SAND -brown, fine-grained	G3		
	CLAY - silty, trace gravel, trace rootlets -light brown, moist, soft -high plastic	G4		
1				223
	SAND - some silt, some boulders -brown, moist	G5		
2	-seepage observed			222
	SAND and GRAVEL (till) -grey, moist	G6		
3	END HOLE AT 3.1 m DUE TO CAVE IN			221
4				220
5				219
6				218
7				

Notes:
1. Sloughing in hole;
2. Seepage at ~2.4m.

COMMENTS

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 3.05 m
REVIEWED BY: Jeremy Fiebelkorn	COMPLETION DATE: 1/25/11
PROJECT ENGINEER: Eric Hutchison	Page 1 of 1

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PROJECT: Grand Beach Lagoon	CLIENT: The Manitoba Water Services Board	TESTHOLE NO: **TP11-02**
LOCATION: 5603869.578 m N 670318.107 m E		PROJECT NO.: 60159090
CONTRACTOR: P & A Contracting Ltd	METHOD: Case CX135SR Excavator	ELEVATION (m): 222.81

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS (✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100; ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100)	UNDRAINED SHEAR STRENGTH (+ Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ⚘ Field Vane ⚘ (kPa) 50 100 150 200)	COMMENTS	ELEVATION
0		TOPSOIL -brown/black, frozen		G7		15.5			
				G8		19			
		SAND - trace silt, trace clay -light brown -some cobbles (<200 mm diameter)							222
1		CLAY-silty -grey, moist, soft -high plastic		G9		23.4			
		CLAY - silty, some sand -grey, moist, soft -intermediate plasticity, becoming low plastic with depth		G10		14.9			221
2		SAND and CLAY -grey, moist, soft -low to intermediate plasticity -seepage observed							
		SAND - trace clay -brown		G11		7.9			
3		GRAVEL and SAND (till) - trace cobbles (<100mm diameter) -grey		G12		7.4			220
				G13		10.2			
		END HOLE AT 3.7 in TILL Notes: 1. No sloughing observed; 2. Seepage at ~1.8m.							219
4									
5									218
6									217
7									216

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 3.66 m
REVIEWED BY: Jeremy Fiebelkorn	COMPLETION DATE: 1/25/11
PROJECT ENGINEER: Eric Hutchison	Page 1 of 1

PROJECT: Grand Beach Lagoon	CLIENT: The Manitoba Water Services Board	TESTHOLE NO: **TP11-03**
LOCATION: 5603869.578 m N 670318.107 m E		PROJECT NO.: 60159090
CONTRACTOR: P & A Contracting Ltd	METHOD: Case CX135SR Excavator	ELEVATION (m): 221.64

SAMPLE TYPE: GRAB, SHELBY TUBE, SPLIT SPOON, BULK, NO RECOVERY, CORE

PENETRATION TESTS: Becker; Dynamic Cone; SPT (Standard Pen Test) (Blows/300mm) 0 20 40 60 80 100; Total Unit Wt (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: Torvane; QU; Lab Vane; Pocket Pen.; Field Vane (kPa) 50 100 150 200

DEPTH (m)	SOIL DESCRIPTION	SAMPLE #	SPT (N)	COMMENTS	ELEVATION
0	TOPSOIL -brown/black, frozen	G14	88.7		
	SAND - some gravel, trace silt, trace clay	G15	16.7		
	-some boulders				221
	-grey, coarse grained -seepage observed	G16	23.7		
1	-some gravel -brown, fine grained	G17	9.7		
					220
2	-some clay	G18	12.2		
	GRAVEL and SAND (till)				
	-layer of coarse grained sand				219
3	END HOLE AT 3.1 min TILL				
	Notes: 1. Sloughing at ~3.0m; 2. Seepage at ~1.0m				218
4					
					217
5					
					216
6					
					215
7					

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LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 3.05 m
REVIEWED BY: Jeremy Fiebelkorn	COMPLETION DATE: 1/25/11
PROJECT ENGINEER: Eric Hutchison	Page 1 of 1

PROJECT: Grand Beach Lagoon	CLIENT: The Manitoba Water Services Board	TESTHOLE NO: **TP11-04**
LOCATION: 5603869.578 m N 670318.107 m E		PROJECT NO.: 60159090
CONTRACTOR: P & A Contracting Ltd	METHOD: Case CX135SR Excavator	ELEVATION (m): 221.62

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / Total Unit Wt (kN/m³) / Plastic MC Liquid	UNDRAINED SHEAR STRENGTH (kPa)	COMMENTS	ELEVATION
0		TOPSOIL - boulders visible at surface -brown/black, frozen	GRAB	G19		33.8			
		CLAY-silty -grey, soft, moist -high plastic	GRAB	G20		24.4			221
		SAND - gravelly, some clay -grey/brown	GRAB	G21		11.5			
1		-boulders below ~1.2 m							220
		-seepage observed							
2			GRAB	G22		12.7			
		GRAVEL and SAND (till) - some boulders -grey	GRAB	G23		6.2			219
3		END HOLE AT 3.1 m IN TILL Notes: 1. No sloughing observed; 2. Seepage below ~1.8m.							218
4									217
5									216
6									215
7									

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LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 3.05 m
REVIEWED BY: Jeremy Fiebelkorn	COMPLETION DATE: 1/25/11
PROJECT ENGINEER: Eric Hutchison	Page 1 of 1

PROJECT: Grand Beach Lagoon	CLIENT: The Manitoba Water Services Board	TESTHOLE NO: **TP11-05**
LOCATION: 5603869.578 m N 670318.107 m E		PROJECT NO.: 60159090
CONTRACTOR: P & A Contracting Ltd	METHOD: Case CX135SR Excavator	ELEVATION (m): 225.21

SAMPLE TYPE: GRAB, SHELBY TUBE, SPLIT SPOON, BULK, NO RECOVERY, CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS (Becker, Dynamic Cone, SPT (Standard Pen Test) (Blows/300mm), Total Unit Wt (kN/m³), Plastic MC Liquid)	UNDRAINED SHEAR STRENGTH (Torvane, QU, Lab Vane, Pocket Pen., Field Vane) (kPa)	COMMENTS	ELEVATION
0		TOPSOIL -brown/black, frozen		G24		69.4			
				G25		27.8			225
		CLAY - trace silt, trace sand, trace gravel -brown, moist -high plastic -silty -light brown, soft		G26		25.3			
1									224
		SAND and CLAY - some silt lenses (<20 mm thick) -intermediate plasticity		G27		13.9			
2									223
		SAND - trace clay, trace gavel -light brown -seepage observed -some cobbles (<150mm diameter)		G28		8.3			
3		GRAVEL and SAND (till)							222
				G29		9.9			
4		END HOLE AT ~4.0 m IN TILL Notes: 1. No sloughing observed; 2. Seepage at ~2.4 m.							221
5									220
6									219
7									

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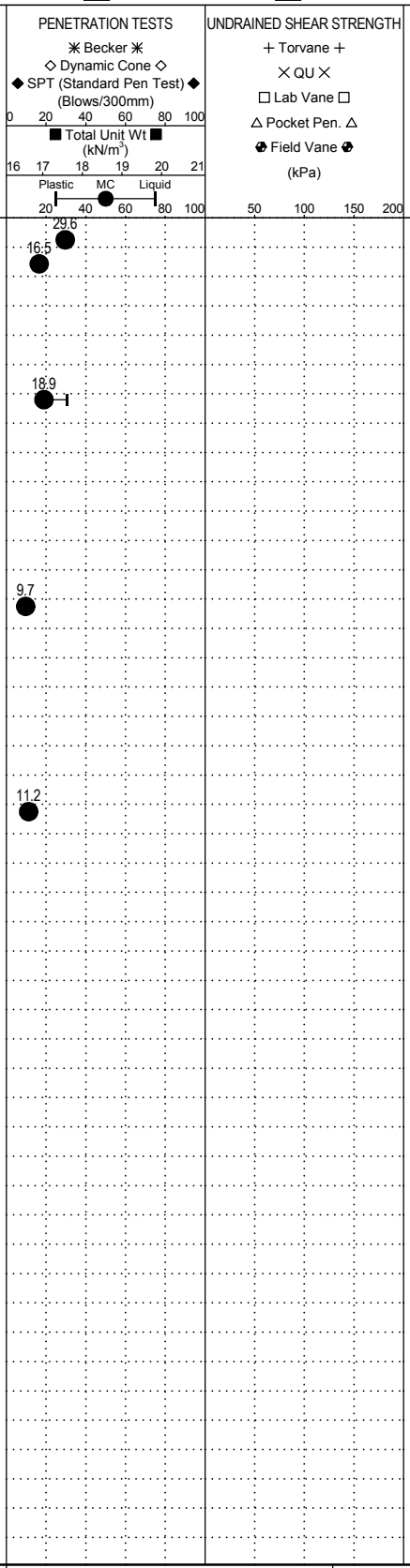
LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 3.05 m
REVIEWED BY: Jeremy Fiebelkorn	COMPLETION DATE: 1/26/11
PROJECT ENGINEER: Eric Hutchison	Page 1 of 1

PROJECT: Grand Beach Lagoon	CLIENT: The Manitoba Water Services Board	TESTHOLE NO: **TP11-06**
LOCATION: 5603869.578 m N 670318.107 m E		PROJECT NO.: 60159090
CONTRACTOR: P & A Contracting Ltd	METHOD: Case CX135SR Excavator	ELEVATION (m): 223.39

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE #	SPT (N)	COMMENTS	ELEVATION
0	TOPSOIL -black/brown, frozen	G30, G31			
	SAND - trace clay, trace rootlets, trace boulders -fine grained				223
	CLAY - silty -brown, moist, soft -intermediate plasticity				
1	-silt lenses below ~0.9 m -becoming low plastic with depth	G32			
	-some boulders -seepage observed				222
	SAND - some gravel, some silt, some clay, some silt lenses, trace boulders -brown/grey				
2		G33		Sample G33: Gravel-11.9%, Sand-64.9%, Silt-11.1%, Clay-12.2%	221
	GRAVEL and SAND (till)				
3		G34			220
	END HOLE AT 3.7 m in TILL Notes: 1. No sloughing observed; 2. Seepage below ~1.2 m.				
4					219
5					218
6					217
7					



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LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 3.66 m
REVIEWED BY: Jeremy Fiebelkorn	COMPLETION DATE: 1/26/11
PROJECT ENGINEER: Eric Hutchison	Page 1 of 1

PROJECT: Grand Beach Lagoon	CLIENT: The Manitoba Water Services Board	TESTHOLE NO: **TP11-07**
LOCATION: 5603869.578 m N 670318.107 m E		PROJECT NO.: 60159090
CONTRACTOR: P & A Contracting Ltd	METHOD: Case CX135SR Excavator	ELEVATION (m): 222.20

SAMPLE TYPE: GRAB, SHELBY TUBE, SPLIT SPOON, BULK, NO RECOVERY, CORE

PENETRATION TESTS: Becker; Dynamic Cone; SPT (Standard Pen Test) (Blows/300mm) 0 20 40 60 80 100; Total Unit Wt (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: Torvane; QU; Lab Vane; Pocket Pen.; Field Vane (kPa) 50 100 150 200

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS	UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
0	TOPSOIL - boulders near surface -frozen		G35		68.5			222
	SAND & CLAY - some silt -brown & grey		G36		16.8			
1	-seepage observed							221
			G37		13.9			
2	GRAVEL and SAND (till)							220
			G38		10.9			
3	END HOLE AT 3.05 m IN TILL DUE TO CAVE IN Notes: 1. Sloughing in hole; 2. Seepage at ~1.2m.							219
4								218
5								217
6								216
7								

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LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 3.05 m
REVIEWED BY: Jeremy Fiebelkorn	COMPLETION DATE: 1/26/11
PROJECT ENGINEER: Eric Hutchison	Page 1 of 1

PROJECT: Grand Beach Lagoon	CLIENT: The Manitoba Water Services Board	TESTHOLE NO: **TP11-08**
LOCATION: 5603869.578 m N 670318.107 m E		PROJECT NO.: 60159090
CONTRACTOR: P & A Contracting Ltd	METHOD: Case CX135SR Excavator	ELEVATION (m): 223.35

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

PENETRATION TESTS: ✳ Becker ✳; ◇ Dynamic Cone ◇; ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100; ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane +; × QU ×; □ Lab Vane □; △ Pocket Pen. △; ⚘ Field Vane ⚘ (kPa) 50 100 150 200

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS	UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
0		TOPSOIL -brown/black, frozen		G39		33			
		SAND - trace clay -brown -fine grained		G40		12			223
1		SAND and CLAY - some silt -brown/grey							222
				G41		12.2			
2		-seepage observed							
		GRAVEL and SAND (till)		G42		9.6			221
3				G43		10.2			220
		END HOLE AT 3.7m IN TILL Notes: 1. No sloughing observed; 2. Seepage below ~1.8m.							
4									219
5									218
6									217
7									

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REVIEWED BY: Jeremy Fiebelkorn	COMPLETION DATE: 1/26/11
PROJECT ENGINEER: Eric Hutchison	Page 1 of 1

PROJECT: Grand Beach Lagoon	CLIENT: The Manitoba Water Services Board	TESTHOLE NO: **TP11-09**
LOCATION: 5603869.578 m N 670318.107 m E		PROJECT NO.: 60159090
CONTRACTOR: P & A Contracting Ltd	METHOD: Case CX135SR Excavator	ELEVATION (m): 224.36

SAMPLE TYPE: GRAB, SHELBY TUBE, SPLIT SPOON, BULK, NO RECOVERY, CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE #	SPT (N)	PENETRATION TESTS / Total Unit Wt (kN/m³) / MC (Plastic–Liquid)	UNDRAINED SHEAR STRENGTH (kPa)	COMMENTS	ELEVATION
0	TOPSOIL -brown/black, frozen	G44		59.1			
	CLAY - trace rootlets, trace silt -brown, moist, soft -high plastic	G45		23.4			224
1	-some silt	G46		19.4			
	-trace silt	G47		17.2			223
2	SAND and CLAY - some silt, some gravel, trace boulders -moist, soft -low to intermediate plasticity -seepage observed in this layer						222
3		G48		13.1			
	GRAVEL and SAND (till)	G49		11.6			221
4	END HOLE AT 4.0m in TILL Notes: 1. No sloughing observed; 2. Seepage below ~2.1m.						220
5							219
6							218
7							

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LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 3.05 m
REVIEWED BY: Jeremy Fiebelkorn	COMPLETION DATE: 1/26/11
PROJECT ENGINEER: Eric Hutchison	Page 1 of 1

PROJECT: Grand Beach Lagoon	CLIENT: The Manitoba Water Services Board	TESTHOLE NO: **TP11-10**
LOCATION: 5603869.578 m N 670318.107 m E		PROJECT NO.: 60159090
CONTRACTOR: P & A Contracting Ltd	METHOD: Case CX135SR Excavator	ELEVATION (m): 223.94

SAMPLE TYPE: GRAB, SHELBY TUBE, SPLIT SPOON, BULK, NO RECOVERY, CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / Total Unit Wt (kN/m³) / MC (Plastic–Liquid)	UNDRAINED SHEAR STRENGTH (kPa)	COMMENTS	ELEVATION
0		TOPSOIL -brown/black, frozen		G50		32.2			
		CLAY - silty, trace gravel -brown, moist, soft -intermediate plasticity		G51		23.9			
1									223
		SAND - clayey, silty, trace gravel -seepage observed -boulder at ~2.3 m		G52		12.3		Sampel G52: Gravel-3.9%, Sand-49.2%, Silt-23.1%, Clay-23.8%	
2									222
		GRAVEL and SAND (till)		G53		8.5			
3									221
		END HOLE AT 3.20m IN TILL Notes: 1. No sloughing observed; 2. Seepage below ~2.1m.							
4									220
5									219
6									218
7									217

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LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 3.20 m
REVIEWED BY: Jeremy Fiebelkorn	COMPLETION DATE: 1/26/11
PROJECT ENGINEER: Eric Hutchison	Page 1 of 1

PROJECT: Grand Beach Lagoon	CLIENT: The Manitoba Water Services Board	TESTHOLE NO: **TP11-11**
LOCATION: 5603869.578 m N 670318.107 m E		PROJECT NO.: 60159090
CONTRACTOR: P & A Contracting Ltd	METHOD: Case CX135SR Excavator	ELEVATION (m): 222.87

SAMPLE TYPE: GRAB, SHELBY TUBE, SPLIT SPOON, BULK, NO RECOVERY, CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS (Becker ✳, Dynamic Cone ◇, SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100; Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100)	UNDRAINED SHEAR STRENGTH (+ Torvane +, × QU ×, □ Lab Vane □, △ Pocket Pen. △, ⊕ Field Vane ⊕ (kPa) 50 100 150 200)	COMMENTS	ELEVATION
0		TOPSOIL -brown/black, frozen		G54		60.3			
		SAND - trace clay, trace silt, trace rootlets -brown, moist, fine-grained		G55		17.5			
1		CLAY - trace rootlets, trace silt -brown, moist, soft -high plastic		G56		32.8			222
				G57		22			
2		SAND -brown, fine-grained -seepage observed		G58		17.7			221
3		GRAVEL and SAND (till)		G59		7.7			220
		END HOLE AT 3.4m IN TILL Notes: 1. No sloughing observed; 2. Seepage at ~1.8m.							219
4									
5									218
6									217
7									216

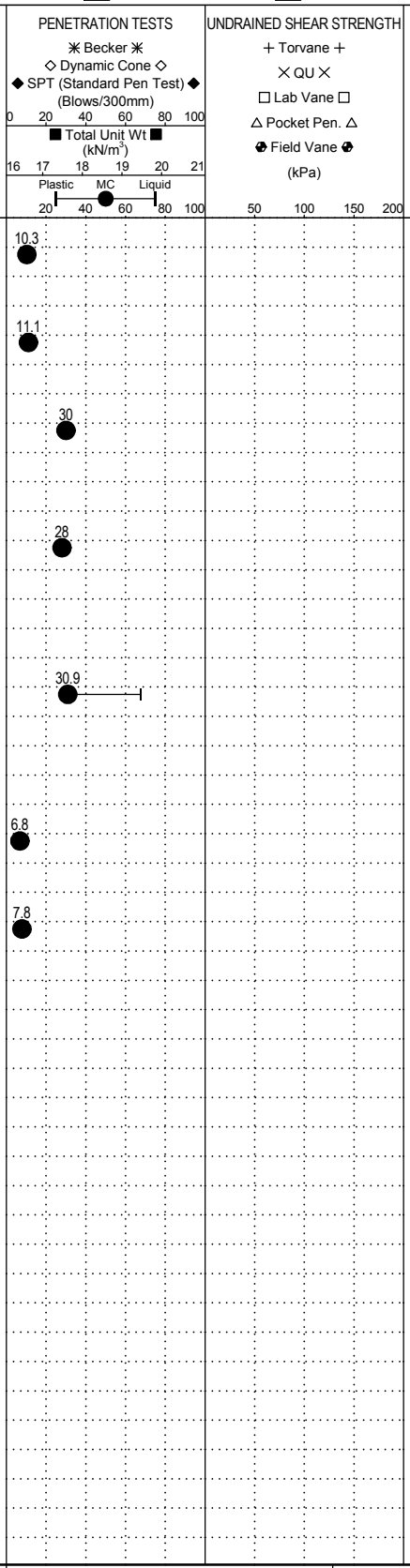
AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 3.35 m
REVIEWED BY: Jeremy Fiebelkorn	COMPLETION DATE: 1/26/11
PROJECT ENGINEER: Eric Hutchison	Page 1 of 1

PROJECT: Grand Beach Lagoon	CLIENT: The Manitoba Water Services Board	TESTHOLE NO: **TP11-12**
LOCATION: 5603869.578 m N 670318.107 m E		PROJECT NO.: 60159090
CONTRACTOR: P & A Contracting Ltd	METHOD: Case CX135SR Excavator	ELEVATION (m): 224.38

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE #	SPT (N)	COMMENTS	ELEVATION
0	TOPSOIL -brown/black, frozen	G60			
	SAND - trace clay, trace rootlets -fine grained	G61			224
1	CLAY - some silt lenses -brown, moist, soft -high plastic	G62			
		G63			223
2		G64			222
3	SAND -brown, fine-grained	G65			
	GRAVEL and SAND (till)	G66			221
4	END HOLE AT 4.0m IN TILL Notes: 1. No sloughing observed; 2. No seepage observed.				220
5					219
6					218
7					



AECOM	LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 3.05 m
	REVIEWED BY: Jeremy Fiebelkorn	COMPLETION DATE: 1/26/11
	PROJECT ENGINEER: Eric Hutchison	Page 1 of 1

PROJECT: Grand Beach Lagoon	CLIENT: The Manitoba Water Services Board	TESTHOLE NO: **TP11-13**
LOCATION: 5603869.578 m N 670318.107 m E		PROJECT NO.: 60159090
CONTRACTOR: P & A Contracting Ltd	METHOD: Case CX135SR Excavator	ELEVATION (m): 226.38

SAMPLE TYPE: GRAB, SHELBY TUBE, SPLIT SPOON, BULK, NO RECOVERY, CORE

BACKFILL TYPE: BENTONITE, GRAVEL, SLOUGH, GROUT, CUTTINGS, SAND

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS (Dynamic Cone / SPT (Standard Pen Test) (Blows/300mm))	Total Unit Wt (kN/m³)	Plastic / MC / Liquid	UNDRAINED SHEAR STRENGTH (Torvane / QU / Lab Vane / Pocket Pen. / Field Vane) (kPa)	COMMENTS	ELEVATION
0	TOPSOIL -brown/black, frozen		G67		41.3					
	SAND - clayey, some gravel (<50mm diameter), trace rootlets		G68		5.2					226
	CLAY - trace silt -brown, moist, soft -high plastic		G69		18.3					
1	-trace silt lenses									225
	CLAY - silty -dark brown, moist, soft -intermediate plasticity		G70		16.5					
2	- boulder at ~ 2.1m									224
	SAND and CLAY- silty, trace gravel -brown, moist, soft		G71		14.9				Sample G71: Gravel-5.2%, Sand-35.9%, Silt-26.2%, Clay-32.7%	
3	-large immovable boulder encountered									
	SAND & CLAY & GRAVEL (till)		G72		10.3					223
4	-seepage observed									
	END HOLE AT 4.3 m IN TILL									222
5										221
6										220
7										

Notes:
1. No sloughing observed;
2. Seepage at ~4.0m;
3. SP11-13 installed to 3.5m
   Groundwater measurements:
   -dry at time of installation
   -February 18, 2011 - 3.35m (el. 222.88m)

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 3.05 m
REVIEWED BY: Jeremy Fiebelkorn	COMPLETION DATE: 1/27/11
PROJECT ENGINEER: Eric Hutchison	Page 1 of 1

PROJECT: Grand Beach Lagoon	CLIENT: The Manitoba Water Services Board	TESTHOLE NO: **TP11-14**
LOCATION: 5603869.578 m N 670318.107 m E		PROJECT NO.: 60159090
CONTRACTOR: P & A Contracting Ltd	METHOD: Case CX135SR Excavator	ELEVATION (m): 222.75

SAMPLE TYPE: GRAB, SHELBY TUBE, SPLIT SPOON, BULK, NO RECOVERY, CORE

PENETRATION TESTS: Becker; Dynamic Cone; SPT (Standard Pen Test) (Blows/300mm) 0 20 40 60 80 100; Total Unit Wt (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: Torvane; QU; Lab Vane; Pocket Pen.; Field Vane (kPa) 50 100 150 200

DEPTH (m)	SOIL DESCRIPTION	SAMPLE #	SPT (N)	Total Unit Wt (kN/m³)	COMMENTS	ELEVATION
0	TOPSOIL -brown/black, frozen	G73		71.7		
	SAND - trace clay, trace gravel -brown, fine grained	G74		17		
	CLAY - trace silt -high plastic -sand layer	G75		26.9		222
1	-silt layer					
	SAND - silty, trace clay, trace gravel -brown -boulder below ~ 1.5 m	G76		11.2		221
2	-seepage observed	G77		8.5		
		G78		10.4		220
3	GRAVEL and SAND (till)	G79		9.8		
	END HOLE AT 3.7m IN TILL					219
4	Notes: 1. No sloughing observed; 2. Seepage at ~2.1m.					
						218
5						
						217
6						
						216
7						

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 3.66 m
REVIEWED BY: Jeremy Fiebelkorn	COMPLETION DATE: 1/27/11
PROJECT ENGINEER: Eric Hutchison	Page 1 of 1

PROJECT: Grand Beach Lagoon	CLIENT: The Manitoba Water Services Board	TESTHOLE NO: **TP11-15**
LOCATION: 5603869.578 m N 670318.107 m E		PROJECT NO.: 60159090
CONTRACTOR: P & A Contracting Ltd	METHOD: Case CX135SR Excavator	ELEVATION (m): 221.55

SAMPLE TYPE: GRAB, SHELBY TUBE, SPLIT SPOON, BULK, NO RECOVERY, CORE

BACKFILL TYPE: BENTONITE, GRAVEL, SLOUGH, GROUT, CUTTINGS, SAND

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS (Becker, Dynamic Cone, SPT (Standard Pen Test) (Blows/300mm), Total Unit Wt (kN/m³), Plastic MC Liquid)	UNDRAINED SHEAR STRENGTH (Torvane, QU, Lab Vane, Pocket Pen., Field Vane) (kPa)	COMMENTS	ELEVATION
0	TOPSOIL -brown/black, frozen		G80		89.7			
	SAND - some clay, trace rootlets -brown, fine grained -seepage observed		G81		19.7			221
1	CLAY - trace silt, trace sand -dark brown, moist, soft -high plastic		G82		32			
2								220
	GRAVEL and SAND (till)							219
3			G83		13.2			
	END HOLE AT 3.1m IN TILL Notes: 1. No sloughing observed; 2. Seepage within sand layer; 3. SP11-15 installed to 3.2m Groundwater measurements: -dry at time of installation -February 18, 2011 - 3.05m (el. 218.50m)							218
4								
								217
5								
								216
6								
								215
7								

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 3.05 m
REVIEWED BY: Jeremy Fiebelkorn	COMPLETION DATE: 1/27/11
PROJECT ENGINEER: Eric Hutchison	Page 1 of 1

PROJECT: Grand Beach Lagoon	CLIENT: The Manitoba Water Services Board	TESTHOLE NO: **TP11-16**
LOCATION: 5603869.578 m N 670318.107 m E		PROJECT NO.: 60159090
CONTRACTOR: P & A Contracting Ltd	METHOD: Case CX135SR Excavator	ELEVATION (m): 221.99

SAMPLE TYPE: GRAB, SHELBY TUBE, SPLIT SPOON, BULK, NO RECOVERY, CORE

PENETRATION TESTS: Becker; Dynamic Cone; SPT (Standard Pen Test) (Blows/300mm); Total Unit Wt (kN/m³); Plastic MC Liquid

UNDRAINED SHEAR STRENGTH: Torvane; QU; Lab Vane; Pocket Pen.; Field Vane (kPa)

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	Total Unit Wt (kN/m³)	COMMENTS	ELEVATION
0	TOPSOIL -brown/black, frozen	GRAB	G84		18.6		
	GRANULAR FILL						
1	CLAY - silty -brown, moist, soft -intermediate plasticity -boulder at ~1.2m	GRAB	G85		26.2		221
2	SAND - silty, some clay, trace gravel	GRAB	G86		9.3	Sample G86: Gravel-5.2%, Sand-54.7%, Silt-25.4%, Clay-14.6%	220
	GRAVEL -seepage observed	GRAB	G87		9.9		
3							219
	END HOLE AT 3.4m IN GRAVEL Notes: 1. No sloughing observed; 2. Seepage in gravel layer.						
4							218
5							217
6							216
7							

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 3.35 m
REVIEWED BY: Jeremy Fiebelkorn	COMPLETION DATE: 1/27/11
PROJECT ENGINEER: Eric Hutchison	Page 1 of 1

PROJECT: Grand Beach Lagoon	CLIENT: The Manitoba Water Services Board	TESTHOLE NO: **TP11-17**
LOCATION: 5603869.578 m N 670318.107 m E		PROJECT NO.: 60159090
CONTRACTOR: P & A Contracting Ltd	METHOD: Case CX135SR Excavator	ELEVATION (m): 221.10

SAMPLE TYPE: GRAB, SHELBY TUBE, SPLIT SPOON, BULK, NO RECOVERY, CORE

DEPTH (m)	SOIL DESCRIPTION	SAMPLE #	SPT (N)	PENETRATION TESTS / Total Unit Wt (kN/m³) / MC (Plastic–Liquid)	UNDRAINED SHEAR STRENGTH (kPa)	COMMENTS	ELEVATION
0	TOPSOIL -brown/black, frozen	G88		17.2			221
	SAND - some gravel -coarse grained	G89		7.7			
1	SAND - silty, some gravel -grey, moist, soft -seepage observed	G90		19.6			220
	SAND - clayey, some silt -brown -boulder at ~1.8m	G91		11.5			
2							219
	GRAVEL and SAND (till)	G92		7.5			
3							218
	END HOLE AT 3.4m IN TILL Notes: 1. No sloughing observed; 2. Seepage at ~1.2m.						
4							217
5							216
6							215
7							

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 3.05 m
REVIEWED BY: Jeremy Fiebelkorn	COMPLETION DATE: 1/27/11
PROJECT ENGINEER: Eric Hutchison	Page 1 of 1

PROJECT: Grand Beach Lagoon	CLIENT: The Manitoba Water Services Board	TESTHOLE NO: **TP11-18**
LOCATION: 5603869.578 m N 670318.107 m E		PROJECT NO.: 60159090
CONTRACTOR: P & A Contracting Ltd	METHOD: Case CX135SR Excavator	ELEVATION (m): 221.34

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

PENETRATION TESTS: Becker; Dynamic Cone; SPT (Standard Pen Test) (Blows/300mm) 0 20 40 60 80 100; Total Unit Wt (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH (kPa): Torvane; QU; Lab Vane; Pocket Pen.; Field Vane 50 100 150 200

DEPTH (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS (Total Unit Wt)	UNDRAINED SHEAR STRENGTH	COMMENTS	ELEVATION
0	TOPSOIL -brown/black, frozen							
	CLAY - trace silt, bouldery to ~1.2m - black, moist, soft - high plasticity							221
1								
			G93		25.1			220
	SILT & SAND -grey							
			G94		12.8			
2								
	GRAVEL and SAND (till)							219
			G95		8.9			
3	END HOLE AT 3.05 m IN TILL							
	Notes: 1. No sloughing observed; 2. No seepage observed.							218
4								
								217
5								
								216
6								
								215
7								

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 3.05 m
REVIEWED BY: Jeremy Fiebelkorn	COMPLETION DATE: 1/27/11
PROJECT ENGINEER: Eric Hutchison	Page 1 of 1

AECOM

Appendix B

Figures

0 20 40 m SCALE 1:2000

LEGEND

- TEST HOLE
- TEST PIT
- STANDPIPE PIEZOMETER

The Manitoba Water Services Board
Grand Beach Lagoon Assessments

Test Hole and Monitoring Instrumentation Location Plan
Figure - 01

AECOM

B SIZE 11" x 17" (279.4mm x 431.8mm)

PLOT: 11/03/04 10:24:15 AM

Saved By: cloustonc

ISS/REV: 0A
AECOM FILE NAME: 60159090-02-B-F01-R0X.dwg

Appendix B

Cost Estimate

Grand Beach Lagoon
Preliminary Cost Estimate

Item	Description	Unit of Measurement	Estimated Total Quantity	Calculated Quantities	Estimated Unit Price	Estimated Total Cost
A	**Forcemain**					
A.1	150 mm Forcemain w/ Common Backfill	lin.m.	350	350.00	$150.00	$52,500.00
A.2	150 mm Forcemain w/ Class 2 Backfill	lin.m.	20	20.00	$250.00	$5,000.00
Sub-Total Section A.						**$57,500.00**
B	**Roads**					
B.1	Subgrade Compaction	sq. m.	1,470	1,400.00	$2.00	$2,940.00
B.2	Granular Base Coarse (150 mm Thickness)	cu. m.	180	160.00	$70.00	$12,600.00
B.3	Granular Subbase (300 mm Thickness)	cu. m.	380	380.00	$60.00	$22,800.00
B.4	Supply & Install Stop Sign (MUTCD type R1-1 750mm X 750mm)	ea	1	1.00	$1,000.00	$1,000.00
B.5	Supply & Install Geotextile, Roads (Woven)	sq. m.	1,470	1,400.00	$3.00	$4,410.00
B.6	Supply & Install 450 mm Diameter CSP 1.6 mm Wall Thickness	lin. m.	48	46.00	$250.00	$12,075.00
Sub-Total Section B.						**$55,825.00**
C	**Lagoon and Related Works**					
C.1	Clearing and Grubbing (Lagoon, Ditching, and Roads)	ha	10	10.00	$6,500.00	$65,000.00
C.2	Topsoil Stripping - Stockpile and Place as required (Lagoon, Ditching, and Roads)	cu. m.	33,000	30,000.00	$8.00	$264,000.00
C.3	Common Excavation (Lagoon, Ditching, and Roads)	cu. m.	49,500	45,000.00	$8.00	$396,000.00
C.4	Borrow Excavation and Placement (Lagoon and Roads)	cu. m.	550	500.00	$10.00	$5,500.00
C.5	Bedrock (Boulders) Excavation	cu. m.	100	100.00	$200.00	$20,000.00
C.6	Supply and Install Sand Liner Bedding					
	a) Bedding Below Liner (150mm)	cu. m.	10,000	9,800.00	$10.00	$100,000.00
	b) Ballast Above Liner (300mm)	cu. m.	14,995	14,700.00	$10.00	$149,950.00

Grand Beach Lagoon
Preliminary Cost Estimate

Item	Description	Unit of Measurement	Estimated Total Quantity	Calculated Quantities	Estimated Unit Price	Estimated Total Cost
C.7	Supply and Install Geotextile (Non Woven), Beneath Liner	sq. m.	71,400	70,000.00	$3.00	$214,200.00
C.8	Supply and Install Geomembrane Liner (60 mil HDPE)	sq. m.	71,400	70,000.00	$9.00	$642,600.00
C.9	Supply and Install Base Coarse on Lagoon Berms (300 mm Thick)	cu. m.	2,310	2,100.00	$70.00	$161,700.00
C.10	Supply and Install 1.82 m Chain Link Fence, complete	lin. m.	1,730	1,730.00	$100.00	$173,000.00
C.11	Seeding (Lagoon, Perimeter and Effluent Ditching)	ha	5	4.70	$3,700.00	$18,500.00
C.12	Lagoon Riprap (50 to 100 mm c/w Geotextile, 300 mm Thickness)	sq. m.	17,115	16,300.00	$30.00	$513,450.00
C.13	Inlet/Outlet Reinforced Concrete Pad	each	8	8.00	$2,500.00	$20,000.00
C.14	Supply and Install Flange x Flange Gate Valve	each	2	2.00	$5,000.00	$10,000.00
C.15	Interconnection Manhole, Complete	lump sum	1	1.00	$30,000.00	$30,000.00
C.16	HDPE DR 17 (Interconnection Pipe)	lin. m.	252	240.00	$250.00	$63,000.00
C.17	HDPE DR 17 c/w one 6.0m 304 Sch40 Stainless Steel End on Higher End (Overflow and Outfall Piping)	lin. m.	47	45.00	$400.00	$18,800.00
C.18	Supply and Install Lagoon Monitoring Wells	each	8	8.00	$1,500.00	$12,000.00
C.19	Supply & Install Signage	each	5	5.00	$1,000.00	$5,000.00
C.20	Filling of New Lagoon to 0.6 m Depth	lump sum	1	1.00	$25,000.00	$25,000.00
C.21	Supply and Install Lagoon Degassing/Dewatering System	lump sum	1	1.00	$100,000.00	$100,000.00
C.22	Random Riprap (100 mm to 300 mm c/w Geotextile, 300 mm Thickness)	cu. m.	22	20.00	$30.00	$660.00
C.23	Concrete Truck Dump Splash Pad	lump sum	1	1.00	$15,000.00	$15,000.00
C.24	Remove and Dispose Existing Interconnection Piping and Valves	lump sum	1	1.00	$10,000.00	$10,000.00
C.25	Ditch Cleaning and Deepening (Along Effluent Discharge Ditch)	lin. m.	189	180.00	$50.00	$9,450.00

Grand Beach Lagoon
Preliminary Cost Estimate

Item	Description	Unit of Measurement	Estimated Total Quantity	Calculated Quantities	Estimated Unit Price	Estimated Total Cost
C.26	Ditch Lining c/w Geotextile (Along Effluent Discharge Ditch)	sq. m.	594	540.00	$50.00	$29,700.00
C.27	Disposal of Contaminated Common Excavation (Off-site)	cu. m.	5,000	5,000.00	$20.00	$100,000.00
Sub-Total Section C.						**$3,172,510.00**
D	**Miscellaneous**					
D.1	Material Testing (Cash Allowance)	lump sum	1	1.00	$10,000.00	$10,000.00
D.2	Tree Planting (Allowance)	lump sum	1	1.00	$10,000.00	$10,000.00
D.3	Rigid Box Insulation (including sides)	lin. m.	33	30.00	$150.00	$4,950.00
D.4	Investigate and Relocate MTS Fiber Optic Cable Along Trail (Cash Allowance)	lump sum	1	1.00	$10,000.00	$10,000.00
D.5	Mobilization, Camp Costs, Insurance, De-Mobilization, Bonding	lump sum	1	1	$350,000.00	$350,000.00
Sub-Total Section D.						**$384,950.00**
E	**Desludging**					
E.1	Dredging and Pumping	cu.m	2,800	2,800	$12.00	$33,600.00
E.2	Water Filling Over Sludge	lump sum	1	1	$20,000.00	$20,000.00
Sub-Total Section E.						**$53,600.00**
SUMMARY:						
A	Forcemain					$57,500.00
B	Roads					$55,825.00
C	Lagoon and Related Works					$3,172,510.00
D	Miscellaneous					$384,950.00
E	Desludging					$53,600.00
Sub-Total						**$3,724,385.00**
	Engineering	15%				$558,657.75
	Contingency Allowance	10%				$372,438.50
	MWSB Finance and Administration	10%				$372,438.50
Total						**$5,027,919.75**

Appendix C

Summary of the Capital, O&M, and Life Cycle Costs

Yearly O&M

Option 1 **Phosphex**

#	Item	Unit	Quantity	Unit Price	Total Amount
1	Grass Mowing and General Maintenance	ls	1	$1,000.00	$1,000
2	Monthly Sample Collection and Analysis	ls	4	$500.00	$2,000
3	Lagoon Access Road Maintenance	ls	1	$1,000.00	$1,000
4	Valves and Maintenance	ls	1	$500.00	$500
5	Power	ls	1	$800.00	$800
6	Pumps & Mechanical Filter Maintenance	ls	1	$1,000.00	$1,000
7	Sacrifical Media Replacement (replaced every 2 yrs)	ls	1	$1,250.00	$1,250
8	C02 for pH control	ls	1	$3,000.00	$3,000
9	Misc. Electrical/ Mechanical	ls	1	$1,000.00	$1,000
Yearly Operations & Maintenance Cost					**$11,550**

Yearly O&M

Option 2 **Alum Dosing**

#	Item	Unit	Quantity	Unit Price	Total Amount
1	Grass Mowing and General Maintenance	ls	1	$1,000.00	$1,000
2	Sample Collection and Analysis	ls	1	$500.00	$500
3	Lagoon Access Road Maintenance	ls	1	$1,000.00	$1,000
4	Valves and Maintenance	ls	1	$500.00	$500
5	Alum	ls	7	$275.00	$1,925
6	Alum Delivery	ls	1	$384.00	$384
Yearly Operations & Maintenance Cost					**$5,309**

O&M Life Cyle Cost

Year	Present Worth Factor	O&M Option 1 Phosphex	O&M Option 2 Alum Dosing	
2011		$11,550.00	$5,309.00	(not included in O&M)
2012	0.962	$11,200.00	$5,200.00	
2013	0.925	$10,700.00	$5,000.00	
2014	0.889	$10,300.00	$4,800.00	
2015	0.855	$9,900.00	$4,600.00	
2016	0.822	$9,500.00	$4,400.00	
2017	0.790	$9,200.00	$4,200.00	
2018	0.760	$8,800.00	$4,100.00	
2019	0.731	$8,500.00	$3,900.00	
2020	0.703	$8,200.00	$3,800.00	
2021	0.676	$7,900.00	$3,600.00	
2022	0.650	$7,600.00	$3,500.00	
2023	0.625	$7,300.00	$3,400.00	
2024	0.601	$7,000.00	$3,200.00	
2025	0.577	$6,700.00	$3,100.00	
2026	0.555	$6,500.00	$3,000.00	
2027	0.534	$6,200.00	$2,900.00	
2028	0.513	$6,000.00	$2,800.00	
2029	0.494	$5,800.00	$2,700.00	
2030	0.475	$5,500.00	$2,600.00	
2031	0.456	$5,300.00	$2,500.00	
O&M Present Worth	1.456	**$158,100.00**	**$73,300.00**	

Discount Rate = 4%

Phosphex Media Replacement Life Cyle Cost

Year	Present Worth Factor	Media Replacement Current	Media Replacement Future
2011		$0	$158,100.00
2012	0.962	$0	$0.00
2013	0.925	$0	$0.00
2014	0.889	$0	$0.00
2015	0.855	$0	$0.00
2016	0.822	$0	$0.00
2017	0.790	$0	$0.00
2018	0.760	$0	$0.00
2019	0.731	$0	$0.00
2020	0.703	$0	$0.00
2021	0.676	$62,500	$42,250.00
2022	0.650	$0	$0.00
2023	0.625	$0	$0.00
2024	0.601	$0	$0.00
2025	0.577	$0	$0.00
2026	0.555	$0	$0.00
2027	0.534	$0	$0.00
2028	0.513	$0	$0.00
2029	0.494	$0	$0.00
2030	0.475	$0	$0.00
2031	0.456	$62,500	$28,500.00
O&M Present Worth	**13.593**	**$125,000**	**$70,750.00**

Discount Rate = 4%

Cost of Media Replacement Supplied by Agassiz Enviro-Systems Inc

Sludge Removal Life Cycle Cost - Alum Doses

Year	Present Worth Factor	Desludging Future Value	Desludging Present Value
2011		$0	$0.00
2012	0.962	$0	$0.00
2013	0.925	$0	$0.00
2014	0.889	$0	$0.00
2015	0.855	$0	$0.00
2016	0.822	$0	$0.00
2017	0.790	$0	$0.00
2018	0.760	$0	$0.00
2019	0.731	$0	$0.00
2020	0.703	$0	$0.00
2021	0.676	$50,000	$33,800.00
2022	0.650	$0	$0.00
2023	0.625	$0	$0.00
2024	0.601	$0	$0.00
2025	0.577	$0	$0.00
2026	0.555	$0	$0.00
2027	0.534	$0	$0.00
2028	0.513	$0	$0.00
2029	0.494	$0	$0.00
2030	0.475	$0	$0.00
2031	0.456	$50,000	$22,800.00
O&M Present Worth	**13.593**	**$100,000**	**$56,600.00**

Discount Rate = 4%

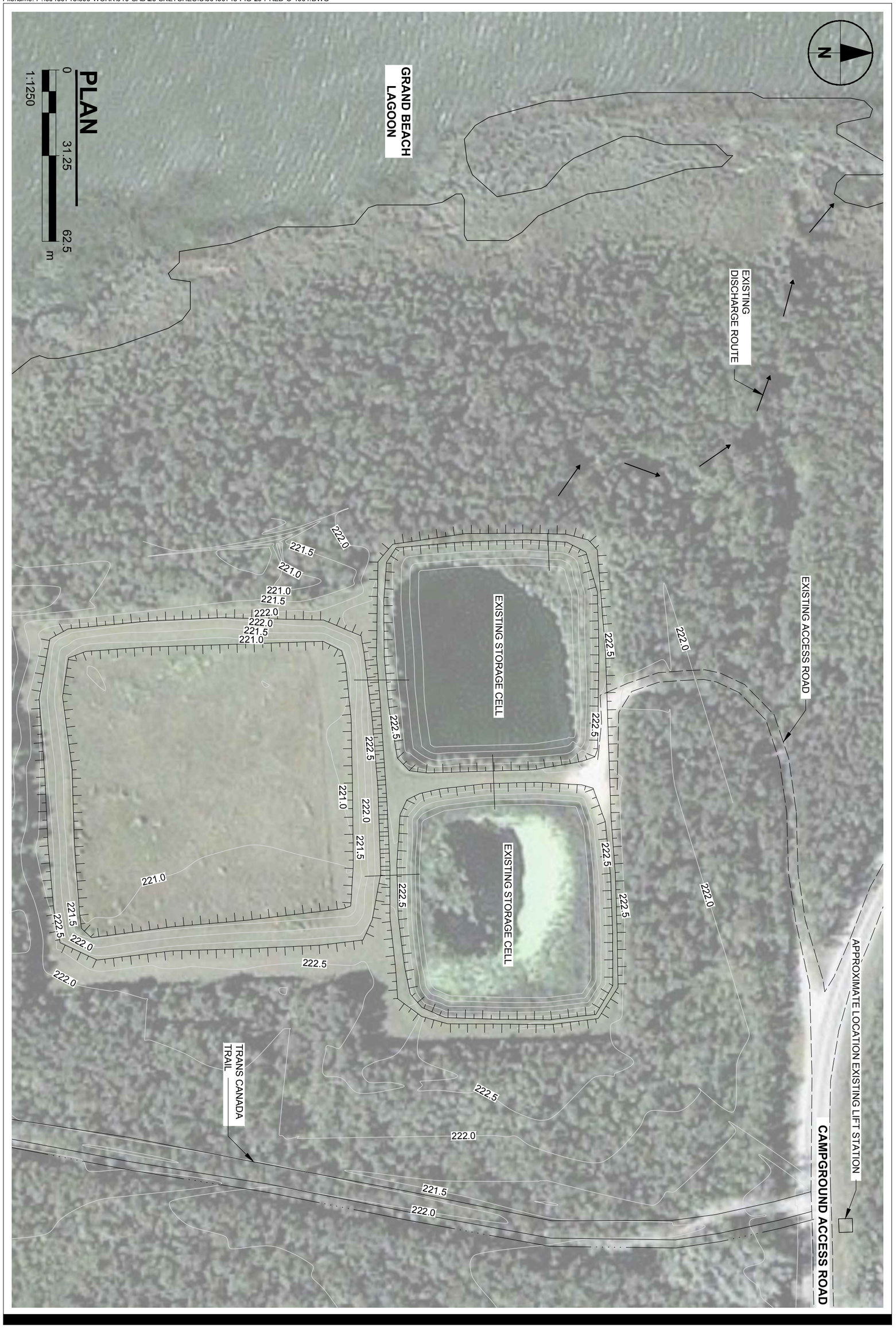
Sludge Removal Life Cycle Cost - No Alum

Year	Present Worth Factor	Desludging Future Value	Desludging Present Value
2011		$0	$0.00
2012	0.962	$0	$0.00
2013	0.925	$0	$0.00
2014	0.889	$0	$0.00
2015	0.855	$0	$0.00
2016	0.822	$0	$0.00
2017	0.790	$0	$0.00
2018	0.760	$0	$0.00
2019	0.731	$0	$0.00
2020	0.703	$0	$0.00
2021	0.676	$0	$0.00
2022	0.650	$0	$0.00
2023	0.625	$0	$0.00
2024	0.601	$0	$0.00
2025	0.577	$0	$0.00
2026	0.555	$0	$0.00
2027	0.534	$0	$0.00
2028	0.513	$0	$0.00
2029	0.494	$0	$0.00
2030	0.475	$0	$0.00
2031	0.456	$50,000	$22,800.00
O&M Present Worth	**13.593**	**$50,000**	**$22,800.00**

Discount Rate = 4%

Appendix D

Drawings

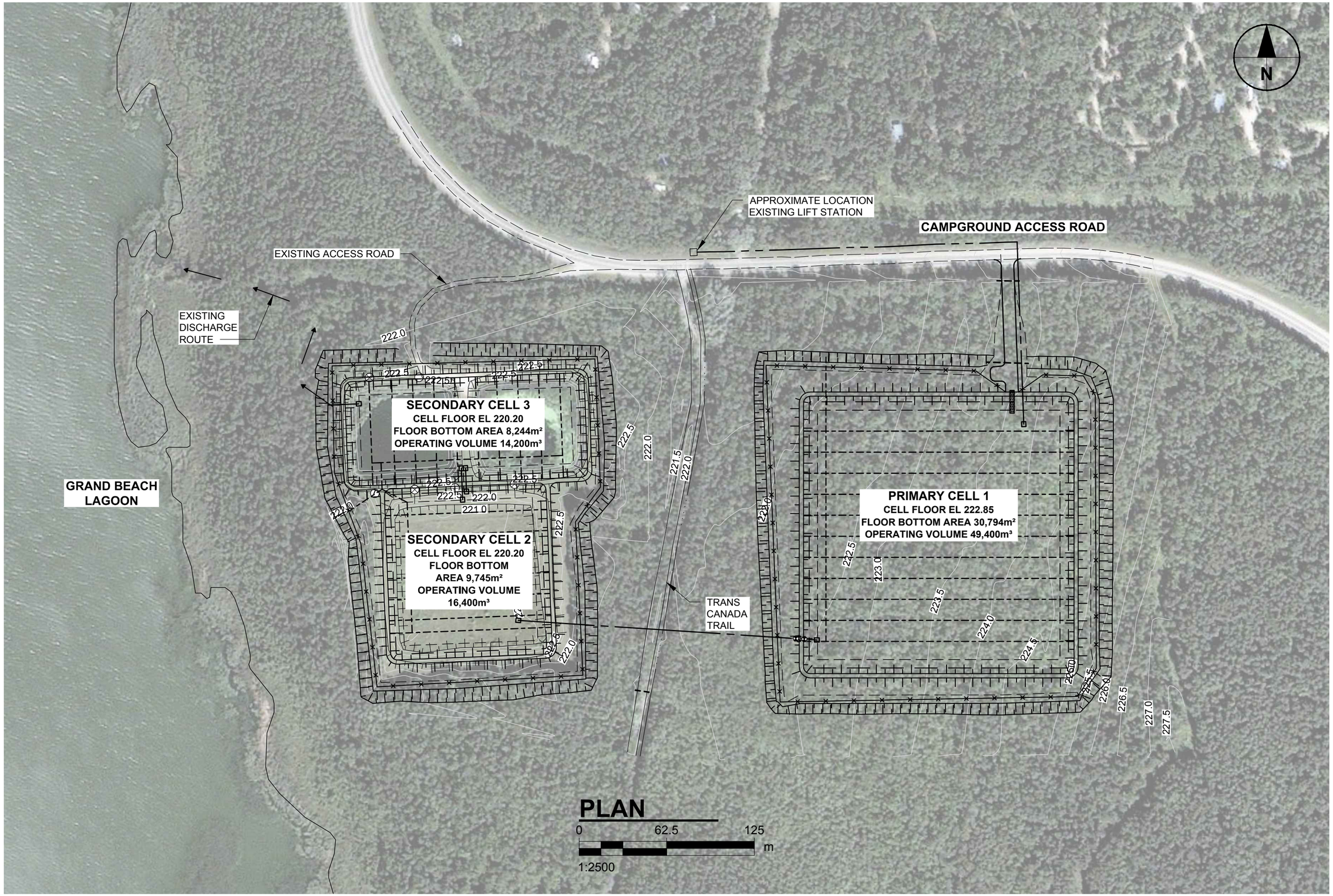


Grand Beach Lagoon Replacement
Predesign Report
Manitoba Water Services Board
Project No.: 60430713 Date: 2015/07/14

EXISTING LAGOON
SITE PLAN

AECOM

Figure: C-1001



AECOM

Figure: C-1002

GENERAL
SITE PLAN

Grand Beach Lagoon Replacement
Predesign Report
Manitoba Water Services Board
Project No.: 60430713 Date: 2015/07/14

Project Management Initials: Designer: ____ Checked: ____ Approved: ____ ANSI B 279.4mm x 431.8mm

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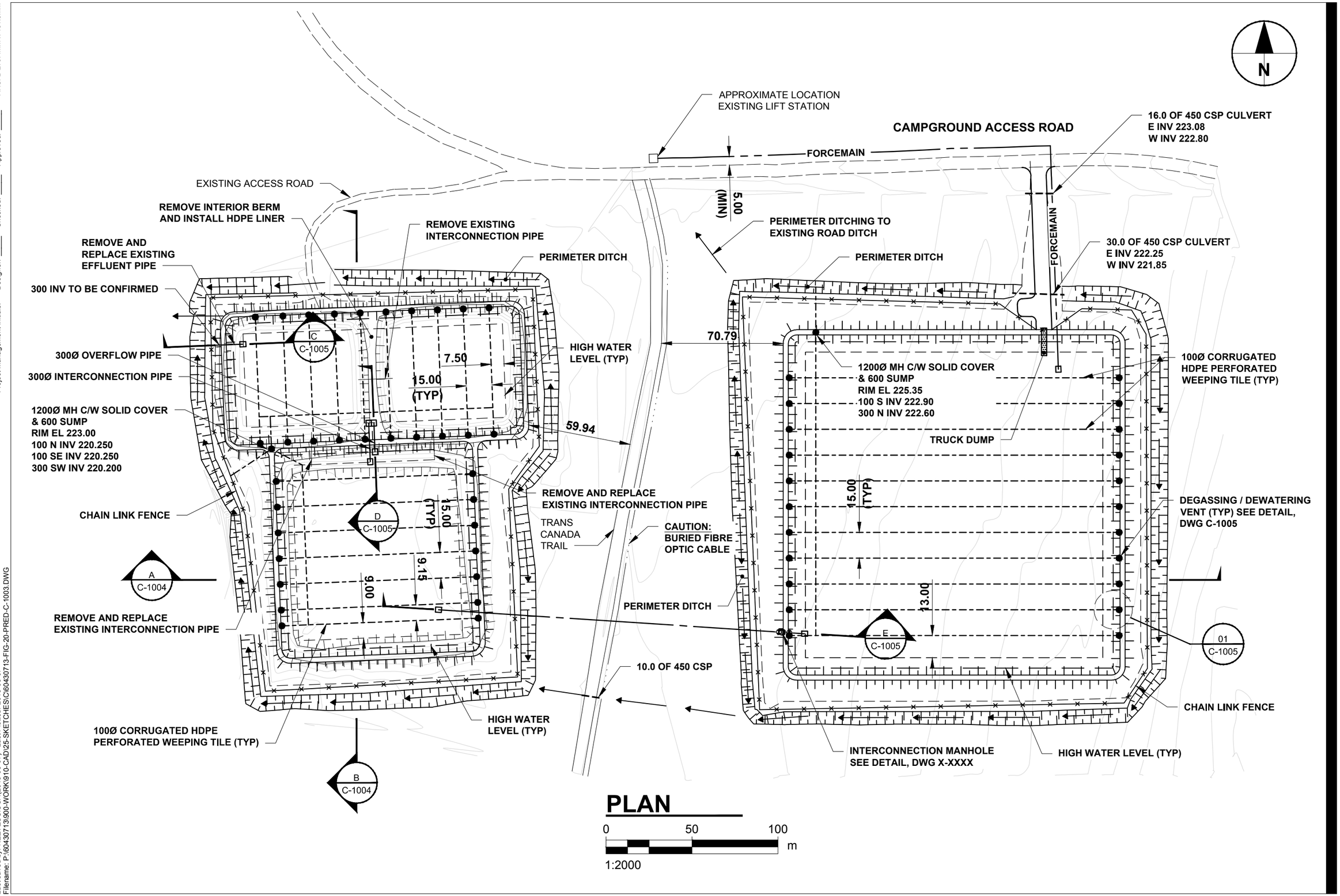

AECOM

Figure: C-1003

LAGOON PLAN

Grand Beach Lagoon Replacement
Predesign Report
Manitoba Water Services Board
Project No.: 60430713 Date: 2015/07/14

Project Management Initials: Designer: ____ Checked: ____ Approved: ____ ANSI B 279.4mm x 431.8mm

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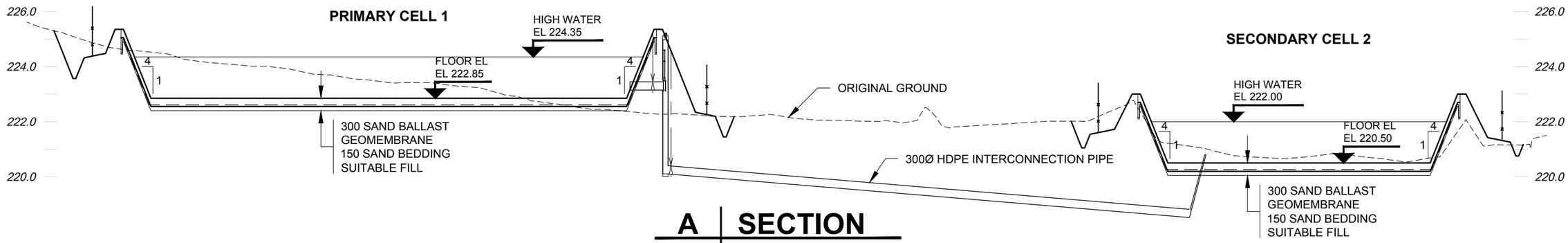

A | SECTION

C-1003

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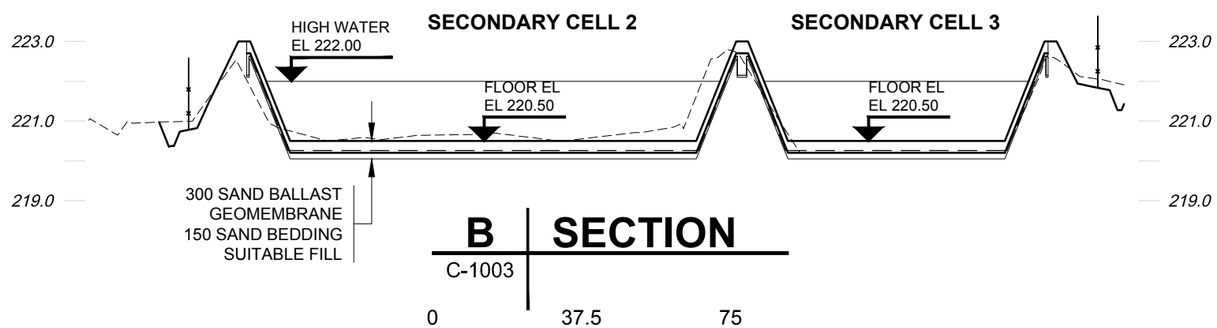
0 3.75 7.5 1:150



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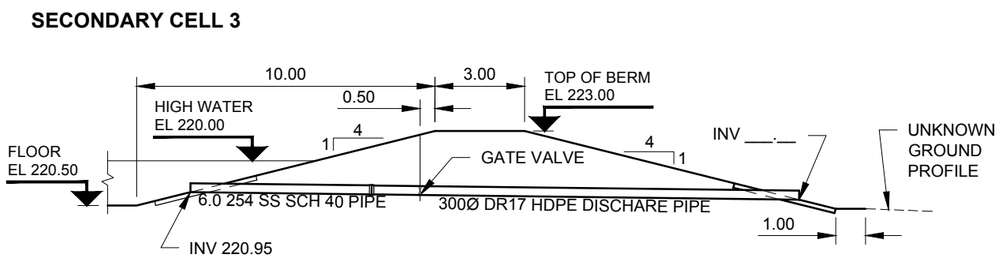

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C-1003 | DISCHARGE PIPING
LINERS NOT SHOWN FOR CLARITY

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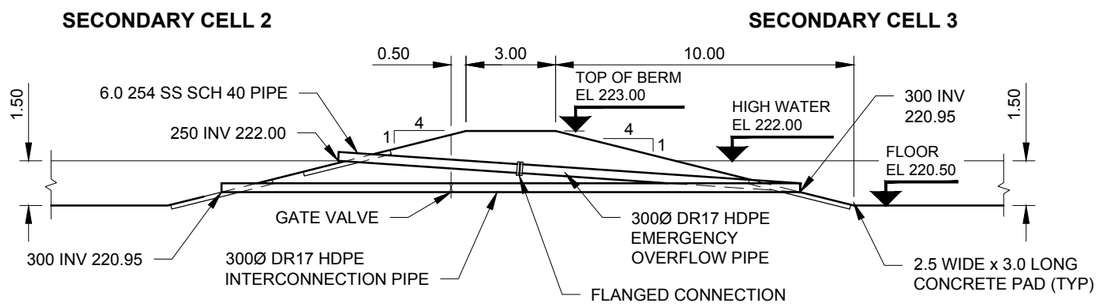
1:200



D | SECTION

C-1003 | INTERCONNECTION PIPING
LINERS NOT SHOWN FOR CLARITY

0 5 10 m
1:200

AECOM

Figure: C-1004

SECTIONS AND DETAILS 1

Grand Beach Lagoon Replacement
Predesign Report
Manitoba Water Services Board
Project No.: 60430713 Date: 2015/07/14

Project Management Initials: Designer: ____ Checked: ____ Approved: ____ ANSI B 279.4mm x 431.8mm

Last saved by: NEZVESCIUCA (2015-07-17) Last Plotted: 2015-08-07
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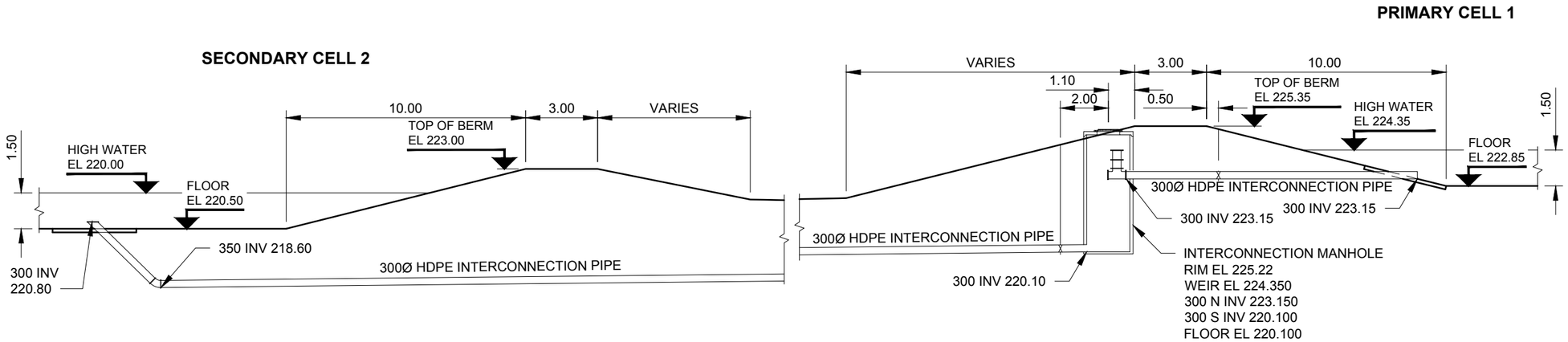

E | SECTION

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LINERS NOT SHOWN FOR CLARITY

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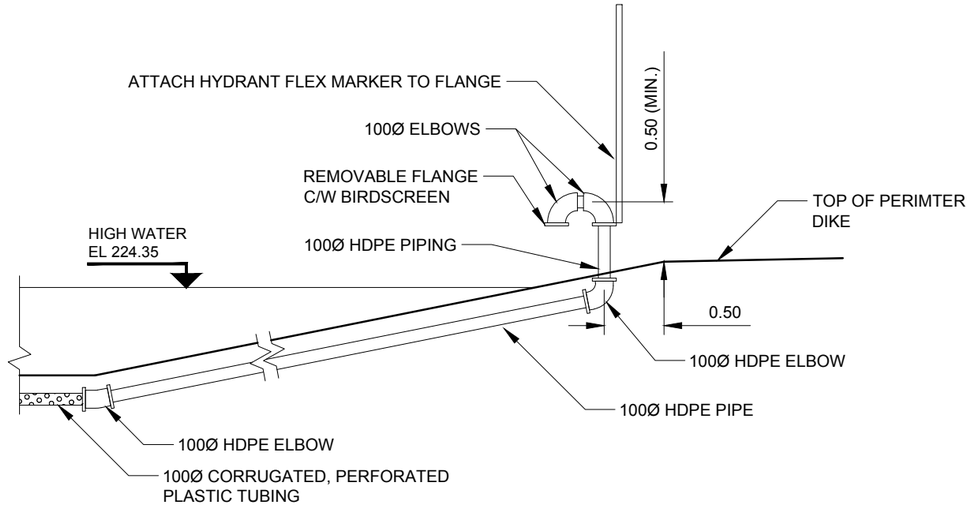

01 | DETAIL

C-1003 | DEGASSING / DEWATERING SYSTEM
VENT AND BERM DETAIL

0 1.25 2.5 m

1:50

AECOM

Figure: C-1005

SECTIONS AND DETAILS 2

Grand Beach Lagoon Replacement
Predesign Report
Manitoba Water Services Board
Project No.: 60430713 Date: 2015/07/14

Project Management Initials: Designer: Checked: Approved: ANSI B 279.4mm x 431.8mm

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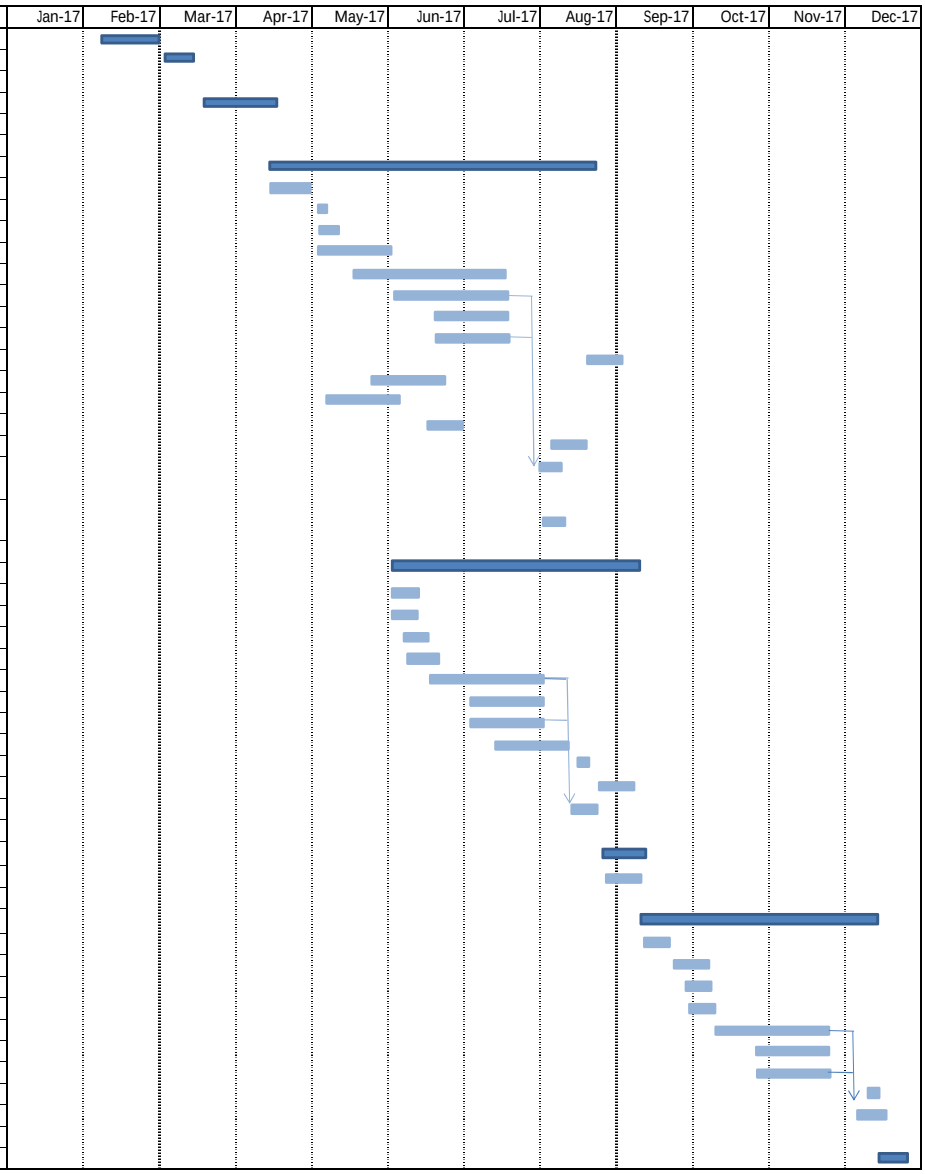
Appendix E

Schedule

Grand Beach Lagoon Preliminary Implementation Schedule

	Duration
Tender period	28 days
Award	14 days
Mobilization	30 days
Equipment, Trailers, Material	
Primary Cell (Construction and Commissioning)	
Clearing and Grubbing	20 days
Perimeter Ditch	5 days
Temporary Roads	10 days
Topsoil and common excavation	30 days
Berm placement	60 days
Supply and install sand liner	45 days
Supply and install geotextile	30 days
Supply and install geomembrane	30 days
Supply and install fence	15 days
Interconnection pipe and control structure	36 days
Degassing and Dewatering System	30 days
Truck Dump	15 days
Lagoon monitoring wells	10 days
Commissioning and transfer operation to primary	10 days
Lagoon access road: compaction, geotextile, granualar base	7 day
Secondary Cell (Construction and Commissioning)	
Clearing and stripping of empty cell	10 days
Perimeter Ditch	10 days
Shaping and repairing existing berms	10 days
Interconnection pipe	12 days
Supply and install sand liner	45 days
Supply and install geotextile	30 days
Supply and install geomembrane	30 days
Degassing and Dewatering System	30 days
Lagoon monitoring wells	5 days
Supply and install fence	15 days
Commission cell	10 days
Desludging of Operating Cells	14 days
Dredging and Pumping	14 days
Construction and Commissioning of New Cell	135 days
Cleaning and stripping of empty cells	10 days
Excavation of interior Bern	15 days
Shaping and outside existing berms	10 days
Repair of outfall pipe	12 days
Supply and install sand liner	45 days
Supply and install geotextile	30 days
Supply and install geomembrane	30 days
Lagoon monitoring wells	5 days
Commission cell	10 days
Demobilization	14 days



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Appendix B

Grand Beach Provincial Park Lift Station and Forcemain Preliminary Design Report

The Manitoba Water Services Board and
Manitoba Conservation

Grand Beach Provincial Park Lift Station and Forcemain
Preliminary Design Report

Prepared by:

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204 477 5381 tel
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April, 2016

Project Number: 60430713

Distribution List

# Hard Copies	PDF Required	Association / Company Name
1	1	The Manitoba Water Services Board
2	1	Manitoba Conservation – Parks and Natural Areas

Revision History

Revision #	Date	Revised By:	Revision Description
0	April 20, 2015	W. Burgess	Draft

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- represents AECOM's professional judgement in light of the Limitations and industry standards for the preparation of similar reports;
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204 284 2040 fax

April 20, 2016

Travis Parsons, P. Eng.
Chief Engineer
The Manitoba Water Services Board
2010 Currie Boulevard
Brandon MB, R7A 6Y9

Dear Mr. Parsons:

Project No: 60430713

Regarding: Grand Beach Provincial Park Lift Station and Forcemain Preliminary Design Report

AECOM is pleased to submit the Draft Report of the Grand Beach Provincial Park Lift Station and Forcemain Preliminary Design Report.

The Report includes design criteria for wastewater flows, site layout, and construction considerations. Preliminary drawings of the proposed lagoon layout are also included.

We appreciate the assistance provided by the Manitoba Conservation and the Manitoba Water Services Board in preparing this report. Please review this draft report and provide your comments. We will then incorporate any required changes into the final report.

Sincerely,
AECOM Canada Ltd.

Eric Hutchison, P. Eng.
Project Manager
Eric.Hutchison@aecom.com

JEH:ag
Encl.

Quality Information

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Bill Burgess, P.Eng.
Civil Design

Report Reviewed By:

Eric Hutchison, P.Eng.
Senior Advisor

Executive Summary

Manitoba Water Services Board (MWSB) retained AECOM to prepare the assessment, preliminary design and detailed design for the Grand Beach Provincial Park Lagoon. This project has been extended to include modifications to the conveyance system to include pumping wastewater flows from the West Beach Wastewater Treatment Plant (WWTP). This facility is owned and operated by Manitoba Conservation. The existing WWTP was constructed in 1979 and recent assessments of the plant have revealed issues which need to be addressed for continued operations. The plant also has historical issues relating to being oversizing as well as being unable to properly handle surges in flow resulting in shock loading.

It is desired to decommission the WWTP in favour of conveying wastewater from its current site to the current site of the East Bach lagoon which currently services the campground. The existing lagoon is located south west of the campground and east of the Grand Beach Wetlands. It was constructed in 1976 as a three cell lagoon, although construction was completed on only two. This lagoon is scheduled to be expanded and modernized and has been sized to allow for flows from the West Beach WWTP.

Current operations at the WWTP only treat wastewater from late spring to early fall when the park sees the most activity. During the off season when the WWTP is not operating wastewater generated from the Parks office as well as flows associated with inflow and infiltration are stored in the equalization tank until the next start-up.

The modifications necessary to enable this work include the construction of a new sewage lift station at the WWTP site, additional gravity sewer piping, and modifying the discharge from the current equalization tank. It has been proposed to use the equalization tank as offline storage both to allow for time to complete structural inspections and repairs but also to mitigate risks associated with the unknown costs necessary to address any unknown deficiencies that may be revealed.

Two alignments for the forcemain were proposed with one following PTH 12 and Causeway Road and the other following the beach front of the West and East Beaches. The Causeway Road alignment was selected due to its road access, reduced geotechnical risk, and reduced environmental impact.

The forcemain will travel south along PTH12 then eastwards along Causeway Road where it will is proposed to cross under the channel with the Grand Beach Wetland by horizontal direction drilling methods. Once across the channel the forcemain will enter the treed area between the Trans Canada Trail and the East Beach Road taking advantage of existing clearings for sending and receiving pits.

Once at the lagoon site the forcemain will be installed on the outside of the north ditch of the new lagoon cell. The lagoon inlet is proposed to be installed is proximity to the truck dump location.

This project is expected is expected to be tendered and awarded in March of 2018 with construction in 2018. Additional design work will be necessary during 2017 and 2018 to undertake detailed topographic survey, geotechnical investigations, and additional flow monitoring.

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1. Introduction

Grand Beach Provincial Park is located at the southeast end of Lake Winnipeg, and is reputed to have one of the best beaches in North America. The 3 km stretch of beach boasts fine silica sand and rolling dunes reaching up to 12 m high. Grand Beach is separated by a natural Wetland into two areas; West Beach and East Beach. The campground is located on the East Beach, while the town site is located on the West Beach. A portion of the wastewater produced by the West Beach site is currently treated by an existing package treatment plant, while the East Beach is serviced by a lagoon.

In 2010, Manitoba Conservation – Parks and Natural Areas (Parks) authorized The Manitoba Water Services Board (MWSB) to hire a consultant to assess the existing Grand Beach lagoon and prepare a preliminary design report for any lagoon upgrades. The MWSB retained AECOM to prepare the assessment and preliminary design for the Grand Beach Provincial Park Lagoon. AECOM submitted a final Preliminary Design Report in August of 2015.

In 2011, AECOM prepared the Grand Beach Wastewater Treatment Plan Assessment Report, which recommended abandoning the treatment facility and directing all wastewater currently treated at the plant to the proposed new wastewater lagoon

In 2016, the MWSB again retained AECOM to complete additional work at Grand Beach Provincial Park. The work involved the preparation of an additional Preliminary Design Report for the installation of a new sewage lift station and forcemain at the West Beach Wastewater Treatment Plant (WWTP) to convey the wastewater to the proposed East Beach Lagoon site. This report builds on previous work conducted by AECOM at Grand Beach Provincial Park Sources of Wastewater

The West Beach WWTP currently provides seasonal treatment for the cottage community and commercial customers in the Grand Beach town site. The plant was sized to treat wastewater produced from the cabins, Beach Safety Building, the two Pavilions, the Parks office, six washroom facilities, and one shower building. However, due to the high cost of connection to the sewage system, 80% of the cabins installed individual holding tanks, which are pumped out and trucked directly to the East Beach lagoon.

This resulted in the overall loading to the plant being lower than expected and the WWTP being subjected to high “shock” loads on the weekends. Parks has experienced ongoing difficulties in managing the biological treatment process at the plant and as a result after completion of the East Beach lagoon upgrades, the WWTP will be decommissioned. Wastewater from the WWTP will be transferred directly to the lagoon via the new forcemain using a new West Beach lift station.

In addition to the process difficulties experienced there are also ongoing and increasing challenges associated with maintaining the facility due to its age. Difficulties are experienced in all areas ranging from the structure, electrical, mechanical, and process equipment.

2. Current and Future Flow Rates

2.1 Catchment Area

Currently, none of the cabins on the Grand Beach town site contributes directly to the hydraulic loading on the piped sewer system. Instead a portion of the cabins and their residents rely on public washroom and shower facilities in the West Beach Area from which wastewater is conveyed to the WWTP by a gravity sewer network. The remainder of the cabins have holding tanks, which are pumped out and the wastewater is trucked directly to the Grand Beach Lagoon site.

2.2 Current Flows

2.2.1 Overview

Presently, the WWTP operates seasonally during the summer months starting May 15th and ending October 31. During the winter months, when it is not in operation, influent wastewater is stored in the equalization tank until the next start up in spring. Wastewater flow data was gathered as a part of a previous assessment AECOM undertook of the WWTP and has been used to determine expected rates of wastewater production during the year.

This flow data from the WWTP was presented in terms of gallons per day and required conversion to hourly rates for the purposes of sizing the lift station and forcemain. A portion of the wastewater generated comes from public shower and bathroom facilities in the park and is not driven by typical population generated rates. Recognizing this, AECOM consulted with Manitoba Conservation and came to the conclusion that most of the daily flows would be generated over a 16 hour period as opposed to a full 24 hour day.

2.2.2 Winter Flow

Current operation practices of the WWTP are to shut down the plant and draw down the equalization tank in preparation for the winter months. Once the shutdown procedures have taken place, any inflow from the wastewater sewer, from either infiltration or flow from the Parks Office, is stored until spring start-up for duration of approximately 190 days. During this period, the tank is not monitored or observed; however, it is noted that no overflows from the tank occur during the shutdown period.

The equalization tank is described as being 11 m x 11 m x 3 m with a sloped bottom to a sump and is located upstream of the WWTP. As-built drawings show the tank to have an active storage depth of approximately 2.14 m above the sump. For the purposes of this analysis, we have excluded the sloped sump from the available storage. The storage volume of the tank is then estimated to be 260 m^3.

AECOM conducted a site visit of the WWTP in April 2011 prior to start-up of the plant. During this time the level of the equalization tank was described as being full. It is therefore concluded that inflow and infiltration of water into the wastewater collection system and the sewage effluent from the Parks Office produce at least 260 m^3 of wastewater during the winter shutdown period. Parks staff have confirmed the operation of the equalization tank during winter and have confirmed that the overflow pipe is not activated during the shutdown period.

This volume of wastewater collected equates to an inflow rate of 0.07 L/s or 1,100 L/day.

2.2.3 Summer Flow

Through previous projects at Grand Beach Provincial Park, AECOM has obtained and analyzed pumping data at the WWTP for three seasons of operation. An analysis of the data revealed two distinct flow patterns depending on the time of the summer season.

Summer flow rates were analyzed as either low season (before the end of June and after the first week in September) season, and high season (July and August). Additional increases in flow were noted around Civic and Statutory holidays.

A summary of the average flow rates noted are provided in the **Table 1**.

Table 1: Seasonal Wastewater Rates – Grand Beach WWTP

Season	Dates	Average Day Flow (L/s)
Low Season	May & June September	1.8
High Season	July & August	3.2
Holidays	Civic Holidays	3.4

2.3 Projected Future Flows

Project stakeholders have indicated there are no anticipated expansions planned of the cabin area or public beach facilities; therefore, both winter and summer flows are projected to remain consistent. Future repairs or upgrading of existing waste water sewers in the park could help to reduce infiltration.

3. Design Criteria

3.1 Sewage Flow Rates

3.1.1 Winter

The design flow rate over the winter storage period are based on the observations made in Section 2.2.2. It is anticipated that this number will not increase, and may be reduced over the life cycle of the lift station and force main through regular maintenance and infrastructure renewal.

3.1.2 Summer

As noted in Section 2.2.3, there are wide variations in flows coming from the West Beach collection system depending on the season and the activities occurring in the Park. For the purposes of this design, the average day flow rate experienced during the summer high season is used for sizing.

Any additional flow rates attributed to activities on civil and statutory holidays are considered to be incorporated into this average.

Sizing of the lift station and forcemain uses a peaking factor of 4.0, based on MOE recommendations for campground type facilities. Based on the selected peaking factor and the average day flow rate in high season the peak flow rate is as follows:

Table 2: Peak Flow Determination

Average Day Flow (L/S)	Peaking Factor	Peak Day Flow (L/s)
3.2	4.0	12.8

3.2 Forcemain

Typically, forcemains are designed in accordance with the following guidelines:

- Minimum main size = 75 mm (3.0 in.).
- Minimum velocity = 0.6 m/sec (2 fps).
- Maximum velocity = 3 m/sec (10 fps).
- Hazen Williams coefficient = 110.
- Pipe material: Polyethylene pipe to ASTM D3036, CSA B137.1 and CGSB 41-GP-25M, Series 60, DR 17, thermal butt fusion welded joints; or approved equal.
- Clean outs are installed at major branch intersections.
- Valve spacing every 1,500 metres or closer.
- Shutoff valves on both sides of water crossings.
- Air release valves as necessary and at accessible locations.
- Maximum Pressure = 345 kPa (or 50 psi).
- Cleanouts installed at high ends of the piping systems.

The forcemain will be equipped with emergency drain facilities where practical (typically this is done within lift stations).

3.3 Lift Station

Typically, lift station installations incorporate the following components:

- Submersible centrifugal pumps capable of passing 50 mm diameter solids.
    - Alternative usage of grinder pumps can be examined during the detailed design phase.
    - Substitution of grinder pumps may lead to additional capital costs as well as introduce other operational considerations such as increased pipe velocities due to the potential increase in solids in the forcemain.
- Duplex system, with each pump capable of pumping the maximum flow entering the station.
- Wet well sized not to exceed maximum pump starts per hour as recommended by pump manufacturer.
- Design inflow = Peak hour Flow = 4.0 x Average Day.
- Pumps with a history of reliable performance, readily available spare parts, good efficiency, and the flexibility to be adapted for higher future flows (i.e. impeller replacement).
- Precast concrete station waterproofed to minimize groundwater infiltration.
- Precast concrete stations employing frost straps.
- Ventilated wet well.
- Equipment and concrete coated to resist deterioration from septic wastewater.
- Stations equipped with hour meters and audible and visual alarms.
- Lift stations consisting of simple subsurface concrete structures (precast manholes), with no building or superstructure overtop.

4. Proposed System

4.1 Overall Description

The proposed final layout of the site involves the construction of a new waste water lift station and forcemain to the East Beach Lagoon. Wastewater from the Townsite will continue to flow by gravity sewer to the site of the current WWTP. During summer operations the wastewater will be diverted to the proposed lift station where it will be conveyed via forcemain to the proposed East Beach Lagoon site. In winter, the lift station will be shut down and prepared for winter by removing the pumps and diverting the wastewater into the equalization tank, where it will be stored until start-up in the spring.

4.2 Forcemain

4.2.1 Overview

The forcemain will connect the existing WWTP site to the site of the new proposed East Beach lagoon expansion and will be operated seasonally with a winter shutdown due to low inflow rates. During the project kickoff meeting two alignments were discussed; one along Causeway Road, and the other beneath the West and East Beach.

Forcemains can be installed by open trench or trenchless methods depending on soil conditions encountered. The use of trenchless methods is often preferred as it causes less ground disturbance, and requires less heavy equipment. Open trench methods can be used equally to trenchless; however, they come at the cost of ground disturbance caused by the trench being excavated and backfilled by heavy machinery. Open trench methods are often used where disturbance is not an issue or if the soils are known to be poor and unsuitable for trenchless methods.

The preferred method of installation will be by trenchless methods to reduce disturbance to the ground and park users.

4.2.2 Evaluation of Forcemain Alignments

4.2.2.1 Option 1 – Causeway Road

The alignment utilizing Causeway Road to get to the East Beach would extend south from the existing WWTP site along the west side of PTH 12 to Causeway Road. From there it would follow the south side of Causeway Road to the east.

The forcemain would have to cross the channel formed by the Grand Beach Wetland. To achieve this crossing the main would be directionally drilled beneath the floor of the channel. Once on the east side of the channel, the forcemain will cross the Trans Canada Trail and turn north and extend through the wooded area, while taking advantage of existing clearings for sending and receiving pits.

This route follows existing roads and pathways. As such, access for the contractor will not be impeded and no additional work will be required for items such as temporary roads.

Parks has provided a sketch showing a fiber optic installation along Causeway Road for a portion of this alignment. The area location of the fiber optic cable is between the flood protection berm, which runs on the northern extension of Donald Street in Grand Marais, and the Trans Canada Trail.

A variation of Option 1 is to alter the final portion of the alignment to run beside the Trans Canada Trail. However, the alignment proposed was based on reducing disruption to park users, as well as the added benefit of minimizing the potential area of conflict with the fiber optic cable.

4.2.2.2 Option 2 – Beachfront

An alternate alignment utilizing the beach front was discussed and evaluated. This alignment would extend north from the existing WWTP site and then eastwards through the West Beach parking lots. The East Beach would be reached by crossing beneath the channel that separates the beaches.

The forcemain would continue eastward towards the Grand Beach Pond, where another crossing beneath the channel separating the East Beach from the shoreline would be required.

This route would require the construction of access roads and travel of heavy equipment along the sand beaches and dunes. The terrain along the proposed route is varied in elevation with large sand dunes rising over the beach and can be changing year by year depending on erosion of the beach caused by storm induced wave action. Selecting an alignment through this area may be problematic, as a route that is on dry land one year may be submerged in another.

The location of the beach along the shoreline of Lake Winnipeg makes the typical composition of sub surface soils along these areas, gravel deposits overlain by sand. The presence of high water table, large rocks, and boulders is also likely, as is seen in other nearby areas of unsheltered shoreline.

This alignment extends through protected and ecologically sensitive areas, where special care is being taken to preserve the unique ecosystems and endangered species.

4.2.3 Confirmation of Geotechnical Conditions

The scope of work for this preliminary design did not include geotechnical investigation. Expected soil conditions were based on typical conditions and not based on direct analysis. A full geotechnical investigation is recommended to be completed for the selected route only.

4.2.4 Selected Route

Due to environmental and constructability issues identified with the route along the beachfront in Section 4.2.2.2, it has been deemed to be non-viable and consideration be given to Option 1 along the Causeway Road.

The route along Causeway Road has better access, does not travel along ecologically sensitive area, and the surface conditions along the route do not have the same stability concerns as was indicated along the beachfront.

Figures have been prepared and provided in **Appendix B** showing the alignment and the locations of wetland crossings, lagoon tie-in, and the modifications being made at the existing WWTP site.

4.2.5 Installation Methods

It is anticipated that the forcemain will be installed by horizontal directional drilling methods. Installation by these methods will reduce ground disturbance in the park as well as help to mitigate working through wet or marshy areas. Construction methods and requirements are to follow the MWSB Standard Construction Specifications.

The forcemain should be installed at the minimum depth of cover required (2.75 m from ground surface to top of pipe).

4.3 Lift Station

Static head difference between the lift station and the lagoon discharge is approximately 9.3 metres, with approximately 4,000 metres of forcemain being required.

Pumps were selected based on the following criteria:

- Design peak inflow of 12.8 L/s.
- Static head as listed above, 9.3 metres.
- Minor losses in the Pumping Station piping (1 pump discharge, 2-90 degree bends, 1 gate valve, 1 check valve, 2 tees with side outlet).
- Friction losses in 3 metres of 100 mm Cast Iron Pumping Station piping (C=100).
- Minor losses in forcemain (2-90 bends, 1 discharge/expansion at the gravity connection).
- Friction losses in the 250 mm forcemain (C=110) with length as listed above.
- 250 mm pump discharge desirable, 100 mm throughlet required.

The resultant design condition is a pumping rate of 22.5 L/s at a total system head of 16.1 metres. Subject to further evaluation during the detailed design stage, the selected pumps were Flygt 3127 SH with 146 mm impellers and a 8.2 kW (11 hp) power input.

4.4 EQ Tank

4.4.1 Current Condition

The equalization tank was originally constructed in 1979 and has undergone limited maintenance or rehabilitation over its nearly 40 year life span. The 2011 AECOM Assessment Report noted issues relating to the trash basket and aeration systems and indicated repair of these systems would be needed to facilitate continued operation of the tank.

No inspection has been completed of the structural components of the tank itself including the concrete roof, cast in place walls and floor, and the integrity of the original waterproofing material applied to the walls.

4.4.2 Future Use

It is recommended that the equalization tank remain in service to maintain the current practice of storing inflow during the winter. Due to the low flow rates it may not be feasible to operate the lift station and forcemain during the winter months due to freezing and residence time concerns. However, due to the age of the tank and its unknown structural condition its use will remain as an offline storage facility in the winter only. The use as off-line storage only will allow for needed inspections, maintenance, and potentially costly repairs to be undertaken. By making the EQ tank off-line storage, the risks of costly repairs can be reduced by not having the EQ tank as an integral part of the system.

The tank will require modifications to both address previously noted deficiencies and reconfigurations necessary to continue to function in the proposed arrangement. Modifications necessary to re-purpose it for the proposed lift station installation include:

- Modifications and repair to the existing trash basket systems.
- New gravity outlet to be installed by coring a hole in the wall of the existing structure and making a water tight connection.
- Overflow pipe to the lake to be abandoned and capped off.

The configurations and arrangement of these piping modifications and how they relate to the existing site are sown on Figure C-1011.

Repairs and maintenance activities necessary to continue keeping the equalization tank in service are as outlined in the assessment report and highlighted below:

- Clean and de-sludge.
- Conduct a structural assessment of the integrity of the tank structure.
- Inspect the integrity of the tank liner for infiltration or exfiltration.
- Reconfiguration of the trash basket system.

4.5 Decommissioning

The existing WWTP building and structure will be decommissioned, demolished, and removed.

5. Schedule

The project schedule for the Grand Beach West Beach Lift Station and Forcemain is a part of a larger project and is influenced by other activities what will precede construction. This is described in detail in the Grand Beach Lagoon Preliminary Design Report and the meeting held on January 6, 2016 with AECOM, Manitoba Conservation, and MWSB. It is based on the following milestones:

- Environment Act Proposal will be submitted as combined document for the lagoon expansion, lift station, and forcemain. Public consultations are proposed for August and September, 2016. The Environment Act Licence will then be issued, likely in late 2016.
- Lagoon Design and Construction:
  - Detailed Design to be completed in 2016.
  - Construction expected to occur in 2017.
- Forcemain and Lift Station:
  - Detailed Design, tender and construction of the forcemain and lift station from the West Beach WWTP to proceed such that construction will occur during 2018.
- Decommissioning of the West Beach WWTP to occur after construction and commissioning of the lift station and forcemain in 2019-2020.

6. Recommendations and Capital Cost Estimate

6.1 General

This section provides a summary of recommendations and capital cost estimates for the project.

AECOM recommends proceeding towards detailed design of the lift station and forcemain based on the selected alignment along Causeway Road and the lift station and forcemain design criteria, as outlined in this report

Prior to the detailed design phase, it is important that a number of additional investigations are carried out. A detailed geotechnical investigation program must be undertaken along the proposed route to confirm suitability of the soils for the proposed methods of construction.

Further information must be collected about winter flows into the EQ tank. There is opportunity to conduct monitoring during the upcoming winter of 2016/2017 to better determine the volume of wastewater that is required to store.

The scope of work is as follows:

- New sewage lift station.
- Approximately 4,000 m of 250 mm HDPE forcemain.
- Crossing of the Grand Beach Wetland Channel at Causeway Road.
- Piping modifications on the existing WWTP site.

6.2 Costs

An estimate of the capital costs associated with the lift station, forcemain, and WWTP site modifications has been completed and is included as **Appendix A**.

The total preliminary cost estimate for this work is $1,536,003 including allowances for engineering (15%), contingency (15%), and MWSB finance and administration (20%).

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Appendix A

Cost Estimate

COST ESTIMATE
GRAND BEACH WEST BEACH LIFT STATION AND FORCEMAIN

DESCRIPTION OF WORK	ESTIMATED QUANTITIES	UNIT	ESIMATED UNIT PRICE	TOTAL
A. FORCEMAIN				
PREFERRED ALIGNMENT				
A.1 Pressure Pipe				
a. 250 mm Forcemain				
i) trenchless installation	4000	lin.m.	$ 160.00	$ 640,000.00
A.2 Valves				
a. 250 mm Gate Valve (c/w box)	3	unit	$ 4,500.00	$ 13,500.00
b. 250 mm Air Release (direct burrial)	1	unit	$ 7,500.00	$ 7,500.00
A.3 Crossings				
a. Water Crossing - Grand Bach Wetland	1	lump sum	$ 30,000.00	$ 30,000.00
b. Road Crossing - Causeway Road	2	unit	$ 5,000.00	$ 10,000.00
Sub Total Section A				**$ 701,000.00**
B. GRAND BEACH TOWNSITE WWTP				
SITE MODIFICATIONS				
B.1 Lift Station #1 - Complete	1	lump sum	$ 400,000.00	$ 400,000.00
B.2 Manhole c/w frame and cover				
a. standard manhole	1	unit	$ 15,000.00	$ 15,000.00
b. standard manhole, c/w internal drop structure	1	unit	$ 20,000.00	
B.3 Watewater Sewer	30	lin.m	$ 276.00	$ 8,280.00
B.4 Wastewater Valves (c/w box)				
a. 250 mm	3	unit	$ 4,500.00	$ 13,500.00
Sub Total Section B				**$ 436,780.00**
	Subtotal			**$ 1,137,780.00**
	ENGINEERING	15%		$ 170,667.00
	CONTINGENCY	15%		$ 170,667.00
	MWSB	20%		$ 227,556.00
	TOTAL			**$ 1,536,003.00**

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Appendix B

Drawings

PLAN

Scale 1:2500

0 62.5 125 m

Project Management Initials: Designer: ____ Checked: ____ Approved: ____ ANSI B 279.4mm x 431.8mm

Last saved by: LEIPPIA(2016-04-20) Last Plotted: 2016-04-20
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Figure: C-1006

Grand Beach - West Beach Lift Station and Forcemain
Predesign Report
Manitoba Water Services Board
Project No.: 60430713 Date: 2016/04/20

Grand Beach - West Beach Lift Station and Forcemain
Predesign Report
Manitoba Water Services Board
Project No.: 60430713 Date: 2016/04/20

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Figure: C-1007

Grand Beach - West Beach Lift Station and Forcemain
Predesign Report
Manitoba Water Services Board
Project No.: 60430713 Date: 2016/04/20

AECOM

Figure: C-1008

Project Management Initials: Designer: ____ Checked: ____ Approved: ____ ANSI B 279.4mm x 431.8mm

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Figure: C-1009

Grand Beach - West Beach Lift Station and Forcemain
Predesign Report
Manitoba Water Services Board
Project No.: 60430713 Date: 2016/04/20

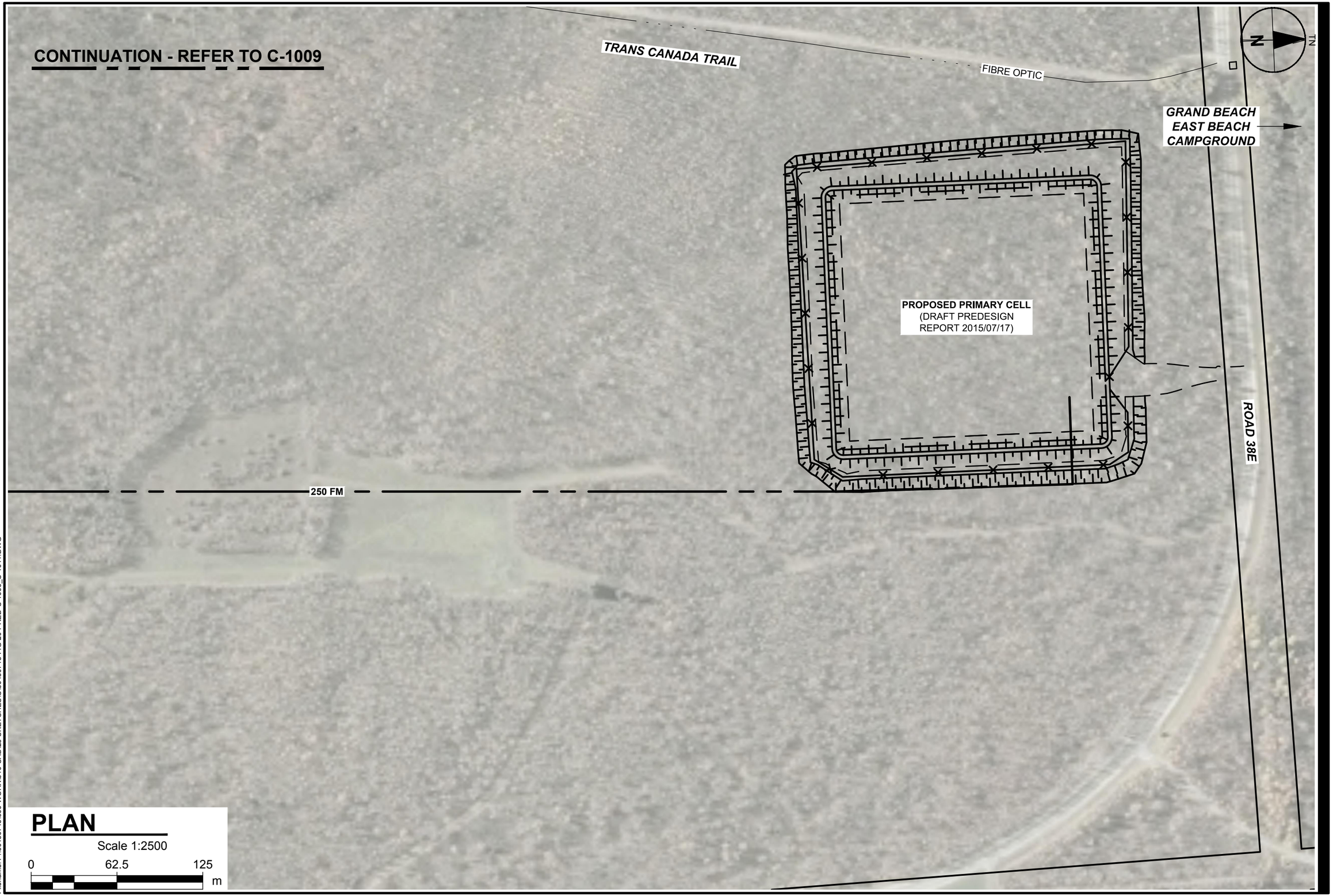

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Figure: C-1010

Grand Beach - West Beach Lift Station and Forcemain
Predesign Report
Manitoba Water Services Board
Project No.: 60430713 Date: 2016/04/20

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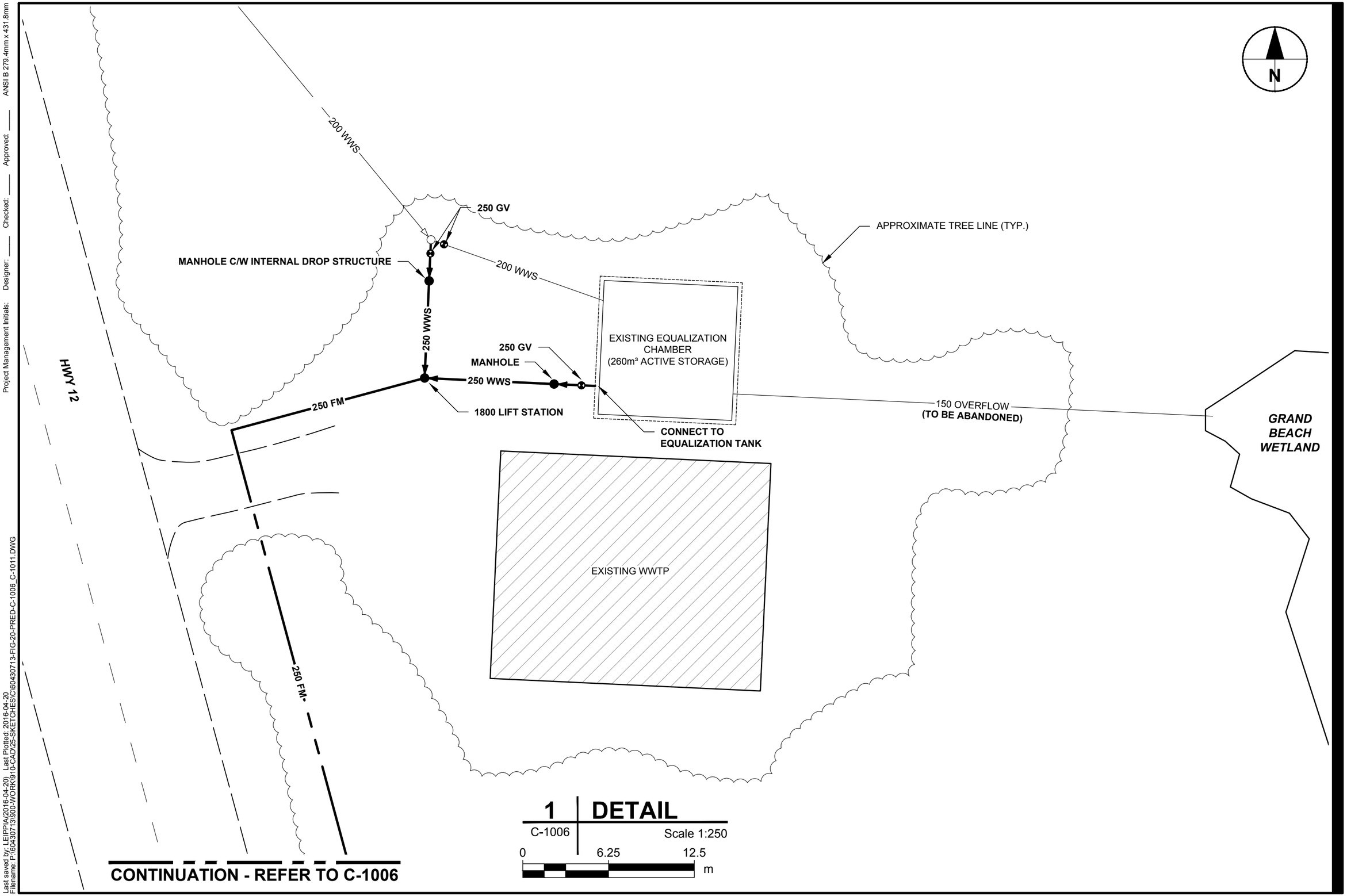

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Figure: C-1011

Grand Beach - West Beach Lift Station and Forcemain
Predesign Report
Manitoba Water Services Board
Project No.: 60430713 Date: 2016/04/20

Project Management Initials: Designer: ____ Checked: ____ Approved: ____ ANSI B 279.4mm x 431.8mm

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Filename: P:\60430713\900-WORK\910-CAD\25-SKETCHES\C\60430713-FIG-20-PRED-C-1006_C-1011.DWG

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AECOM is a premier, fully integrated professional and technical services firm positioned to design, build, finance and operate infrastructure assets around the world for public- and private-sector clients. The firm's global staff — including architects, engineers, designers, planners, scientists and management and construction services professionals — serves clients in over 150 countries around the world.

AECOM is ranked as the #1 engineering design firm by revenue in Engineering News-Record magazine's annual industry rankings, and has been recognized by Fortune magazine as a World's Most Admired Company. The firm is a leader in all of the key markets that it serves, including transportation, facilities, environmental, energy, oil and gas, water, high-rise buildings and government.

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Appendix C

Site Photographs

Appendix C: Site Photographs

Photograph 1 ↑
Looking west towards the existing Lagoon gated entrance.

Photograph 2 ↑
Existing secondary Lagoon storage cell looking southwest.

Photograph 3 ↑
Existing primary Lagoon storage cell looking southeast.

Photograph 4 ↑
Existing truck dump located at the primary Lagoon cell.

Photograph 5 ↑
Looking southeast towards the existing third Lagoon cell (never completely constructed).

Photograph 6 ↑
Looking southwest towards the existing third Lagoon cell (never completely constructed).

Photograph 7 ↑
Looking south along the Trans Canada Trail located east of the existing Lagoon.

Photograph 8 ↑
Wild Rose found along the Trans Canada Trail.

Photograph 9 ↑
Looking east from the Trans Canada Trail along a former cut line for a geotechnical investigation in 2011.

Photograph 10 ↑
Small White Lady-slipper found along the Trans Canada Trail.

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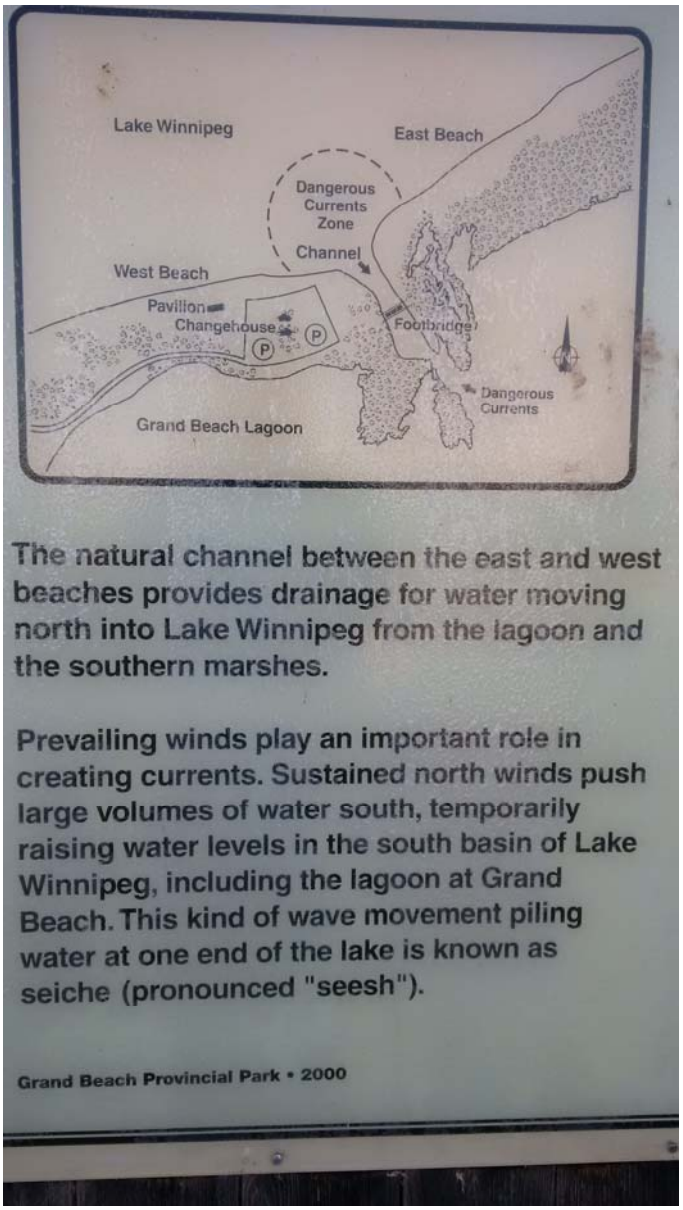
Appendix D

Photographs Provided by Parks

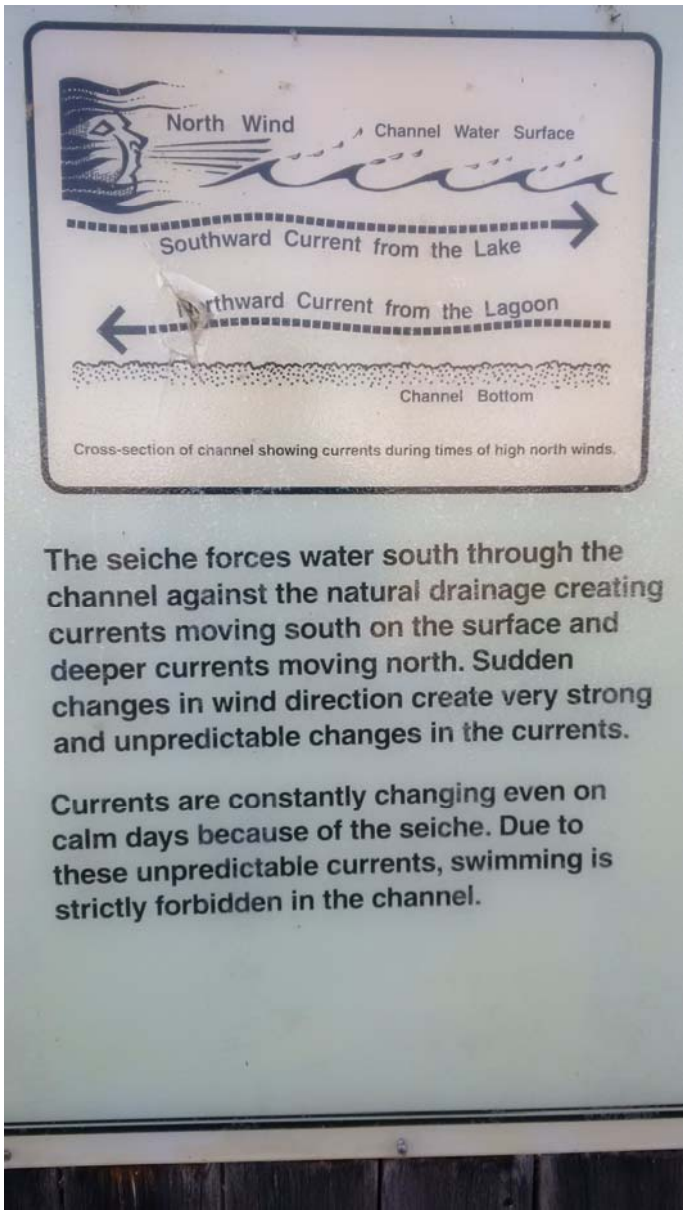
Appendix D: Photographs Provided by Parks

Photograph 1 ↑
Natural channel between Grand Beach East and West Beaches on October 2, 2015.

Photograph 2 ↑
Natural channel between Grand Beach East and West Beaches after high water levels in 2010.



Photograph 3 ↑
Sign located at the entrance to the channel bridge at Grand Beach.



Photograph 4 ↑
Sign located at the entrance to the channel bridge at Grand Beach.

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Appendix E

Heritage Resources Branch Response

Manitoba
Sport, Culture and Heritage

Memorandum

DATE: 2016-12-08

TO: **Kristiina CUSITAR**
Environmental Assessor
AECOM
99 Commerce Drive
Winnipeg, Manitoba
R3P 0Y7

FROM: **Suyoko TSUKAMOTO**
Impact Assessment Archaeologist
Historic Resources Branch
Main Floor – 213 Notre Dame Avenue
Winnipeg, Manitoba
R3B 1N3

PHONE NO: (204) 945-3893
FAX: (204) 948-2384
E-MAIL: Suyoko.Tsukamoto@gov.mb.ca

SUBJECT: Grand Beach Provincial Park Lagoon Upgrade Project - update
AAS File No. AAS-15-9436/AAS-16-11299

No concerns at this time.

Further to your general inquiry regarding the above noted revisions to the lagoon project, the Historic Resources Branch has examined the locations in conjunction with Branch records for areas of potential concern. The potential to impact significant heritage resources has been deemed low in these areas, therefore, the Historic Resources Branch has no immediate concerns with the project.

If at any time, however, heritage resources are encountered in association with these lands during testing and development, the Historic Resources Branch may require that an acceptable heritage resource management strategy be implemented by the developer to mitigate the effects of development on the heritage resources.

If you have any questions or comments, please feel free to contact me as above.

Suyoko Tsukamoto

Manitoba

Memorandum

DATE: August 14, 2015

TO: Kristiina Cusitar
Environmental Assessor,
Environment
AECOM
99 Commerce Drive
Winnipeg, Manitoba
R3P 0Y7

FROM: Christina Nesbitt
Impact Assessment
Archaeologist
Historic Resources Branch
Main Floor 213 Notre Dame
Avenue
Winnipeg MB
R3B 1N3
Christina.Nesbitt@gov.mb.ca
PHONE NO: (204) 945-8145

SUBJECT: Grand Beach Provincial Park
Lagoon Replacement
HRB Review and Comments

HRB FILE: AAS-15-9436

Further to your memo requesting a heritage screening for the above lagoon replacement at Grand Beach Provincial Park (Planned Area), the Historic Resources Branch (HRB) has examined the applicabe areas proposed for development in conjunction with the Branch's records for areas of potential concern, and can advise you that HRB has no concerns with the project at this time.

However, pleased be advised that if any heritage resources are encountered in association with the Planned Area during development, the Developer is required to notify HRB and HRB may require that a heritage resource management strategy be implemented to mitigate the effects of development on the heritage resources.

If you have any questions or comments, please feel free to contact the undersigned at the above noted address, phone number, or e-mail.

Christina Nesbitt

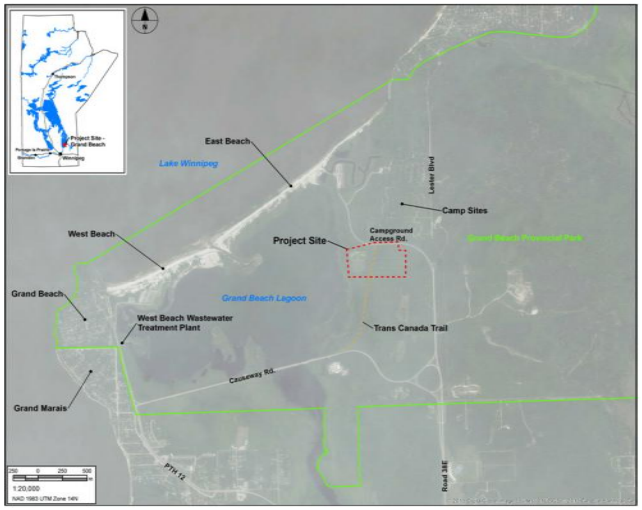
AECOM

Appendix F

Open House Materials

Background

- The Grand Beach Provincial Park wastewater lagoon is a clay-lined lagoon constructed in 1976, which is currently over capacity.
- There are two operating cells:
    1. A primary cell (receives sewage from the Grand Beach campground through the lift station and from the septage haulers)
    2. A secondary cell (provides additional storage)
- Construction on the third cell was started in 1976, but not completed.
- The wastewater lagoon was designed to discharge to a drainage ditch and then into the Grand Beach natural lagoon, which drains directly into Lake Winnipeg.



Location Map

Existing Lagoon

Existing Lagoon

Proposed Wastewater Lagoon

- The total annual projected flow to the wastewater lagoon is the sum of the summer flow from the campground, the year round flow from the cabins, septage, the West Beach Wastewater Treatment Plant, and infiltration.
- The upgraded wastewater lagoon will provide 365 day storage by annually discharging in the fall.

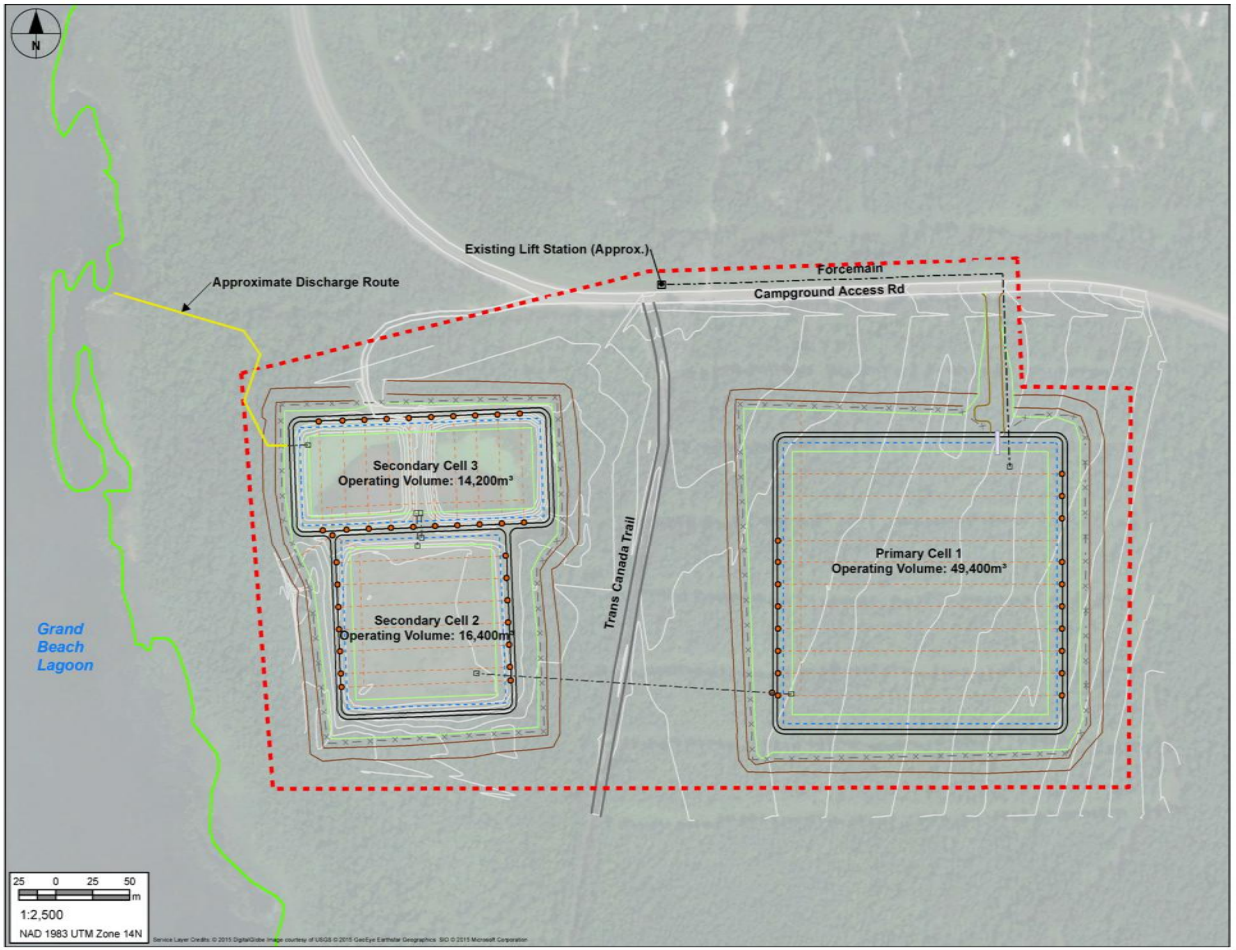
Projected Future Flow – Total Annual Flows

Unit	Total Flow (L)
Campground	16,045,000
Cabins	16,776,000
Septage	75,000
West Beach WWTP	16,700,000
Infiltration	36,500
Total Annual Flow	49,632,500

Liner Installation

Liner Installation

Proposed Wastewater Lagoon



Proposed Lagoon

- A new primary cell will be constructed.
- Existing cells will be upgraded and converted to two secondary cells for wastewater storage.
- A geosynthetic liner will be installed on a 150 millimetre layer of compacted bedding sand over a 300 millimetre granular dewatering and degassing system.
- All wastewater lagoon cells will be fenced.

Environmental Assessment

Surface Water Quality

- The project will provide an improvement in effluent quality.
- Environment Act Licence limits will be met.

Aquatic Environment

- Lake Winnipeg supports extensive commercial and recreational fisheries.
- Vegetation clearing and grading will be required within the existing effluent drainage ditch.
- Toxicity impacts to fish due to effluent discharges are not anticipated.

Flora and Fauna

- No concerns about endangered plants around the new wastewater lagoon location.
- If any endangered species are spotted during construction, appropriate mitigation measures will be applied.
- Investigations for heritage resources are underway.

Walleye

Sauger

Lake Whitefish

Wild Red Columbine

Yellow Lady-slipper

Wild Rose

Environmental Assessment

Groundwater

- Lagoon cells will be lined with a geosynthetic liner to prevent leakage.
- A dewatering/degassing system will be installed below the liner. Liquid from this system will be tested if leaks are suspected.
- Annual groundwater monitoring will be conducted.

Traffic and Noise

- Small volume of traffic associated with the project.
- Construction noise will be typical of heavy equipment.
- Noise during operation may include maintenance noise and periodic truck noise.
- Tree buffer will limit effect of noise on campers.

Emissions

- Periodic lagoon de-sludging (every 10 years) may create odours. Timing of sludge removal will be scheduled during low park use periods.
- Methane generation is anticipated to be minimal.
- Tree buffers around the Lagoon cells will limit odours.

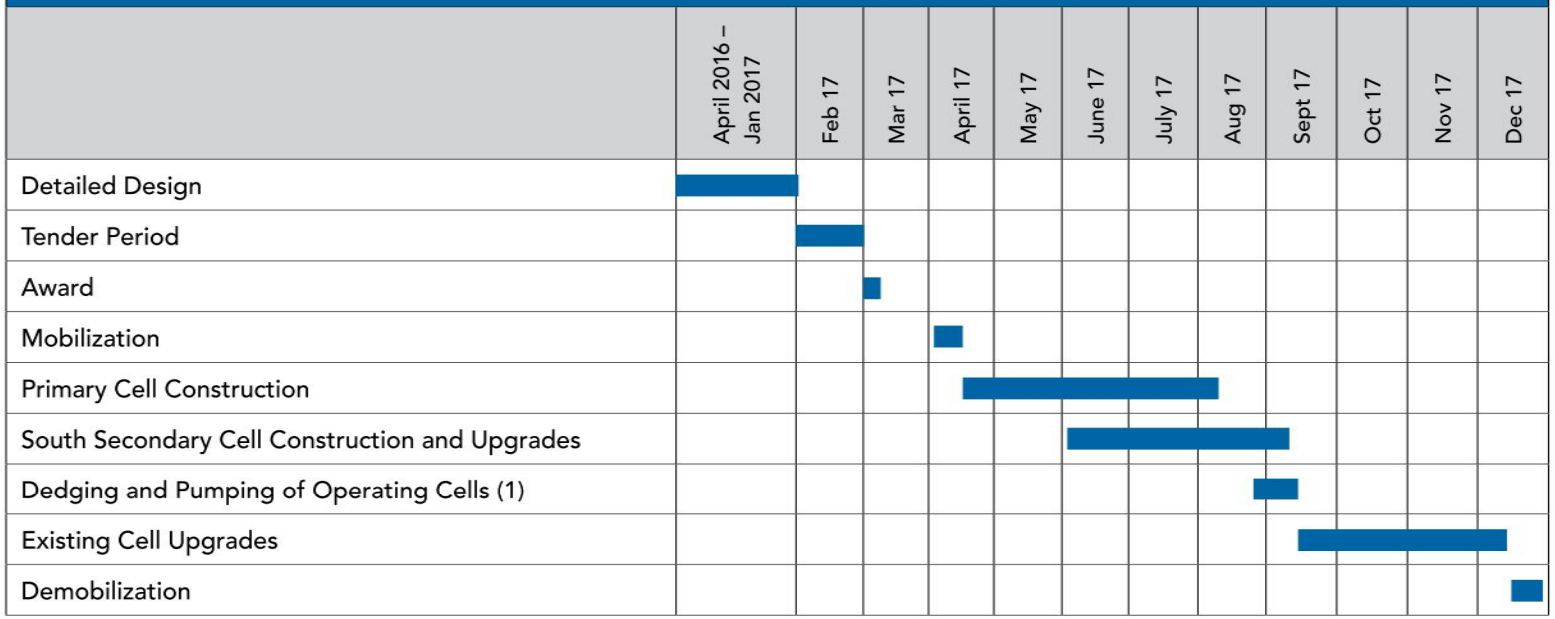
Liner Installation

Liner Installation

Overall Project Schedule

- **Detailed design of the East Beach lagoon upgrades:**
  > April 2016 – December 2016
- **Lagoon construction period:**
  > March 2017 – December 2017
- **Construction of a lift station and forcemain from the West Beach Wastewater Treatment Plant:**
  > April 2018 – October 2018
- **Decommissioning of the West Beach Wastewater Treatment Plant:**
  > April 2019 – October 2019

Grand Beach Lagoon Preliminary Implementation Schedule



Overall estimated cost of the wastewater lagoon upgrade is $5 million.

MANITOBA Parks

Grand Beach Wastewater Lagoon Upgrade

August, 2015

Comment Sheet

Manitoba Conservation and Water Stewardship will be hosting information sessions about the Grand Beach wastewater lagoon upgrade. The lagoon is sized to meet the projected wastewater loadings for the next 20 years and has been designed to comply with today's Environmental Regulations.

Are you satisfied with the proposal? Yes ❑ No ❑

If you have concerns or specific supportive information please assist us with comments in the following areas:

Proposed site: _____

Treatment methodology: _____

Discharge route: _____

Odour: _____

Environmental impacts: _____

Land use: _____

Impact on cottagers: _____

Other: _____

Manitoba

We would like to understand why you are interested in this project.

Do you visit and use the Grand Beach Provincial Park? Yes ❑ No ❑

If yes, are you a:

❑ cottage owner ❑ cottage renter ❑ resort occupant ❑ business owner

❑ day visitor ❑ other (please specify) _____

If no, is your interest in:

❑ park development ❑ watershed development ❑ general environmental issues

Did this open house provide a sufficient overview of the proposed project? If no, what additional information was required? _____

_____

_____

_____

Other Comments: _____

_____

_____

_____

Information on the proposal and comment sheets are also posted on **www.manitobaparks.com**, or available by contacting Manitoba Conservation and Water Stewardship at **204-945-6799** or **1-800-214-6497**.

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