



December 6, 2022

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Mr. James Capotosto  
Director  
Manitoba Environment, Climate and Parks  
Environmental Approvals Branch  
1007 Century Street  
Winnipeg, Manitoba  
R3H 0W4

via courier

E-634.03

Dear Mr. Capotosto,

**Re: RM of Elton – Forrest Wastewater Treatment Lagoon Expansion – Environment Act Proposal**

The Manitoba Environment, Climate and Parks, Parks Branch is proposing to expand the existing Forrest Wastewater Treatment Lagoon. An Environment Act Licence will be required from Manitoba Environment, Climate and Parks, Environmental Approvals Branch for the construction and operation of the expanded lagoon.

As per the requirements of the Environment Act Proposal form, enclosed are:

1. Two (2) bound hard copies of the Environment Act Proposal report
2. One (1) electronic copy of the Environment Act Proposal report (email)
3. Original Environment Act Proposal form attached to cover letter, with a copy contained in each document
4. The EAP application fee of \$7,500 (Cheque made out to the Minister of Finance).

The results of this proposal conclude that there will be no significant negative impacts to the environment as a result of the proposed project, provided the mitigation measures described are taken. The RM of Elton and MWSB would like to complete the requirements of the Environment Act Proposal as soon as possible so that the lagoon construction can begin in the spring of 2023.

If there are any questions or comments, please contact the undersigned.

Yours truly,

JR Cousin Consultants Ltd.



Oswald Wohlgemut, M.Sc.  
Environmental Scientist

enc. Two (2) bound copies, original EAP form, application fee

cc Shawna Paulson, CAO – RM of Elton (via email)  
Rebecca Toews, Manitoba Water Services Board (via email)

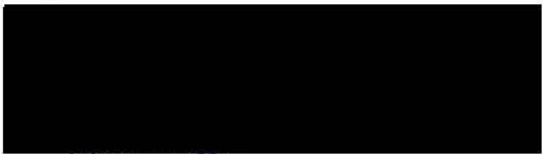
JRCC.ca



**Rural Municipality of Elton  
Environment Act Proposal  
Forrest Wastewater Treatment Lagoon Expansion**



Oswald Wohlgemut, M.Sc.  
Environmental Scientist



Jeff Dyck, P. Eng.  
Senior Municipal Engineer

**December 2022**



## **ACKNOWLEDGMENTS**

To prepare this report various sources of information were investigated and researched. JR Cousin Consultants Ltd. (JRCC) wishes to thank the Manitoba Water Services Board and the Rural Municipality of Elton for contributing to the data and content of this study. In addition, we wish to commend the Rural Municipality of Elton for their fortitude in addressing the need for a long-term solution to wastewater treatment for the Community of Forrest.

## **REMARKS**

JR Cousin Consultants Ltd. has conducted this environment act proposal in accordance with generally accepted professional engineering principles and practices for the purpose of identifying conditions that may have an environmental impact on the site. The findings and recommendations reached in this report are based on information made available to JRCC during the investigation and conditions at the time of the site investigation. Conclusions derived in this report are intended to reduce, but not wholly eliminate the uncertainty regarding potential environmental concerns on the site, and recognizes reasonable limitations with regards to time, accuracy, work scope and cost. It is possible that environmental conditions may change from the date of this report. If conditions appear different from those encountered and expressed in this report, JRCC should be informed so that mitigation recommendations can be reviewed and adjusted as required. Historical data and information obtained from personal communication used in this report, are assumed to be correct, however JRCC has not conducted further investigations into the accuracy of this data. JRCC has produced this report for the use of the client, and takes no responsibility for any third party decisions or actions based on information contained in this report.

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#### Appendix A

Status of Titles

#### Appendix B

Table 1: Forrest Lagoon - Population, Hydraulic and Organic Loading Projections to Design Year 20

Species at Risk Database Search, Manitoba Environment, Climate and Parks - Wildlife and Fisheries Branch, September 1, 2022

#### Appendix C

Geotechnical Investigation Letter Report, JR Cousin Consultants Ltd., December 7, 2021

Sludge Assessment Report, Assiniboine Injections Ltd., October 28, 2021

Sludge Analysis Report, ALS Global, November 21, 2021

## Appendix D

Title Page

Plan 1: Proposed Lagoon Expansion Location with Setbacks

Plan 2: Proposed Lagoon Expansion with Test Hole Locations

Plan 3: Proposed Land Application Area

Plan 4: Proposed Lagoon Storage Cell Layout Plan

Plan 5: Lagoon Dike and Liner Details

Plan 6: Fence, Silt Fence, Valve, Valve Marker, Rip Rap and Ditch Details

# Environment Act Proposal Form



Name of the development: RM of Elton - Forrest Wastewater Treatment Lagoon Expansion		
Type of development per Classes of Development Regulation (Manitoba Regulation 164/88): Class 2 Development - Wastewater Treatment Lagoon		
Legal name of the applicant: RM of Elton		
Mailing address of the applicant: General Delivery		
Contact Person: Shawna Paulson, CAO		
City: Forrest	Province: Manitoba	Postal Code: R0K 0W0
Phone Number: (204) 728-7834 Fax: (204) 725-1865 email: cao@elton.ca		
Location of the development: RM of Elton, Forrest		
Contact Person: Shawna Paulson, CAO		
Street Address:		
Legal Description: SW 31-11-18 WPM		
City/Town: Forrest	Province: Manitoba	Postal Code: R0K 0W0
Phone Number: (204) 728-7834 Fax: (204) 725-1865 email: cao@elton.ca		
Name of proponent contact person for purposes of the environmental assessment: Oswald Wohlgemut, M.Sc.		
Phone: (204) 489-0474	Mailing address: JR Cousin Consultants Ltd. 91 A Scurfield Blvd. Winnipeg, MB.. R3Y 1G4	
Fax: (204) 489-0489		
Email address: owohlgemut@jrcc.ca		
Webpage address: www.jrcc.ca		
Date: 2022-12-02	Signature of proponent, or corporate principal of corporate proponent: 	
	Printed name: Oswald Wohlgemut	

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## EXECUTIVE SUMMARY

### General

The RM of Elton is proposing to expand the existing Forrest wastewater treatment lagoon. An Environment Act Licence will be required from Manitoba Environment, Climate and Parks (MECP) for the construction and operation of the expanded lagoon and for the application of lagoon sludge onto the adjacent agricultural land. JR Cousin Consultants Ltd. (JRCC) was retained for the associated engineering services.

### Description

The existing Forrest wastewater treatment lagoon is in need of expansion, due to existing hydraulic capacity issues, to accommodate the service population. The proposed expansion includes constructing a new storage cell to the east of the existing lagoon cells. These works are required to achieve the hydraulic storage capacities required in the expanded lagoon site to design Year 20. A borrow pit to the east will be required to obtain the needed soil quantities.

Due to accumulation of sludge in the existing lagoon cells, sludge removal and application on adjacent agricultural land to the north is also proposed.

### Population Contributing Effluent

The projected Year 20 population used for sizing the Forrest lagoon expansion consisted of: the residential population in Forrest (189 people), and the out-of-town school students and staff (120 equivalent people).

### Lagoon Loading

The total projected Year 20 organic loading to the lagoon primary cell is estimated to be 40.2 kg BOD<sub>5</sub>/day, which considers average daily loading from the community, and a peak daily load of septage from the community population.

Based on the service population a daily hydraulic loading rate of 74 m<sup>3</sup>/day is projected in design Year 20. Therefore, the lagoon would require a total hydraulic capacity of 17,014 m<sup>3</sup> in design Year 20, for 230 days of storage, which was utilized in design for sizing the new lagoon storage cell.

### Sludge Survey

A sludge survey of the existing primary cell indicated that there was an accumulation of approximately 5,300 m<sup>3</sup> of sludge in the primary cell, with a sludge thickness ranging from 0.3 m to 1.20 m. There was also approximately 1,000 m<sup>3</sup> of sludge in the storage cell, with a sludge thickness ranging from 0.15 m to 0.30 m. Samples of sludge analyzed by the laboratory indicated that the sludge is generally consistent with municipal wastewater sludge.

### Sludge Land Application

Based on the sludge accumulation, it is proposed that sludge be pumped from both cells and injected into the adjacent agricultural field to the north for disposal. Approximately 40.6 ha of land to the north of the lagoon site is required for land application, based on phosphorus application limitations.

## Geotechnical Investigation

The general area of the proposed lagoon expansion is relatively flat agricultural land, and is being used for hay production. The soil profile in the expansion area to the east of the existing lagoon cells generally consists of topsoil followed by a thin layer of silt, followed by medium plastic clay till down to 4.0 m below the surface. The clay and silt layer has a hydraulic conductivity of less than  $1 \times 10^{-7}$  cm/sec, therefore, it would be suitable for construction of a lagoon liner, meeting provincial requirements. Groundwater was observed at depths ranging from 1.6 m to 3.0 m below the surface.

## Lagoon Expansion Design

Based on a review of the projected lagoon organic and hydraulic loadings and the soils investigation of the site, the lagoon expansion will consist of constructing a new L-shaped storage cell to the east. The expanded lagoon would have sufficient organic and hydraulic capacity to design Year 20, based on the estimated population in the service area.

## Lagoon Liner Design

Based on the soils investigation and laboratory analysis, it is proposed that expansion cell be constructed with a vertical lagoon liner (cut-off wall) and horizontal floor liner constructed of reworked soils from the site excavation and adjacent borrow pit. It is expected that the hydraulic conductivity of the liner soils would achieve a hydraulic conductivity value less than  $1 \times 10^{-7}$  cm/sec, as required by MECP for containment of liquids. The cell liner will have a minimum thickness of 1.0 m and will form a continuous structure.

## Design Considerations

The design considerations of the proposed storage cell will include:

- Cell depth of 2.8 m (1.5 m liquid operating depth and 1.3 m freeboard).
- Inner and outer dike slopes of 4H:1V.
- An intercell pipe and valve located in the intercell dike between the existing and new storage cells.
- A new discharge pipe through the east dike of the new storage cell.
- A perimeter ditch around the outside toe of the new storage cell.
- Re-routing the existing discharge ditch around the new expansion cell.
- A chain link perimeter fence located along the outside toe of the new storage cell.

## Nutrient Management Plan

Normal facultative lagoon operation with spring and fall discharges, will typically produce effluent quality meeting provincial and federal requirements for BOD, CBOD, TSS, fecal coliforms, E. coli, and un-ionized ammonia. Phosphorus reduction would be achieved through the application of Alum on the surface of the storage cells, if effluent quality does not meet the provincial requirement of 1 mg/L or less prior to discharge.

## Potential Concerns and Mitigation Measures

From discussions with the RM and a review of the current site operations, the potential concerns identified with the expansion of the wastewater treatment lagoon and associated mitigation measures include:

Potential Concern	Mitigation Measure
Emissions from construction equipment	The construction contractor will maintain heavy equipment to meet provincial and local emission standards.
Dust generation	Dust suppression methods (i.e. wetting) will be utilized if dry and windy conditions are a nuisance to nearby residents.
Odours from lagoon operation and sludge application	The expanded lagoon will have a primary cell sized for the peak organic loading in design Year 20 and injection of sludge into the soil will reduce odours.
Contamination of surface and groundwater from lagoon discharge and seepage and land application of sludge	Lagoon effluent will be treated to the requirements of the Environment Act Licence prior to discharging. The lagoon will utilize a soil liner in accordance with provincial requirements for containment of effluent during operation. The sludge will only be applied at the recommended application rate on lands with suitable land class designation.
Soil erosion after construction works	Areas with bare soil outside of the expansion cell and disturbed areas will be seeded with grass to reduce erosion.
Siltation of discharge route	Silt fencing will be utilized to reduce silt entering the discharge route.
Spills or leaks during construction	Contractor to have emergency spill kit on site. Hazardous materials and fuel to be handled in accordance with all federal and provincial regulations.
Reduce aesthetics of area	Slopes will be seeded after construction and the vegetation on the slopes will be maintained regularly to reduce visual impacts.
Noise impacts from construction works	Construction works will be limited to daylight hours only and minimum setback distances to residences will be maintained.
Heritage or historic resources	If any significant historic or heritage resource is discovered during the construction works, the works will temporarily cease and provincial and federal authorities will be notified.
Public health and safety	Construction workers will be required to adhere to the safety program that will include utilizing personal protective equipment while on site. Access to the construction site will be limited. Warning signs will be utilized at the entrance to the site to prevent unauthorized entry. Limitations of land use and crop growth after sludge application will be applied.

## Schedule and Approvals

The lagoon owner would like to begin the lagoon expansion design works in 2023, after receipt of an Environment Act Licence and funding is obtained. Sludge would be removed and land applied in the fall of 2023.

## 1.0 INTRODUCTION AND BACKGROUND

The development described herein is for the expansion of the existing wastewater treatment lagoon, located near the Community of Forrest, Manitoba, and for the removal of sludge with land application.

### 1.1 Introduction

The RM of Elton has prepared this Environment Act Proposal (EAP) to satisfy the requirements of Manitoba Environment, Climate and Parks (MECP) for the construction and operation of an expanded wastewater treatment lagoon in Forrest, Manitoba. An Environment Act Licence is required from MECP for the proposed works. JR Cousin Consultants Ltd. (JRCC) was retained for the related engineering services.

### 1.2 Contact Information

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R3Y 1G4  
Phone: (204) 489-0474, Fax (204) 489-0487

Ms. Shawna Paulson, CAO  
RM of Elton  
General Delivery  
Forrest, Manitoba  
R0K 0W0  
Phone: (204) 728-7834, Fax (204) 725-1865

### 1.3 Background Information

The Community of Forrest is located approximately 15 km north of Brandon, along PTH 10, in the Rural Municipality of Elton, Manitoba. The existing Forrest wastewater treatment lagoon is located approximately 280 m north of the nearest residence in the community, and 315 m east of the high school, in SW 31-11-18 WPM (see Plan 1 in Appendix D). The lagoon has an access road from McGregor St. to the south.

The Forrest lagoon was originally constructed as a two-cell earthen structure in 1988, to service the Elton Collegiate and Forrest Elementary School. The lagoon was expanded in 2002 with the construction of two new cells to service the Community of Forrest. The in-town residents and school students/staff are currently the only contributors to lagoon loading, via a low pressure piped wastewater collection system. The surrounding rural residents do not utilize the lagoon for wastewater hauling.

Based on a recent housing development and the projected expansion of housing within the community, the wastewater treatment lagoon is in need of further expansion to meet the community's long term needs.

## 1.4 Description of Previous Studies

Several documents pertaining to the existing Forrest wastewater treatment lagoon were reviewed, including:

- Community of Forrest Sewage Infrastructure Assessment. Manitoba Water Services Board, 2000
- EAP for Forrest Sewage Lagoon Expansion. Stantec, 2002
- Pre-Design Report for the Forrest Lagoon. JRCC, 2012
- Preliminary Design Report for Forrest Wastewater Treatment Lagoon. JRCC, 2022.

## 1.5 Project Description

The RM of Elton is in need of an Environment Act Licence for the expansion and continued operation of the Forrest wastewater treatment lagoon and for the land application of sludge from the lagoon cells. Due to concerns with hydraulic capacity in the existing lagoon, an expansion storage cell is being proposed for construction to the east of the existing lagoon cells and sized for the estimated 230 day hydraulic storage capacity. To provide sufficient soil material in the construction works, a borrow pit will also be excavated to the east of the proposed expansion cell. Due to the age of the lagoon, sludge accumulation in the primary cell and partially in the storage cell will be removed, and injected into the surrounding agricultural fields for final disposal.

## 2.0 DESCRIPTION OF THE DEVELOPMENT

For each heading there is an information request from the Environment Act Proposal Form. These requests are repeated herein in italics followed by the pertaining response.

### 2.1 Land Title/Location

*Certificate of Title showing the owner(s) and legal description of the land upon which the development will be constructed; or, in the case of highways, rail lines, electrical transmission lines, or pipelines, a map or maps at a scale no less than 1:50,000 showing the location of the proposed development:*

The location for the proposed wastewater treatment lagoon expansion storage cell is on SW 31-11-18 WPM, east of [adjacent to] the existing lagoon cells, northeast of Forrest. Location of the proposed expanded lagoon layout is included on Plan 1 of Appendix D. The land parcel to be utilized for the new lagoon cell construction is agricultural land currently owned by the RM. A copy of the land titles [No. 2412373 and 2333846/2] for the land parcel are attached in Appendix A.

The adjacent agricultural land to the north to be designated for the sludge application is owned privately by Carole Agnes Dagmar Balmer and Charles Hurley Balmer. A copy of the land title [No. 2693270/2] for the land parcel is attached in Appendix A. The Municipality will prepare a land use agreement(s) with the land owner(s), outlining the acceptable land use and agricultural requirements, based on the licence requirements regarding land application of sludge.

### 2.2 Owner of Land and Mineral Rights

*Owner of land upon which the development is intended to be constructed, and of mineral rights beneath the land, if different from surface owner:*

In accordance with the land titles for parcels "A" and "B" under Plan 26673 BLT0 and Plan 1544 BLT0, and Transfer No. 91-4233, the mines and minerals remain with the surface titles. The Land Transfer No. 91-4233 is attached in Appendix A.

### 2.3 Existing Land Use

*Existing land use on the site and on land adjoining it, as well as changes that will be made in such land use for the purposes of the development:*

The land parcels surrounding the existing lagoon cells and proposed expansion cell are cleared agricultural lands used for growing crops. The proposed development area is cleared grassland with a low lying area in north portion used in the past for borrow soils in the lagoon expansion construction. The remaining land is used for hay production. The proposed development area is bordered to the west by the existing lagoon cells, to the east by a high pressure buried gas line, to the north by agricultural crop land and to the south by grassland.

The surficial vegetation would be cleared and soil would be excavated in the proposed development area for construction of the lagoon cell dikes and drainage ditching, as part of the proposed lagoon expansion. The existing access road and forcemain piping to the lagoon would continue to be utilized.

The lands to be utilized for sludge application are currently being used for agricultural crop growth, with a typical rotation of wheat and canola.

## **2.4 Land Use Designation/Zoning Designation**

*Land use designation for the site and adjoining land as identified in a development plan adopted under The Planning Act or The City of Winnipeg Act, and the zoning designation as identified in a zoning by-law, if applicable:*

The lagoon development land is zoned as Rural Settlement Centre, based on zoning designations in the RM of Elton, which allows for development for a sewage lagoon.

## **2.5 Description of Development**

*Description of proposed development and schedule for stages of the development, including proposed dates for planning, design, construction, commissioning, operation, and decommissioning and/or termination of operation (if known), identifying major components and activities of the development as applicable (e.g. access road, airstrip, processing facility, waste disposal area, etc.).*

### **2.5.1 Project Schedule**

The lagoon expansion design is proposed to begin in 2023, upon receipt of the Environment Act Licence, with site works beginning upon availability of funding. Commissioning and operation of the expanded lagoon would begin upon completion of construction and after approval for use is obtained from MECP. The existing lagoon cells would continue to operate during the construction works, with no expected service interruptions to the community.

The sludge land application would occur in the fall, after crops have been removed from the fields in the late summer or early fall of 2023.

### **2.5.2 Lagoon Site Setbacks and Characteristics**

The location of the Forrest lagoon expansion cell was chosen based on proximity to the existing lagoon cells, infrastructure, surrounding residences, land ownership, land use, soil conditions, topography, and proximity to future development in the community.

The MECP guidelines for the location of a wastewater treatment lagoon (*Information Bulletin – Design Objectives for Wastewater Treatment Lagoon*, Manitoba Conservation, 2014) are outlined in the following Table. A description of the proposed expansion site in relation to each of the guidelines is also provided in the table.

**Table A: Location of Proposed Lagoon Expansion Site in Relation to Provincial Guidelines**

Manitoba Conservation and Climate Guideline	Proposed Relation to Site
Lagoons must be located a minimum of 460 m from the nearest center of population.	The existing and proposed lagoon cells are located approximately 270 m from the nearest community housing in Forrest. The proposed expansion cell will be located further away from the community housing than the existing cells.
Lagoons must be located a minimum of 300 m from any residence. (Measured from the outer toe of the nearest dike).	The existing and proposed lagoon cells are located approximately 270 m from the nearest residence. The proposed expansion cell will be located further away from the community housing than the existing cells.
Consideration should be given to sites in which prevailing winds are in the direction of uninhabited areas.	The prevailing winds are typically from the north and west. The existing and proposed lagoon cells are located east and north of the community.
Sites with an unobstructed wind sweep across the lagoon are preferred.	The existing and proposed lagoon cells are surrounded by open agricultural land.
Areas that are habitually flooded shall be avoided and locations receiving significant amounts of runoff water are discouraged.	The lagoon cells are not located in a flood plain, and the land proposed for new cell construction is not known for overland flooding. A perimeter ditch will also be located around the toe of the new cell to divert runoff water away.
Sewage lagoons are to be designed and constructed such that the interior surface of the proposed lagoon is underlain by at least one metre of soil having a hydraulic conductivity of $1 \times 10^{-7}$ cm/sec or less. In areas sensitive to groundwater contamination or without suitable soils, a flexible synthetic liner may be utilized.	As the excavated soils at the site can provide a consistent permeability of less than $1 \times 10^{-7}$ cm/sec when re-worked, the lagoon cells will be lined with a minimum 1 m thick re-worked and compacted soil to provide containment of wastewater.

The lagoon site is not located near any major rivers or bodies of water, therefore flooding threats would be minimal. The existing and proposed lagoon development area is located within the community housing development residential setbacks (see Plan 1 in Appendix D). The lagoon has been operating within these residential setbacks for several years and new residents are aware of the setback distance. The RM indicated that the lagoon has not created odour nuisance complaints from the community in the past and it is not expected to from future operations.

### 2.5.3 Land Classification

Based on the Nutrient Management Regulation under the Water Protection Act and from a review of agricultural capability mapping for the general area of development, the lands have an agricultural land use capability classification of Class 2W, which is land that has moderate limitations for crop type due to excessive wetness. Class 2 lands are considered to be in Water Quality Management Zone N1, under the *Nutrient Management Regulation (Reg. 62/2008)*. Zone N1 lands do not have any restrictions on developing wastewater treatment lagoons, which will result in the application of nutrients to the soil, through effluent discharge, given that the provincial requirements for effluent quality are met. Therefore, the lagoon expansion to the east of the existing lagoon should not be limited by the Nutrient Management Regulations.

The surrounding agricultural lands intended for the application of lagoon sludge have the same agricultural capability classification and are also in nutrient management Zone N1, which should not have any additional restrictions on application of lagoon sludge nutrients, other than that discussed below in Section 2.9.1.

### 2.5.4 Lagoon Drainage Route

The discharge route follows a natural drainage channel flowing east for approximately 1.3 km into a third order drain that flows approximately 15 km south and east into Willow Creek. Willow Creek flows southwest for approximately 6 km and joins the Assiniboine River. The lagoon expansion would require an alteration of the drainage channel around the new cell. However, the existing drainage route would continue to be utilized (see Plan 4 in Appendix D).

### 2.5.5 Lagoon Access

The existing lagoon is accessed from a granular approach off of McGregor St. The lagoon approach and septic dumping spillway will be unaltered through the proposed expansion works.

## 2.6 Population Contributing Effluent

Population data was obtained from Statistics Canada and from the RM of Elton. The service population currently utilizing the Forrest lagoon is limited to the residents within the Community of Forrest and out of town students and staff from the two schools. No other significant rural, commercial or industrial sources of wastewater were reported to be utilizing the lagoon.

### 2.6.1 Community of Forrest

The Community of Forrest mostly consists of residential housing with some small commercial businesses. According to the RM, Forrest currently has a population of 145 people, with approximately sixteen homes planned for construction in the next 10 to 20 years. Based on information from Census Canada, the RM has an average household size of 2.7 people, therefore, with an additional sixteen homes in the community, it is expected that the population would increase by forty-four people to a total of 189 people in Design Year 20. These additional homes would all be connected to the existing low pressure sewer system in the community.

### 2.6.2 School Population

Additional populations to consider would be the Forrest Elementary School and the Elton Collegiate High School, which are both located in Forrest and contribute to lagoon wastewater loading. Information on the combined number of students and staff that are bussed in or commute in from outside of the community could not be provided by the schools. However, the 2012 report estimated the population was 360 people. The RM indicated that the school population has been in decline in the last several years, therefore, a conservative estimate is that the schools would still have a bussed-in population of 360 people. As students are only in school for approximately 1/3 of the day (8 hours), an equivalent full time resident occupancy factor of 1/3 was assumed for the bussed-in student population. Therefore, the equivalent population from the out-of-town students and staff would be 120 people. Considering a stable school population, no growth was considered for Design Year 20.

### 2.6.3 Rural Population

As indicated by the RM, no rural residents are utilizing the lagoon for truck-hauled wastewater from septic tanks or holding tanks, nor are expected to in the future, as rural wastewater gets hauled out of the RM. Therefore, no additional truck haul loading from rural residents was considered in the lagoon upgrading.

### 2.6.4 Commercial/Industrial Population

As indicated by the RM, there are no large commercial or industrial sources of wastewater to the Forrest lagoon that are not accounted for in the resident population. There are no commercial businesses or industries expected to utilize the Forrest lagoon in the next 20 years.

### 2.6.5 Population Summary

The Design Year 20 population contributing to the Forrest lagoon from the community is estimated to be 284 people, while the out-of-town school population is estimated to be 120 people. The population projections to Design Year 20 are included in Table 1 of Appendix B.

**Table B: Summary of Service Population**

Contributing Population	Current Population	Year 20 Population
Community of Forrest	145	189
Out of Town School Students and Staff	120	120
<b>Total</b>	<b>265</b>	<b>309</b>

## 2.7 Wastewater Production

The Community of Forrest utilizes a low pressure sewer system for the collection of residential wastewater, with one forcemain directing flow into the lagoon primary cell. The low pressure sewer collection system consists of individual household septic tanks connected to the collection piping, which diverts flow into the lagoon. The lagoon also has a truck dump spillway for receiving septage from

residents in Forrest. Septage or hauled wastewater from outside of Forrest is not accepted at the lagoon site and is not expected to be received in the future.

### 2.7.1 Organic Loading

The organic loading calculation is based upon the organics in typical residential wastewater and septage. A typical value of 0.076 kg Biochemical Oxygen Demand (BOD)/person/day is utilized for communities with gravity sewer systems; however, with a low pressure sewer system (LPS) organics are lower in the effluent pumped to the lagoon due to the solids settling in the septic tanks. Therefore, the estimated organic loading from the residential low pressure sewer system is reduced to 0.072 kg BOD<sub>5</sub>/person/day. The current estimated organic load is 19.1 kg BOD<sub>5</sub>/day. Based on the projected Year 20 population of 309 people on the residential low pressure sewer system, the estimated organic load would be 22.2 kg BOD<sub>5</sub>/day.

Truck hauled septage from the LPS septic tanks in the community is considered as additional organic loading to the lagoon, as it will typically impact the peak daily BOD<sub>5</sub> loading. Assuming a population density of 2.7 people/house and a septic tank volume of 4,500 L, which is pumped out every two years, each septic tank pump out generates approximately 9.0 kg BOD<sub>5</sub>. The tank loading is based on 200 L/person/year of septage solids at 0.007 kg BOD<sub>5</sub>/L and 0.000413 kg BOD<sub>5</sub>/L of liquid septage. Therefore, the BOD production from each septic tank is 9.0 kg BOD<sub>5</sub>.

Septage is typically permitted to be hauled to the lagoon over the time period of 135 days, as specified in provincial lagoon licences, therefore it is assumed that a maximum of one truckload would be hauled to the lagoon per day, and that two tank pump outs would fit in one truckload. This would be an organic load of 18.0 kg BOD<sub>5</sub>/day. The volume of septic trucks was confirmed with local septic haulers. Two septic tank loads would be able to fill a truck.

One of the concerns with truck hauling and septage dumping is the odours generated at the lagoon during disposal. The RM would be responsible for limiting local septage haulers to one septic tank load dumped in the lagoon per day to reduce chances of odour nuisance.

The total daily organic loading to the lagoon is currently estimated to be 37.1 kg BOD<sub>5</sub>/day (19.1 + 18.0 kg BOD<sub>5</sub>/day). This organic load is estimated to increase to 40.2 kg BOD<sub>5</sub>/day (22.2 + 18.0 kg BOD<sub>5</sub>/day) in Design Year 20. Table 1 attached in Appendix B shows the current and projected organic loadings to the lagoon.

### 2.7.2 Hydraulic Loading

The hydraulic loading to the lagoon is comprised of residential water consumption and infiltration.

#### 2.7.2.1 Residential Water Usage

From discussions with the RM, it is understood that the community water supply is treated and piped from the RM of Whitehead. From a review of water use records from

2019 to 2021, the average daily water usage during the winter storage period was 49 m<sup>3</sup>/day. Based on the current population in the service area, the average per capita water usage is 184 L/person/day.

With a population growth of forty-four people over the next 20 years, the average daily water usage is estimated to increase to 57 m<sup>3</sup>/day.

### 2.7.2.2 Infiltration Rates

The RM indicated that the main source of infiltration to the LPS is residential weeping tile water from rainfall and groundwater sources. Approximately thirty older homes and several newer homes in the community have weeping tile flow from rainwater diverted into their septic tanks. Per current municipal by laws, none of the newer homes in the community are permitted to have rainwater diversion to the low pressure sewer system.

A typical volume of water to consider for infiltration in a community similar to Forrest would be 15% of the water consumption, however the RM has indicated that the infiltration is likely higher, so 30% infiltration was assumed. Based on the average daily water usage in the community, this would represent a volume of 14.7 m<sup>3</sup>/day. Therefore, the total wastewater flow utilized for the current population was 63 m<sup>3</sup>/day, with a per capita loading rate of 239 L/person/day. For design purposes, in Design Year 20 the average daily hydraulic loading rate would increase to 74 m<sup>3</sup>/day.

### 2.7.2.3 Total Hydraulic Loading

Based on the Design Year 20 total average daily hydraulic loading rate of 74 m<sup>3</sup>/day from residents in Forrest during the winter storage period, the lagoon would require a hydraulic storage capacity of 17,014 m<sup>3</sup>. Table 1 attached in Appendix B summarizes the organic and hydraulic loadings for the current and 20 year design periods.

## 2.7.3 Wastewater Production Summary Table

The current and projected organic and hydraulic loadings for the service area have been included in the summary table below and in Table 1 of Appendix B.

**Table C: Summary of Organic and Hydraulic Loading**

Contributing Wastewater Load	Year 1 Daily Load	Year 20 Daily Load
Organic Loading (kg BOD <sub>5</sub> /day)	37.1	40.2
Hydraulic Loading (m <sup>3</sup> /day)	63	74

## 2.8 Lagoon Sizing Requirements and Existing Capacity

The organic and hydraulic storage capacities of the existing Forrest lagoon were determined from “as constructed” drawings of the lagoon provided by MWSB and measurements made during the onsite investigation. The requirements for lagoon loading, sizing and design were based on the Manitoba *Information Bulletin – Design Objectives for Wastewater Treatment Lagoons* (September 2014).

### 2.8.1 Primary Cell

The minimum sizing of the primary cell is based on the required surface area at a height of 0.75 m from the cell floor and the standard organic treatment rate for a facultative lagoon of 56 kg BOD<sub>5</sub>/ha/day. The minimum required surface area at 0.75 m, to treat the projected peak organic loadings in design Year 20 would be 7,187 m<sup>2</sup>.

The existing Forrest lagoon primary cell currently has a surface area of approximately 9,391 m<sup>2</sup> at a depth of 0.75 m, resulting in a total organic capacity of 52.6 kg BOD<sub>5</sub>/day. The existing lagoon primary cell would have sufficient organic capacity for the current and projected Year 20 organic loading rate, and therefore expansion of the primary cell is not required.

### 2.8.2 Storage Cell

The total hydraulic storage capacity of the lagoon is generated from the volume of the storage cell(s) between the discharge pipe invert (0.3 m) and the maximum liquid operating level (1.5 m), along with the “top half” of the primary cell (0.75 m depth to 1.5 m depth). The total hydraulic storage capacity would need to be sufficient for 230 days of storage from the projected Year 20 hydraulic loadings.

Based on the “as built” drawings of the existing lagoon, it was determined that the northern portion of the primary cell (original cells prior to 2002) was constructed with a total depth of 1.8 m from the cell floor to the top of dike. During the expansion of the lagoon in 2002, the new lagoon cells were constructed with a total depth of 2.8 m from cell floor to top of dike. Based on this information and the requirements of the lagoon licence, it was assumed that the northern portion of the existing primary cell is operated at a maximum depth of 0.75 m, and the southern portion of the existing primary cell is being operated at a maximum depth of 1.75 m. These assumptions were utilized in determining the existing storage capacity.

Based on the estimated hydraulic loading from the community, the lagoon currently requires a total storage volume of 14,591 m<sup>3</sup> over the 230 day storage period, while the projected Year 20 storage capacity requirement is 17,014 m<sup>3</sup>. Based on the “as built” plans, the existing lagoon primary and storage cells have a 230 day storage capacity of approximately 13,021 m<sup>3</sup>. Therefore, the existing lagoon does not have sufficient hydraulic storage for the current or projected hydraulic loading from the Community of Forrest. The RM indicated that the lagoon has not been operating with emergency discharges, potentially because of drier years recently, which would lead to less surface runoff and groundwater entering the sewer system.

### 2.8.3 Wastewater Production and Lagoon Capacity Summary

The following table is a summary of the existing and estimated lagoon organic and hydraulic loading, along with the existing lagoon capacity.

**Table D: Summary of Organic and Hydraulic Loading and Lagoon Capacity**

Lagoon Loading	Existing Lagoon Capacity	Current Capacity Needed	Capacity Needed in Design Year 20 (230 days)
Organic	9,391 m <sup>2</sup>	6,621 m <sup>2</sup>	7,187 m <sup>2</sup>
Hydraulic	13,021 m <sup>3</sup>	14,591 m <sup>3</sup>	17,014 m <sup>3</sup>

Table 1 attached in Appendix B shows the current wastewater (hydraulic and organic) loadings and the required organic and hydraulic storage capacities.

## 2.9 Sludge Assessment

Assiniboine Injections Ltd. conducted a sludge assessment on October 28, 2021 to determine the volume and thickness of sludge accumulation in the lagoon cells and review the chemical properties of the sludge (see report attached in Appendix C).

The sludge assessment of the primary cell indicated a total sludge accumulation of approximately 5,300 m<sup>3</sup>, with a sludge thickness ranging from 0.3 m to 1.20 m. The thickest accumulation (1.20 m) of sludge was near the truck dump spillway, while the average sludge thickness throughout the cell was 0.53 m. The sludge accumulation in a primary cell becomes a concern if the thickness of sludge exceeds 0.75 m, as this is the depth at which the hydraulic capacity is measured. Therefore, the sludge depth in the primary cell is impacting the overall hydraulic capacity.

The sludge assessment of the storage cell indicated a total sludge accumulation of approximately 1,000 m<sup>3</sup>, with a sludge thickness ranging from 0.15 m to 0.30 m. The thickest accumulation (0.30 m) of sludge was near the intercell pipe, while the average sludge thickness throughout the cell was 0.20 m. The sludge accumulation in a secondary cell becomes a concern if the thickness of sludge exceeds 0.3 m, as this is the typical discharge pipe invert height from the cell floor, and is the height of pipe invert in the Forrest lagoon storage cell. The sludge accumulation in the storage cell is not currently compromising the overall hydraulic capacity.

Samples of the sludge were taken from the lagoon cells and sent to ALS Global for laboratory testing. The tables below show select key parameters tested for in the sludge. See Appendix C for the sludge analysis report completed by ALS Global.

### 2.9.1 Sludge Removal and Land Application

Due to the accumulation of sludge in the lagoon primary and storage cells, sludge removal is proposed to improve treatment efficiency and increase hydraulic capacity in the lagoon primary and storage cells. The sludge is proposed to be land applied on the adjacent agricultural field to

the north, which would be a beneficial re-use of nutrients on agricultural fields, minimizing the requirements for synthetic fertilizers.

#### **2.9.1.1 Methodology**

From discussions with Assiniboine Injections, the preferred method of sludge removal and disposal will be pumping liquid sludge from the primary and storage cell floors directly into an injection system, which is dragged along the fields by a tractor and tilled into the soils. The sludge would be injected into the fields at the approved loading rates.

Land application of sludge from municipal sewage lagoons in Manitoba must comply with the requirements of the Manitoba *Nutrient Management Regulation 62/2008*, under The Water Protection Act. Limitations for sludge application on agricultural fields are based on the Manitoba Soil Fertility Guide, based on crop types.

#### **2.9.1.2 Nutrient Management Zone**

Detailed soil survey data for the RM of Elton was reviewed for information on agricultural capability classification. The surficial soil type in the area of the lagoon and surrounding land for sludge application is classified as the Chambers Series and Beresford Series. These soils in the area of land application have an agricultural capability class designations of 2W, which have moderate limitations to the range of crop growth, based on the excess water in the soils. These soils would qualify as a nutrient management zone designation of N1.

#### **2.9.1.3 Land Application Rates**

The *Nutrient Management Regulation (62/2008)* provides criteria for the application rates of nutrients (nitrogen and phosphorus) on lands with varying designations, to protect sensitive surface water bodies and groundwater resources. To determine sustainable levels of nutrient application to receiving lands, the nutrient quality of the sludge needs to be determined, along with the proposed crop uptake and nutrient removal rates obtained from the Manitoba *Soil Fertility Guide*.

##### ***Land Application Rates – Nitrogen***

According to the *Nutrient Management Regulation (62/2008)* for soils within a nutrient management zone designation of N1, the residual concentration of nitrate nitrogen within the top 0.6 m of soil at the end of the growing season, at any place within the application area, shall be no greater than 157.1 kg/ha. Testing of the soils on the receiving lands will be conducted during the design phase of the works. For the calculations below a typical residual Nitrate-N concentration of 30 mg/kg was utilized.

When utilizing sludge on soils as a fertilizer only a portion of the nitrogen is initially

available. The organic nitrogen is mineralized to ammonium nitrogen, which can be readily utilized by plant material during growth. The amount of plant available nitrogen (PAN) added to the land from all sources should not exceed the crop specific uptake rate. A canola crop was assumed for the receiving lands at an uptake rate of 111 kg/ha. Plant available nitrogen is defined as:

$$\text{PAN} = 20\% \text{ of the organic nitrogen-N} + 100\% \text{ of the ammonia-N} + 100\% \text{ of the nitrate-N}$$

The following table provides calculations for the PAN of the sludge sample in the Forrest primary cell and land application rates based on nitrogen.

**Table E: Land Application Rates - Nitrogen**

Parameter	Unit	Primary Cell	Storage Cell
Sludge Volume	m <sup>3</sup>	5,300	1,000
Sludge Volume for calculations (+10%)	m <sup>3</sup>	5,830	1,100
Total Solids	%	28.1	51.6
Dry Tonnes Biosolids Available	tonne	1,638.2	567.6
Total Nitrogen by LECO	mg/kg	3,850	2,710
Available Nitrate-N	mg/kg	1.7	1.1
Available Ammonium-N	mg/kg	109	51
Total Organic Nitrogen	%	0.247	0.15
Total Organic Nitrogen	mg/kg	2,470	1,500
Plant Available Nitrogen (PAN)	mg/kg	604.7	352
Plant Available Nitrogen (PAN)	kg/tonne	0.6047	0.352
Total PAN From Sludge	kg	991	200
<b>Land Required at 157.8 kg PAN/ha</b>	<b>ha</b>	<b>6.0</b>	<b>1.2</b>
Sludge Application Rate	dry tonnes/ha	274	470
Sludge Application Rate (wet)	m <sup>3</sup> /ha	975	912

Based on the PAN from the primary and storage cell, sludge can be applied at a rate of 912 m<sup>3</sup>/ha on a minimum of 7.2 ha of land.

#### *Land Application Rates - Phosphorus*

According to the *Nutrient Management Regulation (62/2008)* for soils within a nutrient management zone designation of N1, the allowable phosphorus application rate is determined based on the background phosphorus levels in the soils as per the following:

- If soil test phosphorus levels are 120 mg/L or less: phosphorus may be applied at two times the applicable phosphorus removal rate for a specific crop type

- If soil test phosphorus levels are 120 - 180 mg/L, phosphorus may be applied at the applicable phosphorus removal rate for a specific crop type.

The phosphorus removal rate is determined by the type of crop to be planted in the field. A chart with typical removal rates is available in the Manitoba *Soil Fertility Guide*. Phosphorus removal rates vary from 16 kg/ha to 85 kg/ha depending on the crop type. The land owner indicated that canola is part of the regular crop rotation on the parcels of land to be utilized, therefore a crop of canola was assumed for sizing purposes. A crop removal rate of 36 kg/ha of P<sub>2</sub>O<sub>5</sub> was used for calculations based on the low end of uptake for a 35 bu/A canola crop.

Laboratory analysis of soils from the proposed agricultural fields for land application will be conducted during the design phase of the project. Assuming the background phosphorus concentration is less than 120 mg/L, this would allow phosphorus to be applied at two times the crop removal rate or 72 kg/ha of available P<sub>2</sub>O<sub>5</sub> (for canola).

The following table provides calculations to determine the available phosphorus in the sludge sample from the Forrest primary and storage cells and land application rates based on available phosphorus.

**Table F: Land Application Rates - Phosphorus**

Parameter	Unit	Primary Cell	Storage Cell
Total Phosphorus	mg/kg	1,120	1,250
Total Phosphorus	kg/tonne	1.12	1.25
P <sub>2</sub> O <sub>5</sub> Equivalent (2.3 x P)	kg/tonne	2.576	2.875
Available P <sub>2</sub> O <sub>5</sub> * (50% available)	kg/tonne	1.288	1.438
P <sub>2</sub> O <sub>5</sub> Crop Removal x2 (canola)	kg/ha	72	72
<b>Land Area Required</b>	<b>ha</b>	<b>29.3</b>	<b>11.3</b>
Sludge Application Rate (dry)	dry tonne/ha	55.9	50.1
Sludge Application Rate (wet)	m <sup>3</sup> /ha	199	97

\*Note: According to the *Process Design Manual Land Application of Sewage Sludge and Domestic Septage* by the United States EPA, 1995 the majority of P in sewage sludge is present as inorganic compounds and approximately 50% is available for plant uptake as the P normally applied in commercial fertilizers.

Based on the phosphorus application rates determined, sludge could be applied at a maximum rate of 199 m<sup>3</sup>/ha from the primary cell and 97 m<sup>3</sup>/ha from the storage cell, on a minimum of 40.6 ha of land, assuming background soil phosphorus levels are less than 120 mg/L.

#### **Land Application Rates - Heavy Metals**

Heavy metals in soil that are of greatest concern include arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc. The sludge application rates also

cannot exceed heavy metal concentrations recommended by the CCME Canadian Soil Quality Guidelines for agricultural land use. The loading of heavy metals on the soils is determined from the heavy metal concentrations in the sludge and the background concentrations in the receiving soils. Concentrations of heavy metals in soils of the receiving lands would be determined during the design phase of the project. The health risks to humans from heavy metals in sludge fertilizer is generally low, as heavy metal uptake into consumable crops is minimal. The metal loading rate in the table below assumes an application rate based on 2x the crop removal for the phosphorus application limits.

**Table G: Land Application Rates - Metals**

Metal	Maximum Measured Concentration [mg/kg]	Metal Loading Rate Based on 55.9 or 50.1 dry tonnes/ha [kg/ha]	Cumulative Rate Allowed by Regulation [kg/ha]
Arsenic (As)	6.5	0.326	21.6
Cadmium (Cd)	0.461	0.023	2.5
Chromium (Cr)	23.0	1.286	115.2
Copper (Cu)	48.9	2.733	113.4
Lead (Pb)	9.49	0.530	126
Mercury (Hg)	0.067	0.004	11.9
Nickel (Ni)	25.9	1.297	90
Zinc (Zn)	99.2	5.545	360

Background soil metal concentrations have not yet been determined and cumulative levels (background soils and sludge levels) would need to be below the regulated values as described in the above table. The metal concentrations in the sludge are significantly lower than the allowable rates and it is not anticipated that the metal concentrations will affect the allowable sludge application rate. This will be confirmed prior to land application.

**Land Application - Salinity**

Adding highly saline sludge material to soils can lead to salinization of the soils, which can impact plant growth. However in general, municipal wastewater sludge does not contain high concentrations of salinity, which can have a detrimental impact on agricultural soils. Salinity testing of the sludge was conducted and the major constituents of soil salinity (Ca, Mg, Na, K, S, pH and EC) are shown in the table below.

**Table H: Salinity in Sludge Samples**

Parameter	Unit	Primary Cell	Storage Cell
Electrical Conductivity (EC)	dS/m	<0.05	<0.05
pH	pH units	8.34	8.56
Calcium (Ca)	mg/kg	79200	85200
Magnesium (Mg)	mg/kg	23600	25400
Potassium (K)	mg/kg	2340	2470
Sodium (Na)	mg/kg	830	716
Sulfur (SO <sub>4</sub> )	mg/kg	7800	7300

Manitoba Agriculture, Food and Rural Initiatives classify an EC of 0 to 4 dS/m as non-saline with no impacts to crop growth. The soil analysis will also include soluble ions such as Ca, Mg, Na, K and S, along with pH and conductivity, to confirm that the receiving fields are not at risk for salinization. Based on the soil description for Newdale Series soils, they are generally non-saline and well drained. Due to the limited application of sludge and non-saline nature of the receiving soils, it is not expected that any significant salinization will occur.

#### *Land Application – Soil Testing*

The soil samples will be a composite sample obtained from different portions of the field, in upper 150 mm of soil. Additional sampling will be required to confirm clay soils to a depth of 1.5 m below the surface to provide a barrier to groundwater.

#### **2.9.1.4 Setbacks and Regulations**

The *Nutrient Management Regulation (62/2008)* and recent Environment Act Licences issued for similar municipal sludge land application projects were reviewed. The following setbacks to various items would be required for land applications:

- Land (for application) must be a minimum of 75 m from any occupied residence (other than owner of land where sludge is to be applied).
- Land (for application) must be a minimum of 400 m from a residential area.
- Land (for application) must:
  - be a minimum of 15 m from first order waterway, 30 m from second order waterway and 50 m from a groundwater well.
  - be a minimum of 100 m from an identifiable boundary of an aquifer, which is exposed to the ground surface.
  - be a minimum of 15 m (if ground is covered with permanent vegetation) or 20 m (if ground is not covered with permanent vegetation) from a groundwater feature, lake, creek, river, or vulnerable stream.

- Be a minimum of 3 m (if ground is covered with permanent vegetation) or 8 m (if ground is not covered with permanent vegetation) to a major wetland, marsh, or swamp.
- not be subject to flooding.
- not be frozen.
- not be classified as N4 as per the Nutrient Management Regulation.
- not have depth of clay or clay till less than 1.5 m between the soil surface and the water table.

All the above setbacks can be met by the proposed lands for sludge application around the Forrest lagoon site, with the exception of the 400 m setback distance to a residential area. The edge of the nearest residential area in Forrest is approximately 100 m from the edge of the land parcel for application, therefore a variance for this setback distance is required or the 400 m setback will be maintained and a portion of the field will not be applied.

The following additional requirements would also apply:

- Surface slope must be less than 5%.
- Soil pH must be greater than 6.0, prior to sludge application.
- Sludge cannot be applied between November 10<sup>th</sup> and April 10<sup>th</sup>.
- There must be a written agreement between the landowner and the RM.
- Cattle are not permitted to pasture on land for three years from the date of sludge application.
- Nitrate-Nitrogen concentrations must not exceed 100 kg/ha in the upper 60 cm of soil, prior to nutrient application.
- Sodium bicarbonate extractable phosphorus as P must not exceed 60 ppm in the upper 15 cm of the soil, prior to nutrient application.
- One of the following crops must be planted at the commencement of the next growing season, following sludge application, and only these crops permitted to be grown for a period of three years from date of sludge application:
  - a cereal crop
  - a forage crop
  - an oil seed crop
  - field peas
  - lentils.

All the above setbacks and requirements will be met by the proposed receiving lands for sludge application and the application restrictions will be discussed in the land use agreement.

## 2.9.2 Summary of Land Requirements

As discussed in the preceding sections the phosphorus application rate will be the limiting factor in the sludge application and a minimum of 40.6 ha of land will be required for sludge application. This assumes that background soil phosphorus levels are less than 120 mg/L and heavy metal concentration in the soil are below CCME guidelines. Liquid sludge would be injected at a maximum rate of 199 m<sup>3</sup>/ha.

## 2.9.3 Land Availability

From discussions with the Municipality, the land available for sludge application is located to the north of the existing lagoon cells. It is estimated that approximately 50.9 ha of land will be available for sludge application (See Plan 3 in Appendix D).

## 2.10 Topography and Geotechnical Investigation

### 2.10.1 Site Conditions and Topography

Based on site observations, the land to the east of the existing lagoon was relatively flat agricultural land, with the exception of a natural drainage channel to the west, south and east of the existing lagoon, which serves as the discharge ditch. A topographical survey of the test holes in the proposed lagoon expansion area to the east was completed using GPS survey equipment. The topographic survey data revealed a gentle slope of 0.7% towards the south and east. The elevations in the lagoon drainage ditch revealed a slope to the east towards Willow Creek. The existing lagoon top of dike elevation was approximately 2.0 m higher than the surrounding prairie grade to the east.

#### *Flood Level Elevations*

The nearest major body of surface water to the Forrest Lagoon is the Assiniboine River, which is located approximately 12 km to the south. Manitoba Infrastructure (MI) was contacted to obtain 200 year flood level elevations for the Assiniboine River near Brandon. They indicated a 200 year flood elevation of 384.7 m above prairie grade. The existing and proposed lagoon top of dike elevation is 436.75 m, which is significantly above the 200 year flood level. Therefore, overland flooding will not be a concern for the lagoon expansion.

### 2.10.2 Geotechnical Information

#### 2.10.2.1 Past Geotechnical Study

A previous soils investigation was conducted by Stantec Consulting Ltd. in 2001, prior to the original lagoon expansion in 2002. This investigation described the soils as being medium plastic, silty clay till. A Shelby tube sample was obtained at the time of the investigation and the soil material had a hydraulic conductivity of  $5.5 \times 10^{-8}$  cm/sec, therefore the in-situ soils were used in constructing the lagoon floor liner. The “as built” drawings for the 2002 lagoon expansion show an area to the east of the lagoon cells that appears to have been used for borrow material in the lagoon

expansion construction. However, it is unknown how much material was extracted from the borrow area or the depth of excavation in that area. An estimation was completed based upon the size of the borrow pit (approximately 4,270 m<sup>2</sup>) and an assumed depth of 1.5 m below the surface. From these assumptions a quantity of 6,405 m<sup>3</sup> from the borrow area would be deemed to be unsuitable material for liner construction.

From discussions MECP, a permeability test was conducted on the completed lagoon dikes in 2002 but not of the lagoon floor bottom. The hydraulic conductivity of the reported medium plastic soils from the dike was  $8.5 \times 10^{-9}$  cm/sec, which met the Provincial regulations.

Additional soil testing was conducted by JRCC in 2012 for the potential expansion of the lagoon cells. The soils from the two test holes were excavated to the east of the lagoon consisted of high plastic and low plastic silty clay till. The low plastic silty clay till material was tested by a laboratory and obtained a permeability of  $1.5 \times 10^{-8}$  cm/sec, which meets the provincial requirements for a lagoon liner.

#### 2.10.2.1 Current Geotechnical Investigation

An onsite investigation of geotechnical conditions was conducted by JRCC on October 7, 2021. A small backhoe was used for excavation of the test holes under the direct supervision of JRCC personnel. During the site investigation, nine test holes were excavated to a maximum depth of 4.0 m in the agricultural lands to the east of the existing lagoon cells. A detailed geotechnical letter report of the investigation and results is included in Appendix C.

#### *Proposed Expansion Area*

Based on the soils observed in the test holes, the subsurface soil profile was fairly consistent across the expansion area to the east, with some minor variations observed on either side of the buried gas line. Groundwater levels were measured at depths ranging from 1.6 m to 3.0 m below the surface. The general soil profile is summarized in the following table.

Primary Soil Type	Average Depth Range of Soil Layer	Secondary Soil Characteristics
Topsoil	0 m – 0.3 m	Clay
Silt (low plastic)	0.3 m – 0.6 m	Clay
Clay till (medium plastic)	0.6 m – 2.7 m	Silt and sand
Clay till (medium plastic)	2.7 m – 4.0 m	Sand and gravel

#### *Laboratory Analysis*

Representative soil samples from the proposed lagoon expansion area were

submitted to Wood Environment and Infrastructure Solutions Inc. for testing and analysis. The following is a summary of the testing results:

Test Hole	Depth of Sample (m)	Liquid Limit	Plastic Limit	Plasticity Index	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
TH3	0.3 – 2.5	44	15	29	2	27	40	31
TH7	0.7 – 2.7	37	16	21	6	30	40	24
TH7	2.7 – 3.9	40	15	25	1	28	48	23

The Shelby tube sample from the layer of clay till (TH2 1.6 m – 2.2 m) obtained a hydraulic conductivity value of  $3.81 \times 10^{-8}$  cm/sec.

Typically soils with the following characteristics would provide a liner with a hydraulic conductivity of  $1 \times 10^{-7}$  cm/sec or less:

- Liquid limit of 30% or greater.
- Plastic index of 10% or greater.
- 30% or more passing a number 200 mesh sieve.
- 20% or more of clay particles.

The clay till material tested met the characteristics described above, and the in situ Shelby tube sample from the same layer of material also met the provincial hydraulic conductivity requirement. It is therefore likely that this clay till material would meet provincial requirements for hydraulic conductivity ( $1 \times 10^{-7}$  cm/sec or less) in an undisturbed or reworked state.

Therefore, it would be recommended to utilize these clay soils in an undisturbed or reworked state when constructing a lagoon liner. Other considerations in the method of liner construction would be the presence of unsuitable materials (sand, gravel, silt) observed within the construction depth.

## 2.11 Lagoon Liner

### 2.11.1 Design Guidelines

Provincial guidelines require that a standard wastewater lagoon soil liner be a minimum of 1.0 m in thickness and have a hydraulic conductivity (i.e. the potential rate of fluid movement through the soil) of  $1 \times 10^{-7}$  cm/sec or less. This low permeability rate is to protect the underlying groundwater from lagoon effluent seepage.

### 2.11.2 Lagoon Expansion Liner Design

Based on the results of the onsite investigation and laboratory analysis, the medium and low

plastic excavated soils located east of the existing lagoon cells are expected to achieve a permeability of  $1 \times 10^{-7}$  cm/sec or less, in an in situ state, however due to soil variability in the development area the new cell liner will be constructed of re-worked clay type soils. Based on the laboratory results, the construction contractor for a lagoon expansion would need to ensure that the soils forming the horizontal and vertical cell liners would be constructed near the optimal soil moisture content, without being too wet or too dry. Lagoon dike details are shown on Plan 5 in Appendix D.

### 2.11.3 Utilization of Onsite Soils

The topsoil material would be stripped from the cell construction area and borrow area, and stockpiled for use as top dressing on the top and outer slopes of the lagoon cells. The medium and low plastic clay and silt soils below the topsoil would be suitable for use in construction of a soil liner (vertical cut-off wall and horizontal floor) after re-working in the proposed storage cell. Any sandy material excavated will be separated and utilized in the outer slope construction, but will not be utilized in the liner or inner slope construction.

There is always a risk associated with utilizing excavated soils for the construction of a lagoon liner after reworking and compacting, due to the possibility of unsuitable soils discovered during construction, which were not present in the test holes. Based on the site observations and laboratory results, the risk associated with construction of the lagoon with the soils encountered is low. Any unsuitable material (sand or stone seams) discovered during construction would need to be removed from the lagoon liner to prevent the possibility of preferential flow paths through the liner.

## 2.12 Review of Regulatory Requirements

The provincial *Design Objectives for Wastewater Treatment Lagoons* (September 2014) was used as a guideline in the layout and design of the lagoon expansion development. The provincial siting requirements are described in Section 2.5.2 above.

### 2.12.1 Effluent Quality Requirements

Any new or expanding wastewater treatment lagoons are required to meet the Manitoba *Water Quality Standards, Objectives and Guidelines - Tier 1 Water Quality Standards* at a minimum, along with the *Federal Wastewater Systems Effluent Regulations*, for discharged effluent. The effluent requirements for the RM wastewater treatment lagoon, at a minimum, would include:

- Fecal coliforms of 200/100 ml or less, or E. coli of 200/100 ml or less
- BOD of 25 mg/L or less
- CBOD of 25 mg/L or less
- TSS of 25 mg/L or less
- Total residual chlorine of 0.02 mg/L or less
- Un-ionized ammonia (as N) of 1.25 mg/L or less, at 15°C
- 1 mg/L Total Phosphorus or demonstrated nutrient reduction strategy.

The lagoon effluent will be tested for the above parameters prior to discharge and the results of the analysis will be provided to Manitoba Enforcement Branch for approval.

### 2.12.2 Nutrient Management Plan

The Manitoba *Water Quality Standards, Objectives, and Guidelines, 2011*, outline the nutrient reduction requirements for effluent in all new, expanding or modified wastewater treatment facilities. The guidelines include province wide standards for biological reduction, suspended solids reduction, phosphorus reduction and where site-specific conditions warrant, nitrogen reduction. The Federal *Wastewater Systems Effluent Regulations, 2012*, outline the limits on un-ionized ammonia concentration in the effluent.

From a review of various methods for reducing phosphorus, the most feasible method for the RM would be the addition of alum to the surface of the storage cells to encourage chemical precipitation, with phosphorus settling out of the liquid phase. The method for alum addition would likely be spraying onto the surface of the cells from the top of the dikes, or by utilizing a boat and adding chemical by hand over the surface of the cells.

Typically, an un-ionized ammonia concentration of 1.25 mg/L can be met by a facultative lagoon cell with no specific treatment for ammonia, however there is the possibility that in mid-summer, high temperatures combined with algae blooms can cause the pH to rise, which could result in an un-ionized ammonia above 1.25 mg/L. If the un-ionized ammonia concentration is above the limits, the most practical solution would be to wait until the temperature and pH drop in the fall, before discharging.

## 2.13 Expanded Lagoon Design Considerations

The expanded lagoon design will consist of:

- Constructing a new L-shaped storage cell to the east of the existing lagoon cells.
- Utilizing a borrow area for clay soils to the east of the expansion cell.

The new storage cell would have the following design characteristics:

- A liner of re-worked and compacted soils.
- Interior and exterior slopes of 4H:1V.
- A total cell depth of 2.8 m to match the existing lagoon depth.
- A minimum liquid depth of 0.3 m above the cell floor after discharge.
- A maximum operating depth of 1.5 m and a 1.3 m freeboard height.
- Top of dike elevation which would match the top of dike elevation in the existing cells.
- A perimeter ditch around the toe of the expansion cell dikes.
- Re-routing the existing discharge ditch around the new expansion cell.
- Installing a chain link fence around the perimeter of the expansion cell dikes.

- Installing an intercell pipe between existing and new storage cells.
- Installing a discharge pipe in the east dike of the new storage cell.

The existing forcemain, lagoon approach and spillway will continue to be utilized.

### 2.13.1 Summary of Lagoon Sizing Design Criteria

The expanded lagoon will be sized to handle the projected organic and hydraulic loadings from the service area, to design Year 20. A summary of design parameters used in sizing the proposed lagoon expansion includes:

- A minimum 20 year design period.
- A total service population of 309 people on the piped collection system.
- A hydraulic storage period of 230 days.
- A total daily organic loading rate of 40.2 kg BOD<sub>5</sub>/day in design year 20.
- A total daily hydraulic loading rate of 74 m<sup>3</sup>/day in design Year 20.
- A total hydraulic capacity of 20,920 m<sup>3</sup>.
- A discharge pipe invert of 0.3 m above the floor of the proposed storage cell.
- Inner and outer dike slopes of 4H:1V in the proposed storage cell.
- Cell depth of 2.8 m (1.5 m liquid operating depth and 1.3 m freeboard) in the proposed storage cell.

## 2.14 Lagoon Expansion Construction Details

The areas proposed for the lagoon expansion cell and borrow pit would be cleared of surface vegetation, and would have the topsoil layer removed and stockpiled. The subsurface soils would be excavated and the dikes constructed with excavated and compacted soil from the cell excavation and from an adjacent borrow pit to the east. For the dike construction, the excavated material will be compacted with a sheepsfoot roller on maximum 150 mm compacted lifts. A limited range of moisture content will be permitted during construction. The soil material shall not be so wet or so dry that compaction equipment cannot compact the fill into a homogeneous mass. Material too wet shall be dried or wasted and material too dry shall be wetted. Any unsuitable soils encountered in the excavation could be used for constructing the outer and inner slopes, however should not be used in the construction of the vertical cut-off wall or liner. The expansion cell and borrow pit to the east would be divided by the existing high pressure buried gas lines, and construction works would not occur within the required 3 m setback from these gas lines.

The top of the lagoon dikes will be constructed with a width of 3.0 m to allow vehicle access. Topsoil removed from the expansion area will be used as cover material on the dike tops and slopes after cell construction is complete. The top of dikes and outside slopes would be seeded with grass upon completion of construction to reduce soil erosion. Rip rap stone would be placed at the intake and outfall of the discharge and intercell piping, to minimize erosion.

A new intercell pipe would be installed between the existing and proposed storage cells, and a discharge pipe would be installed in the east dike of the proposed storage cell, replacing the existing discharge pipe.

A perimeter ditch would be constructed around the outside toe of the proposed storage cell and would connect with the existing perimeter ditching. The outer slope and perimeter drainage ditching would prevent surface drainage from entering into the lagoon and would prevent the ponding of surface drainage water around the perimeter of the lagoon. The existing drainage ditching would be re-routed around the south portion of the new storage cell.

A 1.8 m high chain link wire fence would be installed around the outside toe of the proposed storage cell and would connect to the existing perimeter fencing to discourage unauthorized entry into the lagoon area by people and large animals. This fence would tie into the existing lockable gate at the entrance to the lagoon site. The existing sign at the entrance to the site will continue to be utilized. Plan 6 of Appendix D includes details of the fencing and ditching.

## **2.15 Decommissioning**

The RM is proposing to continue operating the existing and proposed lagoon cells over the next 20 years, as hydraulic and organic capacities allow. Lagoon decommissioning will be considered and examined by the RM after design Year 20 has passed or a new replacement lagoon is proposed.

Decommissioning would typically require a decommissioning plan submitted to MECP, discussing the removal of liquid and sludge, possible leveling of lagoon dikes, site grading and seeding, and discussion of future land use.

## **2.16 Lagoon Maintenance**

Maintenance of the expanded lagoon will include:

- opening and closing the intercell valves, when required.
- maintaining grass cover on dikes to a height of no more than 0.3 m in height.
- removing aquatic vegetation growing on interior slopes of lagoon cells.
- maintaining a program to prevent and remove burrowing animals.
- monitoring liquid level of lagoon cells.
- sampling lagoon effluent prior to the discharge period, in accordance with the lagoon licence requirements.
- maintaining records of discharge events and effluent quality testing.
- discharging effluent from the lagoon storage cells when permitted.

### 3.0 POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

*The biophysical and socioeconomic environment as related to the development, and potential impacts of the development on the environment. Proposed environmental management practices to be employed to prevent or mitigate adverse implications from the impacts identified.*

Environmental issues where they may occur, and mitigating measures where necessary, are presented in the chart on the following pages, which outline the assessment of the expected actions. Environmental features are assessed against the project actions in the chart. The environmental features include: groundwater, surface water, air quality, noise, land/soil, vegetation, wildlife, habitat, special places (cultural, traditional, historic, scientific), health and safety, socio/economic and aesthetics.

Potential ratings of “I” meaning insignificant, “SN” meaning negatively significant, and “SP” meaning positively significant were identified for the environmental issues depending on possible environmental impacts of the project actions on the environmental features. A project action with no potential environmental issues after mitigation measures are applied was considered insignificant. A project action with identified or residual environmental issues after mitigation measures are applied is considered significant. Where a project action with positive impact on the environment or socio-economic aspect is identified, the environmental issue was considered positively significant and the benefits are stated.

The proponent of the development should ensure that the contractor performing the site works is made aware of the potential environmental issues by way of the construction specifications, prior to commencing with the site works, and that mitigation measures discussed below are followed during site works.

**Table I: Potential Impacts, Mitigating Measures and Residual Effects**

Project Action	Environmental		Rating	Mitigating Measures
	Feature	Issue		
1 Clearing, excavation, construction of lagoon cell, ditching and fencing	Groundwater or Surface Water	Contamination from fuel storage and handling spills	I	<p>Handling and storage of petroleum products will be conducted according to federal (<i>Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations</i>) and provincial (<i>Storage and Handling of Petroleum Products and Allied Products Regulation</i>) regulations.</p> <p>The construction specifications should outline to the contractor, requirements for the handling and storage of petroleum products and hazardous materials during construction and for working near water with construction equipment.</p> <p>Any fuel stored and handled on the construction site should be located a minimum of 100 m from a water body, reservoir and low lift station.</p> <p>Proper collection and disposal of waste hazardous materials, oil and lubricating products from construction equipment;</p> <ul style="list-style-type: none"> <li>• Contractor must have emergency spill clean-up materials on site, with a minimum of 25 kg of suitable commercial sorbent, 30 m<sup>2</sup> of 6 mil polyethylene, and an empty fuel barrel for spill collection and disposal;</li> <li>• Notification of project engineer and provincial environment officials in the event of any spills of petroleum products or hazardous materials. Manitoba's Spill Reporting hotline is (204) 945-4888;</li> </ul> <p>Fuel is to be used and stored on site in a properly installed double walled containment unit.</p>
		Contamination from construction equipment leaks	I	<p>Contractor is to ensure construction equipment is inspected regularly and maintained in proper working condition to prevent leaking fluids onto the ground.</p> <p>Any leaks should be cleaned up in a timely manner to ensure groundwater is not impacted. A spill clean-up kit is to be located onsite.</p>

Project Action	Environmental		Rating	Mitigating Measures
	Feature	Issue		
	Soil/Surface Water	Siltation from soil erosion	I	<p>Silt fencing would be installed in the drainage ditch to the east of the lagoon to control sediment runoff into the surface water bodies during construction and installation works. The silt fencing should remain in place until surface vegetation is re-established.</p> <p>Any stockpiled soil should be placed away from drainage features and be covered with tarps or erosion control blankets or re-seeded with grass. Any bare ground exposed through site disruption is to be re-vegetated as soon as possible to prevent future erosion.</p>
1. Construction Works cont'd	Air Quality	Dust	I	If conditions are dry and windy, causing excessive dust and blowing of soils at the time of excavation and construction, works should be temporarily shut down until conditions change or water trucks and/or approved dust control measures are utilized.
		Vehicle emissions from construction equipment	I	The contractor is to ensure construction equipment is properly maintained and that emissions from construction equipment are to comply with federal, provincial and local emissions standards, and are not a nuisance to nearby residents. Idling of vehicles will be kept at a minimum.
	Noise	Disturbance from construction equipment	I	Noise impacts are to be mitigated by operating construction equipment with engine mufflers in good working order. Construction works are to be completed during daylight hours only. Neighboring residents will receive a notice of the construction schedule.
	Land/Soil	Land Alteration/Soil Erosion	I	<p>Any excess excavated soil material should be removed and temporarily stockpiled adjacent to the lagoon, or in the borrow pit area, or on the outside lagoon slopes. Any stockpiles are to be covered by tarps or temporary erosion control blankets or re-seeded. Soil stockpiles will not be located adjacent to the drainage ditching.</p> <p>Any bare soil at the site from construction disturbance should be re-seeded to prevent future soil erosion.</p> <p>Outside slopes of the lagoon cell will have a grade of 4H:1V and will be seeded with grass to reduce erosion.</p>

Project Action	Environmental		Rating	Mitigating Measures
	Feature	Issue		
	Soils	Encountering Contaminated Soils	I	If contaminated soils are encountered during excavation, works should be halted in the area of question and the Engineer will be notified along with any related provincial/federal authorities, as applicable. The extent of contamination will be determined, contaminated material removed and properly disposed of, in accordance with CCME <i>Guidance Manual for Environmental Site Characterization in Support of Environmental and Human Health Risk Assessment</i> , and the <i>Manitoba Contaminated Sites Remediation Regulation</i> . Once the area has been restored, works would resume.

Project Action	Environmental		Rating	Mitigating Measures
	Feature	Issue		
1 Construction Works cont'd	Health and Safety	Construction Hazards	I	<p>To mitigate any impacts on health and safety and public hazards the following mitigating measures are to be used:</p> <ul style="list-style-type: none"> <li>• The Manitoba Workplace Health and Safety Act and Canada Occupational Health and Safety Regulations are to be applied regarding health and safety of operators, employees and the general public at the work sites</li> <li>• Contractor is to abide by an approved health and safety program during construction works</li> <li>• Ensure pits or trenches are constructed in a secure manner prior to any person entering them</li> <li>• Ensure all workers and visitors utilize appropriate PPE at the construction sites</li> <li>• Construction works are to be completed during daylight hours only</li> <li>• Flagmen and barricades are to be utilized where and when necessary</li> <li>• Any spills will be contained and cleaned up immediately, and proper authorities notified</li> <li>• Public access to construction sites will be restricted</li> <li>• Warning signs will be posted at the entrance to the site</li> <li>• Adhere to any federal and provincial public health orders regarding disease transmission (including COVID 19 restrictions).</li> </ul> <p>Any injuries, incidents or fatalities are to be reported immediately to Manitoba Workplace Safety and Health, and the Workers Compensation Board of Manitoba.</p> <p>Setbacks for excavation to the Manitoba Hydro high pressure buried gas line will be maintained throughout construction.</p>
	Heritage and Historic Resources	Discovery of Historic or Cultural Artifacts or Remains	I	<p>If any archaeological, cultural or historical artifacts are discovered during construction, works are to cease immediately and any applicable provincial or federal authority would be contacted to examine the site and determine a proper course of action prior to works commencing in the area.</p>

Project Action	Environmental		Rating	Mitigating Measures
	Feature	Issue		
1 Construction Works cont'd	Vegetation	Removal	I	<p>The surrounding lands are regularly cleared for agricultural purposes. The MECP Wildlife Branch were contacted and no vegetative species at risk were identified in the project area (see attached email).</p> <p>The removal of vegetation should be limited to the development area. Vegetation outside of the development area is to be protected from removal and damage by clearly marking the area of disturbance and the limits of clearing.</p> <p>Silt fencing should be utilized in drainage ditches or channels to reduce impacts of siltation to aquatic vegetation in downstream surface waters.</p> <p>If any vegetative species at risk are identified during the construction works, the local Manitoba Environmental Enforcement officer should be contacted to determine a suitable course of action.</p>
	Wildlife and Birds	Disturbance	I	<p>The surrounding lands are regularly cleared for agricultural purposes. The MECP Wildlife Branch were contacted and no wildlife or bird species at risk were identified in the project area (see attached email). The expanded lagoon area will provide additional habitat for waterfowl.</p> <p>Construction activities will be limited to the development areas by clearly marking the limits of construction. Tree clearing is not needed in the development areas. If species or habitats are identified, construction will be avoided in these areas, if possible, or MECP will be contacted for guidance.</p> <p>Construction activities should be limited to daylight hours only so any species encountered can be visually identified.</p>
	Fish Habitat/Aquatic Life	Habitat Alteration and/or Disturbance	I	<p>The nearest body of surface water with suspected fish species would be Willow Creek, located approximately 15 km from the lagoon. Siltation in the drainage route will be reduced through the use of silt fencing during the construction works. In accordance with subsection 36(3) of the Fisheries Act, no deleterious substance is to be deposited in a body of water that contains fish species. If any deleterious substance is deposited in a body of water, the contractor will take all reasonable measures to counteract, mitigate and remedy any adverse effects.</p>
	Economics	Local Employment and Resource Use	SP	<p>The construction activities will likely have a positive impact on the local economy due to the use of local resources and supplies.</p>
	Social	Heavy Equipment Traffic	I	<p>Construction works and travel will be limited to daylight hours only. The contractor will be made aware of travelling with caution in areas where children may be present (i.e. residential and school zones). Local traffic should not be affected.</p>

Project Action	Environmental		Rating	Mitigating Measures
	Feature	Issue		
1 Construction Works cont'd	Aesthetics	Degradation of View	I	The disturbed areas in the development will be re-seeded and restored to a natural state. The lagoon area is difficult to see from any passing roadways.
		Site Cleanliness	I	The contractor will ensure that the construction site is properly cleaned up of all rubbish, excess materials and temporary structures prior to leaving the site. Any construction materials requiring disposal will be sent to a licenced landfill site. Any hazardous waste material will be hauled to a hazardous waste facility.
2 Sludge Removal	Surface Water/Groundwater	Contamination from lagoon sludge	I	Any sludge dredged and pumped directly into the injector will be protected from spills by utilizing proper hose connections. Any land application of sludge will require approval from MECP. Sludge injection will not occur during times of heavy rain or overland flooding.
	Air Quality	Odours	I	The sludge injection will create odours temporarily, but these odours will be minimized by injection below the soil surface.
3 Operation of Lagoon	Surface Water	Contamination from effluent	I	The wastewater effluent will be treated to meet all provincial and federal guidelines for surface discharge. The operator will test the effluent prior to discharge to ensure that concentrations meet the Environment Act Licence requirements.  Liquid levels in the lagoon cells will be monitored to ensure that a minimum freeboard height is maintained, so that effluent is not spilling over the dikes.
		Flooding along Discharge Route	I	If flooding occurs along the discharge route, the lagoon will not be discharged. Treated effluent will not contribute to overland flooding.
	Groundwater	Seepage from Lagoon Cell	I	The lagoon will be lined with soil to the permeability requirements of the Environment Act Licence to ensure containment of the liquid wastewater.
	Social	Operator Training	SP	Operators for the lagoon will be certified to the level specified by the province for the classification of the facultative lagoon. The operators are to work with Health Canada and MECP to ensure proper operation, maintenance, sampling/testing and emergency protocols are in place.

## 4.0 RESIDUAL AND CUMULATIVE EFFECTS

*Residual environmental effects remaining after the application of mitigation measures, to the extent possible expressed in quantitative terms relative to baseline conditions*

No negative residual effects are anticipated through the construction and operation of the expanded wastewater treatment lagoon, due to the mitigation measures described above. Positive residual effects are expected from a properly sized wastewater treatment system that will allow for expansion of the service area in the future. Positive residual impacts are also expected from the use of local resources and operators, and from the re-use of lagoon sludge as a fertilizer supplement on agricultural land.

No negative cumulative effects are anticipated from other construction works in the area. As the existing lagoon cells will continue to be utilized to discharge effluent, no negative impacts are expected in the discharge route, however, due to the additional hydraulic storage in the proposed storage cell, the discharge period will be longer and a greater volume of effluent will be released during discharge events.

## 5.0 MONITORING AND FOLLOW-UP

*Proposed follow-up activities that will be required at any stage of development (eg. Monitoring, inspection, surveillance, audit, etc.)*

Monitoring of the lagoon operation is to be conducted by a trained lagoon operator, who is to ensure the lagoon is operated under the requirements of the Environment Act licence. The operator is to:

- ensure liquid levels in the lagoon cells are maintained within the required limits
- spread alum in storage cells if needed to reduce phosphorus levels
- conduct sampling of lagoon effluent prior to discharge
- ensure effluent quality parameters as described in the Environment Act licence are met
- maintain records of discharge events and effluent quality monitoring for reporting to MECP, and Environment and Climate Change Canada
- maintain vegetation growth to within limits at the lagoon site
- monitor erosion of slopes.

If there are any concerns with the operation of the lagoon, the licensee is to contact the local environment enforcement officer to discuss mitigation options. The construction contractor is to ensure that grass growth occurs on slopes and disturbed areas, after the construction activities are completed.

## 6.0 FUNDING AND APPROVALS

*Name and address of any Government Agency or program (federal, provincial or otherwise) from which a grant or loan of capital funds have been requested (where applicable). Other federal, provincial or municipal approvals, licences, permits, authorizations, etc. known to be required for the proposed development, and the status of the project's application or approval.*

The project is currently being funded by the Manitoba Water Services Board and the RM of Elton, however additional funding will be pursued for the construction works. No additional approvals, licences or permits are required for the lagoon expansion construction and operation. The RM will also be responsible for registering the lagoon expansion with Environment Canada and providing annually monitoring reports to Environment Canada under the *Federal Wastewater Systems Effluent Regulations*.

## 7.0 PUBLIC CONSULTATION

*Results of any public consultations undertaken or to be undertaken in conjunction with project planning.*

Public consultation by the RM of Elton has not been conducted to date for residents in the Community of Forrest. Public consultation for residents would likely occur during future phases of the project, once funding has been established. Public comments will be received by MECP through the public registry during the Environmental Act Proposal review period.

## 8.0 CONCLUSION

Based on the design of the project and the implementation of the mitigation measures, identified in Section 3.0 above, no significant negative environmental impacts are anticipated. Positive effects to the environment are expected from a properly sized wastewater treatment lagoon.

The proponent would like to complete the requirements of the Environment Act Proposal as soon as possible so that the lagoon construction can begin in a timely fashion.

JR Cousin Consultants Ltd. requests that a draft copy of the Environment Act Licence be forwarded for review prior to the issue of the final licence.

## **APPENDIX**

### **APPENDIX A**

Status of Titles

### **APPENDIX B**

Table 1: Forrest Lagoon – Population, Hydraulic and Organic Loading Projections to Design Year 20  
Species at Risk Database Search, Manitoba Environment, Climate and Parks – Wildlife and Fisheries  
Branch, September 1, 2022

### **APPENDIX C**

Geotechnical Investigations Letter Report, JR Cousin Consultants Ltd., December 7, 2021

Sludge Assessment Report, Assiniboine Injections Ltd., October 28, 2021

Sludge Analysis Report, ALS Global, November 21, 2021

### **APPENDIX D**

Title Page

- Plan 1: Proposed Lagoon Expansion Location with Setbacks
- Plan 2: Proposed Lagoon Expansion with Test Hole Locations
- Plan 3: Proposed Land Application Area
- Plan 4: Proposed Lagoon Storage Cell Layout Plan
- Plan 5: Lagoon Dike and Liner Details
- Plan 6: Fence, Slit Fence, Vale, Valve Marker, Rip Rap and Ditch Details

## **APPENDIX A**

Status of Titles

COMPLETION DATE..... 2008/11/03

CLIENT FILE... E-634.01  
PRODUCED BY... D.ALLARD

**LEGAL DESCRIPTION:**

RURAL MUNICIPALITY OF ELTON

IS REGISTERED OWNER SUBJECT TO SUCH ENTRIES RECORDED HEREON  
IN THE FOLLOWING DESCRIBED LAND

PARCEL "B" PLAN 26673 BLTO  
EXC ALL MINES AND MINERALS AS SET FORTH IN TRANSFER 91-4233  
IN SW 1/4 31-11-18 WPM

**ACTIVE TITLE CHARGE(S):**

R6671/2	ACCEPTED FROM/BY: TO: CONSIDERATION:	CAVEAT PLAINS WESTERN GAS & ELECTRIC CO LTD.	REG'D: 1958/11/27	NOTES:
R94012/2	ACCEPTED FROM/BY: TO: CONSIDERATION:	CAVEAT PLAINS WESTERN GAS (MAN) LTD.	REG'D: 1973/09/07	NOTES: PART
91-2969/2	ACCEPTED FROM/BY: TO: CONSIDERATION:	EASEMENT ROLLING RIVER SCHOOL DIVISION NO. 39, ETAL	REG'D: 1991/04/04	NOTES: RE PLAN 26673

**ADDRESS(ES) FOR SERVICE:**

EFFECT	NAME AND ADDRESS	POSTAL CODE
ACTIVE	RURAL MUNICIPALITY OF ELTON FORREST MB	ROK OWO

COMPLETION DATE..... 2008/11/03

CLIENT FILE... E-634.01  
PRODUCED BY... D.ALLARD

**ORIGINATING INSTRUMENT(S):**

REGISTRATION NUMBER	TYPE	REG. DATE	CONSIDERATION	SWORN VALUE
1230889/2	T	2008/10/23	\$1.00	\$5,000.00

PRESENTED BY: ROY, JOHNSTON & CO (BRANDON)  
FROM: ROLLING RIVER SCHOOL DIVISION NO. 39  
TO: RURAL MUNICIPALITY OF ELTON

**FROM TITLE NUMBER(S):**

196670/2 ALL

**LAND INDEX:**

LOT	BLOCK	SURVEY PLAN
-----	-------	-------------

B 26673  
NOTE: SW 1/4 32-11-18W EXC M&M

ACCEPTED THIS 23RD DAY OF OCTOBER, 2008  
BY K.GRAINGER FOR THE DISTRICT REGISTRAR OF  
THE LAND TITLES DISTRICT OF BRANDON.

CERTIFIED TRUE EXTRACT PRODUCED FROM THE LAND TITLES DATA  
STORAGE SYSTEM ON 2012/02/15 OF TITLE NUMBER 2333846/2.

\*\*\*\*\* END OF STATUS OF TITLE 2333846/2 \*\*\*\*\*

DATE: 2009/11/16  
TIME: 22:52

**MANITOBA**

TITLE NO: 2412373

**STATUS OF TITLE**

PAGE: 1

STATUS OF TITLE.....	ACCEPTED	PRODUCED FOR..	PATERSON, PATERSON, WYMAN & ABEL
ORIGINATING OFFICE...	BRANDON	ADDRESS.....	1-1040 PRINCESS AVE.
REGISTERING OFFICE...	BRANDON		BRANDON MB R7A OP8
REGISTRATION DATE....	2009/11/06		
COMPLETION DATE.....	2009/11/16		
		CLIENT FILE...	RM OF ELTON
		PRODUCED BY...	SYSTEM for Series : 1253596

**LEGAL DESCRIPTION:**

RURAL MUNICIPALITY OF ELTON

IS REGISTERED OWNER SUBJECT TO SUCH ENTRIES RECORDED HEREON IN THE FOLLOWING DESCRIBED LAND:

PARCEL ONE: PARCEL "A" PLAN 26673 BLTO  
IN SW 1/4 31-11-18 WPM

PARCEL TWO: PARCEL "A" PLAN 1544 BLTO  
IN SW 1/4 31-11-18 WPM

PARCEL THREE: THE SW 1/4 OF SECTION 31-11-18 WPM  
EXC FIRSTLY: PLANS 906, 961, 1046, 1244, 1249, 1544, 1545, 1609,  
26673, 31084 AND 49318 BLTO  
SECONDLY: NLY 120 FEET OF WLY 200 FEET  
THIRDLY: ROAD PLAN 1081 BLTO  
FOURTHLY: ALL THAT PORTION BOUNDED AS FOLLOWS:  
ON THE NORTH BY SOUTHERN LIMIT OF PLAN 961;  
ON THE WEST BY EASTERN LIMIT OF PARCEL "A" PLAN 1046;  
ON THE EAST BY THE PRODUCTION SLY OF EASTERN LIMIT OF  
SAID PLAN 961; AND  
ON THE SOUTH BY THE PRODUCTION ELY OF THE LIMIT  
BETWEEN THE NORTH AND SOUTH HALVES OF PARCEL "A"  
PLAN 1046 BLTO  
AND FIFTHLY: ALL MINES AND MINERALS

PARCEL FOUR: ALL MINES AND MINERALS IN THE FOLLOWING DESCRIBED LAND  
AS SET FORTH IN TRANSFER R22884:  
THE SW 1/4 OF SECTION 31-11-18 WPM  
EXC FIRSTLY: PLANS 906, 961, 1046, 1244, 1249, 1545, 1609,  
26673, 31084 AND 49318 BLTO  
SECONDLY: ROAD PLAN 1081 BLTO  
AND THIRDLY: ALL THAT PORTION BOUNDED AS FOLLOWS:  
ON THE NORTH BY SOUTHERN LIMIT OF PLAN 961;  
ON THE WEST BY EASTERN LIMIT OF PARCEL "A" PLAN 1046;  
ON THE EAST BY THE PRODUCTION SLY OF EASTERN LIMIT OF  
SAID PLAN 961; AND  
ON THE SOUTH BY THE PRODUCTION ELY OF THE LIMIT  
BETWEEN THE NORTH AND SOUTH HALVES OF PARCEL "A"  
PLAN 1046 BLTO

PARCEL FIVE: ALL MINES AND MINERALS IN THE FOLLOWING DESCRIBED LAND  
AS SET FORTH IN TRANSFER 91-4233:  
PARCEL "B" PLAN 26673 BLTO  
IN SW 1/4 31-11-18 WPM

PARCEL SIX: ALL MINES AND MINERALS IN THE FOLLOWING DESCRIBED LAND AS  
SET FORTH IN TRANSFERS R7546 & R20736:

CERTIFIED TRUE EXTRACT PRODUCED FROM THE LAND TITLES DATA  
STORAGE SYSTEM ON 2009/11/16 OF TITLE NUMBER 2412373

\*\*\*\*\* STATUS OF TITLE 2412373 BDN CONTINUED ON NEXT PAGE \*\*\*\*\*

DATE: 2009/11/16  
 TIME: 22:52

**MANITOBA**  
**STATUS OF TITLE**

TITLE NO: 2412373

PAGE: 2

STATUS OF TITLE.....	ACCEPTED	PRODUCED FOR..	PATERSON, PATERSON, WYMAN & ABEL
ORIGINATING OFFICE...	BRANDON	ADDRESS.....	1-1040 PRINCESS AVE.
REGISTERING OFFICE...	BRANDON		BRANDON MB R7A 0P8
REGISTRATION DATE....	2009/11/06		
COMPLETION DATE.....	2009/11/16		
		CLIENT FILE...	RM OF ELTON
		PRODUCED BY...	SYSTEM for Series : 1253596

LEGAL DESCRIPTION:

PARCELS 1 AND 2 PLAN 906 BLTO  
 IN SW 1/4 31-11-18 WPM

PARCEL SEVEN: ALL MINES AND MINERALS IN THE FOLLOWING DESCRIBED LAND  
 AS SET FORTH IN TRANSFER R19014:  
 PLAN 961 BLTO  
 IN SW 1/4 31-11-18 WPM

ACTIVE TITLE CHARGE(S):

R6671	BDN ACCEPTED FROM/BY: TO: CONSIDERATION:	CAVEAT PLAINS WESTERN GAS & ELECTRIC CO LTD.	REG'D: 1958/11/27	NOTES:
R94012	BDN ACCEPTED FROM/BY: TO: CONSIDERATION:	CAVEAT PLAINS WESTERN GAS (MAN) LTD.	REG'D: 1973/09/07	NOTES: PT
1023968	BDN ACCEPTED DESCRIPTION: FROM/BY: TO: CONSIDERATION:	CAVEAT GRANT OF RIGHT OF USER AGREEMENT DATED 1995/08/08 CENTRA GAS MANITOBA INC. DOUGLAS A. YOUNG AS AGENT	REG'D: 1997/05/05	NOTES: RE PLAN 33616

ADDRESS(ES) FOR SERVICE:

EFFECT	NAME AND ADDRESS	POSTAL CODE
ACTIVE	R.M. OF ELTON GENERAL DELIVERY FORREST MB	ROK OWO

CERTIFIED TRUE EXTRACT PRODUCED FROM THE LAND TITLES DATA  
 STORAGE SYSTEM ON 2009/11/16 OF TITLE NUMBER 2412373

\*\*\*\*\* STATUS OF TITLE 2412373 BDN CONTINUED ON NEXT PAGE \*\*\*\*\*

DATE: 2009/11/16  
TIME: 22:52

# MANITOBA

TITLE NO: 2412373

## STATUS OF TITLE

PAGE: 3

STATUS OF TITLE.....	ACCEPTED	PRODUCED FOR..	PATERSON,PATERSON,WYMAN & ABEL
ORIGINATING OFFICE...	BRANDON	ADDRESS.....	1-1040 PRINCESS AVE.
REGISTERING OFFICE...	BRANDON		BRANDON MB R7A 0P8
REGISTRATION DATE....	2009/11/06		
COMPLETION DATE.....	2009/11/16		

CLIENT FILE...	RM OF ELTON
PRODUCED BY...	SYSTEM for Series : 1253596

### ORIGINATING INSTRUMENT(S):

REGISTRATION NUMBER	TYPE	REG. DATE	CONSIDERATION	SWORN VALUE
1253599 BDN	ITREQ	2009/11/06	\$0.00	\$0.00
PRESENTED BY:	PATERSON,PATERSON,WYMAN & ABEL			
FROM:	BLTO			
TO:				

### FROM TITLE NUMBER(S):

1423730 BDN BAL

### LAND INDEX:

LOT	BLOCK	SURVEY PLAN
1		906
NOTE:	SW 31-11-18W	M&M
2		906
NOTE:	SW 31-11-18W	M&M
		961
NOTE:	SW 31-11-18W	M&M
A		1544
NOTE:	SW 31-11-18W	
A		26673
NOTE:	SW 31-11-18W	
B		26673
NOTE:	SW 31-11-18W	ALL M&M

### LAND INDEX:

LOT	QUARTER SECTION	SECTION	TOWNSHIP	RANGE
	SW	31	11	18W
NOTE:	PARTS			

ACCEPTED THIS 6TH DAY OF NOVEMBER, 2009  
BY C.RUSSELL FOR THE DISTRICT REGISTRAR OF  
THE LAND TITLES DISTRICT OF BRANDON.

CERTIFIED TRUE EXTRACT PRODUCED FROM THE LAND TITLES DATA  
STORAGE SYSTEM ON 2009/11/16 OF TITLE NUMBER 2412373.

\*\*\*\*\* END OF STATUS OF TITLE 2412373 BDN \*\*\*\*\*

B. TYPE OF PROPERTY  Residential  Farm  Commercial

9. EVIDENCE - FARM LANDS OWNERSHIP ACT

~~The within Land is not farm land within the definition of subsection 1(1) of the Farm Lands Ownership Act; or~~  
/it not being reasonably capable of being used for farming, it being a sewage lagoon.

strike out inappropriate statements) and initial

JACOB PAUL JANZEN  
(Name)

(Name)

(Signature)

Notary Public for Agent

DATE		
Y	M	D
91	01	09

10. DOWER ACT CONSENT (transfer of land or leasehold title only)

I (We) the spouse of the within transferor consent to the within instrument.

(Name)

(Signature)

(Name)

(Signature)

DATE		
Y	M	D

11. DOWER ACT ACKNOWLEDGEMENT

(if required, attach affidavit of witness re: Form C, Subsection 14 (3) The Dower Act, Cap. D100)

The above consent was acknowledged before me by  
apart from (his/her) spouse, to have been voluntarily executed by (him/her) of (his/her)  
own free will and accord without any compulsion on the part of the other spouse.  
(He/She) has further acknowledged that (he/she) is aware of the nature and effect of the same.

(Name)

(Signature)

(Name)

(Signature)

A Commissioner for Oaths/Notary Public in and for the Province of Manitoba  
(as the case may be) My commission expires

DATE		
Y	M	D

12. ENCUMBRANCES, LIENS, AND INTERESTS within document is subject to instrument No.(s)

Caveat R.6671, Caveat R.94012, Caveat 88-554, Easement, 91-2969 ✓

13. INSTRUMENT PRESENTED FOR REGISTRATION BY, (include address, postal code, contact person and phone no.)

ROY, JOHNSON & CO., Barristers and Solicitors, Box 605, 363 - 10th Street, Brandon, Manitoba,  
R7A 5Z7 (Jacob P. Janzen), (727-0761).

LTO USE ONLY

FEES CHECKED REFUND AMOUNT

Certificate of Registration  
Registered this date MAY - 8 1991  
as No. 01233  
I certify that the within Instrument was registered in the  
**BRANDON** Land Titles Office and entered on  
Certificate of Title No. 102405  
  
Deputy or Assistant  
District Registrar  
New Certificate of Title No. 196670 - 196671



The District Registrar hereby certifies that this is a true copy of a record maintained in the public records of The Property Registry of Manitoba

LAND TITLES OFFICE  
FEB 15 2012  
BRANDON, MAN.

91 01233

Transfer

Manitoba  
Justice  
Land Titles



District of BRANDON  
 Transfer of Land  Transfer of Mortgage  Transfer of Leasehold Title  Transfer of Encumbrance

1 TRANSFEROR(S) (VENDOR) [Redacted] STATE TRANSFERRED  
\*see schedule

2 LAND DESCRIPTION  
Parcel B, as shown on Plan of Survey No. 26673 BLTO, excepting thereout all mines and minerals.  
MORTGAGE NUMBER(S) 102405 \*see schedule

3 CONSIDERATION  
Receipt of \$ 1.00 and other good and valuable consideration is acknowledged.

4 LAND TRANSFER TAX - FAIR MARKET VALUE AND, IF APPLICABLE, EXEMPTION EVIDENCE  
1. I certify that the fair market value of the land as a whole with respect to which this transfer is tendered for registration within the meaning of Part III of The Revenue Act is \$ 5,000.00.  
2. IACOB PAUL JANZEN (Name) [Redacted] DATE 91.05.09

5 TRANSFEREE(S) (Purchaser) (True and correct name and address including postal code) AND TENANCY/STATE/SHARE ACQUIRED  
ROLLING RIVER SCHOOL DIVISION, NO. 39, Box 1170, Minnedosa, Manitoba, ROJ 1E0  
\*see schedule

6 ADDRESS OF TRANSFEREE(S) FOR SERVICE (include postal code)  
Box 1170, Minnedosa, Manitoba, ROJ 1E0

7 EVIDENCE OF TRANSFEROR(S) \*see schedule   
Witness [Redacted] DATE 91-05-08  
Witness [Redacted] DATE 91-05-08  
Witness [Redacted]

I hereby certify and verify as an authorized officer of the Land Titles Office that the document and signed by the party making the statement is the same as that which is on file in the Land Titles Office.

attach to Ref

Issuing C.T. No.

Hand for Ref  
to R. 26673  
of Pct B Plan 26673

OFFICE REQUEST

Re: Certificate of Title No. 102405 balance

Attached to Instrument No. 91-4233

- A) Re balance/part of above noted Certificate of Title;
- B) Pursuant to Section 22(1)(h) of The Real Property Act,
- C) Pursuant to registration of a Plan of Subdivision of part of the registered in the BLTO as No. \_\_\_\_\_

Let title(s) issue to Registered Owner(s):

PARCEL ONE: SW 1/4 31-11-18 WPM exc:  
 Firstly: Plans 906, 961, 1046, 1244, 1249, 1544, 1545 and 26673 BLTO  
 Secondly: Nly 240 feet of Wly 600 feet  
 Thirdly: Road Plan 1081  
 Fourthly: All that portion bounded as follows: On North by Sly limit of Plan 961, on West by Ely limit of Parcel A Plan 1046, on East by the production Sly of Ely limit of said Plan 961, on South by the production Ely of limit between North and South halves of Parcel A Plan 1046  
 Fifthly: All mines and minerals.

PARCEL TWO: Parcel A Plan 26673 BLTO  
 In SW 1/4 31-11-18 WPM.

PARCEL THREE: All mines and minerals in the following described land as set forth in Transfer No. R.22884:  
 SW 1/4 31-11-18 WPM exc:  
 Firstly: Plans 1609, 1046, 1244, 1249, 1545 and 26673 BLTO  
 Secondly: All that portion bounded as follows: On North by Sly limit of Plan 961, on West by Ely limit of Parcel A Plan 1046, on East by the production Sly of Ely limit of said Plan 961, on South by the Production Ely of limit between North and South halves of Parcel A Plan 1046  
 Thirdly: Road Plan 1081 BLTO.

PARCEL FOUR: Parcel A Plan 1544 BLTO  
 In SW 1/4 31-11-18 WPM.

PARCEL FIVE: All mines and minerals in the following described land as set forth in Transfer No. 91-4233  
 Parcel B Plan 26673 BLTO  
 in SW 1/4 31-11-18 WPM.

Dated                      1991

  
for District Registrar

Encumbrances: Covenants:  
 R.6671 - all  
 88-554 - pt Pcl 1  
 R.94012 - part  
 Easement Agrt - 91-2969 - re: Pl. 26673

Address:

Forrest, MB.  
ROK awo



As stated in the above noted Certificate of Title, the following is a list of the instruments registered in the D.T.O. as follows:

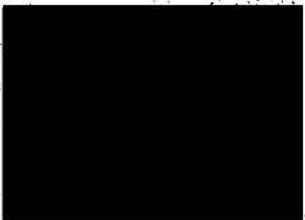
No.	Date	Description
1	1958	...
2	1958	...
3	1958	...
4	1958	...
5	1958	...
6	1958	...
7	1958	...
8	1958	...
9	1958	...
10	1958	...
11	1958	...
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37	1958	...
38	1958	...
39	1958	...
40	1958	...
41	1958	...
42	1958	...
43	1958	...
44	1958	...
45	1958	...
46	1958	...
47	1958	...
48	1958	...
49	1958	...
50	1958	...

C.T. No. 102405

OFFICE REQUEST

The following is a list of the instruments registered in the D.T.O. as follows:

93



THE RURAL MUNICIPALITY OF ELTON

BY-LAW NO. 1096 of 1991

\*\*\*\*\*  
A BY-LAW AUTHORIZING THE SALE OF PARCEL B, AS SHOWN ON PLAN OF  
SURVEY NO. 26673 BLTO, EXCEPTING THEREOUT ALL MINES AND MINERALS  
\*\*\*\*\*

WHEREAS the Rural Municipality of Elton is the owner of the hereinafter described property which is no longer required for Municipal purposes.

AND WHEREAS THE ROLLING RIVER SCHOOL DIVISION NO. 39, Box 1170, Minnedosa, Manitoba, ROJ 1E0 has offered the sum of ONE (\$1.00) DOLLAR, PLUS LEGAL COSTS, for the hereinafter mentioned property.

AND WHEREAS the Council of the Rural Municipality of Elton deem it expedient to accept the said Offer.

NOW THEREFORE the Council of the Rural Municipality of Elton in Council assembled enacts as follows:

THAT Parcel B, as shown on a Plan of Survey No. 26673 BLTO, excepting thereout all mines and minerals

BE AND THE SAME is hereby sold to the ROLLING RIVER SCHOOL DIVISION NO. 39, Box 1170, Minnedosa, Manitoba, ROJ 1E0 for the sum of ONE (\$1.00) DOLLAR, and that the Reeve and Secretary-Treasurer be and they are hereby authorized to execute the necessary TRANSFER to give the said ROLLING RIVER SCHOOL DIVISION NO. 39 title to the said property.

DONE AND PASSED by the Council of the Rural Municipality of Elton in Council Assembled this 8th DAY OF May 1991.

RURAL MUNICIPALITY

PER: \_\_\_\_\_ REEVE

PER: \_\_\_\_\_ Secretary-Treasurer

I, KATHY DOBBYN, of the City of Brandon, in the Province of Manitoba, Secretary-Treasurer, of the Rural Municipality of Elton, HEREBY CERTIFY that the above is a true and correct copy of BY-LAW NO. 1096, of 1991, of the said Rural Municipality of Elton AND FURTHER, that I have compared the said copy with the Original BY-LAW.

\_\_\_\_\_  
Secretary-Treasurer



FORM B

Certificate of Approval No.

H 1070

CERTIFICATE OF APPROVAL OF SUBDIVISION  
UNDER THE PLANNING ACT

Library Arts Building  
638 Princess Avenue  
Brandon, Man. R7A 0P3

File No.: 4124-89-2641

Date: March 6, 1991

Name of Applicant: Rural Municipality of Elton

Approval of a plan of ~~XXXXXX~~ survey of part of the South-West Quarter of Section Thirty-one (31), in Township Eleven (11) and Range Eighteen (18), West of the Principal Meridian, in Manitoba

Development Agreement:

Applicant has been relieved from compliance with the following regulations:

No. of additional lots - one (1)

IT IS CERTIFIED THAT all that portion of the above described lands which is contained within a heavy solid line on a plan of survey prepared by Richard Claude Purvis Manitoba Land Surveyor, and sworn to by him at Brandon, Manitoba on the 15th day of August, 19 89, IS HEREBY APPROVED FOR REGISTRATION. subject to Parcel A being consolidated on Certificate of Title No. 102425

This approval is valid for a period of twelve (12) months from the date hereof.

102425  
102405



ORIGINAL — White

FILE — Yellow

MUNICIPAL COUNCIL — Pink

REGISTRY — Orange

CANADA  
PROVINCE OF MANITOBA

I, Herbert Thomas Tulloch of the Post Office of  
Forest, in the Province of MANITOBA,

To Wit: make oath and say:-

- (1) THAT I am the Transferee named in the within Transfer;
- (2) That the within described parcel of land, together with all buildings and other improvements thereon, is in my opinion of the

value of Nine thousand Dollars,  
and no more.

(3) That the true, correct and full name(s) of the Transferee(s) is (are) spelled  
as follows: Herbert Thomas Tulloch

SWORN before me at the City  
of Brandon, in the  
Province of Manitoba, this 29<sup>th</sup>  
day of Nov

The District Registrar hereby certifies  
that this is a true copy of a record  
maintained in the public records of  
The Property Registry of Manitoba

BRANDON, MAN.

FEB 15 2012

LAND TITLES OFFICE

VIA 263 Rev. 7-59 (Manitoba)

92002

MEMORIAL OF INSTRUMENT

Nature of Instrument	Time of its Production for Registration	Names of Parties thereto	Number of Instrument
[Redacted]	29 Nov 1961 at 11:55 a.m.	Director, V.F.A. to Herbert Thomas Tulloch	R-22884

... this Instrument was presented for Registration at the time above mentioned  
and that the same has been registered in the Land Titles Office at Brandon  
... memorial thereof has been entered in the Register Book on Certificate of Title No. 67765

... certify that at the time this Instrument was presented for Registration no registration appeared  
... at Book which would affect this land other than Nos.

BRANCHING CLERK

pt. 67765

MANITOBA

M/5796 A

"THE REAL PROPERTY ACT"

TRANSFER OF LAND

THE DIRECTOR, THE VETERANS' LAND ACT, being registered owner of an estate in fee simple in possession subject however to such encumbrances, liens and interests as are notified by memorandum underwritten or endorsed hereon in all that piece or parcel of land known and described as follows:--

PARCEL 1: The South West Quarter of Section Thirty-one, Township Eleven and Range Eighteen, West of the Principal Meridian, in Manitoba, excepting thereout FIRSTLY: All that portion shown on a Plan of Survey registered in the Brandon Land Titles Office as No. 906; SECONDLY: All that portion shown on a Plan of Survey registered in the said Office as No. 961, excepting thereout that portion contained within the limits of the said Plan No. 906; THIRDLY: The most Northerly Two Hundred and Forty feet in depth of the most Westerly Six Hundred feet in width excepting thereout that portion contained within the limits of the said Plan No.906; FOURTHLY: All mines and minerals.

PARCEL 2: All mines and minerals whether solid, liquid or gaseous, within, upon, or under the said South West Quarter excepting thereout the most Northerly Two Hundred and Forty feet in depth of the most Easterly Four Hundred feet in width of the most Westerly Six Hundred feet in width thereof.

Doth hereby in consideration of other valuable consideration and the sum of ONE - - dollars (\$ 1.00 ) paid by

HERBERT THOMAS TULLOCH

of the Post Office of Forrest in the Province of Manitoba, Farmer the receipt of such consideration and sum is hereby acknowledged, transfer to the said

HERBERT THOMAS TULLOCH

all his estate and interest in the said piece of land

IN WITNESS WHEREOF THE DIRECTOR, THE VETERANS' LAND ACT hath caused to be hereunto affixed his Corporate Seal and his name to be signed this Twenty-third

day of November A.D. 1961.

WITNESS

Subject to Caveat No. R.6671 and R.20

The Address of the Transferee is:

## STATUS OF TITLE

Title Number **2693270/2**  
Title Status **Accepted**  
Client File



### 1. REGISTERED OWNERS, TENANCY AND LAND DESCRIPTION

CAROLE AGNES DAGMAR BALMER AND CHARLES HURLEY BALMER  
BOTH OF WINNIPEG IN MANITOBA

ARE REGISTERED OWNERS AS JOINT TENANTS SUBJECT TO SUCH ENTRIES  
RECORDED HEREON IN THE FOLLOWING DESCRIBED LAND

THE NW 1/4 OF SECTION 31-11-18 WPM

The land in this title is, unless the contrary is expressly declared, deemed to be subject to the reservations and restrictions set out in section 58 of *The Real Property Act*.

### 2. ACTIVE INSTRUMENTS

Instrument Type: **Caveat**  
Registration Number: **R21922/2**  
Instrument Status: **Accepted**

Registration Date: 1961-09-27  
From/By: PLAINS WESTERN GAS & ELECTRIC CO LTD.  
To:

Amount:  
Notes: No notes  
Description: No description

---

Instrument Type: **Caveat**  
Registration Number: **R93755/2**  
Instrument Status: **Accepted**

Registration Date: 1973-08-23  
From/By: PLAINS WESTERN GAS (MANITOBA) LTD  
To:

Amount:  
Notes: ALL EXC M&M  
Description: No description

Instrument Type: **Caveat**  
Registration Number: **1013275/2**  
Instrument Status: **Accepted**

Registration Date: 1996-10-11  
From/By: MTS NETCOM INC.  
To: W.F. JOHNSTONE AS AGENT

Amount:  
Notes: NLY 20M  
Description: RIGHT OF WAY AGREEMENT DATED 1996/09/17

---

Instrument Type: **Caveat**  
Registration Number: **1016765/2**  
Instrument Status: **Accepted**

Registration Date: 1996-12-20  
From/By: CENTRA GAS MANITOBA INC  
To: DOUGLAS B. YOUNG AS AGENT

Amount:  
Notes: RE PLAN 33616 EXC M&M  
Description: GRANT OF RIGHT OF USER AGMT DATED JULY 15, 1995

---

Instrument Type: **Caveat**  
Registration Number: **1316823/2**  
Instrument Status: **Accepted**

Registration Date: 2012-07-05  
From/By: CENTRA GAS MANITOBA INC.  
To: GLENN W. GRAY, AGENT

Amount:  
Notes: PT RE: PLAN 52592  
Description: GRANT OF RIGHT OF USER AGRT. DATED DECEMBER 9, 2008

Instrument Type: **Caveat**  
Registration Number: **1348720/2**  
Instrument Status: **Accepted**

Registration Date: 2013-10-31  
From/By: IRENE BURNICE CHRISTENSEN  
To: NORMAN HARPER SIMS AS AGENT

Amount:  
Notes: No notes  
Description: LIFETIME OCCUPANCY AGRT DATED 29 OCT 2013

**INSTRUMENTS THAT AFFECT THIS INSTRUMENT**

<u>Registration Number</u>	<u>Instrument Type</u>	<u>Status</u>
1355508/2	Postponement Of Rights	Accepted

---

Instrument Type: **Mortgage**  
Registration Number: **1354904/2**  
Instrument Status: **Accepted**

Registration Date: 2014-02-26  
From/By: CAROLE AGNES DAGMAR BALMER & CHARLES HURLEY BALMER  
To: THE TORONTO-DOMINION BANK

Amount: \$325,000.00  
Notes: No notes  
Description: No description

---

Instrument Type: **Postponement Of Rights**  
Registration Number: **1355508/2**  
Instrument Status: **Accepted**

Registration Date: 2014-03-07  
From/By: IRENE BURNICE CHRISTENSEN  
To: TO MORTGAGE 1354904

Amount:  
Notes: No notes  
Description: No description

Instrument Type:	<b>Easement</b>
Registration Number:	<b>1423984/2</b>
Instrument Status:	<b>Accepted</b>
Registration Date:	2017-11-10
From/By:	CAROLE ANGES DAGMAR BALMER AND CHARLES HURLEY BALMAR
To:	RURAL MUNICIPALITY OF ELTON
Amount:	
Notes:	No notes
Description:	STATUTORY EASEMENT
<b>3. ADDRESSES FOR SERVICE</b>	
	CAROLE A. D. BALMER 39 MUSGROVE ST WINNIPEG MB R3R 2J2
	CHARLES HURLEY BALMER 39 MUSGROVE ST WINNIPEG MB R3R 2J2
<b>4. TITLE NOTES</b>	
	No title notes
<b>5. LAND TITLES DISTRICT</b>	
	Brandon
<b>6. DUPLICATE TITLE INFORMATION</b>	
	Duplicate not produced
<b>7. FROM TITLE NUMBERS</b>	
	2131270/2          All
<b>8. REAL PROPERTY APPLICATION / CROWN GRANT NUMBERS</b>	
	No real property application or grant information

**9. ORIGINATING INSTRUMENTS**

Instrument Type:	<b>Transfer Of Land</b>
Registration Number:	<b>1348719/2</b>
Registration Date:	2013-10-31
From/By:	IRENE BURNICE CHRISTENSEN
To:	CAROLE AGNES DAGMAR BALMER AND CHARLES HURLEY BALMER
Consideration:	\$1.00

**10. LAND INDEX**

NW 31-11-18W

CERTIFIED TRUE EXTRACT PRODUCED FROM THE LAND TITLES DATA STORAGE SYSTEM OF TITLE NUMBER 2693270/2

## **APPENDIX B**

Table 1: Forrest Lagoon – Population, Hydraulic and Organic Loading Projections to Design Year 20

Species at Risk Database Search, Manitoba Environment, Climate and Parks – Wildlife and Fisheries Branch, September 1, 2022

Table 1: Forrest Lagoon – Population, Hydraulic and Organic Loading Projections to Design Year 20

**TABLE 1  
COMMUNITY OF FORREST  
POPULATION, HYDRAULIC, AND ORGANIC LOADING PROJECTIONS TO DESIGN YEAR 20**

Column 1		Column 3		Column 5		Column 7		Column 9		Column 11	
TIMELINE		POPULATION		ORGANIC LOADING				HYDRAULIC LOADING			
CALENDAR YEAR	DESIGN YEAR	COMMUNITY POPULATION	SCHOOL POPULATION	DAILY PER CAPITA BOD	DAILY BOD PRODUCTION	BOD - PEAK DAILY LOADING	PRIMARY CELL Area Req'd at 0.75m	WASTEWATER PRODUCTION	WASTEWATER PRODUCTION	DAILY WASTEWATER VOLUME	WASTEWATER VOLUME
		1% annual growth	Equivalent Population (1/3 of Students and Staff) 0% annual growth	[kg]	[kg]	Septage hauling (1 load/day) [kg]	@56kg BOD/ha/day [sq. m.]	Water Usage L/person/day	Infiltration L/person/day	[cu. m.]	For 230 Days [cu. m.]
2021	0	145	120	0.072	19.1	18.0	6,621	184	55	63	14,591
2022	1	146	120	0.072	19.2	18.0	6,640	184	55	64	14,673
2023	2	148	120	0.072	19.3	18.0	6,660	184	55	64	14,755
2024	3	149	120	0.072	19.4	18.0	6,679	184	55	65	14,838
2025	4	151	120	0.072	19.5	18.0	6,699	184	55	65	14,922
2026	5	153	120	0.072	19.6	18.0	6,718	184	55	65	15,007
2027	6	154	120	0.072	19.7	18.0	6,738	184	55	66	15,093
2028	7	156	120	0.072	19.8	18.0	6,759	184	55	66	15,179
2029	8	157	120	0.072	20.0	18.0	6,779	184	55	66	15,267
2030	9	159	120	0.072	20.1	18.0	6,800	184	55	67	15,355
2031	10	171	120	0.072	21.0	18.0	6,956	184	55	70	16,023
2032	11	173	120	0.072	21.1	18.0	6,981	184	55	70	16,133
2033	12	175	120	0.072	21.2	18.0	7,007	184	55	71	16,243
2034	13	176	120	0.072	21.3	18.0	7,020	184	55	71	16,298
2035	14	178	120	0.072	21.5	18.0	7,046	184	55	71	16,408
2036	15	180	120	0.072	21.6	18.0	7,071	184	55	72	16,519
2037	16	182	120	0.072	21.7	18.0	7,097	184	55	72	16,629
2038	17	184	120	0.072	21.9	18.0	7,123	184	55	73	16,739
2039	18	185	120	0.072	22.0	18.0	7,136	184	55	73	16,794
2040	19	187	120	0.072	22.1	18.0	7,161	184	55	73	16,904
2041	<b>20</b>	189	120	0.072	22.2	18.0	7,187	184	55	74	<b>17,014</b>

Species at Risk database Search, Manitoba Environment, Climate and Parks – Wildlife and Fisheries Branch, September 1, 2022

<b>SEARCH CRITERIA</b>	<b>SITE</b>	<b>COMNAME</b>	<b>S_RANK</b>	<b>ESEA</b>	<b>SARA</b>	<b>COSEWIC</b>
Within	SW-31-011-18W1					
Within 2km radius of site boundary of	SW-31-011-18W1	Bank Swallow	S4B		Threatened	Threatened
Within 2km radius of site boundary of	SW-31-011-18W1	Barn Swallow	S4B		Threatened	Threatened
Within 2km radius of site boundary of	SW-31-011-18W1	Sharp-tailed Grouse	S5			
Records in general area of	SW-31-011-18W1	Plains Gartersnake	S4			
Records in general area of	SW-31-011-18W1	Bobolink	S3S4B		Threatened	Threatened
Records in general area of	SW-31-011-18W1	Prairie Loggerhead Shrike	S1B	Endangered	Threatened	Threatened
Records in general area of	SW-31-011-18W1	Bank Swallow	S4B		Threatened	Threatened
Records in general area of	SW-31-011-18W1	Barn Swallow	S4B		Threatened	Threatened
Records in general area of	SW-31-011-18W1	Sharp-tailed Grouse	S5			
Records in general area of	SW-31-011-18W1	Sprague's Pipit	S2B	Threatened	Threatened	Threatened
Records in general area of	SW-31-011-18W1	Snake Hibernaculum	SNR			

## **APPENDIX C**

Geotechnical Investigations Letter Report, JR Cousin Consultants Ltd., December 7, 2021

Sludge Assessment Report, Assiniboine Injections Ltd., October 28, 2021

Sludge Analysis Report, ALS Global, November 21, 2021

Geotechnical Investigations Letter Report, JR Cousin Consultants Ltd., December 7, 2021



December 7, 2021

600\634\634.03\02\Geotech\Forrest Lagoon - Geotechnical Letter Report.docx

Ms. Rebecca Toews, EIT  
Water Services Branch  
Department of Central Services  
Unit 1A – 2010 Currie Blvd.  
Brandon, Manitoba  
R7B 4E7

**E-634.03**

**P&R 14.81 JRCC**

**Via email**

Dear Ms. Toews,

**RE: Letter Report for the Forrest Lagoon Expansion Geotechnical Investigation**

JR Cousin Consultants Ltd. (JRCC) conducted a geotechnical investigation for the RM of Elton as part of a potential expansion to the Forrest wastewater treatment lagoon. The geotechnical investigation occurred to the east of the existing lagoon cells on land owned by the RM. A test hole location plan is attached. A new lagoon cell will require a liner approved by Manitoba Conservation and Climate for construction and operation. This geotechnical investigation was conducted to determine whether the soil conditions in the proposed expansion area were suitable for construction of a cell liner meeting provincial requirements.

## **1.0 BACKGROUND**

### **1.1 Existing Lagoon Site**

The Forrest wastewater treatment lagoon is located at SW 31-11-18 WPM in the RM of Elton, approximately 300 m east and north of the community. Due to potential growth, the RM is planning for a future lagoon expansion. The only areas that could potentially be used for expansion, due to setbacks, would be east or north of the lagoon cells. As the RM does not own the land to the north, the expansion area was limited to the east. The land to the east was also limited by the location of an existing high pressure buried gas line from Manitoba Hydro.

The original lagoon was expanded in 2002. The expansion cell was constructed of excavated and compacted soils from the site. The soils consisted of medium plastic, silty clay till which met provincial requirements for permeability in a lagoon cell liner.

Additional soil testing was conducted by JRCC in 2012 for the potential expansion of the lagoon cells. The soils from the two test holes were excavated to the east of the lagoon consisted of high plastic and low plastic silty clay till. The low plastic silty clay till material was tested by a laboratory and obtained a permeability of  $1.5 \times 10^{-8}$  cm/sec, which meets the provincial requirements for a lagoon liner.

### **1.2 Canada-Manitoba Soil Survey**

Soils survey data of the area indicate the soils around the lagoon area to the north and east consist of Newdale Series, which are Black Chernozems (loamy till). These soils are moderately well to well-drained and permeability is moderately slow.

JRCC.ca

## 2.0 GEOTECHNICAL FIELD INVESTIGATION

An onsite investigation of geotechnical conditions was conducted by JRCC on October 7, 2021. A CAT loader/excavator was used for excavating the test holes under the direct supervision of JRCC personnel. During the site investigation, nine test holes were excavated to a maximum depth of 4.0 m. The test holes were excavated in the potential expansion area to the east of the lagoon cells, on both sides of the buried high pressure gas line. Test Holes 1, 2, 3, 4, and 9 were located on the west side of the buried gas line and the remaining test holes were located on the east side. There was a low lying area to the east of the lagoon cells that was used as a borrow pit during the 2002 expansion works, which was also reviewed (TH3 and TH4). The test hole locations are shown on the attached Plan 1.

The subsurface soil profile within each test hole was logged, water conditions were noted, and representative soil samples were collected as the soils varied along the profile. The samples were visually field-classified and confirmed through laboratory analysis. An assessment of the groundwater conditions was completed by measuring the groundwater infiltration level in the test holes. All test holes were then backfilled with excavated materials. Details of each test hole soil profile, including depth and description of each soil layer, can be found in the attached test hole logs.

### 2.1 Soil Profile

Based on the soils observed in the test holes, the subsurface soil profile was fairly consistent across the potential expansion area to the east, with variations on either side of the buried gas line. The general soil profile on the east side adjacent to the lagoon cells consisted of surficial topsoil, followed by a thin layer of organic clay, overlying a layer of medium plastic silty clay till (approximately 2 m thick), with trace sand seams. Below this was a sandy, silty, clay till layer with gravel to the bottom of the test holes. The test holes in the former borrow pit area were similar, but had a thin, wet peat layer at the surface instead of topsoil. The following table summarizes the general soil profile observed across this area.

Primary Soil Type	Average Depth Range of Soil Layer	Secondary Soil Characteristics
Topsoil/Peat	0 m – 0.1 m	Silt
Organic Clay (high plastic)	0.1 m – 0.4 m	Silt
Clay Till (medium plastic)	0.4 m – 2.7 m	Silt and Sand
Clay Till (medium plastic)	2.7 m – 4.0 m	Sand and Gravel

The general soil profile on the east side on the buried gas line consisted of surficial topsoil, followed by a layer of silt, overlying a layer of medium plastic silty clay till (approximately 2 m thick). Below this was a sandy, silty, clay till layer with gravel to the bottom of the test holes.

Primary Soil Type	Average Depth Range of Soil Layer	Secondary Soil Characteristics
Topsoil	0 m – 0.3 m	Clay
Silt (low plastic)	0.3 m – 0.6 m	Clay
Clay Till (medium plastic)	0.6 m – 2.7 m	Silt and Sand
Clay Till (medium plastic)	2.7 m – 4.0 m	Sand and Gravel

Details of the soil profile observed in each test hole are attached in the test hole logs.

## 2.2 Groundwater and Bedrock

Groundwater infiltration was observed in TH1, TH2, TH3, TH4, and TH9, all on the west side of the buried gas line, at depths ranging from 1.6 m to 3.0 m. Bedrock was not encountered in any of the test holes.

If site construction works occur, contractors should be made aware of the geotechnical conditions encountered onsite.

## 3.0 LABORATORY TESTING, ANALYSIS AND DISCUSSION

Representative soil samples from the potential expansion area were submitted to Wood Environment and Infrastructure Solutions Inc. for testing and analysis. The following is a summary of the testing results, while the detailed laboratory results are attached.

Three bagged samples were analyzed for the following:

- Atterberg Limits (plastic limit, liquid limit, and plasticity index, ASTM D4318)
- Soil Classification (ASTM D2487)
- Moisture Content (ASTM D2216)
- Particle Size Analysis (Hydrometer test, ASTM D422).

One Shelby tube sample was analyzed for hydraulic conductivity (ASTM 5084).

Details of the soil sample analysis are included in the attached laboratory report. A summary of the laboratory results are as follows:

Test Hole	Depth of Sample (m)	Liquid Limit	Plastic Limit	Plasticity Index	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
TH3	0.3 – 2.5	44	15	29	2	27	40	31
TH7	0.7 – 2.7	37	16	21	6	30	40	24
TH7	2.7 – 3.9	40	15	25	1	28	48	23

The Shelby tube sample from the layer of clay till (TH2 1.6 m – 2.2 m) obtained a hydraulic conductivity value of  $3.81 \times 10^{-8}$  cm/sec.

From previous experience, soils with the following characteristics would likely provide a liner with a hydraulic conductivity of  $1 \times 10^{-7}$  cm/sec or less:

- Liquid limit of 30% or greater
- Plastic limit of 10% or greater
- 30% or more passing a number 200 mesh sieve
- 20% or more of clay particles.

The clay till material tested met the characteristics described above, and the in situ Shelby tube sample from the same layer of material also met the provincial hydraulic conductivity requirement. It is therefore likely that this clay till material would meet provincial requirements for hydraulic conductivity ( $1 \times 10^{-7}$  cm/sec or less) in an undisturbed or reworked state.

## 4.0 LAGOON CELL LINER REQUIREMENTS

### 4.1 Current Guidelines

In accordance with the *Manitoba Design Objectives for Wastewater Treatment Lagoons*, a soil liner is to be a minimum of 1.0 m thick and have a hydraulic conductivity (i.e. the potential rate of fluid movement through the soil) of  $1 \times 10^{-7}$  m/sec or less. This low permeability rate is to protect the underlying groundwater from wastewater seepage. The liner of a lagoon cell can be constructed using in situ (undisturbed native) soils, if the soils can consistently achieve a hydraulic conductivity of  $1 \times 10^{-7}$  cm/sec or less in their in situ state. If in situ soils cannot achieve the required hydraulic conductivity, a cell liner can be constructed by excavating and reworking suitable clay type soils to form the liner.

If the clay content of the soils is so low that even when excavated and reworked, the soils cannot consistently achieve a hydraulic conductivity of  $1 \times 10^{-7}$  cm/sec or less, a liner constructed of high plastic clay from a borrow pit, or a synthetic geomembrane liner would be required. Any lined cell should also have a minimum separation distance of 1.0 m from the bottom of the cell floor to the static groundwater level.

### 4.2 Cell Liner Design

Based on the results of the onsite investigation and laboratory analysis, it is recommended to construct the floor liner of an expansion cell to the east of the existing cells with in situ (undisturbed) soils, at the desired excavation depth for the cell floor. A vertical cut-off wall of re-compacted soils is recommended for the perimeter liner, which would tie into the cell floor liner.

The soils forming the horizontal liner (lagoon cell floor) and vertical liner (cut-off wall) are to have a minimum thickness of 1.0 m. The vertical cut-off wall is recommended to have a minimum thickness of 3.0 m, to accommodate typical soil compaction equipment and vehicle access on the top of the dikes.

### 4.3 Utilization of Onsite Soils

The surficial topsoil material should be stripped from the cell construction area and stockpiled for use as top dressing on the outer slopes of the dikes. Any low plastic silt material excavated should be utilized in construction of the interior or exterior dike slopes. The clay till material excavated should be used to construct the vertical cut-off walls in the perimeter dikes, and the in situ clay till material should be scarified and compacted to form the cell floor. Any unsuitable material (boulders, sand, gravel) should be removed if discovered, and replaced with suitable clay till material.

The cell dike construction would require that soils not be too wet or too dry and that they be compacted to a minimum of 98% of the maximum Standard Proctor Density in maximum 150 mm lifts.

## 5.0 RECOMMENDATIONS AND CLOSURE

### 5.1 Recommendations

The soils to the east of the existing lagoon cells were tested for suitability in construction of a new expansion cell. Based on the site observations and laboratory results, it is recommended that a cell liner of in situ (undisturbed) clay till material be used for the cell floor and re-worked clay till material for the vertical cut-off wall in the perimeter dike. Any unsuitable materials excavated or observed in the cell liner should be removed and replaced with suitable clay till material. Setbacks should be maintained from the buried high pressure gas line to the east of the existing lagoon during site construction or investigation works.

### 5.2 Closure

The conclusions and recommendations in this report are based on the results of the site investigation and laboratory analysis. In addition, soil and groundwater conditions between test hole locations were generalized to provide an overall assessment of the geotechnical site conditions. If conditions appear different from those encountered at the test hole locations as described in this report, or if the assumptions stated herein are not in agreement with the design, JRCC should be informed so that the recommendations can be reviewed and adjusted as required.


The geotechnical site investigation was conducted to identify soil conditions suitable for use in constructing a new lagoon cell. Although no environmental issues were identified during the geotechnical investigation, it does not necessarily follow that such issues do not exist. If the RM or any other parties have any environmental concerns regarding the proposed site and works, an appropriate environmental assessment must be conducted.

It is not uncommon for soil conditions to be highly variable across a site. Previous construction activities and placement of fill at a site can augment the variability of soil conditions, especially surficial soil conditions. Bedrock depth and groundwater conditions can also vary significantly across the site. A contingency must be included in any construction budget to allow for potential variations in soil conditions, which may result in modification of the design and construction procedures.

If you have any questions, please contact the undersigned.

Yours truly,

**JR Cousin Consultants Ltd.**

  
Oswald Wohlgemut, M.Sc.  
Environmental Scientist

**Reviewed by**

Jeff Dyck, P.Eng.  
Senior Municipal Engineer

### **Attachments**

Plan 1: Test Hole Location Plan

Test Hole Logs

Laboratory Test Results, Wood Environment and Infrastructure Solutions Inc.

## **APPENDIX**

Plan 1: Test Hole Location Plan

Test Hole Logs

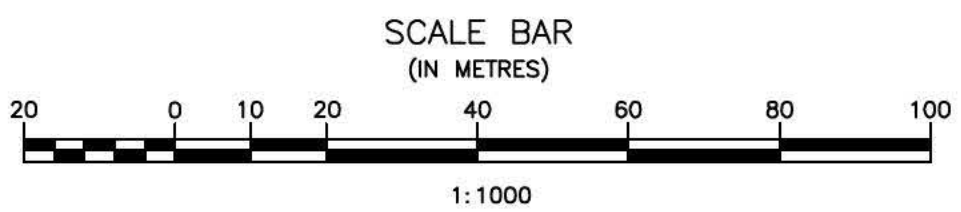
Laboratory Test Results, Wood Environment and Infrastructure Solutions Inc.

Plan 1: Test Hole Location Plan

Test Hole Logs



D:\07\_2021 - 12389\_01\000\04 - Elton R.M. Forrest Lagoon Upgrading\04 - Drainage\04 - Drain\Plan 1 - Test Hole Location Plan.dwg



No.	REVISIONS	DATE	INITIALS

B.M. EL.

LOCATIONS OF UNDERGROUND STRUCTURES/UTILITIES AS SHOWN ARE BASED ON AVAILABLE INFORMATION BUT NO GUARANTEE IS GIVEN OR IMPLIED THAT ALL EXISTING UNDERGROUND STRUCTURES/UTILITIES ARE SHOWN OR THAT THE GIVEN LOCATIONS ARE EXACT. CONFIRMATION OF EXISTENCE AND EXACT LOCATION OF ALL UNDERGROUND STRUCTURES/UTILITIES MUST BE OBTAINED FROM THE APPROPRIATE AUTHORITY/OWNER, BY THE CONTRACTOR, BEFORE PROCEEDING WITH CONSTRUCTION.

ENGINEER'S SEAL

**JR Cousin Consultants Ltd.**  
 91A Scurfield Blvd. Winnipeg MB R3Y 1G4  
 p. (204) 489-0474  
 f. (204) 489-0487  
 www.jrcc.ca

ENGINEERING EXCELLENCE SINCE 1981

CODE: E-634.03	PROJECT: ELTON R.M. FORREST LAGOON UPGRADING
DESIGNED BY: OW	TITLE: TEST HOLE LOCATION PLAN
DRAWN BY: OT	SCALE: 1:1000
REVIEWED BY: OW	DATE: 21/11/30
	PLAN: 1
	SHEET: 1 of 1

**J. R. Cousin Consultants Ltd.**  
TEST HOLE LOGS

**SYMBOL INDEX**



GW. : Well graded gravels and gravel sand mixtures, little or no fines



GP. : Poorly graded gravels, gravel - sand mixtures, little or no fines



GM. : Silty gravels, gravel-sand-silt mixtures



GC. : Clayey gravels, gravel-sand-clay mixtures



SW. : Well graded sands, gravelly sands, little or no fines



SP. : Poorly graded sands, or gravelly sands, little or no fines



SM. : Silty sands, sand-silt mixtures



SC. : Clayey sands, sand-clay mixtures



ML. : Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity



CL. : Inorganic clays of low plasticity, gravelly clays, sandy or silty clays, lean clays



OL. : Organic silts and organic silty clays of low plasticity



CI. : Inorganic clays of medium or intermediate plasticity



MH. : Inorganic silts, fine sandy or silty soils



CH. : Inorganic clays of high plasticity, fat clays



OH. : Organic clays of medium to high plasticity, organic silts



Pt. : Peat, humus, swamp soils with high organic contents



TOPSOIL

The soil logs are based upon objective data available to us at the time of forming our opinions. The soil logs indicate site specific soil characteristics and must not be generalized over larger areas due to the limited number of test holes as compared to that of an unlimited number of test holes. Every effort is made to evaluate the information by methods generally recognized. The soil logs represent our opinions. J R Cousin Consultants Ltd cannot be responsible for actual site conditions proved to be materially at variance from our analysis or from the data generalization over untested areas.

# J. R. Cousin Consultants Ltd.

## TEST HOLE LOG SHEET

LOCATION : SW 31-11-18 WPM (East of Lagoon)    CODE: E-634.03

DATE : October 7, 2021

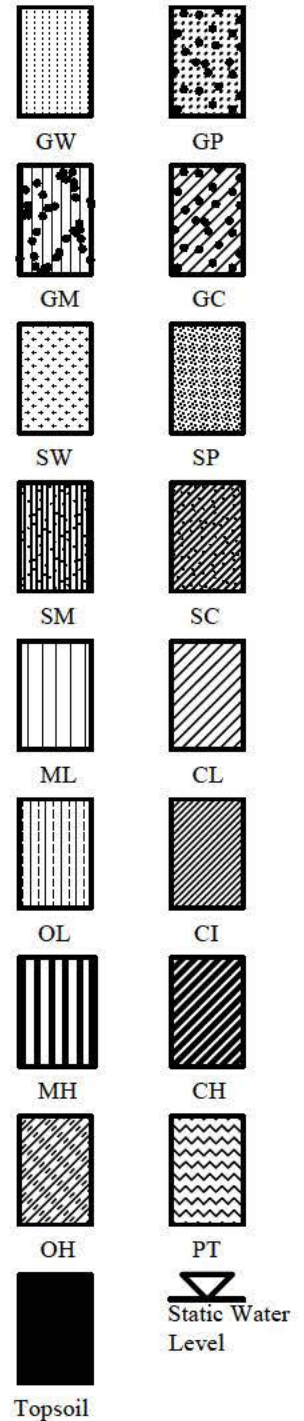
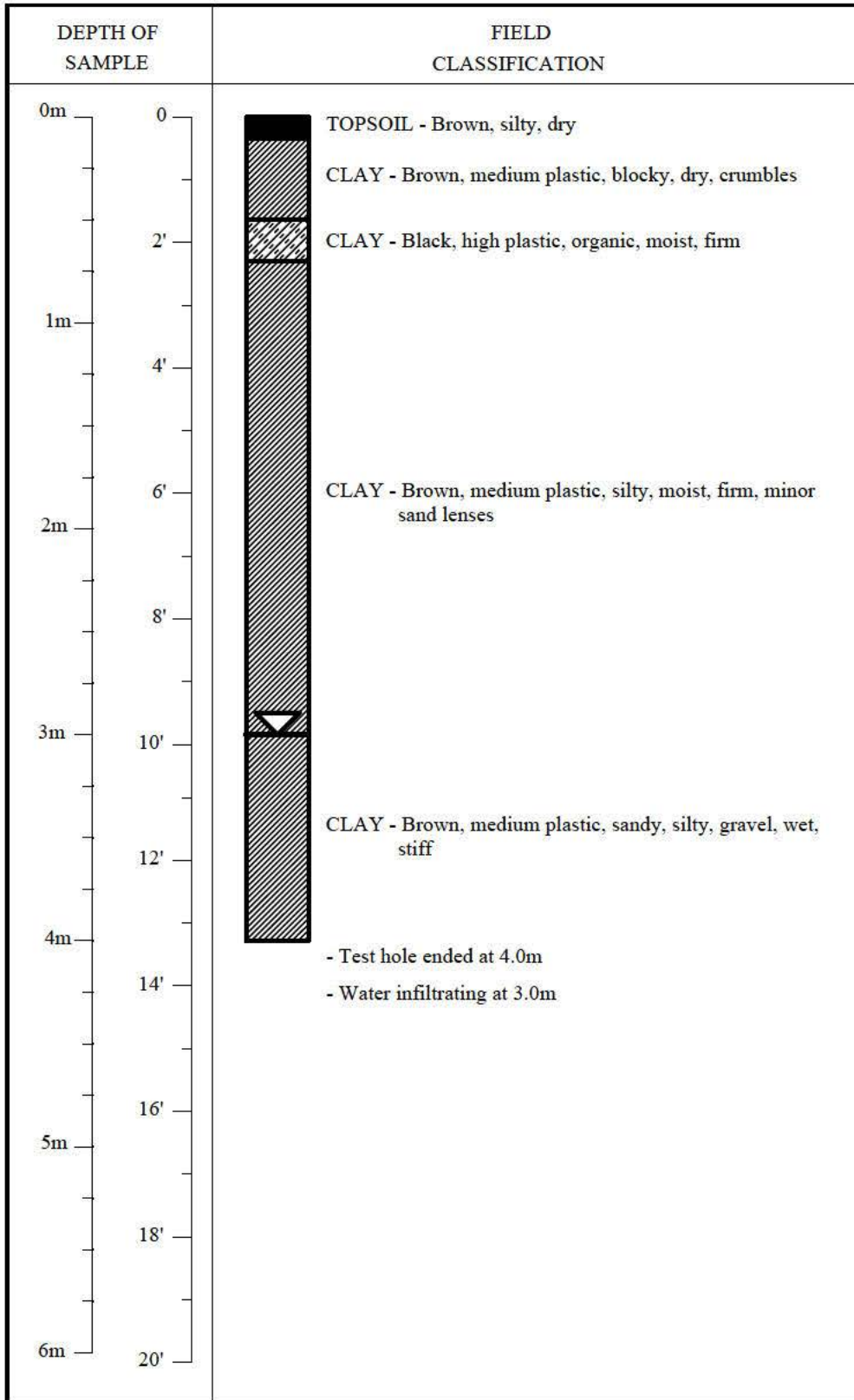
COORDINATES: 5535269N, 433585E

ELEVATION: 434.564m

PROJECT : Forest Lagoon Upgrades

METHOD OF SAMPLING: Backhoe

TEST HOLE # 1



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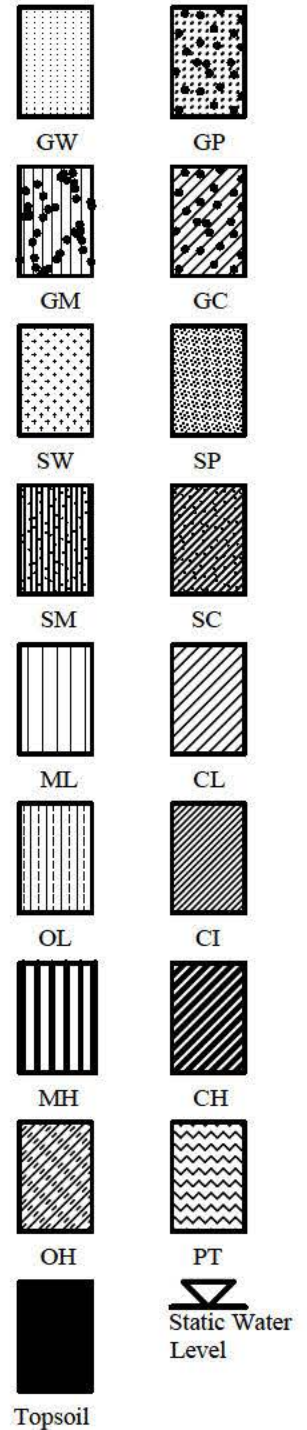
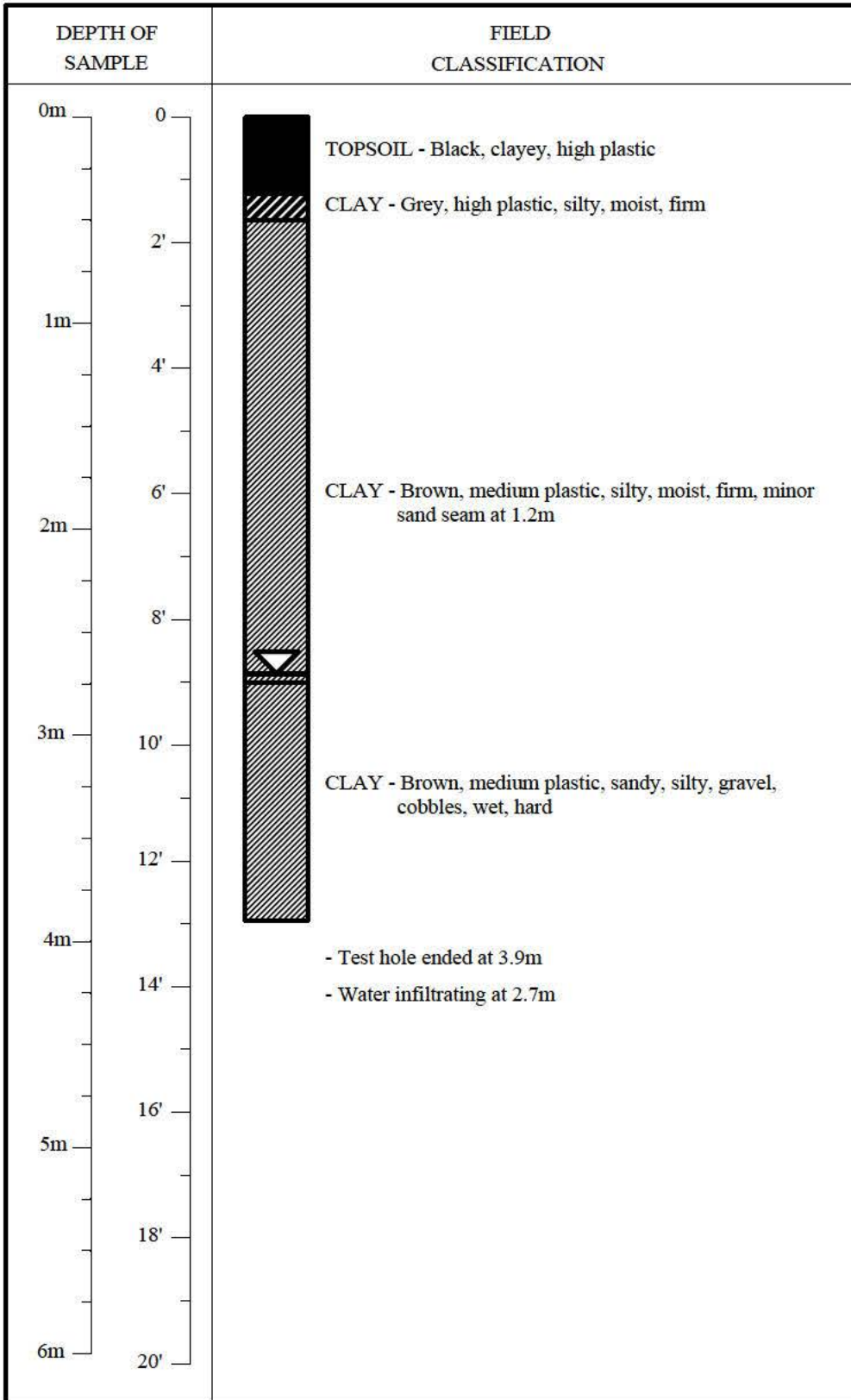
COORDINATES: 5535332N, 433595E

ELEVATION: 434.217m

PROJECT : Forest Lagoon Upgrades

METHOD OF SAMPLING: Backhoe

TEST HOLE # 2



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DATE : October 7, 2021

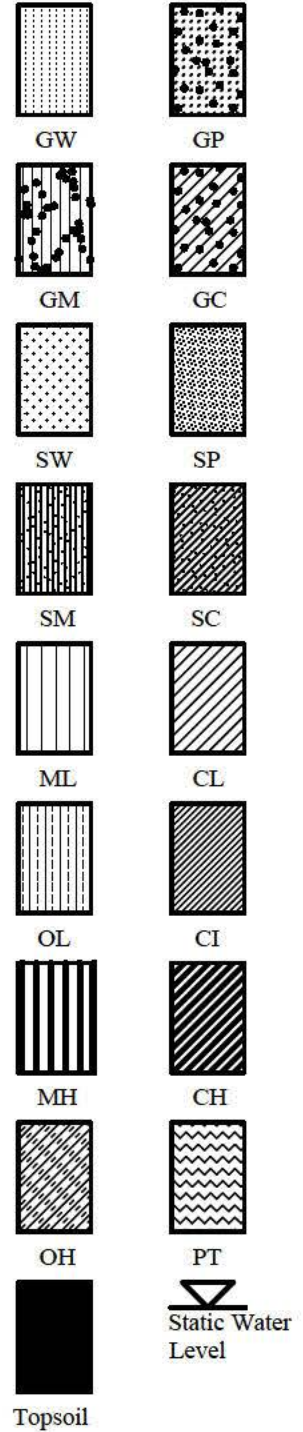
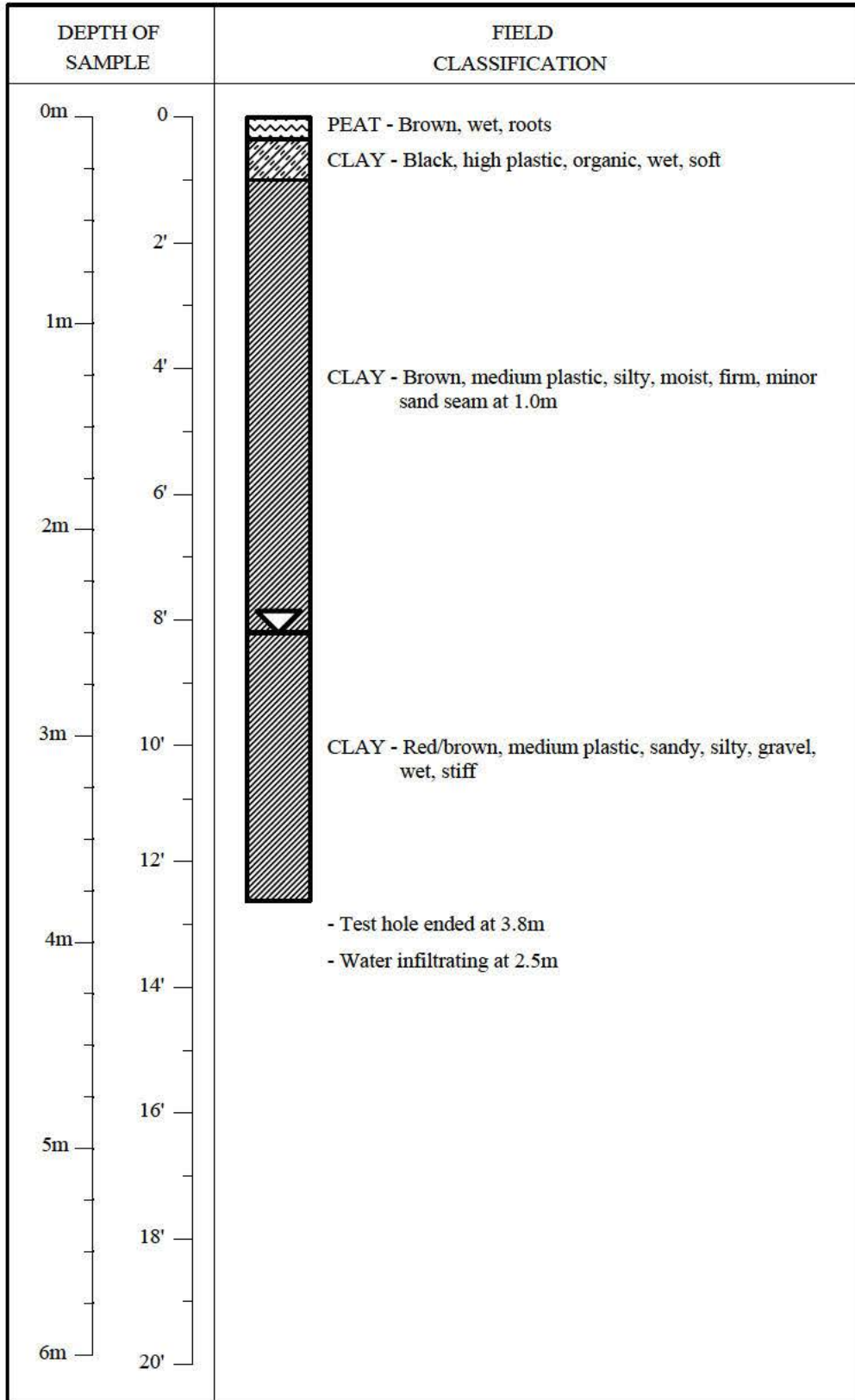
COORDINATES: 5535387N, 433582E

ELEVATION: 434.252m

PROJECT : Forest Lagoon Upgrades

METHOD OF SAMPLING: Backhoe

TEST HOLE # 3



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LOCATION : SW 31-11-18 WPM (East of Lagoon)    CODE: E-634.03

DATE : October 7, 2021

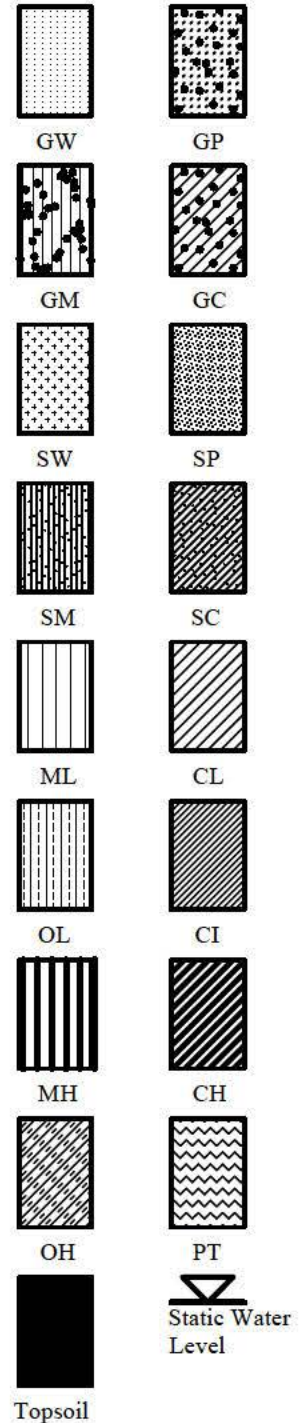
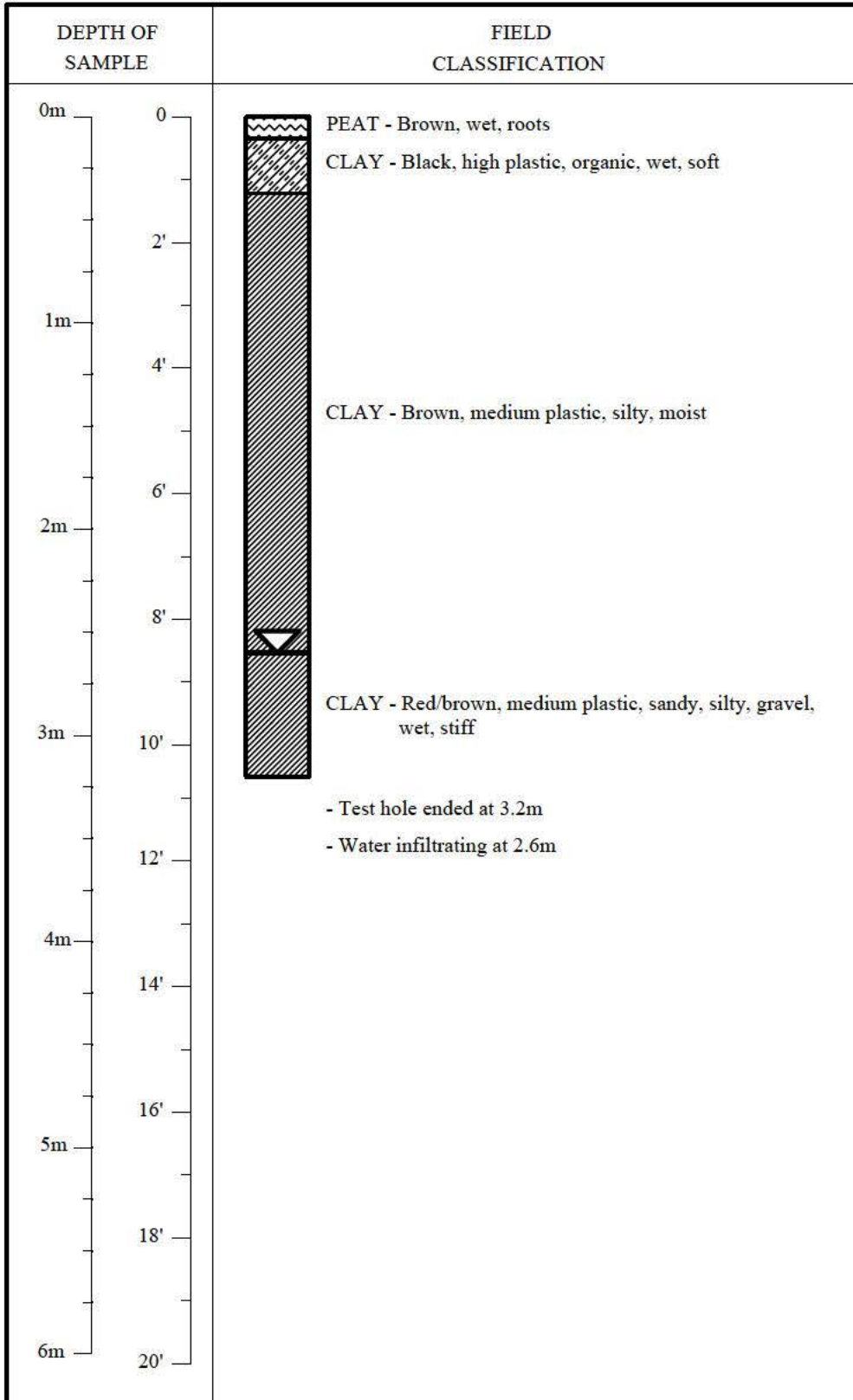
COORDINATES: 5535408N, 433595E

ELEVATION: 434.107m

PROJECT : Forest Lagoon Upgrades

METHOD OF SAMPLING: Backhoe

TEST HOLE # 4



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LOCATION : SW 31-11-18 WPM (East of Lagoon) CODE: E-634.03

DATE : October 7, 2021

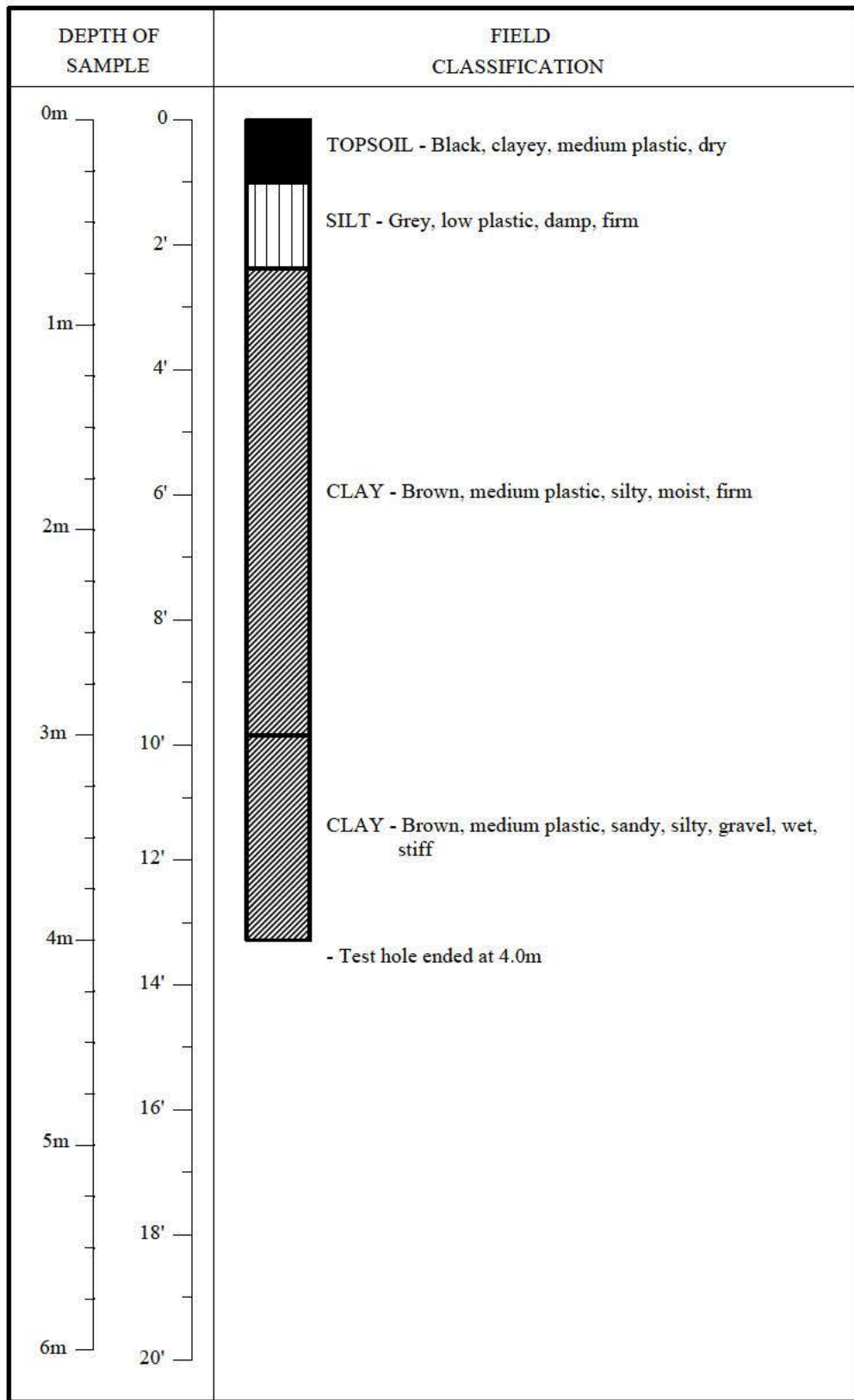
COORDINATES: 5535437N, 433664E

ELEVATION: 434.860m

PROJECT : Forest Lagoon Upgrades

METHOD OF SAMPLING: Backhoe

TEST HOLE # 5



GW	GP
GM	GC
SW	SP
SM	SC
ML	CL
OL	CI
MH	CH
OH	PT
Topsoil	Static Water Level

The soil logs are based upon objective data available to us at the time of forming our opinions. The soil logs indicate site specific soil characteristics and must not be generalized over larger areas due to the limited number of test holes as compared to that of an unlimited number of test holes. Every effort is made to evaluate the information by methods generally recognized. The soil represent our opinions. J.R. Cousin Consultants Ltd. cannot be responsible for actual site conditions proved to be materially at variance from our analysis or from the data generalization over untested areas.

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DATE : October 7, 2021

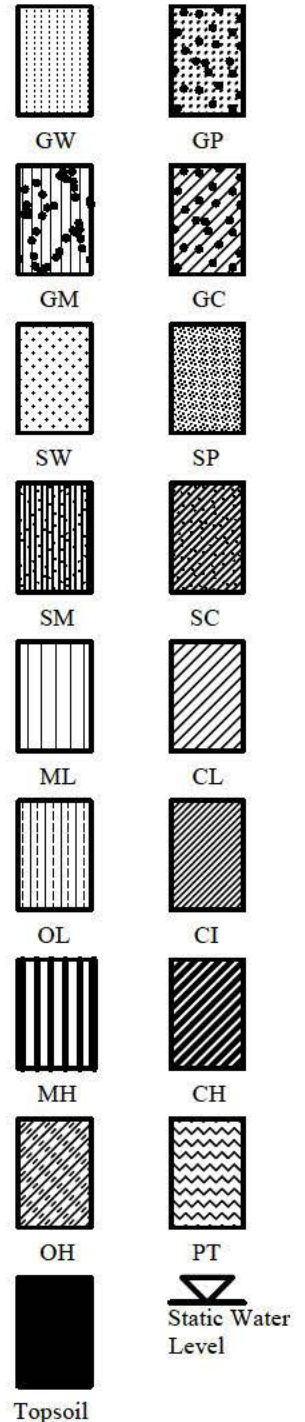
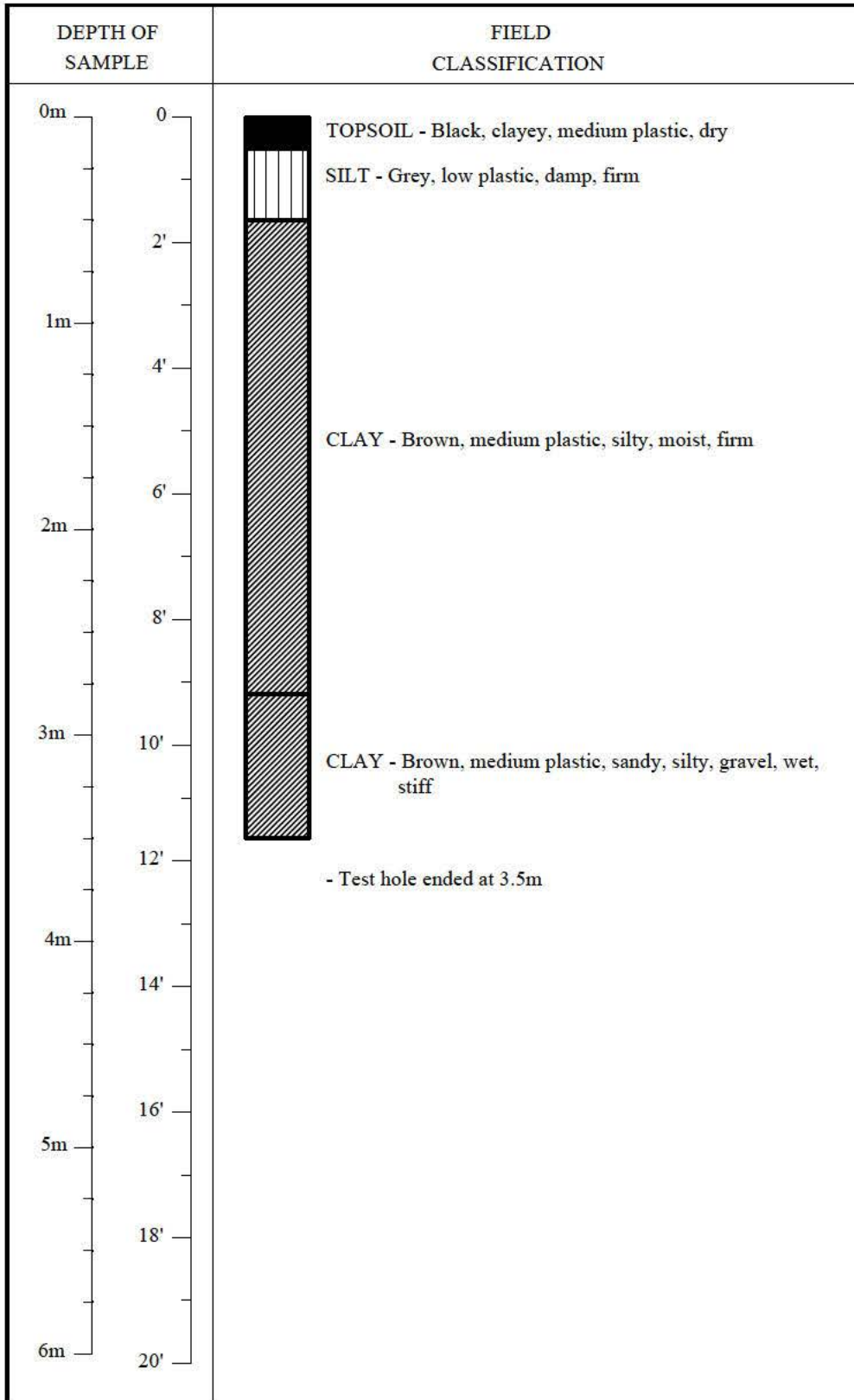
COORDINATES: 5535397N, 433726E

ELEVATION: 434.298m

PROJECT : Forest Lagoon Upgrades

METHOD OF SAMPLING: Backhoe

TEST HOLE # 6



The soil logs are based upon objective data available to us at the time of forming our opinions. The soil logs indicate site specific soil characteristics and must not be generalized over larger areas due to the limited number of test holes as compared to that of an unlimited number of test holes. Every effort is made to evaluate the information by methods generally recognized. The soil represent our opinions. J.R. Cousin Consultants Ltd. cannot be responsible for actual site conditions proved to be materially at variance from our analysis or from the data generalization over untested areas.

# J. R. Cousin Consultants Ltd.

## TEST HOLE LOG SHEET

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DATE : October 7, 2021

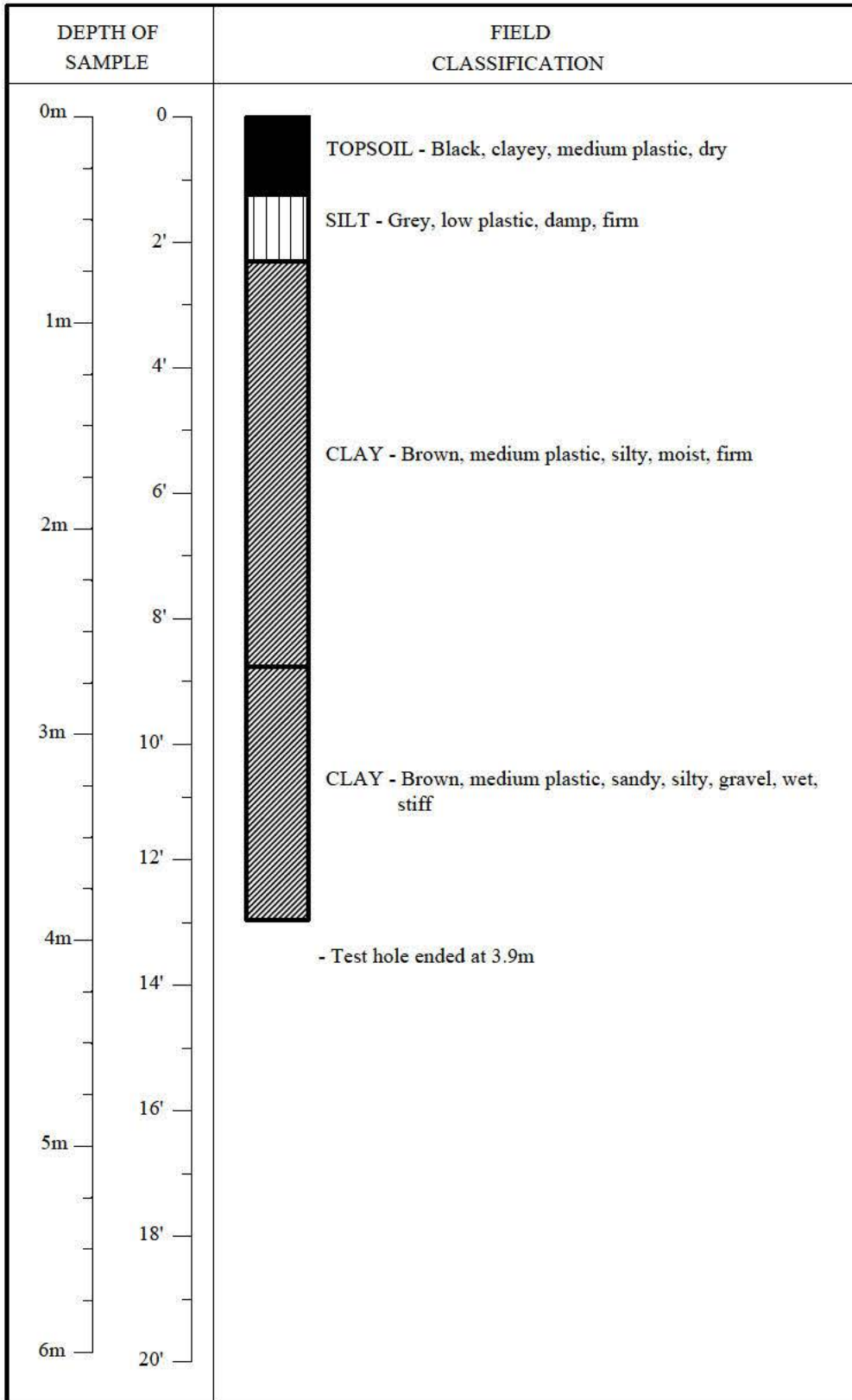
COORDINATES: 5535356N, 433776E

ELEVATION: 434.000m

PROJECT : Forest Lagoon Upgrades

METHOD OF SAMPLING: Backhoe

TEST HOLE # 7



GW	GP
GM	GC
SW	SP
SM	SC
ML	CL
OL	CI
MH	CH
OH	PT
Topsoil	Static Water Level

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## TEST HOLE LOG SHEET

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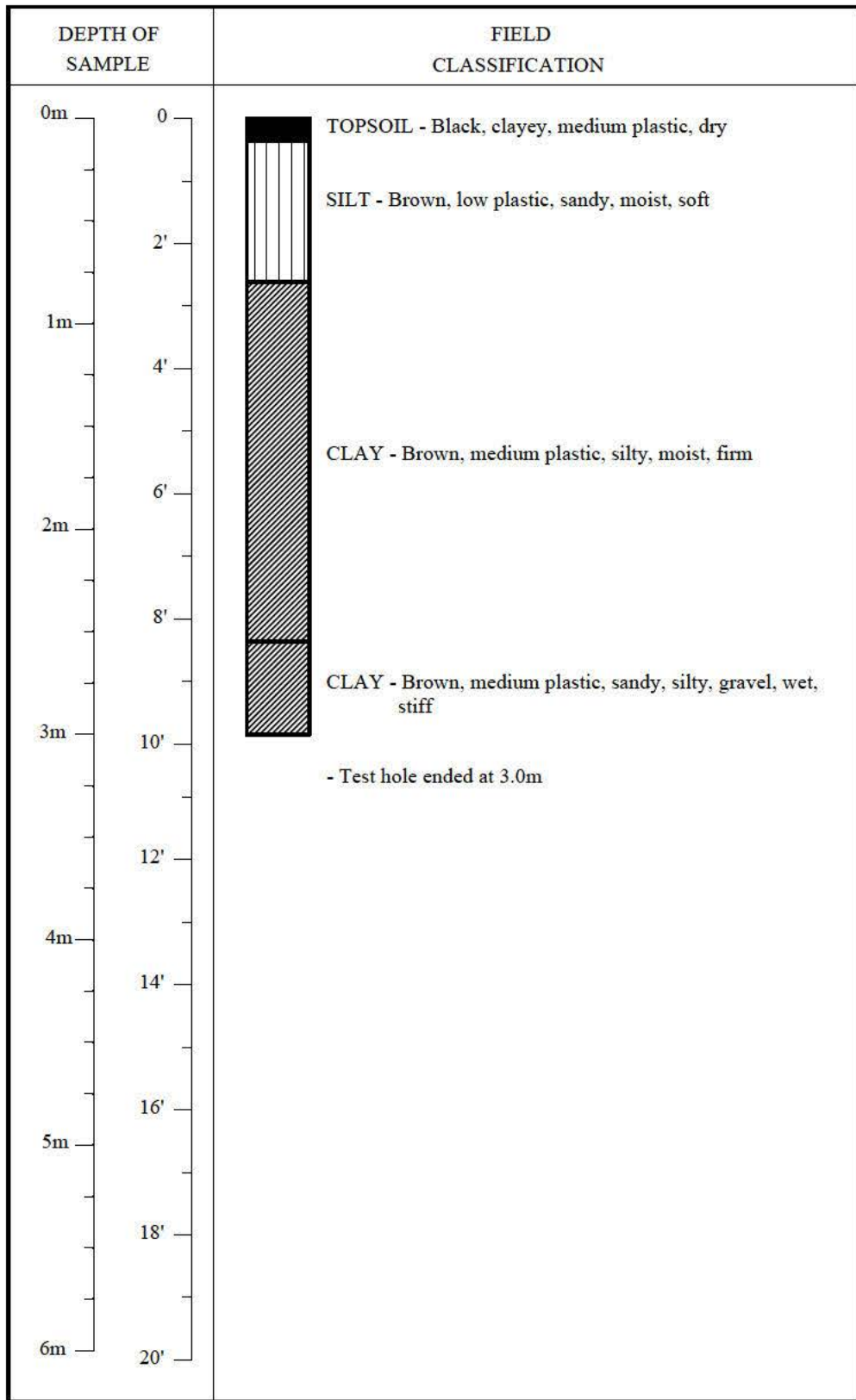
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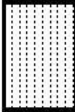



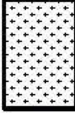
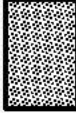

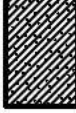
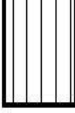


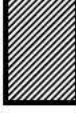
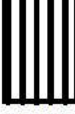

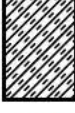



ELEVATION: 433.671m

PROJECT : Forest Lagoon Upgrades

METHOD OF SAMPLING: Backhoe

TEST HOLE # 8



	
GW	GP
	
GM	GC
	
SW	SP
	
SM	SC
	
ML	CL
	
OL	CI
	
MH	CH
	
OH	PT
	
Topsoil	Static Water Level

The soil logs are based upon objective data available to us at the time of forming our opinions. The soil logs indicate site specific soil characteristics and must not be generalized over larger areas due to the limited number of test holes as compared to that of an unlimited number of test holes. Every effort is made to evaluate the information by methods generally recognized. The soil represents our opinions. J.R. Cousin Consultants Ltd. cannot be responsible for actual site conditions proved to be materially at variance from our analysis or from the data generalization over untested areas.

# J. R. Cousin Consultants Ltd.

## TEST HOLE LOG SHEET

LOCATION : SW 31-11-18 WPM (East of Lagoon)    CODE: E-634.03

DATE : October 7, 2021

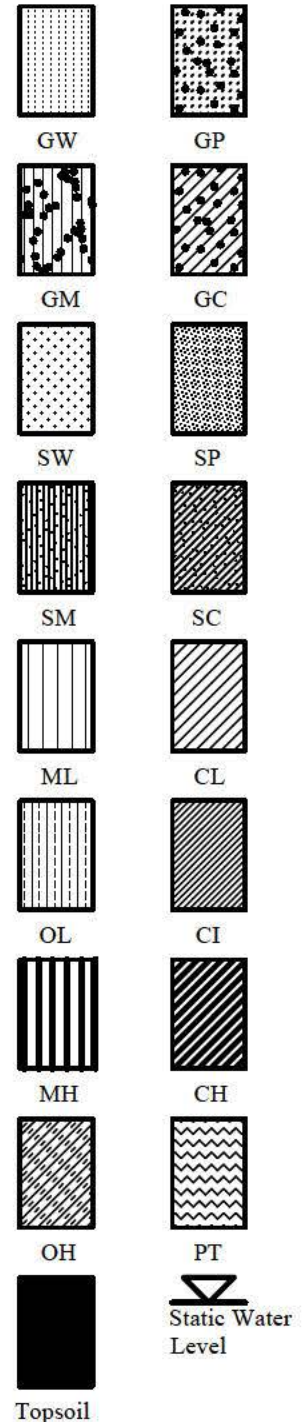
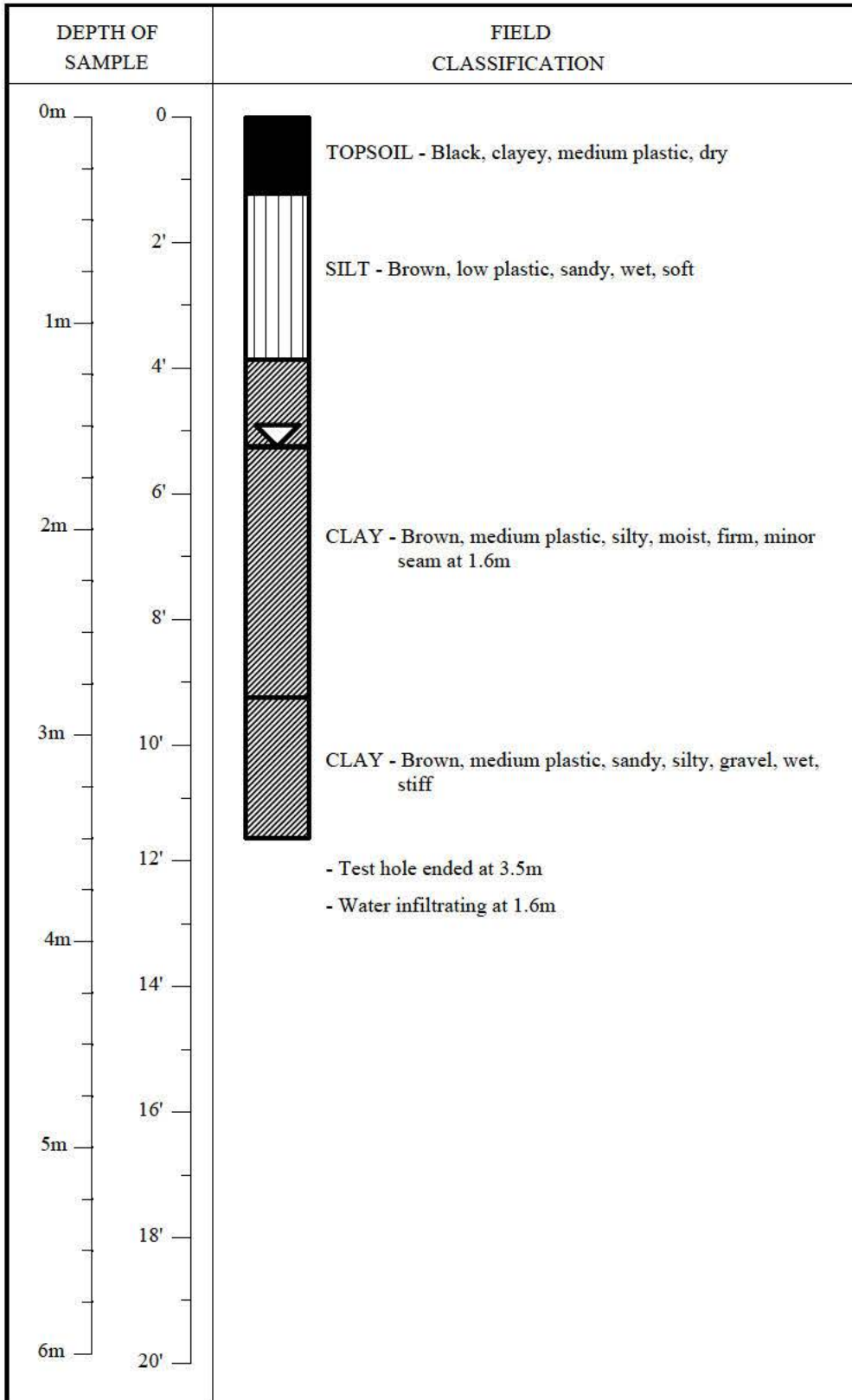
COORDINATES: 5535328N, 433669E

ELEVATION: 433.709m

PROJECT : Forest Lagoon Upgrades

METHOD OF SAMPLING: Backhoe

TEST HOLE # 9



The soil logs are based upon objective data available to us at the time of forming our opinions. The soil logs indicate site specific soil characteristics and must not be generalized over larger areas due to the limited number of test holes as compared to that of an unlimited number of test holes. Every effort is made to evaluate the information by methods generally recognized. The soil represent our opinions. J.R. Cousin Consultants Ltd. cannot be responsible for actual site conditions proved to be materially at variance from our analysis or from the data generalization over untested areas.

Laboratory Test Results, Wood Environment and Infrastructure Solutions Inc.

# PARTICLE SIZE ANALYSIS

Report Date: 22 October 2021

**Client**

Name: JRCC

Address:

Attention:

PO Number:

**Project**

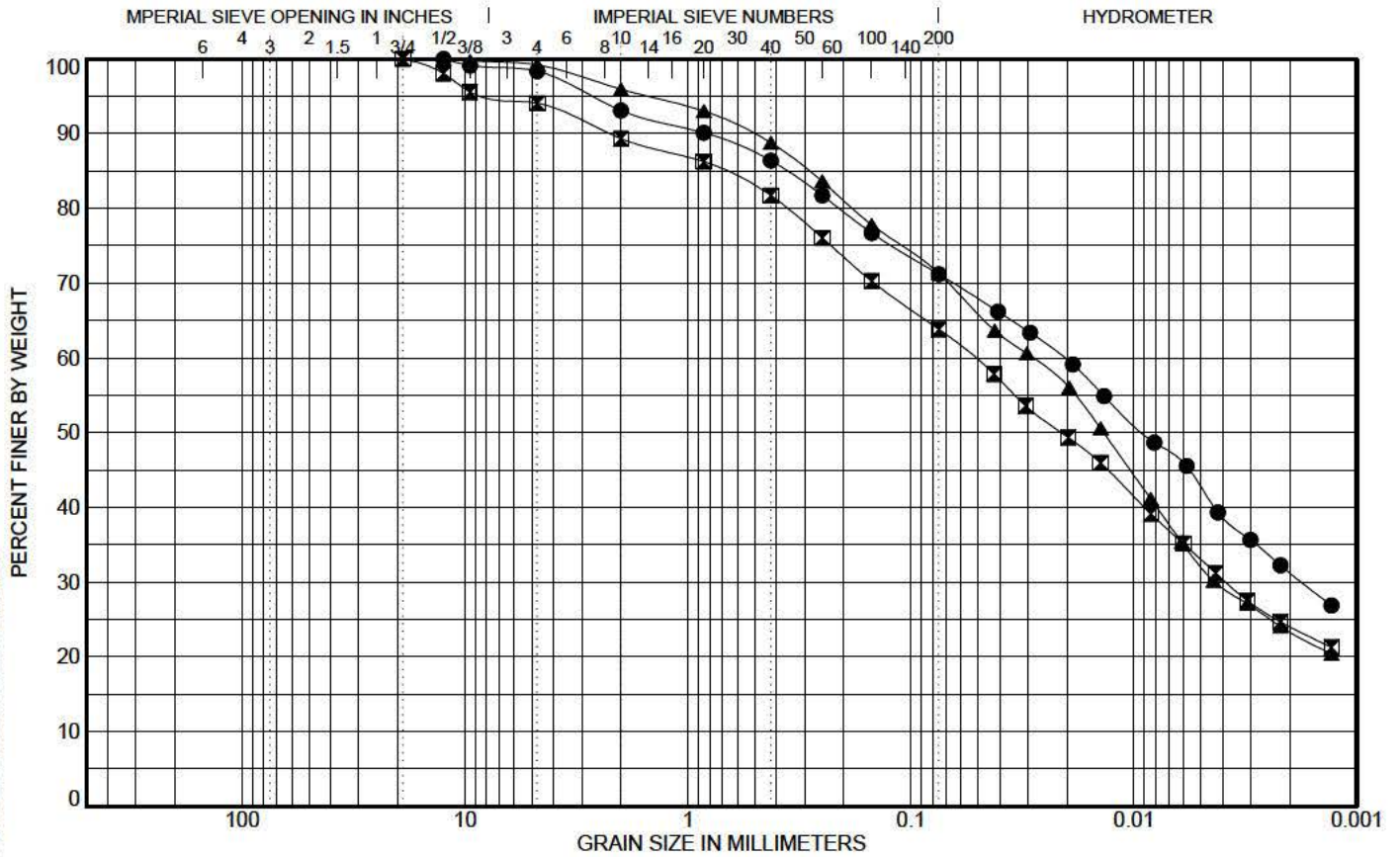
Name: Forrest Lagoon Expansion

Address:

Project No.: WX11334.4800

Manager: JW

**Gradation Specification:**



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID	mUSCS	MC	D100	D60	D30	D10	LL	PL	% Gravel	% Sand	% Fines
● TH3, 0.5 m	CI	22.4	12.5	0	0		44	15	2	27	40 (Silt) : 31 (Clay)
☒ TH7, 0.7 m	CI	18.0	19	0.1	0		37	16	6	30	40 (Silt) : 24 (Clay)
▲ TH7, 2.7 m	CI	19.8	12.5	0	0		40	15	1	28	48 (Silt) : 23 (Clay)

Reporting of these results constitutes a testing service only. Engineering interpretation or evaluation of the test results is provided only on written request.  
Wood Environment & Infrastructure Solutions - 440 Dovercourt Drive - Winnipeg, MB - R3Y 1N4

WX11334.4800 FORREST LAGOON EXPANSION.GPJ 21/10/22 03:33 PM (WOOD - PSA MULTI RESULT WITH ATTERBERG)

**ASTM D5084 - HYDRAULIC CONDUCTIVITY REPORT**



**TO:** Oswald Wohlgenut  
 JR Cousin Consultants Ltd  
 91 Scurfield Boulevard  
 Winnipeg, MB R3Y 1G4

**PROJECT NO:** WX11334.4800  
**CLIENT:** JR Cousin  
**DATE SUBMITTED:**

**PROJECT:** Forrest Lagoon

**SAMPLE:** Undisturbed Clay  
**SAMPLE NO.:** TH2  
**SAMPLE DEPTH:** 1.6 - 2.2 m  
**PERMEANT:** De-Aired Tap Water  
**HYDRAULIC GRADIENT:** 26.22

**CONSTANT HEAD METHOD (K = cQL/thA)**

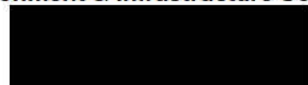
	Sample Height, L (cm)	Sample Dia. (cm)	Water Content (%)	Dry Density (kg/m <sup>3</sup> )	Degree of Saturation (%)	Cell Pressure (kPa)	Back Pressure (kPa)	Differential Pressure, h (kPa)
<b>Initial</b>	8.04	7.24	23.0%	1795	122.9%	241.4	196.5	20.7
<b>Final</b>	7.93	7.19	15.2%	1959	108.8%			

Date & Time		Time, t (seconds)	Flow (Q)		Temp. Corr, c	Hyd. Cond. Corrected, K (cm/s)
Start	End		Influent (ml)	Effluent (ml)		
11/16/21 8:10 AM	11/16/21 4:00 PM	28200	1.25	1.20	1.238	4.98E-08
11/16/21 4:00 PM	11/17/21 7:45 AM	56700	2.65	2.80	0.980	4.36E-08
11/17/21 7:45 AM	11/17/21 4:30 PM	31500	1.30	1.40	0.980	3.89E-08
11/17/21 4:30 PM	11/18/21 8:00 AM	55800	2.45	2.50	0.980	4.03E-08
11/18/21 8:00 AM	11/18/21 5:15 PM	33300	1.35	1.50	0.980	3.88E-08
11/18/21 5:15 PM	11/19/21 8:10 AM	53700	2.20	2.30	0.980	3.80E-08
11/19/21 8:10 AM	11/22/21 8:10 AM	259200	9.90	10.20	0.980	3.52E-08

**Average Temperature**  
**Corrected Value (cm/s):** 3.81E-08

**Wood Environment & Infrastructure Solutions**

Per:



Jorden Wiwcharyk, P.Eng.  
 Geotechnical Engineer

*Reporting of these results constitutes a testing service only.  
 Engineering interpretation or evaluation of the test results is provided only on written request.*

Sludge Assessment Report, Assiniboine Injects Ltd., October 28, 2021

Assiniboine Injections Ltd.  
 BOX 160, 177 Notre Dame Ave  
 Notre Dame de Lourdes, MB, R0G 1M0  
 PH: 204-248-2559 FAX: 204-248-2799  
 Email: info@lagooncleaning.com

**BIOSOLIDS SURVEY**

**LOCATION**

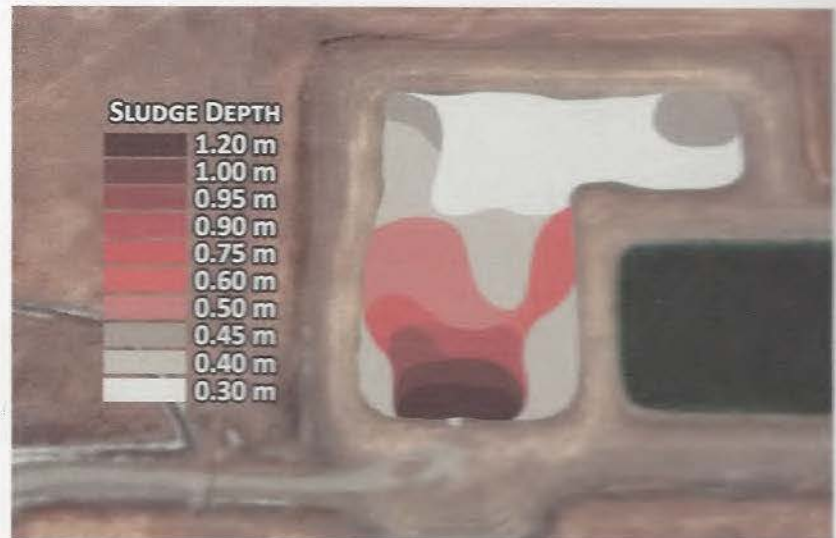
FORREST, MB  
 49.966691, -99.928614

**DATE MEASURED - OCTOBER 28, 2021**

**FORREST  
PRIMARY CELL**

**AVERAGE SLUDGE DEPTH  
0.534 METERS**

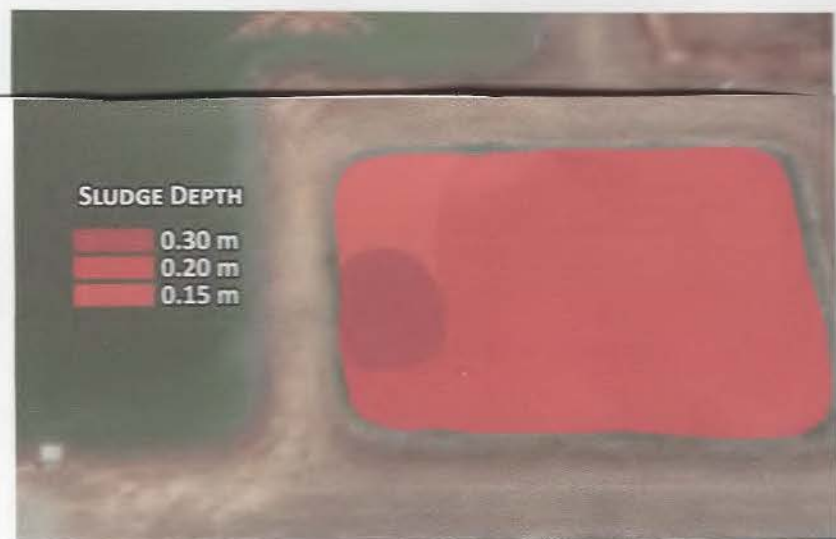
**SLUDGE VOLUME  
5,300 m<sup>3</sup>**



**FORREST  
SECONDARY CELL**

**AVERAGE SLUDGE DEPTH  
0.2 METERS**

**SLUDGE VOLUME  
1,000 m<sup>3</sup>**



All measurements are taken from a watercraft within the cell and surveyed using a grid pattern. Our surveyors probe the bottom of the cell obtaining accurate measurements using physical measuring tools. The sludge depth is determined by gauging the top of the sludge blanket to the base of the lagoon.

Sludge Analysis Report, ALS Global, November 21, 2021



Assiniboine Injections Ltd. (Notre Dame De  
Lourdes)  
ATTN: NOEL BOISVERT  
Box 160  
126 Notre Dame Ave W.  
Notre Dame De Lourdes MB ROG 1M0

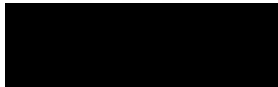
Date Received: 29-OCT-21  
Report Date: 30-NOV-21 08:51 (MT)  
Version: FINAL

Client Phone: 204-745-7817

## Certificate of Analysis

Lab Work Order #: L2657046  
Project P.O. #: NOT SUBMITTED  
Job Reference: FORREST MANITOBA LAGOON  
C of C Numbers:  
Legal Site Desc:

Comments: ADDITIONAL 29-OCT-21 12:38



Hua Wo  
Chemistry Laboratory Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 1329 Niakwa Road East, Unit 12, Winnipeg, MB R2J 3T4 Canada | Phone: +1 204 255 9720 | Fax: +1 204 255 9721  
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

## ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2657046-1	L2657046-2		
		Description	Lagoon Sludge	Lagoon Sludge		
		Sampled Date	28-OCT-21	28-OCT-21		
		Sampled Time	14:00	14:00		
		Client ID	FORREST MANITOBA LAGOON CELL 1	FORREST MANITOBA LAGOON CELL 2		
Grouping	Analyte					
<b>SOIL</b>						
<b>Physical Tests</b>	Conductivity (1:2) (dS m-1)	<0.050	<0.050			
	Loss on Ignition @ 550 C (%)	9	7			
	% Moisture (%)	71.9	48.4			
	pH (1:2 soil:water) (pH)	8.34	8.56			
<b>Leachable Anions &amp; Nutrients</b>	Total Kjeldahl Nitrogen (%)	0.258	0.155			
	Total Organic Nitrogen (%)	0.247	0.150			
<b>Anions and Nutrients</b>	Total Nitrogen by LECO (%)	0.385	0.271			
<b>Organic / Inorganic Carbon</b>	Inorganic Carbon (%)	2.77	2.89			
	Inorganic Carbon (as CaCO3 Equivalent) (%)	23.1	24.0			
	Organic Matter (%)	6.2	4.7			
	Total Carbon by Combustion (%)	6.35	5.61			
	Total Organic Carbon (%)	3.6	2.7			
<b>Plant Available Nutrients</b>	Available Ammonium-N (mg/kg)	109	51			
	Available Nitrate-N (mg/kg)	1.7	1.1			
	Available Phosphate-P (mg/kg)	40.2 <sup>DLHC</sup>	98.0 <sup>DLHC</sup>			
<b>Metals</b>	Aluminum (Al) (mg/kg)	11500	10500			
	Antimony (Sb) (mg/kg)	0.39	0.45			
	Arsenic (As) (mg/kg)	4.88	6.50			
	Barium (Ba) (mg/kg)	149	156			
	Beryllium (Be) (mg/kg)	0.56	0.56			
	Bismuth (Bi) (mg/kg)	0.76	0.22			
	Boron (B) (mg/kg)	23.4	23.6			
	Cadmium (Cd) (mg/kg)	0.441	0.461			
	Calcium (Ca) (mg/kg)	79200	85200			
	Chromium (Cr) (mg/kg)	23.0	20.3			
	Cobalt (Co) (mg/kg)	8.26	7.97			
	Copper (Cu) (mg/kg)	48.9	22.2			
	Iron (Fe) (mg/kg)	17600	17300			
	Lead (Pb) (mg/kg)	9.49	8.46			
	Lithium (Li) (mg/kg)	19.2	21.1			
	Magnesium (Mg) (mg/kg)	23600	25400			
	Manganese (Mn) (mg/kg)	639	781			
	Mercury (Hg) (mg/kg)	0.0670	0.0437			
	Molybdenum (Mo) (mg/kg)	3.04	3.39			
	Nickel (Ni) (mg/kg)	24.8	25.9			

\* Please refer to the Reference Information section for an explanation of any qualifiers detected.

## ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2657046-1	L2657046-2			
		Description	Lagoon Sludge	Lagoon Sludge			
		Sampled Date	28-OCT-21	28-OCT-21			
		Sampled Time	14:00	14:00			
		Client ID	FORREST MANITOBA LAGOON CELL 1	FORREST MANITOBA LAGOON CELL 2			
Grouping	Analyte						
<b>SOIL</b>							
<b>Metals</b>	Phosphorus (P) (mg/kg)	1120	1250				
	Potassium (K) (mg/kg)	2340	2470				
	Selenium (Se) (mg/kg)	2.71	1.21				
	Silver (Ag) (mg/kg)	0.15	<0.10				
	Sodium (Na) (mg/kg)	830	716				
	Strontium (Sr) (mg/kg)	151	156				
	Sulfur (S) (mg/kg)	7800	7300				
	Thallium (Tl) (mg/kg)	0.331	0.342				
	Tin (Sn) (mg/kg)	2.2	<1.0				
	Titanium (Ti) (mg/kg)	133	101				
	Tungsten (W) (mg/kg)	<0.50	<0.50				
	Uranium (U) (mg/kg)	12.0	10.0				
	Vanadium (V) (mg/kg)	51.4	51.5				
	Zinc (Zn) (mg/kg)	99.2	61.7				
	Zirconium (Zr) (mg/kg)	4.2	3.2				

\* Please refer to the Reference Information section for an explanation of any qualifiers detected.

# ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2657046-1	L2657046-2			
		Description	Lagoon Sludge	Lagoon Sludge			
		Sampled Date	28-OCT-21	28-OCT-21			
		Sampled Time	14:00	14:00			
		Client ID	FORREST MANITOBA LAGOON CELL 1	FORREST MANITOBA LAGOON CELL 2			
Grouping	Analyte						
<b>WATER</b>							
Physical Tests	Specific Gravity (g/mL)	1.18	1.04				

\* Please refer to the Reference Information section for an explanation of any qualifiers detected.

## Reference Information

### Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).

### Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
<b>C-TIC-PCT-SK</b>	Soil	Total Inorganic Carbon in Soil	CSSS (2008) P216-217
		A known quantity of acetic acid is consumed by reaction with carbonates in the soil. The pH of the resulting solution is measured and compared against a standard curve relating pH to weight of carbonate.	
<b>C-TOC-CALC-SK</b>	Soil	Total Organic Carbon Calculation	CSSS (2008) 21.2
		Total Organic Carbon (TOC) is calculated by the difference between total carbon (TC) and total inorganic carbon. (TIC)	
<b>C-TOT-LECO-SK</b>	Soil	Total Carbon by combustion method	CSSS (2008) 21.2
		The sample is ignited in a combustion analyzer where carbon in the reduced CO <sub>2</sub> gas is determined using a thermal conductivity detector.	
<b>ETL-N-TOTORG-CALC-SK</b>	Soil	Nitrogen, Total Organic - calculation	APHA 4500 Norg-Calculated as TKN - NH <sub>3</sub> -N
<b>HG-200.2-CVAA-SK</b>	Soil	Mercury in Soil by CVAAS	EPA 200.2/1631E (mod)
		Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAAS.	
<b>IC-CACO3-CALC-SK</b>	Soil	Inorganic Carbon as CaCO <sub>3</sub> Equivalent	Calculation
<b>LOI-550-SK</b>	Soil	Loss on Ignition @ 550 C	CSSS (1993) p.461-462
		The sample is air dried at 40C overnight, then ground to < 2mm in particle size using a flail grinder. A portion of the dried and ground sample is dried at 105C overnight, then ignited at 550C for 16-20 hours. Loss on ignition at 550C is reported on a dry sample basis.	
		Loss on Ignition at 550C can be used as an estimation of Organic Matter (CSSS 2008)	
<b>MET-200.2-CCMS-SK</b>	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)
		Soil/sediment is dried, disaggregated, and sieved (2 mm). Strong Acid Leachable Metals in the <2mm fraction are solubilized by heated digestion with nitric and hydrochloric acids. Instrumental analysis is by Collision / Reaction Cell ICPMS.	
		Limitations: This method is intended to liberate environmentally available metals. Silicate minerals are not solubilized. Some metals may be only partially recovered (matrix dependent), including Al, Ba, Be, Cr, S, Sr, Ti, Tl, V, W, and Zr. Elemental Sulfur may be poorly recovered by this method. Volatile forms of sulfur (e.g. sulfide, H <sub>2</sub> S) may be excluded if lost during sampling, storage, or digestion.	
<b>MOIST-SK</b>	Soil	Moisture Content	CCME PHC in Soil - Tier 1 (mod)
		The weighed portion of soil is placed in a 105°C oven overnight. The dried soil is allowed to cooled to room temperature, weighed and the % moisture is calculated.	
<b>N-TOT-LECO-SK</b>	Soil	Total Nitrogen by combustion method	CSSS (2008) 22.4
		The sample is ignited in a combustion analyzer where nitrogen in the reduced nitrous oxide gas is determined using a thermal conductivity detector.	
<b>N-TOTKJ-COL-SK</b>	Soil	Total Kjeldahl Nitrogen	CSSS (2008) 22.2.3
		The soil is digested with sulfuric acid in the presence of CuSO <sub>4</sub> and K <sub>2</sub> SO <sub>4</sub> catalysts. Ammonia in the soil extract is determined colorimetrically at 660 nm.	
<b>NH4-AVAIL-SK</b>	Soil	Available Ammonium-N	CSSS Carter 6.2 / Comm Soil Sci 19(6)
		Ammonium (NH <sub>4</sub> -N) is extracted from the soil using 2 N KCl. Ammonium in the extract is mixed with hypochlorite and salicylate to form indophenol blue, which is determined colorimetrically by auto analysis at 660 nm.	
<b>NO3-AVAIL-SK</b>	Soil	Available Nitrate-N	Alberta Ag / APHA 4500 NO <sub>3</sub> F
		Available Nitrate and Nitrite are extracted from the soil using a dilute calcium chloride solution. Nitrate is quantitatively reduced to nitrite by passing of the sample through a copperized cadmium column. The nitrite (reduced nitrate plus original nitrite) is then determined by diazotizing with sulfanilamide followed by coupling with N-(1-naphthyl) ethylenediamine dihydrochloride. The resulting water soluble dye has a magenta color which is measured at colorimetrically at 520nm.	
<b>OM-CALC-SK</b>	Soil	Organic Matter Calculation	SPAC
		Soil organic matter is calculated by using the Van Bemmelen Factor to convert from Total Organic Carbon (TOC)	
		For use with C-TC,TOC,TIC-SK	
<b>PH,EC-1:2-SK</b>	Soil	pH and EC (1:2 Soil:Water Extraction)	AB Ag (1988) p.7

## Reference Information

1 part dry soil and 2 parts de-ionized water (by volume) is mixed. The slurry is allowed to stand with occasional stirring for 30 - 60 minutes. After equilibration, pH of the slurry is measured using a pH meter. Conductivity of the filtered extract is measured by a conductivity meter.

**PO4-AVAIL-OLSEN-SK** Soil Available Phosphate-P by Olsen CSSS (2008) 8

Plant available phosphorus is extracted from air dried soil using a fixed ratio bicarbonate extraction. Phosphorus is determined by colorimetry.

**SPECGRAV-ED** Water Specific Gravity ASTM D5057

A portion of sample is weighed in a container that is calibrated for volume. Specific Gravity is reported as the mass of sample per mass of an equal volume of pure water, where the density of pure water is taken to be 1.00 g/mL.

\*\* ALS test methods may incorporate modifications from specified reference methods to improve performance.

*The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:*

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA

### Chain of Custody Numbers:

#### GLOSSARY OF REPORT TERMS

*Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.*

*mg/kg - milligrams per kilogram based on dry weight of sample.*

*mg/kg wwt - milligrams per kilogram based on wet weight of sample.*

*mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.*

*mg/L - milligrams per litre.*

*< - Less than.*

*D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).*

*N/A - Result not available. Refer to qualifier code and definition for explanation.*

*Test results reported relate only to the samples as received by the laboratory.*

**UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.**

*Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.*



## Quality Control Report

Workorder: L2657046

Report Date: 30-NOV-21

Page 1 of 8

Client: Assiniboine Injections Ltd. (Notre Dame De Lourdes)  
 Box 160 126 Notre Dame Ave W.  
 Notre Dame De Lourdes MB R0G 1M0

Contact: NOEL BOISVERT

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>SPECGRAV-ED</b>		<b>Water</b>						
Batch	R5637614							
WG3654317-2	DUP	L2657046-2						
Specific Gravity		1.04	1.04		g/mL	0.1	2	08-NOV-21
WG3654317-1	IRM	DI H2O						
Specific Gravity			99.9		%Recov		94.7-104.7	08-NOV-21
<b>C-TIC-PCT-SK</b>		<b>Soil</b>						
Batch	R5637125							
WG3652707-4	IRM	08-109_SOIL						
Inorganic Carbon			97.1		%		80-120	06-NOV-21
WG3652707-2	LCS	0.5						
Inorganic Carbon			94.2		%		90-110	06-NOV-21
WG3652707-3	MB							
Inorganic Carbon			<0.050		%		0.05	06-NOV-21
<b>C-TOT-LECO-SK</b>		<b>Soil</b>						
Batch	R5636928							
WG3652546-1	DUP	L2657046-1						
Total Carbon by Combustion		6.35	6.40		%	0.8	20	05-NOV-21
WG3652546-2	IRM	08-109 SOIL						
Total Carbon by Combustion			99.5		%		80-120	05-NOV-21
WG3652546-4	LCS	SULFADIAZINE						
Total Carbon by Combustion			104.9		%		90-110	05-NOV-21
WG3652546-3	MB							
Total Carbon by Combustion			<0.05		%		0.05	05-NOV-21
<b>HG-200.2-CVAA-SK</b>		<b>Soil</b>						
Batch	R5637859							
WG3652437-5	CRM	SCP SS-2 SOIL						
Mercury (Hg)			103.1		%		70-130	08-NOV-21
WG3652437-3	LCS							
Mercury (Hg)			101.5		%		80-120	08-NOV-21
WG3652437-1	MB							
Mercury (Hg)			<0.0050		mg/kg		0.005	08-NOV-21
<b>LOI-550-SK</b>		<b>Soil</b>						
Batch	R5638097							
WG3652735-3	IRM	SAL2001						
Loss on Ignition @ 550 C			101.0		%		80-120	06-NOV-21
WG3652735-2	MB							
Loss on Ignition @ 550 C			<1		%		1	06-NOV-21
<b>MET-200.2-CCMS-SK</b>		<b>Soil</b>						



## Quality Control Report

Workorder: L2657046

Report Date: 30-NOV-21

Page 2 of 8

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-200.2-CCMS-SK</b>		<b>Soil</b>						
<b>Batch</b>	<b>R5644037</b>							
<b>WG3652437-5</b>	<b>CRM</b>	<b>SCP SS-2 SOIL</b>						
Aluminum (Al)			103.0		%		70-130	08-NOV-21
Antimony (Sb)			105.0		%		70-130	08-NOV-21
Arsenic (As)			109.3		%		70-130	08-NOV-21
Barium (Ba)			113.0		%		70-130	08-NOV-21
Beryllium (Be)			101.5		%		70-130	08-NOV-21
Boron (B)			9.0		mg/kg		3.5-13.5	08-NOV-21
Bismuth (Bi)			0.13		mg/kg		0-0.34	08-NOV-21
Cadmium (Cd)			99.5		%		70-130	08-NOV-21
Calcium (Ca)			95.0		%		70-130	08-NOV-21
Chromium (Cr)			100.5		%		70-130	08-NOV-21
Cobalt (Co)			100.0		%		70-130	08-NOV-21
Copper (Cu)			99.5		%		70-130	08-NOV-21
Iron (Fe)			100.1		%		70-130	08-NOV-21
Lead (Pb)			97.7		%		70-130	08-NOV-21
Lithium (Li)			112.7		%		70-130	08-NOV-21
Magnesium (Mg)			100.6		%		70-130	08-NOV-21
Manganese (Mn)			98.2		%		70-130	08-NOV-21
Molybdenum (Mo)			100.3		%		70-130	08-NOV-21
Nickel (Ni)			100.1		%		70-130	08-NOV-21
Phosphorus (P)			98.5		%		70-130	08-NOV-21
Potassium (K)			103.6		%		70-130	08-NOV-21
Selenium (Se)			0.13		mg/kg		0-0.34	08-NOV-21
Silver (Ag)			80.3		%		70-130	08-NOV-21
Sodium (Na)			102.4		%		70-130	08-NOV-21
Strontium (Sr)			97.4		%		70-130	08-NOV-21
Thallium (Tl)			0.107		mg/kg		0.029-0.129	08-NOV-21
Tin (Sn)			96.5		%		70-130	08-NOV-21
Titanium (Ti)			106.1		%		70-130	08-NOV-21
Uranium (U)			108.2		%		70-130	08-NOV-21
Vanadium (V)			103.4		%		70-130	08-NOV-21
Zinc (Zn)			95.8		%		70-130	08-NOV-21
Zirconium (Zr)			103.1		%		70-130	08-NOV-21
<b>WG3652437-3</b>	<b>LCS</b>							
Aluminum (Al)			102.3		%		80-120	08-NOV-21



## Quality Control Report

Workorder: L2657046

Report Date: 30-NOV-21

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-200.2-CCMS-SK</b>		<b>Soil</b>						
<b>Batch</b>	<b>R5644037</b>							
<b>WG3652437-3</b>	<b>LCS</b>							
Antimony (Sb)			102.6		%		80-120	08-NOV-21
Arsenic (As)			101.1		%		80-120	08-NOV-21
Barium (Ba)			105.9		%		80-120	08-NOV-21
Beryllium (Be)			99.5		%		80-120	08-NOV-21
Boron (B)			90.3		%		80-120	08-NOV-21
Bismuth (Bi)			102.0		%		80-120	08-NOV-21
Cadmium (Cd)			100.3		%		80-120	08-NOV-21
Calcium (Ca)			100.7		%		80-120	08-NOV-21
Chromium (Cr)			100.2		%		80-120	08-NOV-21
Cobalt (Co)			101.2		%		80-120	08-NOV-21
Copper (Cu)			98.6		%		80-120	08-NOV-21
Iron (Fe)			106.4		%		80-120	08-NOV-21
Lead (Pb)			99.7		%		80-120	08-NOV-21
Lithium (Li)			109.2		%		80-120	08-NOV-21
Magnesium (Mg)			103.3		%		80-120	08-NOV-21
Manganese (Mn)			96.6		%		80-120	08-NOV-21
Molybdenum (Mo)			101.8		%		80-120	08-NOV-21
Nickel (Ni)			100.4		%		80-120	08-NOV-21
Phosphorus (P)			106.8		%		80-120	08-NOV-21
Potassium (K)			99.0		%		80-120	08-NOV-21
Selenium (Se)			100.4		%		80-120	08-NOV-21
Silver (Ag)			100.6		%		80-120	08-NOV-21
Sodium (Na)			101.8		%		80-120	08-NOV-21
Strontium (Sr)			101.1		%		80-120	08-NOV-21
Sulfur (S)			97.4		%		80-120	08-NOV-21
Thallium (Tl)			96.7		%		80-120	08-NOV-21
Tin (Sn)			97.6		%		80-120	08-NOV-21
Titanium (Ti)			99.2		%		80-120	08-NOV-21
Tungsten (W)			100.8		%		80-120	08-NOV-21
Uranium (U)			105.6		%		80-120	08-NOV-21
Vanadium (V)			103.9		%		80-120	08-NOV-21
Zinc (Zn)			100.5		%		80-120	08-NOV-21
Zirconium (Zr)			103.5		%		80-120	08-NOV-21
<b>WG3652437-1</b>	<b>MB</b>							



## Quality Control Report

Workorder: L2657046

Report Date: 30-NOV-21

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-200.2-CCMS-SK</b>	<b>Soil</b>							
<b>Batch</b>	<b>R5644037</b>							
<b>WG3652437-1</b>	<b>MB</b>							
Aluminum (Al)			<50		mg/kg		50	08-NOV-21
Antimony (Sb)			<0.10		mg/kg		0.1	08-NOV-21
Arsenic (As)			<0.10		mg/kg		0.1	08-NOV-21
Barium (Ba)			<0.50		mg/kg		0.5	08-NOV-21
Beryllium (Be)			<0.10		mg/kg		0.1	08-NOV-21
Boron (B)			<5.0		mg/kg		5	08-NOV-21
Bismuth (Bi)			<0.20		mg/kg		0.2	08-NOV-21
Cadmium (Cd)			<0.020		mg/kg		0.02	08-NOV-21
Calcium (Ca)			<50		mg/kg		50	08-NOV-21
Chromium (Cr)			<0.50		mg/kg		0.5	08-NOV-21
Cobalt (Co)			<0.10		mg/kg		0.1	08-NOV-21
Copper (Cu)			<0.50		mg/kg		0.5	08-NOV-21
Iron (Fe)			<50		mg/kg		50	08-NOV-21
Lead (Pb)			<0.50		mg/kg		0.5	08-NOV-21
Lithium (Li)			<2.0		mg/kg		2	08-NOV-21
Magnesium (Mg)			<20		mg/kg		20	08-NOV-21
Manganese (Mn)			<1.0		mg/kg		1	08-NOV-21
Molybdenum (Mo)			<0.10		mg/kg		0.1	08-NOV-21
Nickel (Ni)			<0.50		mg/kg		0.5	08-NOV-21
Phosphorus (P)			<50		mg/kg		50	08-NOV-21
Potassium (K)			<100		mg/kg		100	08-NOV-21
Selenium (Se)			<0.20		mg/kg		0.2	08-NOV-21
Silver (Ag)			<0.10		mg/kg		0.1	08-NOV-21
Sodium (Na)			<50		mg/kg		50	08-NOV-21
Strontium (Sr)			<0.50		mg/kg		0.5	08-NOV-21
Sulfur (S)			<1000		mg/kg		1000	08-NOV-21
Thallium (Tl)			<0.050		mg/kg		0.05	08-NOV-21
Tin (Sn)			<1.0		mg/kg		1	08-NOV-21
Titanium (Ti)			<1.0		mg/kg		1	08-NOV-21
Tungsten (W)			<0.50		mg/kg		0.5	08-NOV-21
Uranium (U)			<0.050		mg/kg		0.05	08-NOV-21
Vanadium (V)			<0.20		mg/kg		0.2	08-NOV-21
Zinc (Zn)			<2.0		mg/kg		2	08-NOV-21
Zirconium (Zr)			<1.0		mg/kg		1	08-NOV-21



## Quality Control Report

Workorder: L2657046

Report Date: 30-NOV-21

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MOIST-SK</b>		<b>Soil</b>						
Batch	R5637820							
WG3651912-3	LCS							
% Moisture			100.9		%		90-110	06-NOV-21
WG3651912-2	MB							
% Moisture			<0.10		%		0.1	06-NOV-21
<b>N-TOT-LECO-SK</b>		<b>Soil</b>						
Batch	R5636928							
WG3652546-1	DUP	L2657046-1						
Total Nitrogen by LECO		0.385	0.386		%	0.4	20	05-NOV-21
WG3652546-2	IRM	08-109 SOIL						
Total Nitrogen by LECO			100.7		%		80-120	05-NOV-21
WG3652546-4	LCS	SULFADIAZINE						
Total Nitrogen by LECO			100.5		%		90-110	05-NOV-21
WG3652546-3	MB							
Total Nitrogen by LECO			<0.020		%		0.02	05-NOV-21
<b>N-TOTKJ-COL-SK</b>		<b>Soil</b>						
Batch	R5659009							
WG3660871-2	IRM	08-109_SOIL						
Total Kjeldahl Nitrogen			86.5		%		80-120	25-NOV-21
WG3660871-3	LCS							
Total Kjeldahl Nitrogen			90.4		%		80-120	25-NOV-21
WG3660871-4	MB							
Total Kjeldahl Nitrogen			<0.020		%		0.02	25-NOV-21
<b>NH4-AVAIL-SK</b>		<b>Soil</b>						
Batch	R5638477							
WG3654705-1	DUP	L2657046-2						
Available Ammonium-N		51	53		mg/kg	3.2	20	09-NOV-21
WG3654705-3	IRM	ALS SAL 2019						
Available Ammonium-N			102.0		%		80-120	09-NOV-21
WG3654705-4	LCS							
Available Ammonium-N			106.1		%		80-120	09-NOV-21
WG3654705-2	MB							
Available Ammonium-N			<1.0		mg/kg		1	09-NOV-21
<b>NO3-AVAIL-SK</b>		<b>Soil</b>						
Batch	R5638998							
WG3653749-3	IRM	ALS SAL 2019						
Available Nitrate-N			85.4		%		70-130	09-NOV-21
WG3653749-4	LCS							



## Quality Control Report

Workorder: L2657046

Report Date: 30-NOV-21

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>NO3-AVAIL-SK</b>								
<b>Batch R5638998</b>								
<b>WG3653749-4</b>	<b>LCS</b>							
Available Nitrate-N			103.6		%		70-130	09-NOV-21
<b>WG3653749-2</b>	<b>MB</b>							
Available Nitrate-N			<1.0		mg/kg		1	09-NOV-21
<b>PH,EC-1:2-SK</b>								
<b>Batch R5641257</b>								
<b>WG3653748-1</b>	<b>DUP</b>	<b>L2657046-2</b>						
Conductivity (1:2)		<0.050	<0.050	RPD-NA	dS m-1	N/A	20	09-NOV-21
pH (1:2 soil:water)		8.56	8.54	J	pH	0.02	0.3	09-NOV-21
<b>WG3653748-3</b>	<b>IRM</b>	<b>13-120 SOIL</b>						
Conductivity (1:2)			99.6		%		80-120	09-NOV-21
pH (1:2 soil:water)			7.97		pH		7.83-8.43	09-NOV-21
<b>WG3653748-4</b>	<b>LCS</b>							
Conductivity (1:2)			98.0		%		80-120	09-NOV-21
pH (1:2 soil:water)			6.90		pH		6.66-7.06	09-NOV-21
<b>WG3653748-2</b>	<b>MB</b>							
Conductivity (1:2)			<0.050		dS m-1		0.05	09-NOV-21
<b>PO4-AVAIL-OLSEN-SK</b>								
<b>Batch R5641239</b>								
<b>WG3654721-1</b>	<b>DUP</b>	<b>L2657046-1</b>						
Available Phosphate-P		40.2	39.3		mg/kg	2.4	30	09-NOV-21
<b>WG3654721-3</b>	<b>IRM</b>	<b>FARM2005</b>						
Available Phosphate-P			99.2		%		80-120	09-NOV-21
<b>WG3654721-4</b>	<b>LCS</b>							
Available Phosphate-P			102.4		%		80-120	09-NOV-21
<b>WG3654721-2</b>	<b>MB</b>							
Available Phosphate-P			<1.0		mg/kg		1	09-NOV-21

# Quality Control Report

Workorder: L2657046

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## Legend:

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Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

## Sample Parameter Qualifier Definitions:

---

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

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# Quality Control Report

Workorder: L2657046

Report Date: 30-NOV-21

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## Hold Time Exceedances:

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ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
<b>Plant Available Nutrients</b>							
Available Nitrate-N							
	1	28-OCT-21 14:00	03-NOV-21 17:00	3	6	days	EHT
	2	28-OCT-21 14:00	03-NOV-21 17:00	3	6	days	EHT

## Legend & Qualifier Definitions:

- 
- EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
  - EHTR: Exceeded ALS recommended hold time prior to sample receipt.
  - EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
  - EHT: Exceeded ALS recommended hold time prior to analysis.
  - Rec. HT: ALS recommended hold time (see units).

## Notes\*:

Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.  
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2657046 were received on 29-OCT-21 10:17.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

---

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



15 Messages



### Sludge Survey - Forrest Manitoba Lagoon



As far as sampling goes, I am assuming that there is a standard sampling package for lagoon sludge.

But if you need more detail, the following list should be tested for:

- Physical Characteristics: moisture content, total and volatile solids, organic matter content, total carbon, mineral content and specific gravity
- Salinity: chloride, calcium, potassium, magnesium, sodium, sulfur, SAR, EC, pH
- Nutrients: Nitrogen (TKN, nitrate-nitrogen, ammonium nitrogen, total Nitrogen by LECO, total organic nitrogen), total and bi-carbonate phosphorus, available phosphate-phosphorus, potassium, sulfate-sulfur
- Metals: Metals scan including (arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc)

Cheers,





## **APPENDIX D**

Title Page

Plan 1: Proposed Lagoon Expansion Location with Setbacks

Plan 2: Proposed Lagoon Expansion with Test Hole Locations

Plan 3: Propose Land Application Area

Plan 4: Proposed Lagoon Storage Cell Layout Plan

Plan 5: Lagoon Dike and Liner Details

Plan 6: Fence, Silt Fence, Valve, Valve Marker, Rip Rap and Ditch Details

# RM OF ELTON

## FORREST LAGOON UPGRADING

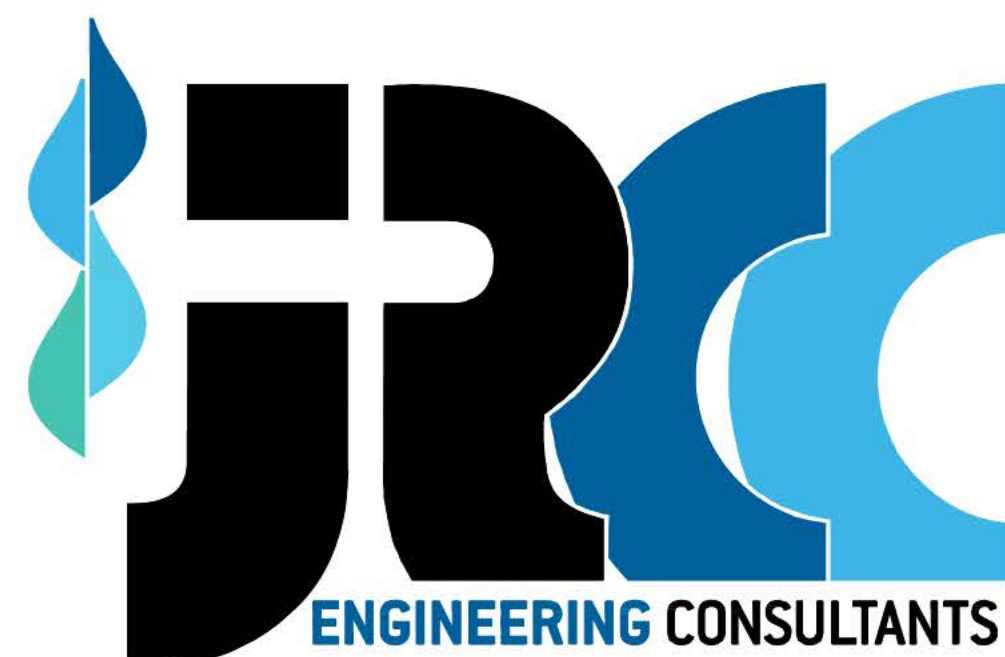
### ENVIRONMENT ACT PROPOSAL

**PRELIMINARY**  
NOT FOR CONSTRUCTION

## PLAN INDEX

### PLAN INDEX

- PLAN 1. PROPOSED LAGOON EXPANSION LOCATION WITH SETBACKS
- PLAN 2. PROPOSED LAGOON EXPANSION WITH TEST HOLE LOCATIONS
- PLAN 3. PROPOSED LAND APPLICATION AREA
- PLAN 4. PROPOSED LAGOON STORAGE CELL LAYOUT PLAN
- PLAN 5. LAGOON DIKE AND LINER DETAILS
- PLAN 6. FENCE, SILT FENCE, VALVE, VALVE MARKER, RIP RAP AND DITCH DETAILS



JR Cousin Consultants Ltd.

91A Scurfield Blvd. Winnipeg MB R3Y 1G4

p. (204) 489-0474

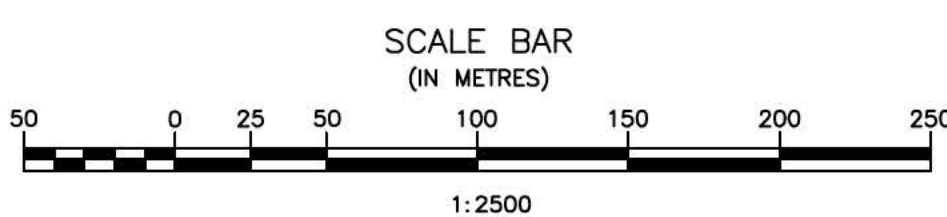
f. (204) 489-0487

[www.jrcc.ca](http://www.jrcc.ca)

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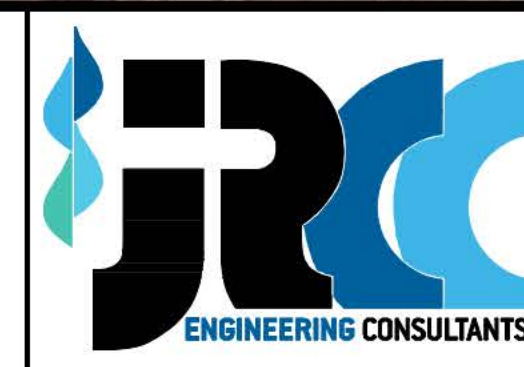


No.	REVISIONS	DATE	INITIALS

B.M. EL.

LOCATIONS OF UNDERGROUND STRUCTURES/UTILITIES AS SHOWN ARE BASED ON AVAILABLE INFORMATION BUT NO GUARANTEE IS GIVEN OR IMPLIED THAT ALL EXISTING UNDERGROUND STRUCTURES/UTILITIES ARE SHOWN OR THAT THE GIVEN LOCATIONS ARE EXACT. CONFIRMATION OF EXISTENCE AND EXACT LOCATION OF ALL UNDERGROUND STRUCTURES/UTILITIES MUST BE OBTAINED FROM THE APPROPRIATE AUTHORITY/OWNER, BY THE CONTRACTOR, BEFORE PROCEEDING WITH CONSTRUCTION.

ENGINEER'S SEAL  
**PRELIMINARY**



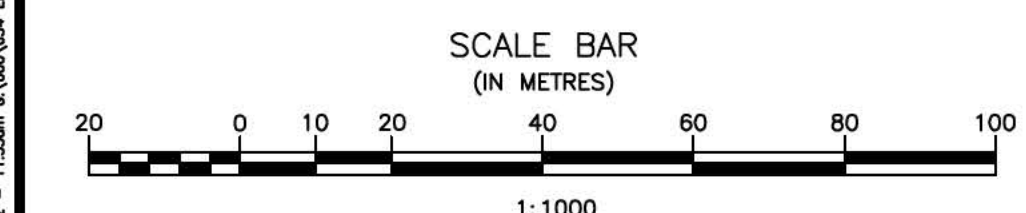
**JR Cousin Consultants Ltd.**  
91A Scurfield Blvd. Winnipeg MB R3Y 1G4  
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f. (204) 489-0487  
www.jrcc.ca

CODE: E-634.03	PROJECT: RM OF ELTON FORREST LAGOON UPGRADING
DESIGNED BY: OW	TITLE: PROPOSED LAGOON EXPANSION LOCATION WITH SETBACKS
DRAWN BY: OT	SCALE: 1:2500
REVIEWED BY: OW	DATE: 22/11/10
	PLAN: 1
	SHEET: 1 of 6

Doc: 02\_2022 - 1154mm 03/08/2024 Elton RM 004203 Forrest Lagoon Upgrading\03\_Drawing\04\_Plan\04\_Plan 1 - Lagoon Expansion with Setbacks.rvt



**PRELIMINARY**  
NOT FOR CONSTRUCTION

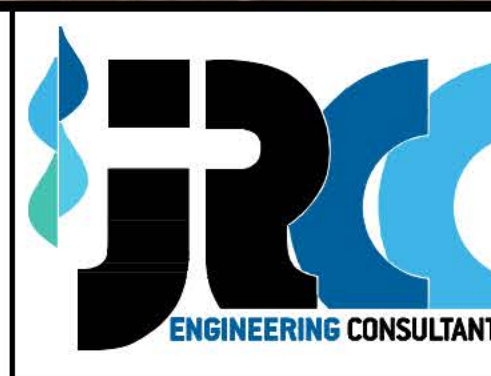


No.	REVISIONS	DATE	INITIALS

B.M. EL.  
LOCATIONS OF UNDERGROUND STRUCTURES/UTILITIES AS SHOWN ARE BASED ON AVAILABLE INFORMATION BUT NO GUARANTEE IS GIVEN OR IMPLIED THAT ALL EXISTING UNDERGROUND STRUCTURES/UTILITIES ARE SHOWN OR THAT THE GIVEN LOCATIONS ARE EXACT. CONFIRMATION OF EXISTENCE AND EXACT LOCATION OF ALL UNDERGROUND STRUCTURES/UTILITIES MUST BE OBTAINED FROM THE APPROPRIATE AUTHORITY/OWNER, BY THE CONTRACTOR, BEFORE PROCEEDING WITH CONSTRUCTION.

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PRELIMINARY



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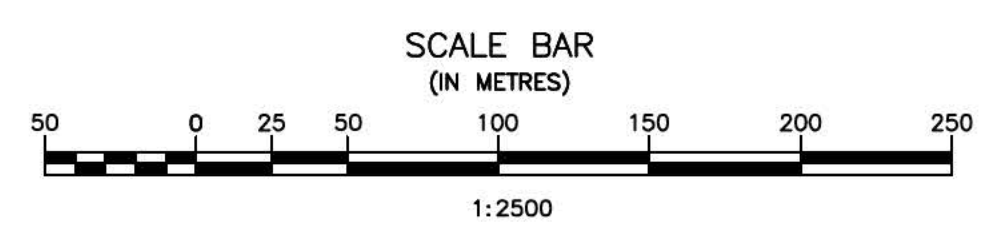
CODE: E-634.03	PROJECT: RM OF ELTON FORREST LAGOON UPGRADING
DESIGNED BY: OW	TITLE: PROPOSED LAGOON EXPANSION WITH TEST HOLE LOCATIONS
DRAWN BY: OT	SCALE: 1:1000
REVIEWED BY: OW	DATE: 22/11/10
	PLAN: 2
	SHEET: 2 of 6

Date: 02/2022 - 1:15pm 03/09/2024 Elton RM 004333 Former Lagoon Upgrading 03 Drainage/Utility/Map/Plan 2 - Test Hole Location Plotting



**PRELIMINARY**  
NOT FOR CONSTRUCTION

Date: 02/2022 - 1:15pm 03/09/2024 Elton 181004333 Forrest Lagoon Upgrading 03 Drawings/03/09/2024/03/09/2024 - Proposed Land Application Area.dwg



No.	REVISIONS	DATE	INITIALS

B.M. EL.

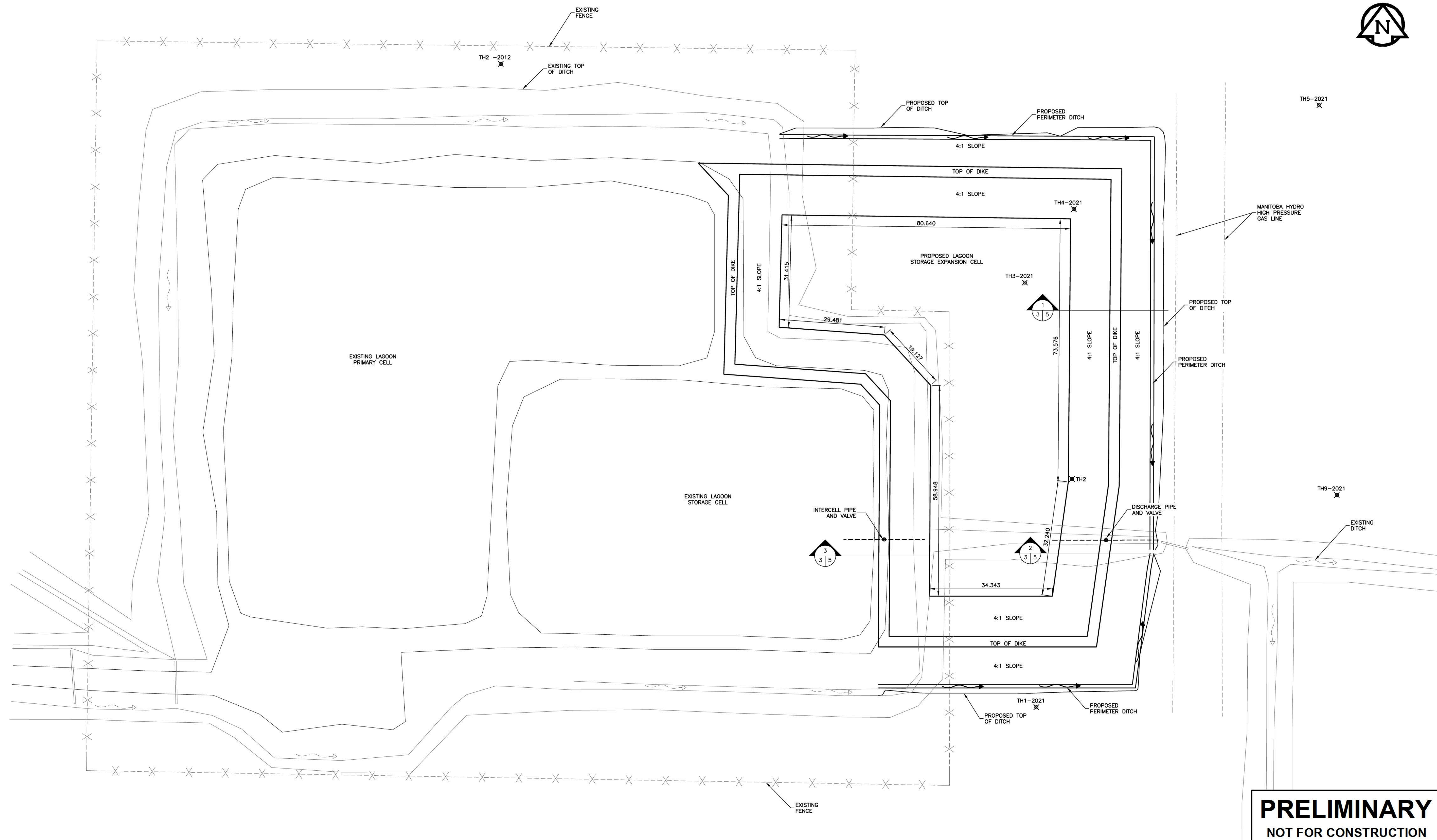
LOCATIONS OF UNDERGROUND STRUCTURES/UTILITIES AS SHOWN ARE BASED ON AVAILABLE INFORMATION BUT NO GUARANTEE IS GIVEN OR IMPLIED THAT ALL EXISTING UNDERGROUND STRUCTURES/UTILITIES ARE SHOWN OR THAT THE GIVEN LOCATIONS ARE EXACT. CONFIRMATION OF EXISTENCE AND EXACT LOCATION OF ALL UNDERGROUND STRUCTURES/UTILITIES MUST BE OBTAINED FROM THE APPROPRIATE AUTHORITY/OWNER, BY THE CONTRACTOR, BEFORE PROCEEDING WITH CONSTRUCTION.

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**PRELIMINARY**

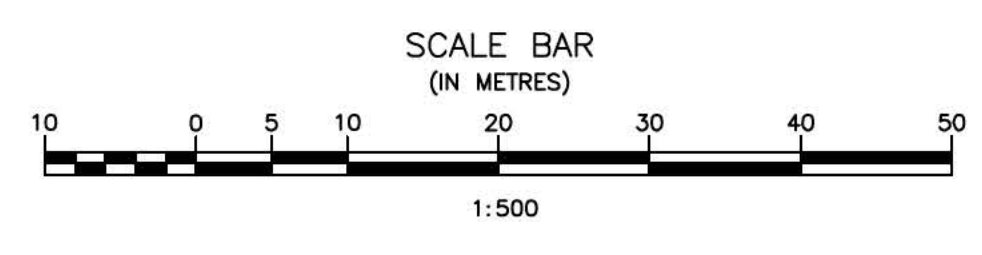


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CODE: E-634.03	PROJECT: RM OF ELTON FORREST LAGOON UPGRADING
DESIGNED BY: OW	TITLE: PROPOSED LAND APPLICATION AREA
DRAWN BY: OT	SCALE: 1:2500
REVIEWED BY: OW	DATE: 22/11/10
	PLAN: 3
	SHEET: 3 of 6



**PRELIMINARY**  
NOT FOR CONSTRUCTION



No.	REVISIONS	DATE	INITIALS

B.M. EL.  
LOCATIONS OF UNDERGROUND STRUCTURES/UTILITIES AS SHOWN ARE BASED ON AVAILABLE INFORMATION BUT NO GUARANTEE IS GIVEN OR IMPLIED THAT ALL EXISTING UNDERGROUND STRUCTURES/UTILITIES ARE SHOWN OR THAT THE GIVEN LOCATIONS ARE EXACT. CONFIRMATION OF EXISTENCE AND EXACT LOCATION OF ALL UNDERGROUND STRUCTURES/UTILITIES MUST BE OBTAINED FROM THE APPROPRIATE AUTHORITY/OWNER, BY THE CONTRACTOR, BEFORE PROCEEDING WITH CONSTRUCTION.









ENGINEER'S SEAL  
**PRELIMINARY**

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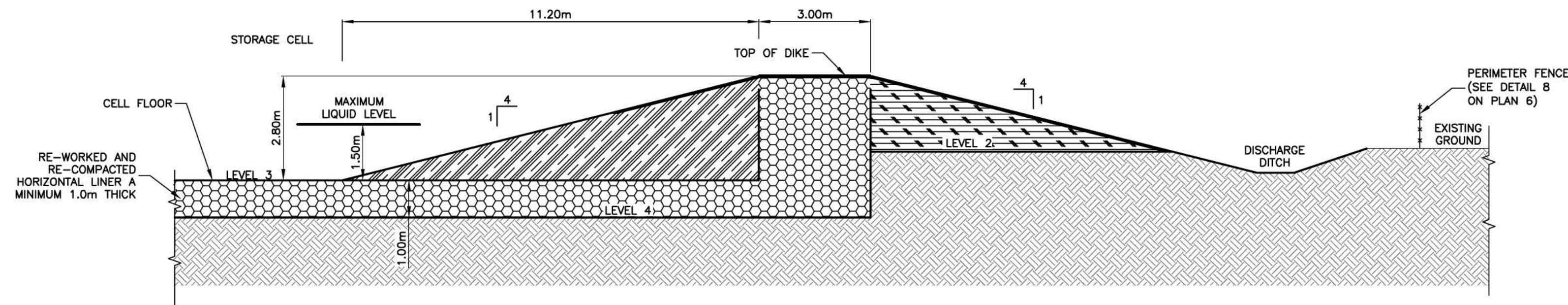
CODE: X-000.00	PROJECT: RM OF ELTON FORREST LAGOON UPGRADING
DESIGNED BY: OW	TITLE: PROPOSED LAGOON STORAGE CELL LAYOUT PLAN
DRAWN BY: OT	SCALE: 1:500
REVIEWED BY: OW	DATE: 22/11/10
	PLAN: 4
	SHEET: 4 of 6

Dec 02, 2022 - 1:50pm C:\Users\jrc\OneDrive\Documents\Projects\Elton\Elton\Drawings\Layout\Plan\4 - Lagoon Storage Cell Layout Plan.dwg

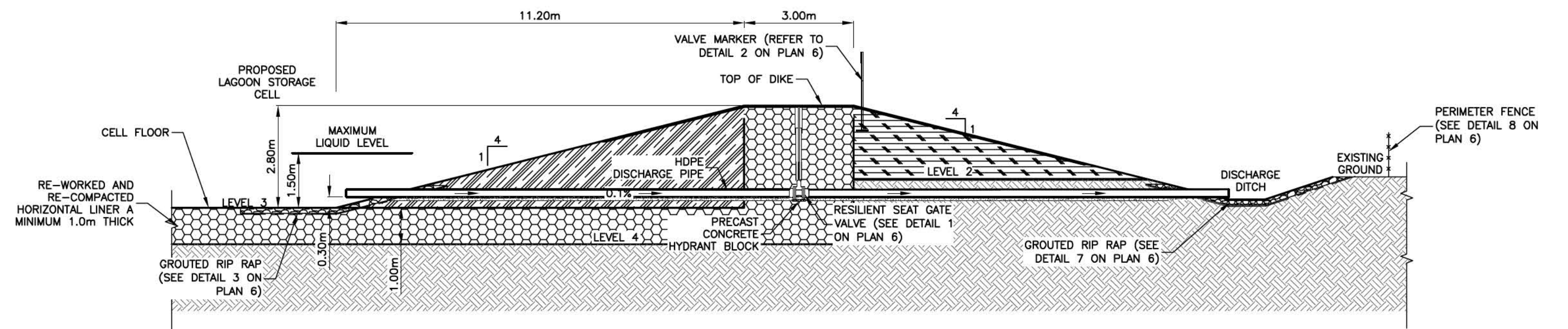
LEGEND:

-  EXCAVATED AND COMPACTED MEDIUM PLASTIC CLAY TYPE SOIL
-  EXCAVATED AND COMPACTED MIXTURE OF SOILS SUITABLE FOR OUTER DIKE
-  INSITU MEDIUM PLASTIC CLAY TYPE SOIL
-  EXISTING TOPSOIL
-  RIP RAP
-  TOPSOIL
-  EXISTING DIKE
-  EXCAVATED AND COMPACTED MIXTURE OF SOILS SUITABLE FOR INNER DIKE

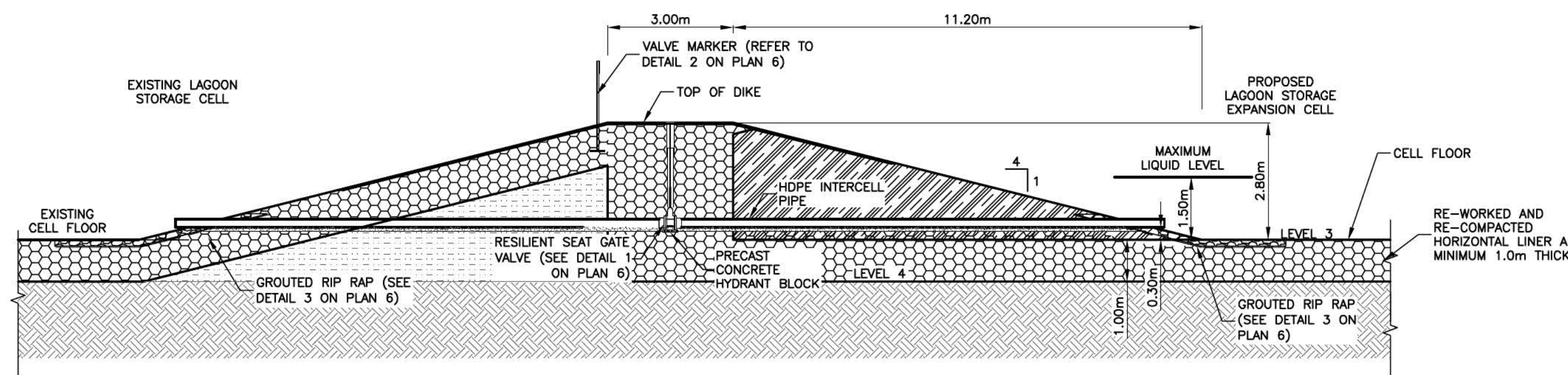
- LEVEL 1 - PRE-CONSTRUCTION EXISTING GROUND ELEVATION
- LEVEL 2 - ELEVATION FOLLOWING TOPSOIL REMOVAL
- LEVEL 3 - FINISHED CELL BOTTOM ELEVATION
- LEVEL 4 - BOTTOM OF HORIZONTAL LINER AND CUTOFF WALL



1 TYPICAL PERIMETER DIKE IN STORAGE CELL  
SCALE = 1:100



2 STORAGE CELL AT DISCHARGE PIPE  
SCALE = 1:100



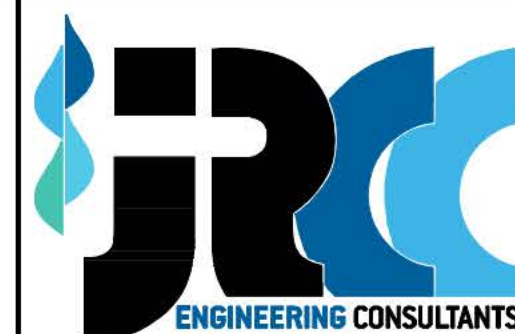
3 STORAGE CELL AT INTERCELL PIPE  
SCALE = 1:100

**PRELIMINARY**  
NOT FOR CONSTRUCTION

No.	REVISIONS	DATE	INITIALS	B.M. EL.

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CODE: E-634.03	PROJECT: RM OF ELTON FORREST LAGOON UPGRADING
DESIGNED BY: OW	TITLE: LAGOON DIKE AND LINER DETAILS
DRAWN BY: OT	SCALE: 1:100
REVIEWED BY: OW	DATE: 22/11/14
	PLAN: 5
	SHEET: 5 of 6

