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March 28, 2017

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

Reference: Environmental Act Proposal
Domestic Wastewater Lagoon
Meadowbrook Village, RM of Cornwallis, MB

Dear Director,

Burns Maendel Consulting Engineers Ltd. is pleased to submit an Environment Act Proposal for the proposed Domestic Wastewater Lagoon in the Municipality of Cornwallis on behalf of Meadowbrook Village. This Domestic Wastewater Lagoon will be constructed in two phases to accommodate the growing needs of Meadowbrook Village. The final lagoon will be sized to treat wastewater from a design population of 793 people.

All of the information relating to the Environmental Act Proposal has been compiled in the attached document. Four (4) hard copies of our proposal have been included, as well as one (1) electronic copy. If you have any questions or comments, please don't hesitate to contact the undersigned.

Regards,

PROVINCE OF MANITOBA
D. A. BURNS
Member
21508
REGISTERED PROFESSIONAL ENGINEER

APEGM
Certificate of Authorization
Burns Maendel Consulting Engineers Ltd.
No. 4559 Date: 28/Mar/2017

Daniel Burns, P. Eng.
Civil Engineer

Cc: Don Sawatsky, Sawatsky Group

/enclosed

Environment Act Proposal Form

Manitoba
Sustainable Development

Name of the development:	Meadowbrook Village
Type of development per Classes of Development Regulation (Manitoba Regulation 164/88):	Class 2 - Wastewater Treatment Lagoon
Legal name of the applicant:	6843191 Manitoba Ltd.
Mailing address of the applicant:	4259 Portage Avenue
Contact Person:	Don Sawatsky
City: Headingly	Province: MB Postal Code: R4H 1C6
Phone Number: (204) 895-2393	Fax: (204) 896-4167 email: dsawatsky@sawatskygroup.com
Location of the development:	Rural Municipality of Cornwallis
Contact Person:	Don Sawatsky
Street Address:	N/A
Legal Description:	NE 33-10-18 WPM
City/Town:	Province: MB Postal Code: R4H 1C6
Phone Number: (204) 895-2393	Fax: (204) 896-4167 email: dsawatsky@sawatskygroup.com
Name of proponent contact person for purposes of the environmental assessment:	Burns Maendel Consulting Engineers Ltd.
Phone: (204) 728-7364 Fax: (204) 728-4418	Mailing address: 1331 Princess Avenue Brandon MB, R7A 0R4
Email address:	d.burns@bmce.ca
Webpage address:	www.bmce.ca
Date: 2017-03-28	Signature of proponent, or corporate principal of corporate proponent: Daniel Burns Printed name: Daniel A. Burns, P.Eng.

PRINT RESET

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

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

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

Class 1 Developments	$1,000
Class 2 Developments	$7,500
Class 3 Developments:	
Transportation and Transmission Lines	$10,000
Water Developments	$60,000
Energy and Mining	$120,000

Submit the complete EAP to:

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

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

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

Environmental Act Proposal

Domestic Wastewater Lagoon
Meadowbrook Village, MB

Submitted by:

Burns Maendel Consulting Engineers Ltd.
1331 Princess Ave.
Brandon, MB R7A 0R4
Tel: 204.728.7364
Fax: 204.728.4418

On behalf of:

Meadowbrook Village / 6843191 MB Ltd.
c/o Don Sawatsky
4259 Portage Avenue
Headingly, MB R4H 1C6
Tel: 1-877-271-1111

March 28, 2017

Executive Summary

Meadowbrook Village (formerly known as Campbell's Mobile Home Park) is planning to expand the mobile home park in a phased manner in the Rural Municipality of Cornwallis, approximately 6 km east of Brandon, Manitoba. All proposed phases of expansion will be on property owned by Meadowbrook Village. The mobile home park is located in the southeast quarter of 33-10-18 WPM. Surrounding Meadowbrook Village is currently cultivated farm land to the north, Glen Lea Golf Course to the west and south, and privately owned residences to the east. Meadowbrook Village has retained Burns Maendel Consulting Engineers Ltd. (BMCE) for engineering services regarding the expansion and necessary upgrades required to accommodate the increased population.

The original park was constructed in the 1970's along with the existing wastewater treatment lagoon located on the northeast quarter of 33-10-18 WPM. Since its construction, the park has grown in size and overloaded the existing lagoon. Meadowbrook Village will require a new wastewater treatment facility to manage their current wastewater effluent, as well as additional effluent produced from the proposed expansions. Due to the site conditions as well as the isolation of the site, BMCE is proposing a new domestic wastewater lagoon be built adjacent to the existing lagoon. BMCE is responsible for the design of the wastewater treatment lagoon, as well as the generation of this corresponding EAP. BMCE is proposing a new three-cell remoulded clay-lined lagoon be constructed immediately north of the existing lagoon on NE 33-10-18 WPM. The primary cell will have a volume of 13,166 m^3 and the secondary cells will have a volume of 19,393 m^3 and 16,506 m^3. The first secondary cell has been sized to accommodate the existing mobile home park as well as phase 1 of the four proposed expansion phases. The second secondary cell will be constructed prior to the development of phase 2 of the expansion which is anticipated to occur within the next five years. Once all three cells have been completed, the combined total active storage will be 42,482 m^3.

The proposed discharge location for the lagoon is into a natural drainage ditch south of the lagoon which discharges to irrigation reservoirs in Glen Lea Golf Course. The golf course currently uses discharge from the existing lagoon for irrigation purposes. Meadowbrook Village and Glen Lea Golf Course hold a caveat to discharge the lagoon to this location. No significant adverse impact on human health or the environment is anticipated to result from the proposed construction, operation of the lagoon, or wastewater irrigation, as will be elaborated on within the Environmental Act Proposal.

Once approval for the lagoon has been received from Manitoba Sustainable Development, construction is planned to begin in early summer 2017.

Standard Limitations

This report was prepared by Burns Maendel Consulting Engineers Ltd. (BMCE) for the account of Meadowbrook Village (the Client). The disclosure of any information contained in this report is the sole responsibility of the Client. The material in this report reflects BMCE's best judgment in light of the information available to it at the time of preparation. Should this report be used by a third party, any reliance or decisions made based on this report are the responsibility of such third party. BMCE accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made or actions based on this report. BMCE makes no representation concerning the legal significance of the findings or the information contained within this report.

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1. Introduction and Background

Meadowbrook Village, formerly known as Campbell's Mobile Home Park, is located in the southeast quarter of 33-10-18 WPM in the Rural Municipality of Cornwallis, just east of the City of Brandon. The original park was constructed in the 1970's along with the existing wastewater treatment lagoon which is located in the northeast quarter of 33-10-18 WPM.

In 2000, a four phase expansion to the park was conceptualized and a lagoon expansion was undertaken. An updated Environmental Act License No. 2441 was issued at this time. Complications during construction of the lagoon lead to the abandonment of the expansion which has sat partially complete to this day. None of the expansion phases have been completed to date due to wastewater and potable water capacity restrictions.

BMCE has been retained to complete the design and environmental approvals associated with the expansion of the existing wastewater lagoon as well as a new water treatment plant to address existing park deficiencies.

1.1. Existing Lagoon

Domestic wastewater from Meadowbrook Village residents is currently treated by the existing two cell lagoon located approximately 185 meters north of the nearest residence. Wastewater is collected by a gravity sewer system which flows to a lift station located directly south of the primary cell along Spruce Street in Meadowbrook Village where wastewater is then pumped to the lagoon via a force main.

Currently, there is no operational procedure in place for the existing lagoon. The lagoon has become overloaded since its construction in the 1970's and has been poorly maintained. The lagoon berms have become covered with vegetation due to the poor maintenance procedures.

Once construction of the new facility is complete, the existing lagoon facility will be decommissioned. Decommissioning will involve the removal of biosolids materials for the purpose of land application, which will include the submission of an Environment Act Proposal (EAP). The required EAP will be prepared and submitted separately from this report at a later date.

1.1.1. Lagoon Survey

There is no as-built information available to determine the original construction specifications for the existing lagoon; however, BMCE conducted a survey of the lagoon on August 26, 2016 and January 13, 2017 to determine the approximate size, berm dimensions and slopes, water and sludge depth, outlet valve location, and overall condition of the existing structure.

At the time of the inspection, January 13, 2017, the wastewater in the primary cell was on average approximately 1.5m deep, and the wastewater in the

secondary cell was on average approximately 1.0m deep. This is an approximation, as the bottom elevation varied throughout. The sludge depths in both cells varied throughout but generally ranged between 0.20m and 0.30m depth.

Also noted during the survey was the fact that the surface water elevations varied between the primary and secondary cells. This indicates that the equalization pipe between the two cells is plugged or not working. This also suggests that currently the lagoon is overtopping the common berm between the primary and secondary as a means of liquid flow between the cells. According to the survey it is suspected the water is overflowing on the northern portion of the common berm as this is the lowest portion.

Through discussions with the Client on the operation of the lagoon it was identified that it has not be operated in accordance with typical discharge procedures. It is likely that the secondary cell of the lagoon is overflowing as well in the southwest corner where the berm is at its lowest point. This would suggest the lagoon is operating in a continuous discharge configuration by overtopping the secondary cell berm.

Drawings obtained from Manitoba Sustainable Development for the previously submitted EAP and NoA in 1999 and 2000 by Glen Newton, P.Eng. indicated the following information:

- Interior Side Slopes: 3:1
- Freeboard: 0.30m
- Dead Space Provided: 0.00m
- Active Storage Depth: 1.20m
- Total Berm Height: 1.50m

The information provided by the previous submission is the best available information for the configuration of the existing lagoon and was utilized by BMCE in the determination of the existing lagoon capacities. It can be noted however that survey collected by BMCE would suggest that the information contained within the report is not accurate. For the purposes of the review of the existing lagoon the assumptions from G.D. Newton & Associates will be utilized.

Currently, the existing lagoon provides wastewater treatment to approximately 365 people; refer to the population calculations in Section 1.2 for more information. Utilizing typical loading and treatment rates found in Section 2.3 of this report, the existing organic loading rate was found to be 28 kg BOD_5/day while the hydraulic loading was found to be 84.0 m^3/day. The available treatment area at the average water depth (0.6 m from bottom) in the primary cell was determined to be 3,254 m^2 which can provide treatment to a corresponding organic load of 18.2 kg BOD_5/day. The volume of the existing

primary cell was estimated at 3,910 m^3, while the secondary cell was estimated at 6,820 m^3. This provides a total hydraulic capacity of 8,770m^3 or 38.1m^3/day when utilizing a 230 day detention period.

Based on these observed and measured site conditions, the existing lagoon is organically over loaded by approximately 154% and hydraulically over loaded by approximately 220% with the current day population.

1.1.2. Discharge

The existing lagoon discharges through a natural drainage ditch, approximately 320 meters long, on to the south neighboring property of Glen Lea Golf Course and into their irrigation reservoir which is used for irrigation; see Section 2.5 for more information on the discharge route. There is currently a caveat between the owners of the lagoon and Glen Lea Golf Course to discharge the lagoon to this location, see Appendix A.

1.1.3. Condition

A condition assessment of the existing facility was not completed prior to snowfall. The condition of the lagoon facility is largely unknown at this time. Plant overgrowth was observed along the berm throughout the side slopes. This issue was also identified by Manitoba Sustainable Development in a previous site inspection of the lagoon.

1.2. Population and Loading Projections

1.2.1. Current and Future Populations Served

Currently, Meadowbrook Village consists of 146 modular and mobile homes, or a population of approximately 365 people. In the ~40 years since the lagoon's construction, the mobile home park has expanded and is planning to continue with the development of the four future phases in which 172 new residences are proposed, or an approximate 430 additional people. Refer to Table 1 below for further details:

Table 1: Current and Future Populations

Phase of Construction	Assumed Construction Completion	Mobile Homes	Assumed People per Residence	Cumulative Population
Current	-	146	2.5	365
Phase 1	2018	195	2.5	488
Phase 2	2020	244	2.5	610
Phase 3	2022	293	2.5	733
Phase 4	2024	318	2.5	795

Sewage infrastructure for the mobile home park and proposed future phases consists of a gravity flow sewer network which services the residences throughout the park. It should be noted that no industrial or commercial waste will be generated in the mobile home park or proposed future phases. The gravity flow sewers from the mobile home park and proposed future phases are connected to separate lift stations, which pump the wastewater to the lagoon. The mobile home park and the proposed future phases (as constructed) are expected to immediately connect to the lagoon once the lagoon expansion is complete.

1.2.2. Proposed Lagoon Loading Criteria

Using a typical loading rate of 0.077 kg BOD_5/cap/d, the expected future average daily organic loading is provided in Table 2. The average day hydraulic loading is also shown in Table 2 based on the estimated wastewater generation rates for the population as outlined in Section 1.2.

The hydraulic loading attributable to the mobile home park members was estimated at a value of 200 L/c/d. This is based off water meter readings from the mobile home park potable water distribution building over a period of approximately 6 months, and historical design wastewater loading rates from other mobile home parks.

Table 2: Lagoon Loading Criteria

Phase of Construction	Cumulative Organic Loading (kg BOD_5/d)	Cumulative Hydraulic Loading (m^3/d)
Current	28.1	84.0
Phase 1	37.6	112.1
Phase 2	47.0	140.3
Phase 3	56.4	168.5
Phase 4	61.2	182.9

1.3. Projected Load Growth

The final lagoon expansion will not be designed to service an increased capacity beyond the four proposed future phases in Section 1.2. No other expansions are planned for the life of the facility. Assumed construction completion timelines for each phase of development have also been provided in Table 1 in Section 1.2.1.

1.4. Lagoon Feasibility Report

As the existing lagoon is currently overloaded both organically and hydraulically, the lagoon will either need to be modified and expanded, or a new facility will need to be constructed. BMCE completed a review of options available to Meadowbrook Village

and determined that ultimately there are two options; the construction of a new lagoon facility and decommissioning the existing lagoon, or upgrade and expand the existing lagoon to provide the required capacity.

1.4.1. Modification and Expansion of Existing Lagoon

The existing lagoon consists of a primary and secondary cell. To provide sufficient storage, the two cells would need to be combined to form one larger cell, which would function as the new primary cell. If these cells were combined it would provide a capacity which could serve up to and including Phase 3 of development, but was not adequate to service the entire proposed expansion. In order to accommodate the full expansion, expansion of the primary cell would also need to be completed. In addition to the capacity, the existing lagoon would require upgrades to bring the slopes, freeboard, and dead space provided up to current standards. This would involve a significant reconstruction of the existing lagoon. As the condition and construction of the existing lagoon is largely unknown, this presents a significant challenge and largely unknown cost to the project.

Staged secondary cells would be required to be built to the north of the existing lagoon. These secondary cells would need to be built at the same elevation as the existing lagoon which is quite deep into the ground. The cells would require significant earthworks as you move northward due to the natural grade changes in the area. Additionally the existing depth of the lagoon cell bottom does not provide adequate grade to ensure drainage of the discharge pipe to the golf course property.

This option presents several challenges including expansion and upgrade of the existing lagoon facility, large earthworks quantities in the secondary cell construction, and challenges in staging the construction with temporary diversion to accommodate continuous operation of Meadowbrook's wastewater system.

1.4.2. New Lagoon, Adjacent to Existing

The second option is construction of a new facility adjacent to the existing lagoon. The benefit of this option over the previous is that construction sequencing is much simpler. Specifically, the existing lagoon could be used for storage and treatment of wastewater during construction of the new facility. Then, once the new facility has been constructed and commissioned, the existing lagoon could be decommissioned without the time sensitivity of the previous option.

The new lagoon would include a primary cell sized to treat all wastewater from the final build out of the expansion areas.

1.4.3. Recommendation

Due to the presence of an existing wastewater lagoon at this location, a lagoon was deemed to be the most feasible wastewater treatment option as compared to a regional or alternative treatment system. This is due to the fact that the mobile home park is reasonably isolated, as it is approximately 1.7 kilometers away from the nearest community (Chater, MB). Another consideration is the ease of use and lack of maintenance required as compared to an alternative wastewater treatment system. Additionally, as there is an existing wastewater treatment lagoon on site, impacts to the surrounding area will be minimal. These combined factors make a lagoon treatment system the most logical method for treating wastewater in Meadowbrook Village.

BMCE choose to proceed with the new lagoon option versus rehabilitation of the existing lagoon. This is due to the staging challenges and unknowns with regards to the existing lagoon. This also allows for easy construction sequencing and involves significantly less risk to the absence of temporary wastewater diversion during construction. The remaining portion of this EAP will proceed with the design of a new lagoon and ultimately the decommissioning of the existing lagoon once construction is complete.

1.5. Community Consultation & Identified Concerns

Community consultation was not completed since this is an expansion to an existing lagoon facility.

2. Description of Proposed Development

2.1. Certificate of Title

The legal land description where the domestic wastewater lagoon is situated is NE 33-10-18 WPM. The legal landowner of the existing lagoon land is 6843191 Manitoba Ltd. also known as Meadowbrook Village. Refer to Appendix B for a copy of the Certificate of Title. Additional property purchases are not required for the proposed lagoon expansion.

2.2. Sealed Engineering Drawings

For sealed Engineering drawings detailing the proposed wastewater lagoon expansion, refer to Appendix C.

2.3. Proposed Lagoon Design

2.3.1. Lagoon Design Parameters

Table 3 details the lagoon design parameters which were utilized during the final design of the wastewater lagoon. These parameters are in conformance

with the Information Bulletin – Design Objectives for Wastewater Treatment Lagoons published by Manitoba Sustainable Development.

Table 3: Lagoon Design Parameters

Parameter	Result
Winter Storage Period	Nov. 1 to Jun. 15
Detention Time (days)	230
Organic Loading Rate (kg BOD_5 / cap / d)	0.077
Organic Treatment Rate (kg BOD_5 / ha / d)	56.0
Active Storage Depth (m)	1.20
Freeboard (m)	1.00
Dead Space (m)	0.30
Total Depth (m)	2.50
Cell Interior Side Slope	4:1

An explanation of the various lagoon design parameters has been provided to outline the rationale behind them:

- The detention time was set at **230 days**. 227-230 days are commonly used detention times, based on the operational requirement that the wastewater effluent be discharged between June 15 and November 1.
- The design organic loading rate per person is set at **0.077 kg BOD/person/day**. This is a value used commonly in wastewater treatment design in Manitoba.
- The maximum organic loading rate is set at **56 kg BOD_5/ha/day**. This value is commonly used in wastewater lagoon design across Manitoba.
- As per common practice and design standards for wastewater lagoon design, the available storage will be 1.50m, and active storage will be 1.20m.
- As per common practice and design standards for wastewater lagoon design, the available freeboard will be 1.00m.
- The area below the interconnecting pipe inverts is considered dead storage, and is not part of the design storage volume or freeboard. The dead storage height is 0.30m, as per common design practice and Manitoba Conservation Design standards.
- The interior slope of the primary and secondary cells will be 4:1. The outside berm slopes will be 5:1.
- For all other lagoon design details, refer to drawings in Appendix C.

2.3.2. Lagoon Design Rationale

BMCE completed the design of the new wastewater treatment lagoon. The new lagoon has been designed to be constructed in two phases. The first phase of construction will include the primary cell and the northwestern secondary cell, while the second phase will include the northeastern secondary cell.

The primary cell will be sized to treat the wastewater from the final population of Meadowbrook Village including the four phase expansion to ensure that no future upgrades are required to this cell. The northwest secondary cell will be sized to treat the wastewater from the exiting Meadowbrook Village and up to the first phase of the four phase expansion. The northeastern secondary cell will include the remaining capacity to treat wastewater from phases two through four of the expansion.

2.3.3. Primary Cell Design (Organic Loading)

The primary cell design has been completed and is outlined in Table 4. The organic loading rates calculated in Section 1.2.2 have also been included in the table to clearly demonstrate the proposed sizing can accommodate the organic loading for all four phases of expansion. The lagoon design parameters utilized were outlined in Section 2.3.1. The area outlined in the table was determined at the average active storage depth in the lagoon. This represents a depth of 0.6m from the high water level or 0.9m from the bottom of cell which will represent the average water depth in the lagoon throughout the year. The organic treatment capacity provided was calculated by multiplying the area by typical organic treatment rate. As you can see in the summary table the primary cell provides 61.6 kg BOD_5 / day of treatment which exceeds the loading rate of 61.2 kg BOD_5 / day.

Table 4: Primary Cell Design Summary

Parameter	Result
Top of Berm Dimensions - L x W (m)	73.0 x 199.50
Floor Dimensions - L x W (m)	52.0 x 178.50
Area at Average Active Storage Depth (m^2)	10,993
Organic Treatment Capacity Provided (kg BOD_5 / d)	61.6
Organic Loading Rate (kg BOD_5 / d) (Refer to Section 1.2.2)	61.2
Volume Provided (m^3)	13,166

2.3.4. Secondary Cell Design (Hydraulic Loading)

Refer to Table 5 for a summary of the secondary cell design with regards to the hydraulic capacity of the lagoon. The northwest secondary cell provides

adequate hydraulic capacity to accommodate flows up to and including phase 1 of the expansion. The northeast secondary cell is intended to be constructed in the future and has the hydraulic capacity to accommodate flows up to and including phase 4 of the expansion. This staged secondary construction allows Meadowbrook Village to bring a new lagoon online initially to meet the current and immediate needs of the existing park and expansion while limiting the required capital investment at this time. The future lagoon expansion then allows for an easy increase in capacity for the lagoon when Meadowbrook Village is ready to proceed with subsequent phases of expansion.

Table 5: Secondary Cells Design Summary

Parameter	Result
Northwest Secondary Cell	
Top of Berm Dimensions - L x W (m)	132.0 x 150.50
Floor Dimensions - L x W (m)	111.0 x 129.50
NW Secondary Cell Volume Provided (m^3)	19,393
Primary Cell Volume Provided (m^3)	13,166
Total Active Storage Volume Provided (m^3)	25,976
Hydraulic Capacity Provided (m^3/d) (Using 230 day detention time)	112.9
Hydraulic Loading up to Phase 1 (Refer to Section 1.2.2)	112.1
Northeast Secondary Cell (Future Expansion)	
Top of Berm Dimensions - L x W (m)	122.0 x 150.50
Floor Dimensions - L x W (m)	101.0 x 129.50
NE Secondary Cell Volume Provided (m^3)	16,506
NW Secondary Cell Volume Provided (m^3)	19,393
Primary Cell Volume Provided (m^3)	13,166
Total Active Storage Volume Provided (m^3)	42,482
Hydraulic Capacity Provided (m^3/d) (Using 230 day detention time)	184.7
Hydraulic Loading up to Phase 4 (Refer to Section 1.2.2)	182.9

The total active storage volume provided for the secondary cells was calculated using the volume of the secondary cell(s) plus half of the volume of the primary cell as per Manitoba Sustainable Development's Design Objectives for Wastewater Treatment Lagoons. The subsequent hydraulic capacity provided is then calculated by dividing the total active storage volume provided by the detention time to get an average inflow rate over this period of time that the lagoon can accommodate. This hydraulic capacity can then be compared to the hydraulic loading calculated from population projections in Section 1.2.2.

2.4. Lagoon Design

The lagoon containment will consist of a minimum 1.0m thick remolded clay liner at the surface of the berms surrounding and throughout the cells. BMCE anticipates that there will be adequate quantity of clay materials on site for liner construction which will meet the hydraulic conductivity requirement of 1 x 10^{-7} cm/s when remolded. Some additional exploration will need to be completed in the spring to confirm the depth, location, and quantity of available clay liner material on site. If there is not enough clay available on site, there is a source 1.6 kilometers away that can be utilized.

2.4.1. Geotechnical Report

A geotechnical investigation was completed by TREK Geotechnical on March 17, March 18, and June 3, 2016. The Geotechnical Investigation Report has been included in Appendix D. The report contains the test hole and test pit logs throughout the site including at the previously partially completed expansion site. The report makes the following recommendations for construction of the lagoon facility with a compacted soil liner:

- Clay till used for fill should be well mixed and homogeneous, unfrozen, free of deleterious materials, organic matter and debris.
- Topsoil or otherwise unsuitable materials (non-clay till material) should not be used for liner construction but may be selectively used for dyke construction and re-vegetation of exterior slopes.
- The clay till should be packed using a sheepsfoot compactor in 150mm maximum lifts to 95% of Standard Proctor Maximum Density (SPMDD) at or within 2% of the optimum moisture.

The report recommends that strict quality control will be required to prevent inclusion of undesirable soils and to confirm adequate compaction of the clay till throughout construction. BMCE will be on hand throughout the construction to monitor progress and ensure liner materials meets the requirements as set out in the geotechnical report.

2.5. Effluent Discharge

The existing lagoon is constructed adjacent to Meadowbrook Village. The proposed discharge location will continue to be into Glen Lea Golf Course's irrigation reservoir(s) via a natural drainage ditch, immediately south of the proposed future phases and west of Meadowbrook Village. See Figure 1.

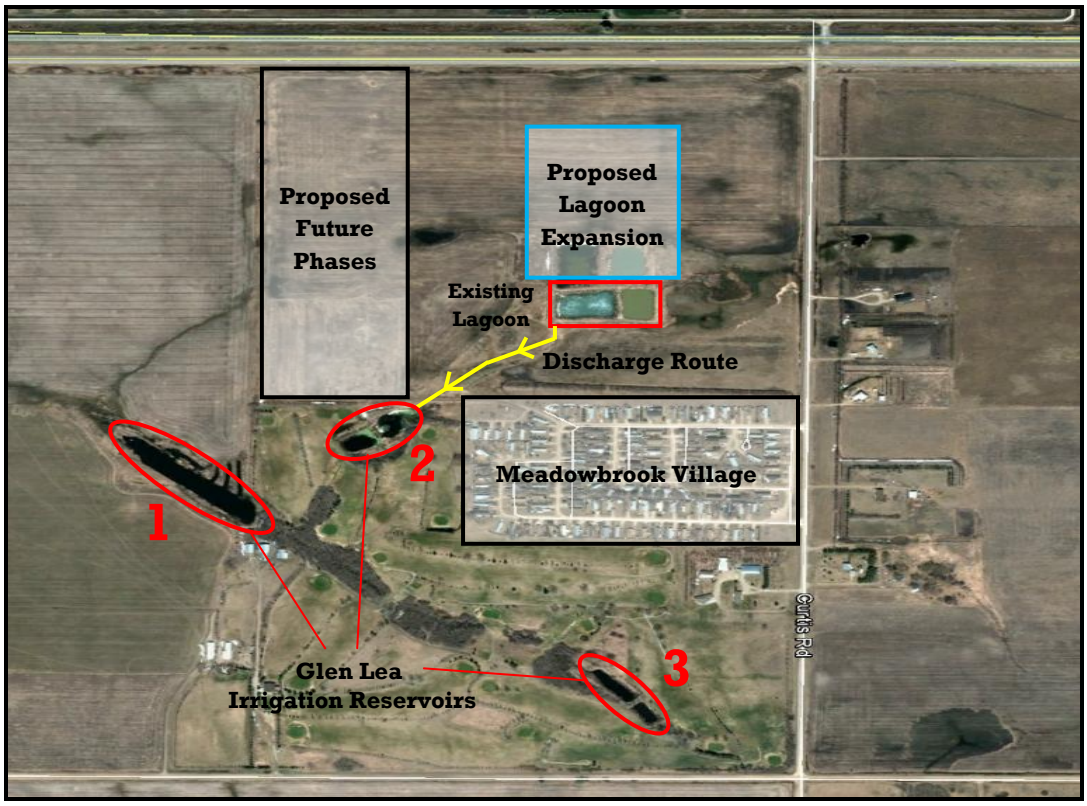


Figure 1: Discharge Route

Reservoir 2 has a 12,588m^3 storage capacity, Reservoir 1 has a 70,527m^3 storage capacity, and Reservoir 3 has a 13,026m^3 storage capacity. The combined total of golf course storage reservoirs is 96,141m^3. This combined storage volume is expected to increase in the future as Glen Lea Golf Course is currently planning to expand Reservoir 1 to the northwest. All reservoir capacities and irrigation rates were provided to BMCE by Glen Lea Golf Course.

As shown in Figure 2 below, there is only one natural drain in the immediate area of Meadowbrook Village. The effluent drains from the lagoon through approximately 320m of a heavily vegetated natural drain into the irrigation reservoirs located on the Glen Lea Golf Course. This drainage route is protected by an easement agreement between both property owners that was executed in 1999, see Appendix A. The effluent is diluted with existing reservoir water and is applied as irrigation water to Glen Lea Golf Course throughout the golf season.

It is common for Glen Lea Golf Course to deplete their stored reservoir water in mid-summer and require the lagoon effluent to supplement their irrigation needs. BMCE discussed the discharge with Glen Lea owners on March 17, 2017. Glen Lea has advised that they are happy to continue to receive the discharges and look forward to working with the new park owners.

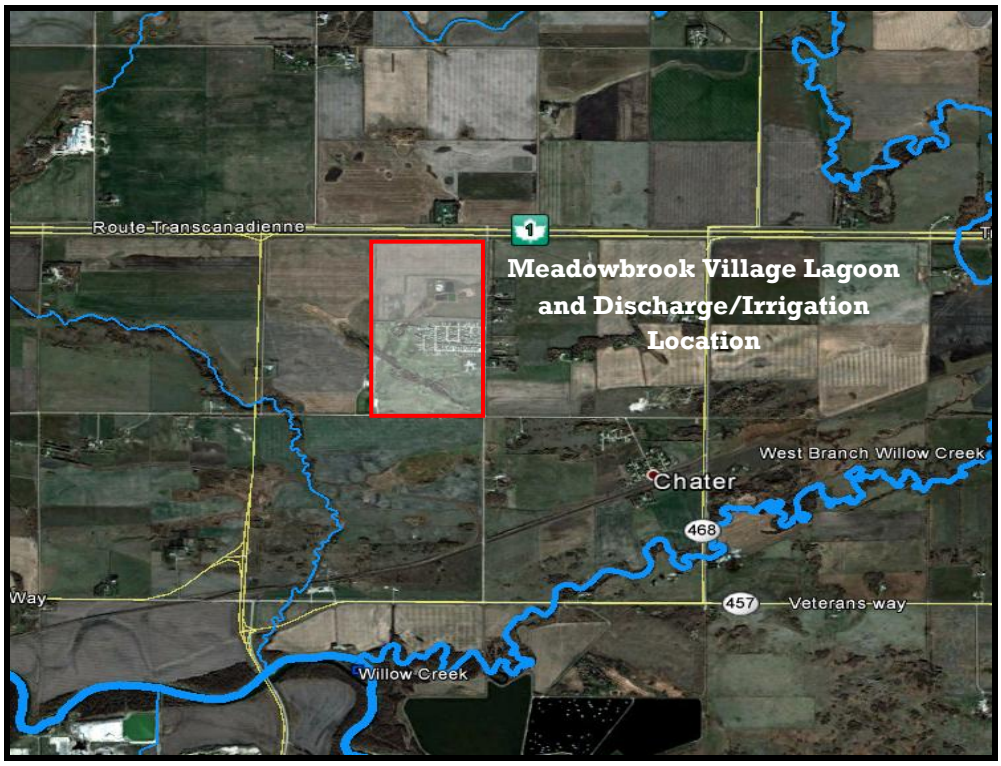


Figure 2: Nearest Drains

2.5.1. Effluent Use by Glen Lea Golf Course

The Glen Lea Golf Course has a multiple reservoir storage system with a combined capacity of 96,141m^3 to supply their irrigation needs throughout the summer months.

The golf course has provided the total water utilized annually for irrigation purposes is 65,940m^3 or approximately 802m^3/day on average, with a max rate of 1,455m^3/day during peak irrigation season when a lagoon discharge would occur. The irrigation season is between April-October. As determined in Section 2.3, the maximum discharge volume from the lagoon will be 25,976m^3 after the construction of the lagoon for phase 1 and up to 42,482m^3 after the construction of the second secondary cell. During lagoon discharge, Glen Lea Golf Course will receive approximately 8,640m^3/day over the course of three days after the construction of the lagoon for phase 1. After the construction of the second secondary cell the golf course will receive the same discharge rate over the course of five days. The lagoon discharge rate was hydraulically calculated as an Outlet-Controlled Culvert with a Submerged Inlet, using a typical high density polyethylene discharge pipe size and length of 150mm and 22m respectively. These discharge rates are based on a single discharge event of the lagoons secondary cell(s) with a half opened valve. Discharge volumes will also be reduced by infiltration/evaporation of the effluent along the 320m long drainage ditch.

Meadowbrook Village lagoon discharge will drain into Reservoir 2, see Figure 1. In the event Reservoir 2 is full, effluent will then be pumped from Reservoir 2 to Reservoir 1, via an underground transfer pipe. In the event Reservoir 1 is full, overflow will both extend northwest of Reservoir 1 onto the agricultural land, and follow a natural drainage ditch through the golf course to Reservoir 3.

In the event of a wet year and all reservoirs are at full capacity when the lagoon needs to be discharged, flow from Reservoir 3 will overflow and follow a natural drainage ditch to Curtis Road and continue south until it reaches Willow Creek and shortly thereafter, the Assiniboine River; the total drainage path from Reservoir 3 to Willow Creek is approximately 3.1km long. See Figure 3 for details on the overflow drainage path.

Figure 3: Overflow Drainage Path

Since the lagoon will be discharged during peak summer months, when golf course irrigation reservoirs are expected to be low, the occurrence of discharge along this drainage path is unlikely.

In the event of overflow, the 3-reservoir dilution process and lengthy, vegetated, drainage path to dilute and polish the wastewater; no impacts are expected to the fish habitat in Willow Creek and the Assiniboine River.

Communication between Glen Lea Golf Course and Meadowbrook Village will be upheld to ensure adequate warning when a lagoon discharge will be taking place, as well as confirming the capacity of the golf course to receive the lagoon discharge. If necessary, Meadowbrook Village will discharge the lagoon twice to reduce the volume of effluent received at one time.

2.6. Facility Operation

Wastewater effluent will be collected via a gravity sewer network and pumped from lift stations into the lagoon, where the wastewater will be stored and treated until it is released in the summer/fall.

The discharge operation is summarized in the following steps:

Two weeks prior to the time of sampling the valve permitting flow between the primary and secondary cell(s) will be closed. This will ensure a representative water sample can be taken from the secondary cell.

Two weeks after the valve has been closed, a water sample from the secondary cell(s) will be obtained, using sample bottles supplied from an accredited laboratory. Water sampling and submission procedures will be performed in accordance with Manitoba Conservation and laboratory guidelines.

If the water samples meet Manitoba Sustainable Development requirements water from the secondary cell(s) can be discharged. Water will only be discharged within the June 15 to November 1 time period. If the samples do not meet Manitoba Sustainable Development requirements, testing will be repeated until the samples have passed the testing criteria. Additional time will allow for natural processes such as sunlight and settling to positively affect the wastewater effluent quality.

Once the effluent has been drained from the secondary cell(s), the discharge valve will be closed and the valve permitting flow between the primary and secondary cell will be opened.

Once the water level between the primary and secondary cell has been equalized, the secondary cell can be drained a second time if necessary to ensure adequate capacity for winter. In this event, the valve between the primary and secondary cell will again need to be closed for two weeks, and the secondary cell wastewater will need to be re-tested prior to discharge. However, we do not anticipate a second discharge will be necessary.

2.7. Seasonal Maintenance

Regular observation of the lagoon will be undertaken by Meadowbrook Village Staff to ensure that there are no damages to the lagoon structure. The following tasks will be performed to ensure that the integrity of the lagoon is maintained and that it functions properly:

The lagoon will be inspected for signs of wildlife. Any wildlife burrowing into the berm or otherwise causing damage will be removed.

Valves and drainage areas will be checked and cleared of obstructions on a regular basis.

Snow will be cleared on the access road so that the lagoon may be accessed at any time.

2.8. Decommissioning

Decommissioning of the existing lagoon will be completed following construction and commissioning of the new lagoon facility. Once the existing facility is taken offline, the liquid will be transferred via pump to the new facility for treatment. Once all liquids have been removed, the biosolids will need to be land applied. Refer to Section 2.8.1 for more info on biosolids application. Once the existing lagoon has been emptied and biosolids removed, the existing piping will all be removed and disposed of followed by the leveling of the existing berms. Once the surface has been leveled, topsoil and seed will be placed to remediate the lagoon site to a natural condition.

2.8.1. Biosolids Application

Disposal of biosolids is regulated under The Classes of Development Regulation (Manitoba Regulation 164/88). According to the regulation, disposal of biosolids is classified as a Class 2 Development, and will require preparation and submission of an Environment Act Proposal. The required application will be prepared and submitted separately from this report at a later date.

3. Description of Pre-Development Environment

3.1. Land Use

The current land use is cultivated farmland on the north half of the section and the location of the existing wastewater lagoon as well as some low lying swamp area on the southern half. A local farmer is actively using the north half of this section to grow crops. Zoning is currently designated as Agricultural General Zone (AG80) of all of the quarter section except the western 219.45m which was rezoned to Residential Mobile Home Park (RMP) to allow for the proposed four phase expansion.

3.2. Topography

The location of the lagoon will be adjacent to Meadowbrook Village on NE 33-10-18 WPM. The land is relatively flat, with a gradual slope to the south west. Most runoff from the land eventually exists to the south west on to Glen Lea Golf Course where it is stored for irrigation purposes. There is an agreement in principal between Meadowbrook Village and Glen Lea Golf Course to accept this drainage. Both parties' lawyers are currently working on this agreement such that a caveat will be put in place to accept this drainage.

3.3. Soil Conditions

The general soil stratigraphy in descending order from ground surface consists of organic topsoil followed by a veneer of glacio-fluvial sediment (mixtures of sand, silt, and clay) overlying clay till. The clay till is silty, contains trace sand, trace gravel, is brown, moist, firm to very stiff, and of intermediate to high plasticity. Geotechnical information was provided by a Geotechnical Investigation Report prepared by Trek Geotechnical and dated July 11, 2016; see Appendix D.

3.4. Groundwater

Groundwater was encountered at shallow depths of approximately 1.5m in several test holes completed in the existing lagoon and along the eastern boundary of the lagoon site. The test holes completed along the western side of the existing wastewater lagoon all were dry with no seepage or sloughing at the completion of drilling. Groundwater was encountered at shallow depths in this area due to the presence of water bearing strata near the surface. During construction ditches will need to be established around the lagoon to help lower this water level and ensure surface water has a route to runoff the site and not saturate the soils.

3.5. Wildlife in Project Area

3.5.1. Existing Wildlife

Existing wildlife in the area is not likely to be affected by the construction of the new lagoon facility. As an existing facility has been in place for many years with negligible effects on the wildlife, it is anticipated the new facility will function in a similar manner. The proposed lagoon expansion is being constructed in a previously disturbed area, and existing agricultural land. Due to this existing land use it is anticipated that no wildlife habitat will be affected.

3.5.2. Fish Habitat

The lagoon discharge is not being transmitted to, or stored within a fish bearing water body.

3.5.3. Protected or Endangered Species

Due to the relatively close proximity of the proposed expansion to the current lagoon location, and the fact that the area of land being developed into residential lots was previously actively cultivated agricultural land, effects to protected and endangered species are considered to be minimal.

A request was submitted to the Manitoba Conservation Data Centre to inquire about any protected or endangered species known to be in the area. The search revealed that no protected or endangered species are known to be in close proximity to the proposed lagoon expansion.

3.6. Socioeconomic Environment

The socioeconomic environment is not a large factor in the development, as the lagoon expansion is being constructed adjacent to the existing Meadowbrook Village, north of the existing lagoon. The nearest neighbouring residence not associated with Meadowbrook Village will be located approximately 300 meters away, as per Figure 4.

Figure 4: Neighbouring Residence

The nearest residence within the existing Meadowbrook Village is approximately 183 meters away from the existing lagoon. With the lagoon location shifting north, this distance will increase to 260 meters from the proposed lagoon to nearest existing residence. The residences to the west will be located 210 meters away from the

existing and proposed lagoon as the setback will not change. These distances are less than the 300 meter setbacks within as outlined in the *Information Bulletin – Design Objectives for Wastewater Treatment Lagoons* by Manitoba Conservation. The setbacks have been determined to be acceptable however as they are part of Meadowbrook Village, which is serviced by the wastewater lagoon.

One important factor to take into consideration would be the odour produced by the facility. As the existing facility is overloaded both organically and hydraulically, it likely produces more odour than a properly designed and sized facility. The new facility will not be overloaded, and it is likely that the odours would be reduced below existing levels minimizing the socioeconomic impact to the residences in the area.

4. Description of Environmental and Health Effects of the Proposed Development

4.1. Impact on Biophysical Environment

4.1.1. Construction

Construction of the new lagoon will involve land clearing, excavation, and construction of the lagoon berm walls, infrastructure, and liner. As the existing land use is currently agricultural and used for the existing lagoon, the impact on the natural terrestrial environment is expected to be minimal. Furthermore, as the lagoon expansion is being constructed directly between Meadowbrook Village and PTH No.1, the site should not be attractive to wildlife.

4.1.2. Operation

Following lagoon construction, no impact is expected on local groundwater. A properly designed and functioning lagoon will not allow wastewater to infiltrate into the surrounding environment except during wastewater discharge, which only occurs once wastewater has been treated to acceptable levels. For a detailed review of the facility operation, please refer back to Section 2.6.

4.2. Type, Quantity and Concentration of Pollutants

4.2.1. General

Treated effluent, tested according to the Manitoba Conservation license requirements, will be discharged into the natural drainage ditch leading to Glen Lea Golf Course's irrigation reservoir as shown in Appendix C and Figure 1. As is commonly allowed in lagoon licenses, effluent will be discharged between June 15th and November 1st of any year. Effluent must be tested to determine whether it is consistent with Manitoba Sustainable Development

guidelines. Regulations for nutrient concentrations are laid out in The Water Protection Act. The Act sites Manitoba Water Quality Standards, Objectives, and Guidelines for the limits on acceptable wastewater discharge.

Odour is only expected to be a factor during spring and fall turnover, as this the time when noxious gases are released. This will be mitigated by the fact that the prevailing wind should direct the odours away from Meadowbrook Village. Furthermore, the nearest neighboring community is approximately 1.7 km away, giving time for the odour to disperse. The period which odours are released is short and likely will not be a nuisance for residents in the immediate area.

4.2.2. Phosphorus

The limit for phosphorus concentration for an equivalent population less than 2,000 is 1 mg/L or a demonstrated nutrient reduction strategy. Testing will be performed two weeks prior to discharge to determine whether the effluent is suitable for release. The plant-life along the drainage ditch will uptake additional phosphorus as part of their natural processes, effectively cleansing the effluent. As per typical lagoon discharge operations, a trickle discharge over a 2 week interval will be utilized to minimize phosphorus concentrations from impacting the water quality at one specific point.

If there is consistent difficulty in meeting the phosphorus concentration targets or if regulations become more conservative in the future, a more intensive nutrient reduction strategy will be implemented. Phosphorus reduction will have to include the addition of aluminum sulfate (alum) to cause phosphorus to settle. Once the flocculent has settled, it can be collected off the cell bottom once the lagoon is drained.

4.2.3. Other Nutrients

Other nutrients of concern during testing include nitrogen, total coliforms / fecal coliforms, 5-day biochemical oxygen demand, and total suspended solids. All parameters will be tested according to the standards set out in the Manitoba Water Quality Standards, Objectives and Guidelines 2011 document. In the event that any of the tests fail, water will be re-tested according to the procedure set out in Section 2.6.

4.3. Fish Habitat

The Department of Fisheries and Oceans has made available on their website maps detailing fish habitat across Manitoba. The maps are part of a report published by D.W. Milani titled, "Fish community and fish habitat inventory of streams and constructed drains throughout agricultural areas of Manitoba (2002 - 2006)". We have included a map showing the Meadowbrook Village lagoon discharge location in Appendix E. As

the map demonstrates, the discharge location is near a Habitat E location, unconnected to any other habitat location and approximately 1.5 km away from a Habitat C location which has been marked "B-04-088" as a "No Catch" location. Habitat E indicates the absence of sufficient flow duration for fish to complete one or more of their life processes. The flow rate is slowed by plant-life which improves sedimentation processes and allows for increased absorption into the stream bed. This also allows for increased absorption by native plant-life. Overall, the discharge route makes use of the natural cleansing processes of streams and rivers to fully treat the effluent; therefore, no fish impact is expected.

4.4. Socio-Economic, Climate Change Implications

Meadowbrook Village requires a new wastewater treatment system to adequately provide wastewater treatment to the existing park residents, as well as for future development and expansion to the park.

As this lagoon and proposed expansion is taking advantage of natural treatment processes, no significant climate change impacts are expected.

4.5. Potential Impact on Human Health and Safety

The site location is adjacent to Meadowbrook Village. Common practice according to Manitoba Conservation guidelines is to construct a lagoon with a minimum setback of 300 meters from any individual residence. However, this is an existing facility, and the use of a lagoon in this location has already been established, see Section 3.6.

Safety features will include a 6-foot tall fence and descriptive signs to discourage unauthorized access to the lagoon, and to make known the potential danger. In the event that someone enters the lagoon facility area unauthorized and falls in, the 4:1 slopes armoured with rip-rap should provide sufficient surface to assist the person in exiting the water.

The effluent discharge route was examined to determine if there were any downstream users within sufficient range to be affected. As per Section 2.5, effluent discharge does not impact any nearby drains and subsequently will not affect any public downstream users.

Therefore, no impact on human health and safety is expected.

4.5.1. Wastewater Irrigation on Glen Lea Golf Course

BMCE conducted a review of available documentation to determine the potential impact of human health and safety from the use of wastewater for irrigation purposes on the adjacent golf course. Manitoba does not currently have any regulations associated with wastewater irrigation; therefore, BMCE will use the Alberta *Guidelines for Municipal Wastewater Irrigation 2000* and the

Alberta *Code of Practice for Wastewater Systems Using a Wastewater Lagoon 2003* for the basis of our rationale.

BMCE also conducted a review of the current License No. 2441 issued February 18, 2000 for the existing lagoon and found the discharge requirements stated to be equal to or more stringent than the Alberta guidelines for wastewater irrigation of a golf course or park.

Therefore, if irrigation is conducted in accordance with the new license issued by Manitoba Sustainable Developments and the Alberta guidelines for wastewater irrigation, impacts to human health and safety will be negligible.

5. Mitigation Measures and Residual Environmental Effects

5.1. Protection

Practices to be used during construction of the lagoon are common to projects of a similar nature. As there is already an existing facility, and the expansion will be built on previously cultivated farmland, we anticipate that the proposed design will not adversely affect the environment. A clay-lined lagoon will provide environmentally sound storage and treatment of wastewater.

5.2. Monitoring

On-going monitoring of the lagoon will be performed to ensure the proper functioning of the lagoon. Regular inspection will ensure that there is no damage to the lagoon from erosion, failures or other causes. Further attention will be paid to odour, and if excessive odour is noticeable the cause will be identified and dealt with accordingly. The general condition of the lagoon will be observed on an ongoing basis during all seasons.

Appendix A – Glen Lea Golf Course Caveat

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
MAR 18 2015
BRANDON, MAN.

LTO USE ONLY

FEES CHECKED	REFUND AMOUNT

Certificate of Registration

Registered this date AUG - 6 1999

as No. 101,7402

I certify that the within instrument was registered in the BRANDON Land Titles Office and entered on Title No. 170998, 1428498

For District Registrar

CAVEAT

LAND TITLES OFFICE
AUG - 6 1999
BRANDON, MAN.

Meighen, Haddad & Co. - Form 18.1

AUG 11 1999

101,7402

e) Subject to the terms of this Agreement (the "Agreement"), the parties, for themselves and for and on behalf of their assigns and successors wish to entitle Campbell, for his benefit and for the benefit of Glen Lea to discharge contents from the waste water treatment lagoon (the "effluent") over, upon and into the Glen Lea land from time to time and that pursuant to this Agreement, a Caveat be filed;

NOW THEREFORE, for value received and in consideration of the Agreements and promises herein contained, and for other good and valuable consideration (the receipt and sufficiency whereof each of the parties hereby acknowledges), Campbell and Glen Lea do hereby covenant and agree, to and with each other, as follows:

1. a) The preamble hereto and all schedules annexed hereto are specifically incorporated by reference thereto herein.

b) Unless otherwise specified herein, or the context hereof otherwise necessarily requires, the expressions "Campbell" and "Glen Lea" shall mean the parties to this Agreement who execute it and each of their respective successors entitled to, respectively, the Campbell land and the Glen Lea land.

2. Subject to the provisions hereof, Glen Lea hereby grants, transfers, assigns and conveys to Campbell an exclusive easement and right for the benefit of the Campbell land and its successors in title thereto and those claiming under and through such owners, in and against the Glen Lea lands and binding Glen Lea and the successors in title to the Glen Lea land and those claiming under or through Glen Lea and such other successors, to discharge effluent from the waste water treatment lagoon into, over and upon the Glen Lea land in such amounts, and in such manner and by such means and onto such parts of the Glen Lea land as may be authorized from time to time in accordance with the licence then in effect as issued to Campbell in accordance with the Manitoba Environment Act or such other or successor legislation as may be in force now or hereafter.

3. Glen Lea does hereby further grant, transfer, assign and convey to Campbell the right, by one or more employees, agents or contractors of Campbell as Campbell determines necessary, to enter upon the Glen Lea land from time to time in furtherance of and in conjunction with the rights and easements granted to Campbell pursuant to the preceding paragraph.

4. Campbell shall obtain, at his own expense, all required authorizations, permits and licences from any provincial, federal or municipal authority as may be required from time to time to permit the lawful exercise of the easements and rights herein provided by Glen Lea to Campbell.

5. Campbell shall, at all times, comply with the conditions and requirements contained in such authorizations, permits and licences and shall exercise the rights granted herein wholly in compliance with the same.

6. Notwithstanding anything hereinbefore or hereinafter contained or set forth, the parties covenant and agree as follows:

a) effluent shall be discharged from the waste water treatment lagoon into, over and upon the Glen Lea land only at such times as the golf course situate on the Glen Lea land is closed to the public;

b) the golf course shall not be opened for use to the public while any pools or puddles of effluent remain on the surface of the Glen Lea land;

c) only low angle spray nozzles shall be used in the discharge of effluent onto the Glen Lea land;

d) permanent signs having letters not less than 5 cm in height shall be installed at all access points to the golf course situate on the Glen Lea land advising of the use of treated effluent for irrigation purposes; and

e) treated effluent shall be discharged for irrigation only when weather conditions and irrigation spray locations are such that effluent will not be carried onto public roadways or onto adjacent properties.

7. The costs associated with the discharge of treated effluent as contemplated by the terms of this Agreement, and the maintenance of any machinery or equipment utilized for that purpose shall be borne by the parties in such proportions as they from time to time agree upon.

8. Provided that Campbell fulfills the requirements of this Agreement, Glen Lea shall have no claim of any nature or kind whatsoever against Campbell, whether in nuisance or otherwise, by reason of anything done by or on behalf of Campbell in exercising any of Campbell's rights hereunder.

9. Any notice, document or other communication required, permitted or desired to be given hereunder or with respect to the subject matters hereof shall be in writing and shall be deemed to have been duly given if delivered by hand, mailed by prepaid registered mail, telexed or telecopied to the party to which it is to be given as follows:

a) to Campbell:
Box 11 Campbell's Mobile Home Park
R.R. #5, Brandon, Manitoba R7A 5Y5

b) to Glen Lea:
Box 17, Site 500, R.R. #5
Brandon, Manitoba R7A 5Y5

or to such other address as either of the parties hereto may respectively in writing advise the other. Any such notice, document or other communication shall be deemed to have been given and received if delivered, when delivered, and if mailed, on the

fourth business day following the mailing thereof, and if sent by telex or telecopy, 9:00 a.m. on the business day next following the day the same has been transmitted. In the event of the occurrence of a disruption in the mail for any reason whatsoever or a disruption is reasonably anticipated, notice shall not be given by mail.

IN WITNESS WHEREOF, Allen John Campbell has hereunto set his hand and seal this 4th day of August, 1999.

SIGNED,SEALD AND DELIVERED)
IN THE PRESENCE OF)
)
)
Witness)

Allen John Campbell

IN WITNESS WHEREOF 2528887 Manitoba Ltd. has affixed the hand of its proper officers in that behalf this 4th day of August, 1999.

2528887 MANITOBA LTD.

PER:
President

Appendix B – Certificate of Title

STATUS OF TITLE

Title Number **2827368/2**
Title Status **Accepted**
Client File 6843191 Manitoba Ltd

The Property Registry
A Service Provider for the Province of Manitoba

1. REGISTERED OWNERS, TENANCY AND LAND DESCRIPTION

6843191 MANITOBA LTD.

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

THE NLY 1320 FEET PERP OF
THE NE 1/4 OF SECTION 33-10-18 WPM
EXC ROAD PLAN 1661 BLTO

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:	**Old System Miscellaneous**
Registration Number:	**OS143851/2**
Instrument Status:	**Accepted**
Registration Date:	1974-04-25
From/By:	MANITOBA TELELPHONE SYSTEM
To:	
Amount:	
Notes:	R/W AGREEMENT - PT
Description:	No description

Instrument Type:	**Caveat**
Registration Number:	**1084948/2**
Instrument Status:	**Accepted**
Registration Date:	2000-09-06
From/By:	RURAL MUNICIPALITY OF CORNWALLIS
To:	DONALD JOHN SHELDON AS AGENT
Amount:	
Notes:	No notes
Description:	WRITTEN DEVELOPMENT AGREEMENT DATED 22 JUNE 2000

Instrument Type:	**Caveat**
Registration Number:	**1096819/2**
Instrument Status:	**Accepted**
Registration Date:	2001-06-13
From/By:	MTS COMMUNICATIONS INC.
To:	WILLIAM F. JOHNSTONE AS AGENT
Amount:	
Notes:	ELY 20M
Description:	RT OF WAY AGRT DATED 19 AUGUST 1991

Instrument Type:	**Caveat**
Registration Number:	**1110576/2**
Instrument Status:	**Accepted**
Registration Date:	2002-03-27
From/By:	THE MANITOBA HYDRO-ELECTRIC BOARD
To:	W. BRUCE MACFARLANE AS AGENT
Amount:	
Notes:	PT RE: PLAN 40410
Description:	GRANT OF EASEMENT AGREEMENT DATED JULY 18, 2001

Instrument Type:	**Mortgage**
Registration Number:	**1393524/2**
Instrument Status:	**Accepted**
Registration Date:	2016-02-18
From/By:	6843191 MANITOBA LTD.
To:	VANGUARD CREDIT UNION LIMITED
Amount:	$3,343,000.00
Notes:	No notes
Description:	No description

3. ADDRESSES FOR SERVICE

6843191 MANITOBA LTD.
4250 PORTAGE AVENUE
HEADINGLEY MB
R4H 1C6

4. TITLE NOTES

No title notes

5. LAND TITLES DISTRICT

Brandon

6. DUPLICATE TITLE INFORMATION

Duplicate not produced

7. FROM TITLE NUMBERS

1705617/2 All

8. REAL PROPERTY APPLICATION / CROWN GRANT NUMBERS

No real property application or grant information

9. ORIGINATING INSTRUMENTS

Instrument Type:	**Transfer Of Land**
Registration Number:	**1393523/2**
Registration Date:	2016-02-18
From/By:	VERNA ELAINE CAMPBELL
To:	6843191 MANITOBA LTD.
Consideration:	$1,710,000.00

10. LAND INDEX

NE 33-10-18W
NLY 1320' EX RD PL 1661

CERTIFIED TRUE EXTRACT PRODUCED FROM THE LAND TITLES DATA STORAGE SYSTEM OF TITLE NUMBER 2827368/2

STATUS OF TITLE

Title Number **2827369/2**
Title Status **Accepted**
Client File 6843191 Manitoba Ltd

The Property Registry
A Service Provider for the Province of Manitoba

1. REGISTERED OWNERS, TENANCY AND LAND DESCRIPTION

6843191 MANITOBA LTD.

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

THE NE 1/4 OF SECTION 33-10-18 WPM
EXC THE NLY 1320 FEET PERP

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:	**1067402/2**
Instrument Status:	**Accepted**
Registration Date:	1999-08-06
From/By:	ALLEN JOHN CAMPBELL
To:	WARREN GEORGE BARBER AS AGENT
Amount:	
Notes:	DOMINANT
Description:	EASEMENT AGRT DATED 4 AUG 1999

Instrument Type:	**Caveat**
Registration Number:	**1084948/2**
Instrument Status:	**Accepted**
Registration Date:	2000-09-06
From/By:	RURAL MUNICIPALITY OF CORNWALLIS
To:	DONALD JOHN SHELDON AS AGENT
Amount:	
Notes:	No notes
Description:	WRITTEN DEVELOPMENT AGREEMENT DATED 22 JUNE 2000

Instrument Type:	**Caveat**
Registration Number:	**1096819/2**
Instrument Status:	**Accepted**
Registration Date:	2001-06-13
From/By:	MTS COMMUNICATIONS INC.
To:	WILLIAM F. JOHNSTONE AS AGENT
Amount:	
Notes:	ELY 20M
Description:	RT OF WAY AGRT DATED 19 AUGUST 1991

Instrument Type:	**Caveat**
Registration Number:	**1110576/2**
Instrument Status:	**Accepted**
Registration Date:	2002-03-27
From/By:	THE MANITOBA HYDRO-ELECTRIC BOARD
To:	W. BRUCE MACFARLANE AS AGENT
Amount:	
Notes:	PT RE: PLAN 40410
Description:	GRANT OF EASEMENT AGREEMENT DATED JULY 18, 2001

Instrument Type:	**Easement Declaration**
Registration Number:	**1323835/2**
Instrument Status:	**Accepted**
Registration Date:	2012-10-03
From/By:	VERNA ELAINE CAMPBELL
To:	
Amount:	
Notes:	No notes
Description:	No description

Instrument Type:	**Mortgage**
Registration Number:	**1393524/2**
Instrument Status:	**Accepted**
Registration Date:	2016-02-18
From/By:	6843191 MANITOBA LTD.
To:	VANGUARD CREDIT UNION LIMITED
Amount:	$3,343,000.00
Notes:	No notes
Description:	No description

Instrument Type:	**Easement**
Registration Number:	**1401083/2**
Instrument Status:	**Accepted**
Registration Date:	2016-07-08
From/By:	6843191 MANITOBA LTD.
To:	THE MANITOBA HYDRO-ELECTRIC BOARD AND MTS INC.
Amount:	
Notes:	No notes
Description:	STATUTORY EASEMENT

Instrument Type:	**Easement**
Registration Number:	**1401937/2**
Instrument Status:	**Accepted**
Registration Date:	2016-07-27
From/By:	6843191 MANITOBA LTD.
To:	MTS INC.
Amount:	
Notes:	No notes
Description:	STATUTORY EASEMENT

3. ADDRESSES FOR SERVICE

6843191 MANITOBA LTD.
4250 PORTAGE AVENUE
HEADINGLEY MB
R4H 1C6

4. TITLE NOTES

No title notes

5.	**LAND TITLES DISTRICT** Brandon
6.	**DUPLICATE TITLE INFORMATION** Duplicate not produced
7.	**FROM TITLE NUMBERS** 1705611/2 All
8.	**REAL PROPERTY APPLICATION / CROWN GRANT NUMBERS** No real property application or grant information
9.	**ORIGINATING INSTRUMENTS** Instrument Type: **Transfer Of Land** Registration Number: **1393523/2** Registration Date: 2016-02-18 From/By: VERNA ELAINE CAMPBELL To: 6843191 MANITOBA LTD. Consideration: $1,710,000.00
10.	**LAND INDEX** NE 33-10-18W EX NLY 1320'

CERTIFIED TRUE EXTRACT PRODUCED FROM THE LAND TITLES DATA STORAGE SYSTEM OF TITLE NUMBER 2827369/2

STATUS OF TITLE

Title Number **2827370/2**
Title Status **Accepted**
Client File 6843191 Manitoba Ltd

The Property Registry
.A Service Provider for the Province of Manitoba

1. REGISTERED OWNERS, TENANCY AND LAND DESCRIPTION

6843191 MANITOBA LTD.

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

LOT 2 PLAN 30444 BLTO
IN SE 1/4 33-10-18 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:	**R133071/2**
Instrument Status:	**Accepted**
Registration Date:	1978-11-24
From/By:	MANITOBA HYDRO-ELECTRIC BOARD, ETAL
To:	
Amount:	
Notes:	No notes
Description:	No description

Instrument Type:	**Caveat**
Registration Number:	**R134930/2**
Instrument Status:	**Accepted**
Registration Date:	1979-02-23
From/By:	THE R.M. OF CORNWALLIS
To:	
Amount:	
Notes:	No notes
Description:	No description

Instrument Type:	**Caveat**
Registration Number:	**R146455/2**
Instrument Status:	**Accepted**
Registration Date:	1980-09-03
From/By:	THE R.M. OF CORNWALLIS
To:	
Amount:	
Notes:	No notes
Description:	No description

Instrument Type:	**Caveat**
Registration Number:	**R148188/2**
Instrument Status:	**Accepted**
Registration Date:	1980-12-04
From/By:	THE R.M. OF CORNWALLIS
To:	
Amount:	
Notes:	No notes
Description:	No description

Instrument Type:	**Caveat**
Registration Number:	**84-5874/2**
Instrument Status:	**Accepted**
Registration Date:	1984-07-10
From/By:	MANITOBA TELEPHONE SYSTEM
To:	
Amount:	
Notes:	PART
Description:	No description

Instrument Type:	**Caveat**
Registration Number:	**1063404/2**
Instrument Status:	**Accepted**
Registration Date:	1999-05-21
From/By:	ALLAN JOHN CAMPBELL
To:	WARREN BARBER AS AGENT
Amount:	
Notes:	DOMINANT
Description:	EASEMENT AGREEMENT DATED 9 JUNE 1998

Instrument Type:	**Caveat**
Registration Number:	**1063405/2**
Instrument Status:	**Accepted**
Registration Date:	1999-05-21
From/By:	ALLAN JOHN CAMPBELL
To:	WARREN BARBER AS AGENT
Amount:	
Notes:	DOMINANT
Description:	EASEMENT AGREEMENT DATED 9 JUNE 1998

Instrument Type:	**Personal Property Security Notice**
Registration Number:	**1317853/2**
Instrument Status:	**Accepted**
Registration Date:	2012-07-19
From/By:	VANGUARD CREDIT UNION LIMITED
To:	ALICIA LEANNE MACGILL, TENANT
Amount:	
Notes:	No notes
Description:	INTEREST EXPIRES JULY 13, 2017. AGENT JARETT D. KEHLER

Instrument Type:	**Easement Declaration**
Registration Number:	**1323835/2**
Instrument Status:	**Accepted**
Registration Date:	2012-10-03
From/By:	VERNA ELAINE CAMPBELL
To:	
Amount:	
Notes:	No notes
Description:	No description

Instrument Type:	**Mortgage**
Registration Number:	**1393524/2**
Instrument Status:	**Accepted**
Registration Date:	2016-02-18
From/By:	6843191 MANITOBA LTD.
To:	VANGUARD CREDIT UNION LIMITED
Amount:	$3,343,000.00
Notes:	No notes
Description:	No description

3. ADDRESSES FOR SERVICE

6843191 MANITOBA LTD.
4250 PORTAGE AVENUE
HEADINGLEY MB
R4H 1C6

4. TITLE NOTES

No title notes

5. LAND TITLES DISTRICT

Brandon

6. DUPLICATE TITLE INFORMATION

Duplicate not produced

7. FROM TITLE NUMBERS

1705615/2 All

8. REAL PROPERTY APPLICATION / CROWN GRANT NUMBERS

No real property application or grant information

9. ORIGINATING INSTRUMENTS

Instrument Type:	**Transfer Of Land**
Registration Number:	**1393523/2**
Registration Date:	2016-02-18
From/By:	VERNA ELAINE CAMPBELL
To:	6843191 MANITOBA LTD.
Consideration:	$1,710,000.00

10. LAND INDEX

Lot 2 Plan 30444
SE 1/4 33-10-18W

CERTIFIED TRUE EXTRACT PRODUCED FROM THE LAND TITLES DATA STORAGE SYSTEM OF TITLE NUMBER 2827370/2

Appendix C – Drawing Package

BURNS MAENDEL
CONSULTING ENGINEERS LTD.

1331 Princess Ave.
Brandon, Manitoba
R7A 0R4
Tel: (204) 728-7364
Fax: (204) 728-4418

MEADOWBROOK VILLAGE WASTEWATER LAGOON DESIGN

NE 33-10-18 WPM
RM OF CORNWALLIS

CIVIL DRAWINGS

DWG NO.	DRAWING NAME	REV
C1.1	LAGOON LOCATION PLAN	0
C1.2	LAGOON PLAN VIEW	0
C3.1	SECTIONS & DETAILS	0
C3.2	SECTIONS & DETAILS	0
C3.3	SECTIONS & DETAILS	0

BUILDING DRAWINGS

DWG NO.	DRAWING NAME	REV

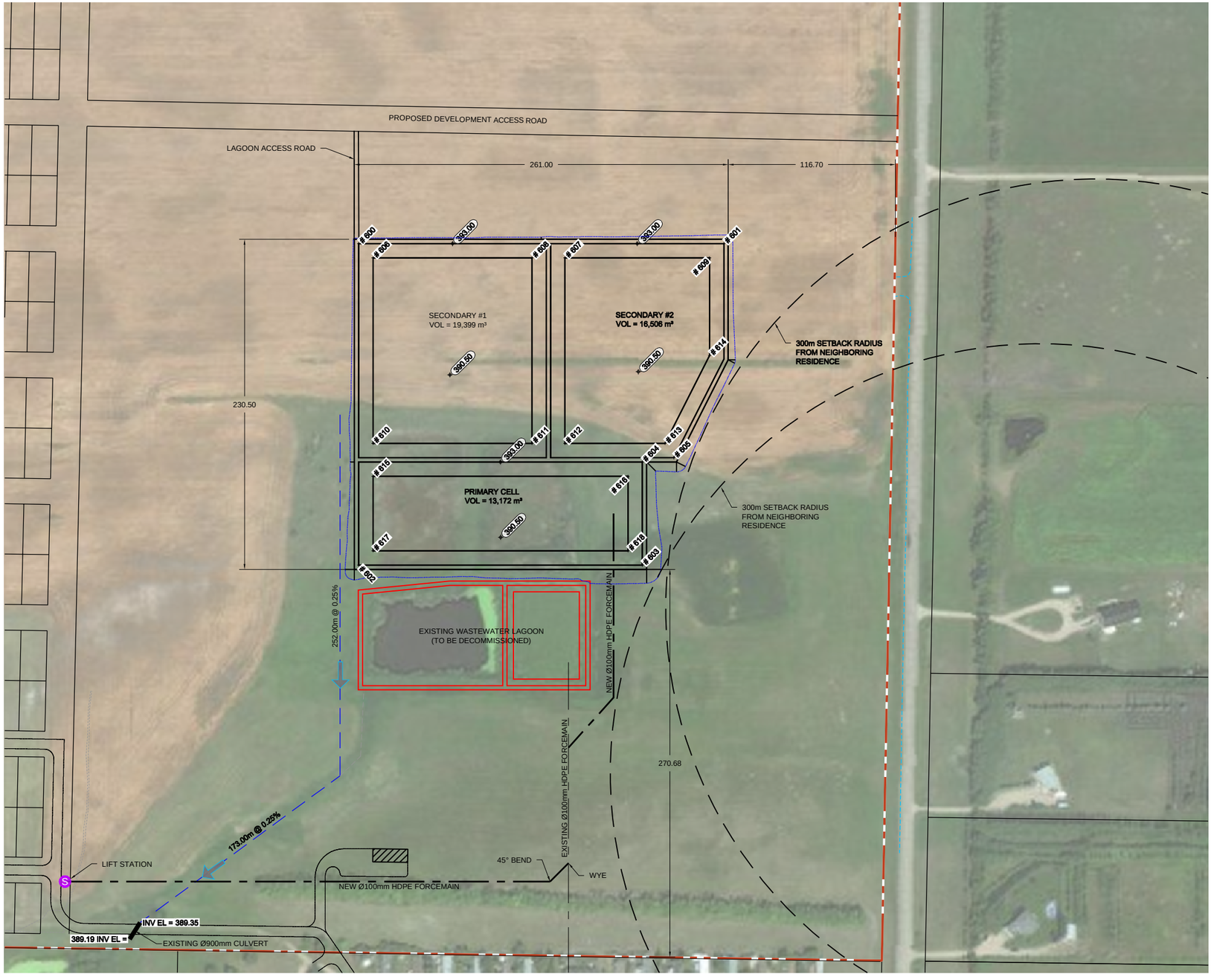
STRUCTURAL DRAWINGS

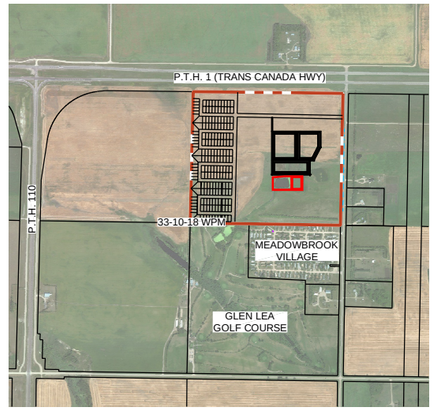
DWG NO.	DRAWING NAME	REV

PROJECT DESCRIPTION

DATE
MAR 28, 2017

PROJECT NO:
BMCE16-109-330





LOCATION PLAN

SCALE: N.T.S.

GENERAL NOTES

1. DECIMALIZED NUMBERS INDICATE METRES AND WHOLE NUMBERS INDICATE MILLIMETRES,
2. EXISTING FEATURE LOCATIONS & PROPERTY LINE INFORMATION IS DERIVED FROM SURVEY INFORMATION COLLECTED BY RICHMOND SURVEYS.
3. CONFIRMATION OF EXISTENCE AND EXACT LOCATION OF ALL SERVICES MUST BE OBTAINED FROM THE INDIVIDUAL UTILITIES BEFORE PROCEEDING WITH CONSTRUCTION.
4. ALL CONSTRUCTION TO BE IN ACCORDANCE WITH THE LATEST EDITION OF MANITOBA WATER SERVICES BOARD STANDARD CONSTRUCTION SPECIFICATIONS.

POINT TABLE

POINT #	ELEVATION	NORTHING	EASTING
600	393.00	5526081.50	438661.25
601	393.00	5526081.50	438916.25
602	393.00	5525857.00	438661.25
603	393.00	5525857.00	438859.25
604	393.00	5525929.00	438859.25
605	393.00	5525932.00	438881.25
606	390.50	5526071.50	438671.25
607	390.50	5526071.50	438805.25
608	390.50	5526071.50	438782.25
609	390.50	5526071.50	438906.25
610	390.50	5525942.00	438671.25
611	390.50	5525942.00	438782.25
612	390.50	5525942.00	438805.25
613	390.50	5525942.00	438875.11
614	390.50	5526003.39	438906.25
615	390.50	5525919.00	438671.25
616	390.50	5525919.00	438849.25
617	390.50	5525867.00	438671.25
618	390.50	5525867.00	438849.25

LEGEND

PROPERTY LINE	
CONTOUR LINE	
PROPOSED ELEVATION	✦ 100.00
POINT TABLE #	✦ # 600
PROPOSED DITCH/SWALE	
OUTSIDE TOE OF BERM	
MAJOR DRAINAGE ARROW	

3	MAR 28, 2017	D.B.	J.K.	ISSUED FOR CONSTRUCTION
2	JAN 23, 2017	D.B.	J.K.	ISSUED FOR PRELIMINARY INFORMATION
NO:	DATE	APP.	BY	DESCRIPTION

REVISIONS

APEGM
Certificate of Authorization
Burns Maendel Consulting Engineers Ltd.
No. 4559 Expiry: April 30, 2018

PROVINCE OF MANITOBA — D. J. BURNS — Member 21509 — REGISTERED PROFESSIONAL ENGINEER — Dec 12 2017

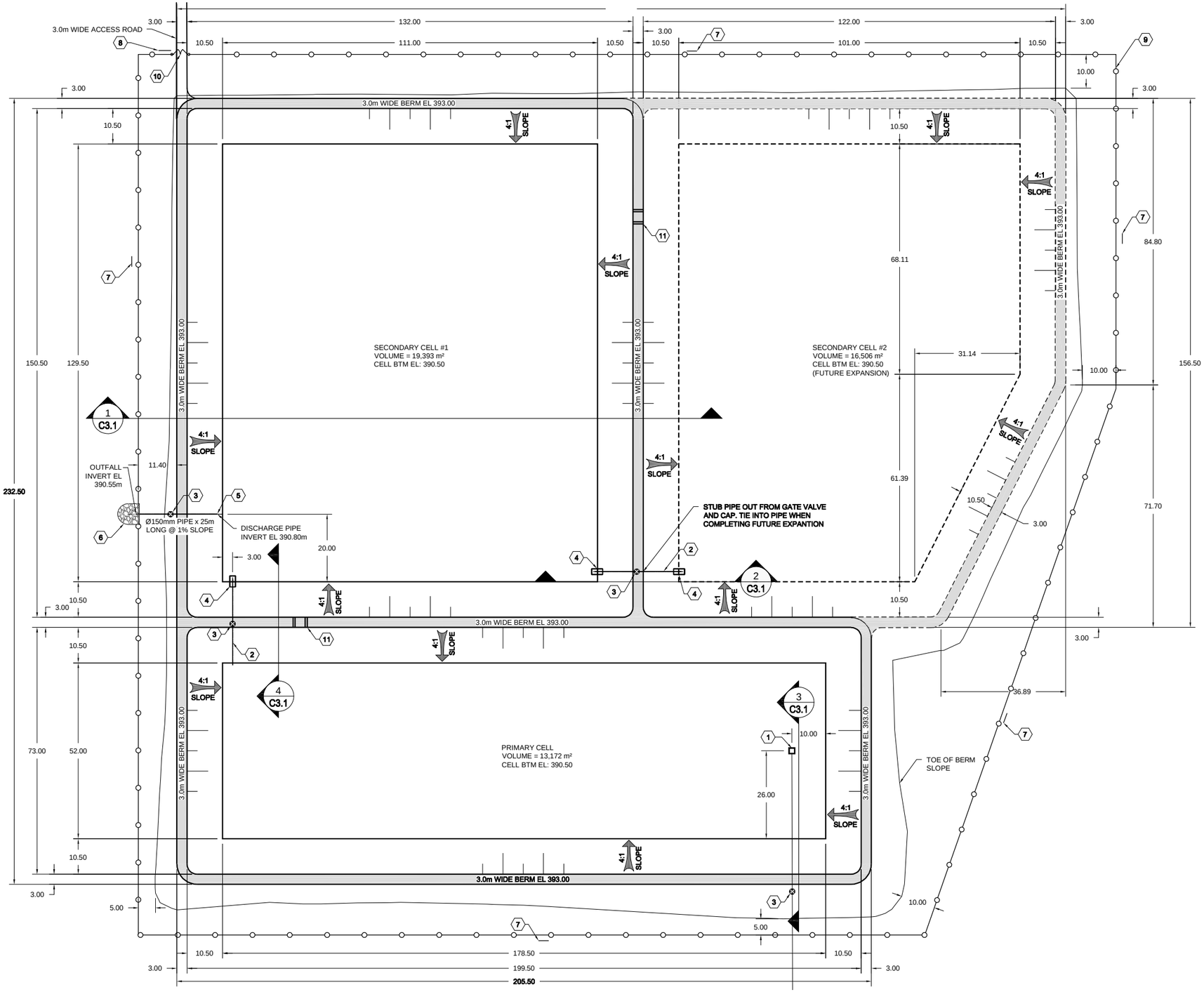
DESIGNED BY: R.J. | REVIEWED BY: D.B.
DRAWN BY: J.K.
PROJECT START DATE: SEP 2016
PLOT SIZE: A1 (594x841)
SCALE: 1:1500

PROJECT NAME:
MEADOWBROOK VILLAGE
WASTEWATER LAGOON DESIGN
NE 33-10-18 WPM, RM OF CORNWALLIS

BURNS MAENDEL CONSULTING ENGINEERS LTD.
1331 Princess Ave.
Brandon, Manitoba
R7A 0R4
Tel: (204) 728-7364
Fax: (204) 728-4418

DRAWING TITLE:
LAGOON LOCATION PLAN

PROJECT NUMBER: BMCE16-109-330
DRAWING NO: C1.1



GENERAL NOTES

1. DECIMALIZED NUMBERS INDICATE METRES AND WHOLE NUMBERS INDICATE MILLIMETRES,
2. EXISTING FEATURE LOCATIONS & PROPERTY LINE INFORMATION IS DERIVED FROM SURVEY INFORMATION COLLECTED BY RICHMOND SURVEYS.
3. CONFIRMATION OF EXISTENCE AND EXACT LOCATION OF ALL SERVICES MUST BE OBTAINED FROM THE INDIVIDUAL UTILITIES BEFORE PROCEEDING WITH CONSTRUCTION.
4. ALL CONSTRUCTION TO BE IN ACCORDANCE WITH THE LATEST EDITION OF MANITOBA WATER SERVICES BOARD STANDARD CONSTRUCTION SPECIFICATIONS.

KEYNOTES

1. 1800 x 1800 x 150mm THICK CONCRETE INLET PAD c/w 200mm HIGH CURB, REFER TO DETAIL ON SHEET C3.2
2. Ø150mm EQUALIZATION PIPE.
3. GATE VALVE. REFER TO DETAIL ON SHEET C3.2
4. 1800mm x 3100mm x 150mm THICK CONCRETE SPLASH PAD w/ 200mm HIGH CURB. REFER TO DETAIL ON SHEET C3.2.
5. Ø150mm DISCHARGE PIPE @ 1.0% SLOPE
6. DISCHARGE PIPE OUTFALL c/w GEOTEXTILE FABRIC AND 3m x 3m x 0.3m OF RIP RAP
7. PERIMETER SIGN. REFER TO SHEET C3.3 FOR DETAILS
8. MAIN ENTRANCE SIGN. REFER TO SHEET C3.3 FOR DETAILS
9. PERIMETER FENCE. REFER TO SHEET C3.3 FOR DETAILS
10. PERIMETER FENCE GATE. REFER TO SHEET C3.3 FOR DETAILS
11. 3.0 m WIDE BERM NOTCH. DROP BERM 100mm @ 4:1 SLOPE. BER NOTCH BETWEEN SECONDARY CELL #1 AND #2 SHALL BE CONSTRUCTED AS PART OF THE FUTURE EXPANSION.

LAGOON DESIGN PARAMETERS:

DOMESTIC LOADING	
DETENTION TIME:	230 DAYS
LOADING RATE:	200 LITRES / PERSON / DAY
POPULATION:	485 PEOPLE
	(795 PEOPLE FUTURE EXPANSION)
ORGANIC LOADING RATE:	0.077kg BOD5 / PERSON / DAY
ORGANIC TREATMENT RATE:	56 kg BOD5 / (HA*DAY)

LAGOON GEOMETRIC PARAMETERS:

CELL HEIGHT (INCLUDES DEAD SPACE):	1.50 m
FREEBOARD:	1.00 m
TOTAL CELL HEIGHT:	2.50 m
INTERIOR SIDE SLOPE:	4:1
EXTERIOR SIDE SLOPE:	5:1
BERM WIDTH:	3.00 m

NO:	DATE	APP.	BY	DESCRIPTION
3	MAR 28, 2017	D.B.	J.K.	ISSUED FOR CONSTRUCTION

REVISIONS

APEGM
Certificate of Authorization
Burns Maendel Consulting Engineers Ltd.
No. 4559 Expiry: April 30, 2018

PROVINCE OF MANITOBA D. A. BURNS Member 21508 REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY:	REVIEWED BY:
R.J.	D.B.

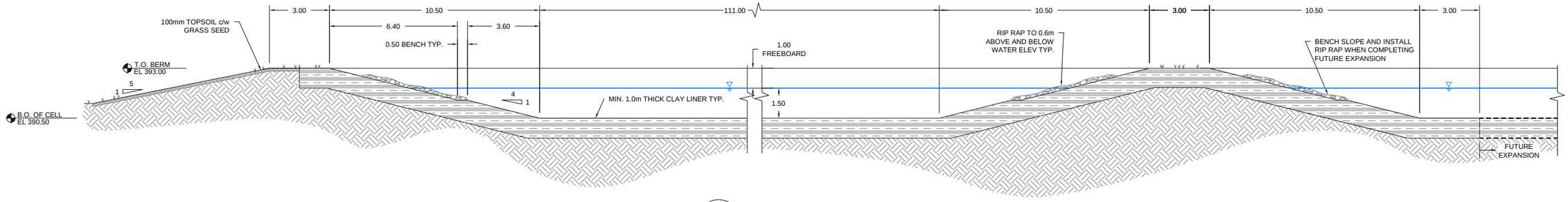
DRAWN BY: J.K.
PROJECT START DATE: SEP 2016
PLOT SIZE: A1 (594x841)
SCALE: 1:600

PROJECT NAME:
MEADOWBROOK VILLAGE
WASTEWATER LAGOON DESIGN
NE 33-10-18 WPM, RM OF CORNWALLIS

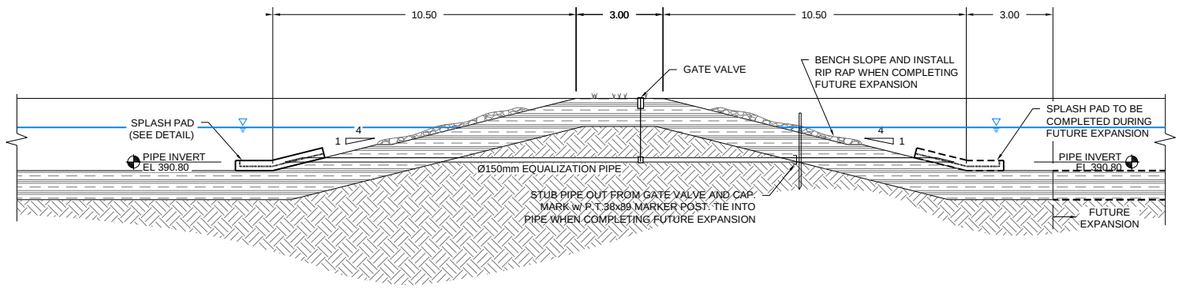
BURNS MAENDEL CONSULTING ENGINEERS LTD.
1331 Princess Ave.
Brandon, Manitoba
R7A 0R4
Tel: (204) 728-7364
Fax: (204) 728-4418

DRAWING TITLE:
LAGOON PLAN VIEW

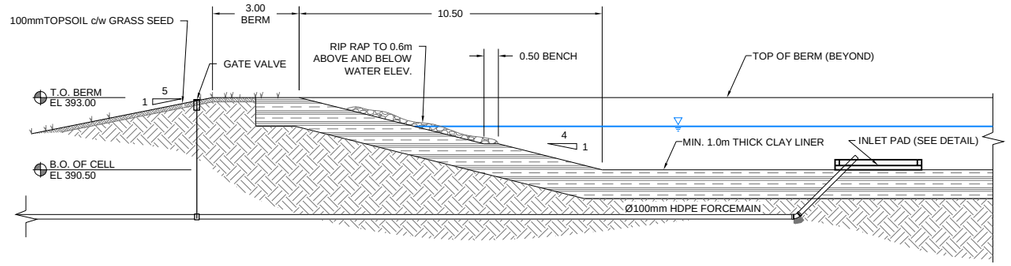
PROJECT NUMBER: BMCE16-109-330
DRAWING NO: C1.2



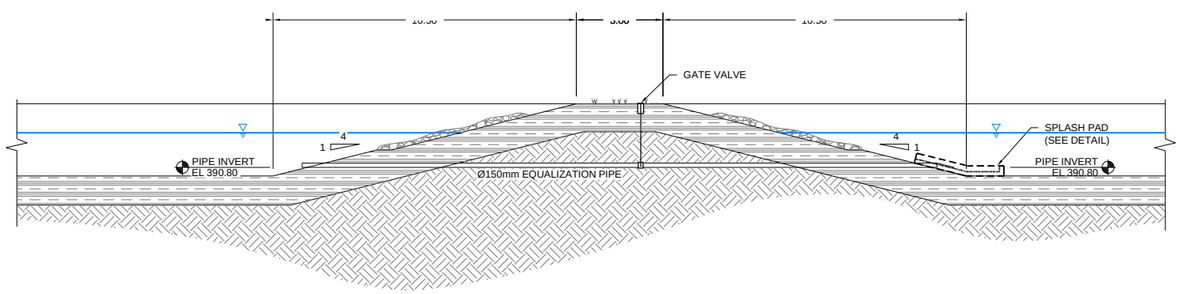
1 C1.2 SECTION
SCALE: 1:100



2 C1.2 SECTION
SCALE: 1:100



3 C1.2 SECTION
SCALE: 1:100



4 C1.2 SECTION
SCALE: 1:100

NO:	DATE	APP.	BY	DESCRIPTION
3	MAR 28, 2017	D.B.	J.K.	ISSUED FOR CONSTRUCTION

REVISIONS

APEGM
Certificate of Authorization
Burns Maendel Consulting Engineers Ltd.
No. 4559 Expiry: April 30, 2018

PROVINCE OF MANITOBA — J. K. BURNS — Member 21508 — REGISTERED PROFESSIONAL ENGINEER — 28 Mar 2017

DESIGNED BY:	REVIEWED BY:
R.J.	D.B.

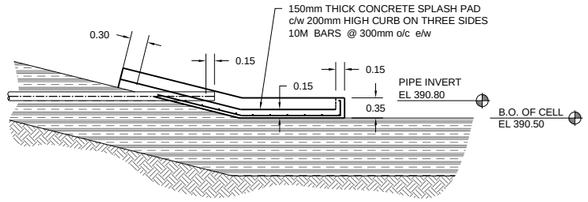
DRAWN BY: J.K.
PROJECT START DATE: SEP 2016
PLOT SIZE: A1 (594x841)
SCALE: AS NOTED

PROJECT NAME:
MEADOWBROOK VILLAGE
WASTEWATER LAGOON DESIGN
NE 33-10-18 WPM, RM OF CORNWALLIS

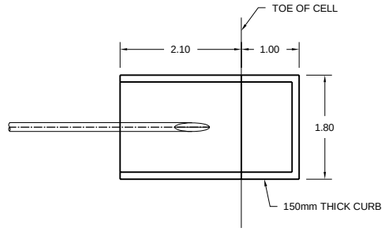
BURNS MAENDEL CONSULTING ENGINEERS LTD.
1331 Princess Ave.
Brandon, Manitoba
R7A 0R4
Tel: (204) 728-7364
Fax: (204) 728-4418

DRAWING TITLE:
SECTIONS & DETAILS

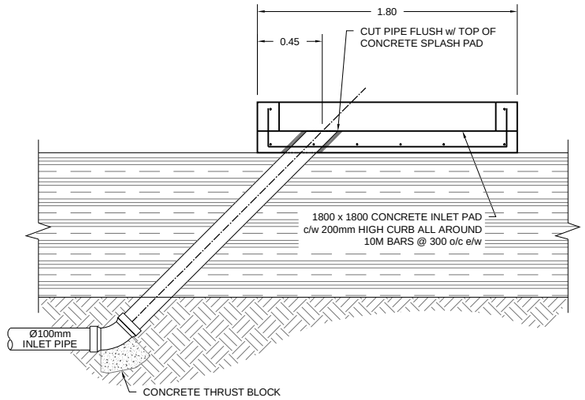
PROJECT NUMBER: BMCE-16-109-330
DRAWING NO: C3.1



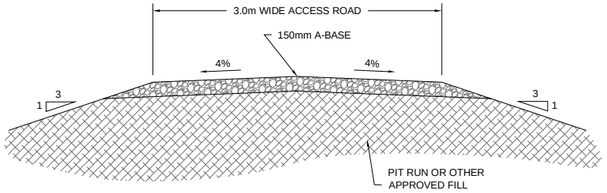
TYPICAL SPLASH PAD DETAIL
SCALE: 1:50



TYPICAL SPLASH PAD - PLAN VIEW
SCALE: 1:50



INLET PAD DETAIL
SCALE: 1:20



ACCESS ROAD DETAIL
SCALE: 1:30

(1) GRADE

(2) DUCTILE IRON UPPER SECTION

(3) 50mm SQUARE OPERATING NUT

(4) STONE DISC.

(5) ADJUSTABLE VALVE BOX

(6) PVC or DUCTILE IRON LOWER SECTION

(7) MINIMUM 50mm SQUARE EXTENSION SPINDLE

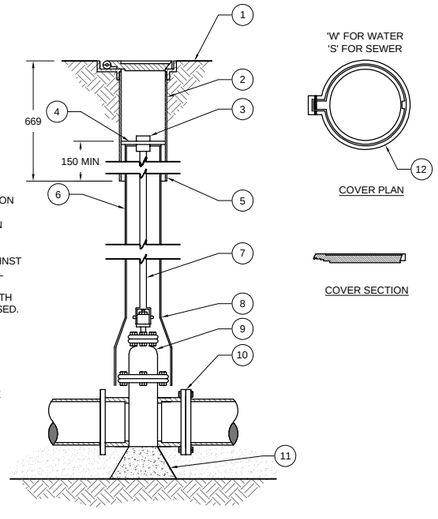
(8) VALVE BOX TO BE PROTECTED AGAINST LATERAL MOVEMENT DURING BACKFILL

(9) AWWA C500 or C509 GATE VALVE WITH JOINTS COMPATIBLE TO PIPE BEING USED. (FLANGED & PUSH ON ARE SHOWN)

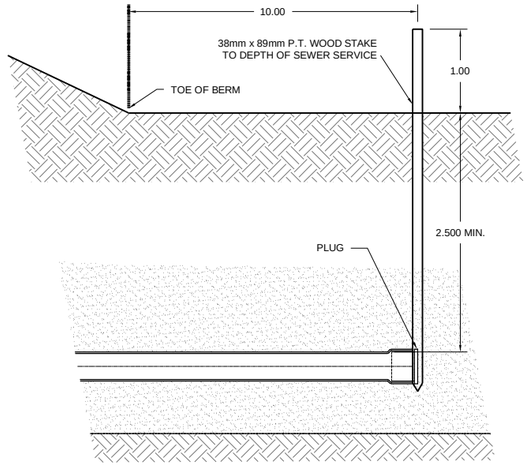
(10) GASKET

(11) THRUST BLOCK SHALL BE CAST IN PLACE BETWEEN GATE VALVE AND UNDISTURBED SOIL. MIN 450W X 450L X 150H.

(12) DUCTILE IRON COVER



TYPICAL GATE VALVE DETAIL
SCALE: 1:10



TYPICAL PIPE STUB DETAIL
SCALE: N.T.S.

3	MAR 28, 2017	D.B.	J.K.	ISSUED FOR CONSTRUCTION
NO:	DATE	APP.	BY	DESCRIPTION

REVISIONS

APEGM
Certificate of Authorization
Burns Maendel Consulting Engineers Ltd.
No. 4559 Expiry: April 30, 2018

PROVINCE OF MANITOBA
D. R. BURNS
Member
21508
REGISTERED PROFESSIONAL ENGINEER
28 Apr 2017

DESIGNED BY: R.J.
REVIEWED BY: D.B.
DRAWN BY: J.K.
PROJECT START DATE: SEP 2016
PLOT SIZE: A1 (594x841)
SCALE: AS NOTED

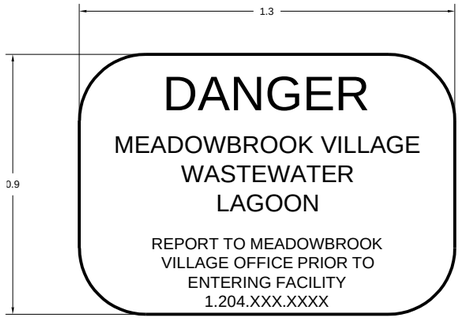
PROJECT NAME:
MEADOWBROOK VILLAGE
WASTEWATER LAGOON DESIGN
NE 33-10-18 WPM, RM OF CORNWALLIS

BURNS MAENDEL
CONSULTING ENGINEERS LTD.
1331 Princess Ave.
Brandon, Manitoba
R7A 0R4
Tel: (204) 728-7364
Fax: (204) 728-4418

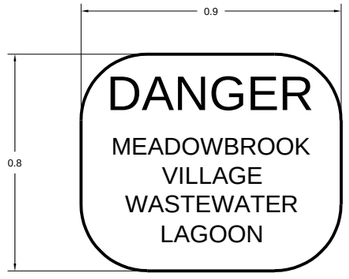
DRAWING TITLE:
SECTIONS & DETAILS

PROJECT NUMBER: BMCE-16-109-330

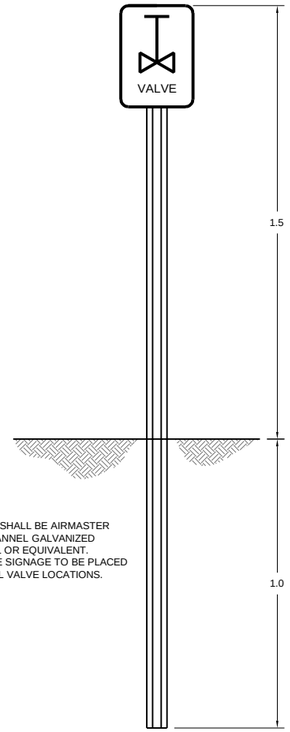
DRAWING NO: C3.2



NOTES:
1) MAIN ENTRANCE SIGNAGE TO BE ATTACHED AND INSTALLED WITH TWO 4x4 PRESSURE TREATED WOOD POSTS.
2) SIGN TO BE CONSTRUCTED OF ALUMINUM AIR MASTER QUALITY OR APPROVED EQUAL.

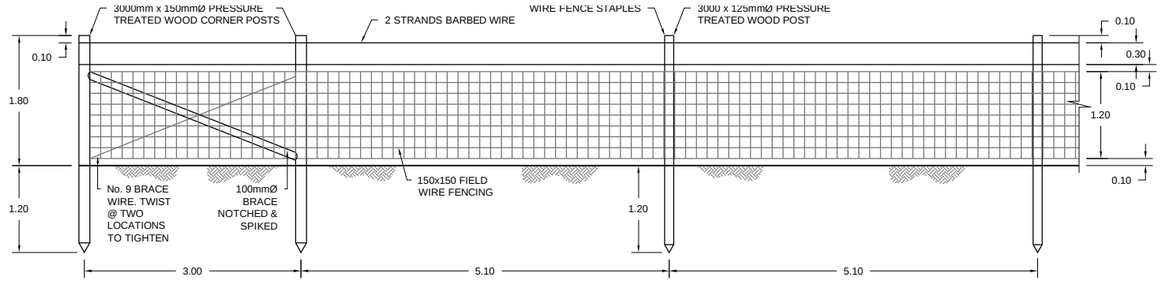


NOTES:
1) PERIMETER SIGNAGE TO BE SECURED TO PERIMETER FENCE POSTS EVERY 50m AROUND ENTIRE FACILITY.
2) SIGNS TO BE CONSTRUCTED OF ALUMINUM AIR MASTER QUALITY OR APPROVED EQUAL.

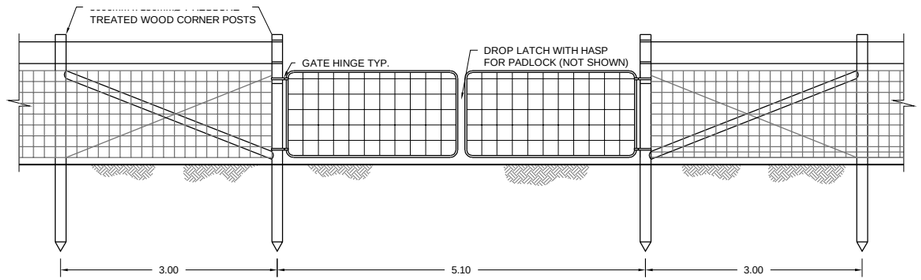


NOTES:
1) POST SHALL BE AIRMASTER U-CHANNEL GALVANIZED STEEL OR EQUIVALENT.
2) VALVE SIGNAGE TO BE PLACED AT ALL VALVE LOCATIONS.

SIGNAGE DETAILS
SCALE: N.T.S.



PAGE WIRE FENCE DETAIL
SCALE: N.T.S.



PAGE WIRE FENCE GATE DETAIL
SCALE: N.T.S.

NO:	DATE	APP.	BY	DESCRIPTION
3	MAR 28, 2017	D.B.	J.K.	ISSUED FOR CONSTRUCTION

REVISIONS

APEGM
Certificate of Authorization
Burns Maendel Consulting Engineers Ltd.
No. 4559 Expiry: April 30, 2018

PROVINCE OF MANITOBA D. BURNS Member 21508 REGISTERED PROFESSIONAL ENGINEER 28 Apr 2017

DESIGNED BY:	REVIEWED BY:
R.J.	D.B.

DRAWN BY: J.K.
PROJECT START DATE: SEP 2016
PLOT SIZE: A1 (594x841)
SCALE: AS NOTED

PROJECT NAME:
MEADOWBROOK VILLAGE
WASTEWATER LAGOON DESIGN
NE 33-10-18 WPM, RM OF CORNWALLIS

BURNS MAENDEL CONSULTING ENGINEERS LTD.
1331 Princess Ave.
Brandon, Manitoba
R7A 0R4
Tel: (204) 728-7364
Fax: (204) 728-4418

DRAWING TITLE:
SECTIONS & DETAILS

PROJECT NUMBER: BMCE-16-109-330
DRAWING NO: C3.3

Appendix D – Geotechnical Investigation

Quality Engineering | Valued Relationships

G.D. Newton & Associates Inc.

Geotechnical Investigation Report
Meadowbrook Lagoon, Manitoba

Prepared for:

Mr. Glen Newton, P.Eng.
G.D. Newton & Associates Inc.
727A – 10th Street
Brandon, Manitoba
R7A 4G7

Project Number:
0252 002 00

Date:
August 11, 2016

www.trekgeotechnical.ca
1712 St. James Street | Winnipeg, Manitoba R3H 0L3 | Tel 1.204.975.9433 | Fax 1.204.975.9435

TREK GEOTECHNICAL Quality Engineering | Valued Relationships

August 11, 2016 Our File No. 0252 002 00

Attn: Mr. Glen Newton, P.Eng.
G.D. Newton & Associates Inc.
727A – 10th Street
Brandon, Manitoba
R7A 4G7

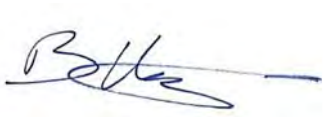
RE: Meadowbrook Lagoon, Manitoba
Final Geotechnical Investigation Report

TREK Geotechnical Inc. is pleased to submit our Final Geotechnical Investigation Report for the proposed development.

Please contact Brent Hay of our office if you have any questions. Thank you for the opportunity to work with you on this assignment.

Sincerely,

TREK Geotechnical Inc.
Per:



Brent Hay, P.Eng.
Partner, Geotechnical Engineer
Tel: 204.975.9433 Ext. 105

Revision History

Revision No.	Author	Issue Date	Description
0	BSH	July 11, 2016	Draft Report
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Authorization Signatures

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APEGM
Certificate of Authorization
Trek Geotechnical Inc.
No. 4877 Date: Aug 11/16

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1.0 Introduction

This report summarizes the results of the geotechnical investigation completed by TREK Geotechnical Inc. (TREK) for a proposed lagoon expansion for the Meadowbrook Village Mobile Home Park near Brandon, Manitoba. The terms of reference for the investigation are included in our proposal to G.D. Newton & Associates Inc. dated April 12th, 2016. The scope of work includes a sub-surface investigation, laboratory testing, and an engineering assessment of the on-site soils relative to the design and construction of the proposed lagoon.

2.0 Background

The Meadowbrook Village Mobile Home Park is located ~7 km east of Brandon, approximately 500 m south of the Trans-Canada Highway. TREK understands that additional treatment capacity is required for the existing wastewater lagoon facility which consists of a new primary and secondary cell. As part of a planned expansion, the existing two cells are to be combined into one large primary cell and two new secondary cells added to the north side. Construction of the secondary cells was partially completed in 2000 when what appeared to be unsuitable soils were encountered and work was suspended. Future lagoon expansions are also under consideration to the east and north of the partially completed secondary cells.

An assessment of soil conditions is required to determine if suitable clay material exists on-site, in sufficient quantity, to construct a clay lined cell for the proposed expansion and finish the partially completed cells.

3.0 Field Program

3.1 Sub-surface Investigation

Sub-surface investigations were undertaken on March 17th-18th and June 3rd, 2016 under the supervision of TREK personnel to determine the soil and groundwater conditions at the site and collect samples for laboratory testing. Sixteen test holes (TH16-01 to 16-16) were initially drilled using a track-mounted Acker SX drill rig equipped with 125 mm diameter solid stem augers. Five test pits (TP16-17 to 16-21) were subsequently excavated using a track mounted CAT 320 DL excavator. The location of the test holes and test pits are shown on Figure 01.

THs16-01 to 16-05 were drilled along the perimeter and divider dikes of the partially completed secondary cells to determine the suitability of the material already in place. THs 16-06 to 16-10 and 16-11 to 16-14 were drilled in potential expansion areas to the east and north of the partially completed secondary cells respectively. THs 16-15 and 16-16 were drilled to the west of the lagoon to assess the potential of the area as a clay borrow source. TPs 16-17 to 16-21 were excavated inside of the partially completed east secondary cell once standing water had been pumped out to assist in delineating problematic soils encountered in the vicinity.

Test hole locations and elevations were surveyed by G.D. Newton & Associates and provided to TREK. Test hole and test pit logs are attached and include a description of the soil units encountered and other pertinent information such as groundwater and sloughing conditions, and a summary of select laboratory testing results.

3.2 Site Conditions

The site is located within agricultural land which is largely grass covered with a few small trees throughout. Site drainage appears to be relatively poor, with low lying areas, specifically towards the eastern portion of the site (Figure 01). Based on observations during the site visits and a review of aerial photos, the east portion of the site has likely been historically wet, marshy land. Currently, the interiors of the partially completed cells contain tall grass and standing water from time to time.

4.0 Sub-surface Conditions

4.1 Soil Stratigraphy

A general description of the soil units encountered at the test hole locations during drilling is provided below. All interpretations of soil stratigraphy for the purposes of design should refer to the detailed information provided on the attached test hole logs.

Apart from the lagoon berms, the general soil stratigraphy in descending order from ground surface consists of organic topsoil followed by a veneer of glacio-fluvial sediment (mixtures of sand, silt and clay) overlying clay till. The glacial fluvial sediments were not encountered TH16-06, 16-08 and 16-11, in which case the clay till was overlain directly by the topsoil. Thicker layers of the surficial organics and glacio-fluvial sediments were encountered in the southeast portion of the partially completed secondary cells within the low-lying area of the site. The clay till is silty, contains trace sand, trace gravel, is brown, moist, firm to very stiff and of intermediate to high plasticity. Elevation contours showing the interpreted contact elevation of the clay till is shown on Figure 01.

The stratigraphy along the partially completed secondary cell dikes consists of 1.2 to 2.2 m of organic clay fill overlying native clay till (THs 16-01, 16-03, and 16-04). A 0.6 m thick sand layer overlying clay till (TH16-02) and 1.5 m of silt layer overlying clay till in TH16-05 were also encountered. The organic clay fill is silty, contains trace sand, trace gravel, is brown to black, moist, firm to stiff and of intermediate plasticity.

4.2 Groundwater Conditions

Seepage and sloughing was observed at various depths within the organic or glacio-fluvial deposits in twelve of the twenty-one test holes/pits completed. The east area of the investigation exhibited more instances of seepage and sloughing (TH16-05, 16-07, 16-09 and 16-10) compared to the other test holes or test pits. Short term water levels were measured in test holes ranging from 1.2 to 1.5 m below ground surface, indicating a relatively high ground water table in the area. Information relative to groundwater conditions at specific areas should refer to the test hole and test pit logs. A standpipe piezometer was installed in TH16-10 above the clay till, within the glacio-fluvial sediments. A groundwater level of 0.77 m below ground surface was measured in the piezometer on May 12, 2016.

Observations on groundwater conditions are short-term and should not be considered reflective of (static) groundwater levels at the site, which would require monitoring over an extended period to determine. It is also important to recognize that groundwater conditions may vary seasonally, annually, or as a result of construction activities.

4.3 Laboratory Testing

Sub-surface soils observed during the investigations were visually classified based on the Unified Soil Classification System (USCS). Disturbed grab samples and relatively undisturbed Shelby tube samples were retrieved and transported to TREK's testing laboratory in Winnipeg, Manitoba. Laboratory testing consisted of moisture content determination on all samples, six Atterberg limit tests and three flexible wall permeameter tests to measure hydraulic conductivity (two *in situ* and one remoulded) of the clay till. Standard Proctor tests were carried out on two bulk samples (combined grab samples) to determine the optimum moisture content and maximum dry density of the clay till. Soils laboratory results are attached in Appendix with the results of testing on clay till samples summarized in Table 01.

Table 01 – Clay Till Testing Results

Test Hole ID	Sample ID	Sample Depth (m)	Moisture Content (%)	Plastic Limit (%)	Liquid Limit (%)	Plasticity Index (%)	Liquidity index (0-1)	Hydraulic Conductivity (cm/s)
TH16-01	G03	1.4-1.5	21	17	52	34	0.12	-
TH16-02	T15	2.9-3.0	19	-	-	-	-	1.49×10^{-7}
TH16-03	G24	1.5-1.7	27	19	40	21	0.38	-
TH16-04	T32	2.1-2.7	19	18	33	16	0.06	2.26×10^{-7}
TH16-11	G82	0.8-0.9	19	16	41	26	0.12	-
TH16-15	G116	2.3-2.4	31	20	64	44	0.25	-
TH16-11	G82, 83 & 84*	0.8-2.4	20	-	-	-	-	2.22×10^{-8}

* - *composite sample, remoulded*

5.0 Discussion of Results

To meet the seepage control criterion for a natural *in situ* liner, the hydraulic conductivity of the soil must be $1x10^{-7}$ cm/sec or lower[1]. The results of the laboratory testing indicate that this criterion cannot be met using the *in situ* clay till and therefore, an engineered liner is required. There are several alternatives for an engineered liner but based on the laboratory testing results, a compacted clay liner would meet the hydraulic conductivity (seepage) criterion of $1x10^{-7}$ cm/sec, although other alternatives such as a synthetic liner could also be considered. The selection of the liner type should take careful consideration of the location and elevation of soft soils and/or high groundwater levels which could hamper the use of heavy construction equipment. In particular, the potential for hydrostatic pressure beneath liners must be considered. Based on the soil types encountered, reconstruction or lining of the partially constructed secondary cell clay dikes will be required.

5.1 Compacted Soil Liner

Clay till from the cell excavation or adjacent borrow area is expected to meet the seepage control criteria providing it is broken up and recompacted in controlled lifts to create a compacted soil liner at least 1 m in thickness. Given the variability of surficial soil deposits (type and thickness), disturbance from previous construction activities, strict quality control will be required to prevent the inclusion of undesirable soils and to confirm adequate compaction of the select fill (clay till) has been achieved.

Construction of a compacted soil liner on native clay till can be carried out with little difficulty; this condition exists over most portions of the site with the exception of the southeast corner of the partially completed east secondary cell where the till is overlain by wet silt and sand (e.g. TP16-17); if possible from an operational perspective, reconfiguration of the secondary cells to avoid the south east corner of the site may be preferred. Removal of the problematic soils and replacement with engineered fill in this area of the site may not be economical and consideration could be given to alternative liner systems that precludes the requirement for excavations up to 1 m below the cell floor (as required for a compacted soil liner) and the use of heavy compaction equipment. Methods to temporarily lower the groundwater level and stabilize soft subgrade soils could be considered but may not be economical. For these reasons, future expansion to the east of the existing lagoon is not recommended.

Additional considerations related to construction of a compacted soil liner are provided below:

1. Clay till used for as fill should be well mixed and homogenous, unfrozen, free of deleterious materials, organic matter and debris.
2. Topsoil or otherwise unsuitable materials (non-clay till material) should not be used for liner construction but may be selectively used for dyke construction and revegetation of exterior slopes.

[1] Manitoba Conservation and Water Stewardship

3. The clay till should be packed using a sheepsfoot compactor in 150 mm maximum lifts to 95% of Standard Proctor Maximum Dry Density (SPMDD) at or within 2% of the optimum moisture content.

5.2 Synthetic Liners

A synthetic liner could be considered in lieu of a compacted soil liner, in particular for the southeast secondary cell. Special care will be required in placing the liner over areas of soft subgrade and consideration of hydrostatic pressure will be required (sufficient cover will be required to prevent heaving). Gas collection systems will also be required under synthetic liners. Given the installation difficulties associated with potential areas of soft subgrade soils, a geosynthetic clay liner (GCL) may be preferred; this liner system and be installed over soft soils providing rutting from deployment equipment can be minimized and sufficient panel overlap provided. Liner providers should be consulted for specifications guidelines specific to their particular product.

6.0 Closure

The geotechnical information provided in this report is in accordance with current engineering principles and practices (Standard of Practice). The findings of this report were based on information provided (field investigation and laboratory testing). Soil conditions are natural deposits that can be highly variable across a site. If subsurface conditions are different than the conditions previously encountered on-site or those presented here, we should be notified to adjust our findings if necessary.

All information provided in this report is subject to our standard terms and conditions for engineering services, a copy of which is provided to each of our clients with the original scope of work or standard engineering services agreement. If these conditions are not attached, and you are not already in possession of such terms and conditions, contact our office and you will be promptly provided with a copy.

This report has been prepared by TREK Geotechnical Inc. (the Consultant) for the exclusive use of Glen Newton & Associates Inc. (the Client) and their agents for the work product presented in the report. Any findings or recommendations provided in this report are not to be used or relied upon by any third parties, except as agreed to in writing by the Client and Consultant prior to use.

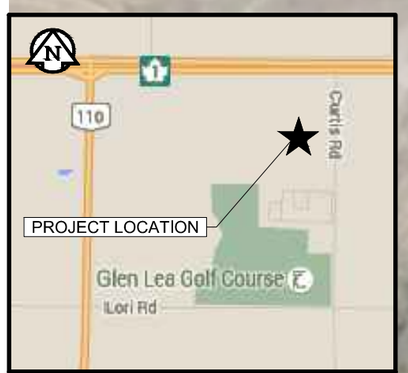
Figures

TREK GEOTECHNICAL

0252 002 00
G.D Newton & Associates Inc.
Meadowbrook Village Sewage Lagoon

ANSI full bleed B (11.00 x 17.00 Inches)

TH16-12
PROPOSED EXPANSION FOOTPRINT
±150 m
TH16-14
TH16-13
TH16-11
±75 m
POTENTIAL BORROW AREA
TH16-01
TH16-03
TH16-04
391.0
TH16-08
TH16-06
TP16-19
390.5
PROPOSED EXPANSION FOOTPRINT
TH16-15
TP16-21
390.0
389.0
388.5
388.0
389.5
PARTIALLY COMPLETED CELLS
TH16-07
TP16-17
TH16-16
TH16-02
TP16-18
389.0
TH16-09
388.5
TH16-10
TP16-20
388.0
TH16-05
CURTIS RD
LOW LYING WET AREA
OPERATING CELLS



KEY PLAN
SCALE: N.T.S.

FIG 001 2016-07-08 Site Plan 0_1_HA 0252 002 00.dwg, 7/8/2016 2:19:33 PM

0 25 50 75 m
SCALE = 1 : 1 750 (279 mm x 432 mm)

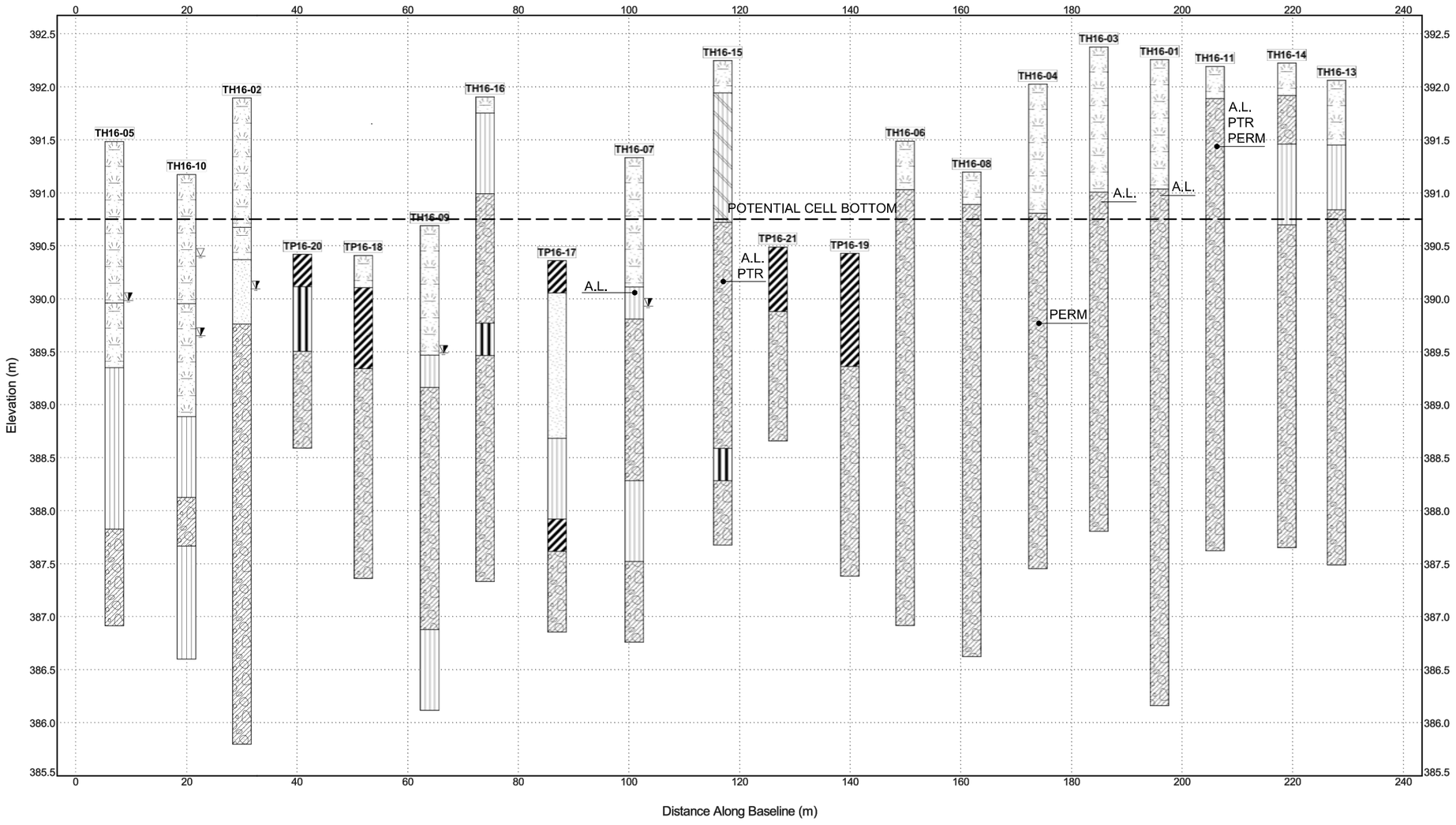
LEGEND:
TEST HOLE (TREK, MARCH 16-17, 2016)
TEST PIT (TREK, JUNE 3, 2016)
389.5 CONTOURS REPRESENT INTERPRETED CLAY TILL CONTACT

NOTES:
1. AERIAL IMAGE FROM GOOGLE EARTH APRIL 27, 2011

FIGURE 01
Test Hole and Test Pit Location Plan

SOUTH

NORTH



0.0 0.5 1.0 1.5 2.0 m
SCALE = 1 : 50 (279 mm x 432 mm)

LEGEND:

- TOPSOIL
- SILT AND CLAY
- CLAY (TILL)
- SILT (LOW PLASTICITY)
- SAND
- SILT (INTERMEDIATE PLASTICITY)

A.L. ATTERBERG LIMITS
PTR PROCTOR
PERM PERMEABILITY TEST

FIGURE 02
Subsurface Statigraphy

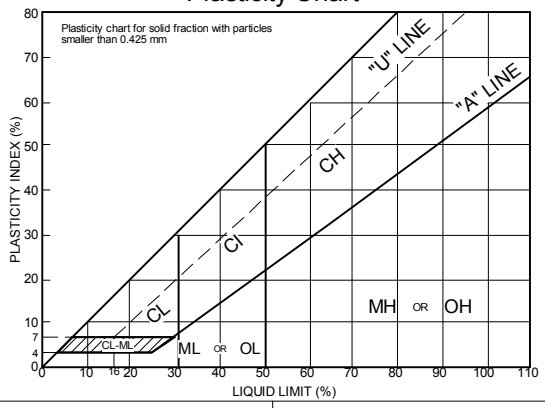
Test Hole Logs

EXPLANATION OF FIELD AND LABORATORY TESTING

GENERAL NOTES

1. Classifications are based on the United Soil Classification System and include consistency, moisture, and color. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate.
2. Descriptions on these test hole logs apply only at the specific test hole locations and at the time the test holes were drilled. Variability of soil and groundwater conditions may exist between test hole locations.
3. When the following classification terms are used in this report or test hole logs, the primary and secondary soil fractions may be visually estimated.

Major Divisions			USCS Classification	Symbols	Typical Names	Laboratory Classification Criteria
Coarse-Grained soils (More than half the material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than 4.75 mm)	Clean gravel (Little or no fines)	GW		Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain size curve, depending on percentage of fines (fraction smaller than No. 200 sieve) coarse-grained soils are classified as follows: Less than 5 percent..... GW, GP, SW, SP; More than 12 percent..... GM, GC, SM, SC; 6 to 12 percent..... Borderline case4s requiring dual symbols* — $C_U = \frac{D_{60}}{D_{10}}$ greater than 4; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			GP		Poorly-graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW
		Gravel with fines (Appreciable amount of fines)	GM		Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4 — Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
			GC		Clayey gravels, gravel-sand-silt mixtures	Atterberg limits above "A" line or P.I. greater than 7
	Sands (More than half of coarse fraction is smaller than 4.75 mm)	Clean sands (Little or no fines)	SW		Well-graded sands, gravelly sands, little or no fines	$C_U = \frac{D_{60}}{D_{10}}$ greater than 6; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			SP		Poorly-graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW
		Sands with fines (Appreciable amount of fines)	SM		Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4 — Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
			SC		Clayey sands, sand-clay mixtures	Atterberg limits above "A" line or P.I. greater than 7
Fine-Grained soils (More than half the material is smaller than No. 200 sieve size)	Silts and Clays (Liquid limit less than 50)		ML		Inorganic silts and very fine sands, rock floor, silty or clayey fine sands or clayey silts with slight plasticity	Plasticity Chart
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
			OL		Organic silts and organic silty clays of low plasticity	
	Silts and Clays (Liquid limit greater than 50)		MH		Inorganic silts, micaceous or distomaceous fine sandy or silty soils, organic silts	
			CH		Inorganic clays of high plasticity, fat clays	
			OH		Organic clays of medium to high plasticity, organic silts	
	Highly Organic Soils		Pt		Peat and other highly organic soils	Von Post Classification Limit — Strong colour or odour, and often fibrous texture



Particle Size			Material
ASTM Sieve sizes	mm		
#10 to #4	2.00 to 4.75		Sand
#40 to #10	0.425 to 2.00		Coarse
#200 to #40	0.075 to 0.425		Medium
< #200	< 0.075		Fine
			Silt or Clay

Particle Size			Material
ASTM Sieve Sizes	mm		
> 12 in.	> 300		Boulders
3 in. to 12 in.	75 to 300		Cobbles
3/4 in. to 3 in.	19 to 75		Gravel
#4 to 3/4 in.	4.75 to 19		Coarse
			Fine

* Borderline classifications used for soils possessing characteristics of two groups are designated by combinations of groups symbols. For example; GW-GC, well-graded gravel-sand mixture with clay binder.

Other Symbol Types

	Asphalt		Bedrock (undifferentiated)		Cobbles
	Concrete		Limestone Bedrock		Boulders and Cobbles
	Fill		Cemented Shale		Silt Till
			Non-Cemented Shale		Clay Till

EXPLANATION OF FIELD AND LABORATORY TESTING

LEGEND OF ABBREVIATIONS AND SYMBOLS

LL - Liquid Limit (%)
PL - Plastic Limit (%)
PI - Plasticity Index (%)
MC - Moisture Content (%)
SPT - Standard Penetration Test
RQD - Rock Quality Designation
Qu - Unconfined Compression
Su - Undrained Shear Strength
VW - Vibrating Wire Piezometer
SI - Slope Inclinometer

▽ Water Level at Time of Drilling

▼ Water Level at End of Drilling

▼ Water Level After Drilling as Indicated on Test Hole Logs

FRACTION OF SECONDARY SOIL CONSTITUENTS ARE BASED ON THE FOLLOWING TERMINOLOGY

TERM	EXAMPLES	PERCENTAGE
and	and CLAY	35 to 50 percent
"y" or "ey"	clayey, silty	20 to 35 percent
some	some silt	10 to 20 percent
trace	trace gravel	1 to 10 percent

TERMS DESCRIBING CONSISTENCY OR COMPACTION CONDITION

The Standard Penetration Test blow count (N) of a non-cohesive soil can be related to compactness condition as follows:

Descriptive Terms	SPT (N) (Blows/300 mm)
Very loose	< 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	> 50

The Standard Penetration Test blow count (N) of a cohesive soil can be related to its consistency as follows:

Descriptive Terms	SPT (N) (Blows/300 mm)
Very soft	< 2
Soft	2 to 4
Firm	4 to 8
Stiff	8 to 15
Very stiff	15 to 30
Hard	> 30

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

Descriptive Terms	Undrained Shear Strength (kPa)
Very soft	< 12
Soft	12 to 25
Firm	25 to 50
Stiff	50 to 100
Very stiff	100 to 200
Hard	> 200

Sub-Surface Log

Test Hole TH16-01
1 of 1

Client:	G.D. Newton & Associates Inc.	**Project Number:**	0252 002 00
Project Name:	Meadowbrook Village Sewage Lagoon	**Location:**	UTM N-5525950, E-438706
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	392.26 m
Method:	125 mm Solid Stem Auger, Acker SX Track Mount	**Date Drilled:**	16 March 2016

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	SPT (N)
	0		CLAY (TOPSOIL) - silty, trace sand, trace gravel, trace organics, trace rootlets - black - moist, firm to stiff - intermediate plasticity		G01	
	0.5					
			- stiff to very stiff below 0.8 m		G02	
391.0	1.0					
			CLAY (TILL) - silty, trace sand, trace gravel, trace oxidation - brown - moist, very stiff to 1.5 m, stiff below 1.5 m - intermediate to high plasticity		G03	
	1.5					
	2.0					
					G04	
	2.5					
	3.0				G05	
	3.5					
			- firm to stiff below 3.8 m		G06	
	4.0					
	4.5				G07	
			- dark grey below 4.6 m			
	5.0					
	5.5				G08	
386.2	6.0				G09	

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100 — PL MC LL

Undrained Shear Strength (kPa): 0 50 100 150 200 250

Test Type: △ Torvane △ ✪ Pocket Pen. ✪ ☒ Qu ☒ ○ Field Vane ○

END OF TEST HOLE AT 6.1 m IN CLAY (TILL)

Notes:
1. No seepage or sloughing observed.
2. Test Hole open to 6.1 m depth and dry.
3. Test Hole backfilled with bentonite to surface.

Logged By: Beta Taryana **Reviewed By:** Brent Hay **Project Engineer:** Brent Hay

Sub-Surface Log

Test Hole TH16-02
1 of 1

Client:	G.D. Newton & Associates Inc.	**Project Number:**	0252 002 00
Project Name:	Meadowbrook Village Sewage Lagoon	**Location:**	UTM N-5525885, E-438734
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	391.90 m
Method:	125 mm Solid Stem Auger, Acker SX Track Mount	**Date Drilled:**	16 March 2016

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	SPT (N)
	0		CLAY (TOPSOIL) - silty, trace to some sand, trace gravel, trace silt inclusions (<10 mm diam.), trace organics, trace rootlets - black - moist, stiff to very stiff - intermediate plasticity		G10	
	0.5		- firm to very stiff below 0.8 m		G11	
390.7	1.0		SILT (TOPSOIL) - trace to some clay, trace to some sand, trace gravel, black, moist, soft, intermediate plasticity		G12	
390.4	1.5		SAND - silty, trace gravel - brown - wet to moist, loose - poorly-graded, fine sand to coarse gravel		SS13	6
389.8	2.0		CLAY (TILL) - silty, trace sand, trace gravel, trace oxidation - brown - moist, stiff - intermediate to high plasticity		G14	
	2.5				T15	
	3.0				SS16	10
	3.5					
	4.0		- soft to firm below 3.8 m		G17	
	4.5		- dark grey, stiff to very stiff below 4.6 m		SS18	16
	5.0					
	5.5				G19	
385.8	6.0				G20	

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21
Particle Size (%): 0 20 40 60 80 100
PL MC LL: 0 20 40 60 80 100
Undrained Shear Strength (kPa): 0 50 100 150 200 250
Test Type: △ Torvane △ ✪ Pocket Pen. ✪ ☒ Qu ☒ ○ Field Vane ○

END OF TEST HOLE AT 6.1 m IN CLAY (TILL)

Notes:
1. Seepage at 1.5 m depth in SAND layer.
2. Sloughing observed at 1.5 m in SAND layer.
3. Test Hole open to 1.8 m depth and water at 1.8 m depth fifteen minutes after drilling.
4. Test Hole backfilled with bentonite to surface.

Logged By: Beta Taryana **Reviewed By:** Brent Hay **Project Engineer:** Brent Hay

PTH 83 TH LOGS MIT FONT LOGS 2016-07-05 MEADOWBROOK VILLAGE SEWAGE LAGOON 0_E_BT 0252 002 00.GPJ TREK GEOTECHNICAL.GDT 11/7/16

Sub-Surface Log

Test Hole TH16-03

Client:	G.D. Newton & Associates Inc.	**Project Number:**	0252 002 00
Project Name:	Meadowbrook Village Sewage Lagoon	**Location:**	UTM N-5525948, E-438735
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	392.38 m
Method:	125 mm Solid Stem Auger, Acker SX Track Mount	**Date Drilled:**	16 March 2016

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	SPT (N)	Bulk Unit Wt (kN/m³) 16 17 18 19 20 21 / Particle Size (%) 0 20 40 60 80 100 / PL MC LL	Undrained Shear Strength (kPa) 0 50 100 150 200 250
	0		CLAY (TOPSOIL) - silty, trace sand, trace gravel, trace rootlets, trace organics - black - moist, stiff to very stiff - intermediate plasticity		G21			
	0.5							
					G22			
	1.0							
391.0			- stiff below 1.2 m		G23			
	1.5		CLAY (TILL) - silty, trace sand, trace gravel, trace oxidation - brown, moist, firm - intermediate to high plasticity		G24			
	2.0		- stiff to very stiff, high plasticity below 1.8 m					
					G25			
	2.5							
	3.0				G26			
	3.5							
					G27			
	4.0							
387.8	4.5				G28			

END OF TEST HOLE AT 4.6 m IN CLAY (TILL)

Notes:
1. No seepage or sloughing observed.
2. Test Hole open to 4.6 m depth and dry.
3. Test Hole backfilled with bentonite to surface.

Logged By: Beta Taryana **Reviewed By:** Brent Hay **Project Engineer:** Brent Hay

Sub-Surface Log

Test Hole TH16-04
1 of 1

Client:	G.D. Newton & Associates Inc.	**Project Number:**	0252 002 00
Project Name:	Meadowbrook Village Sewage Lagoon	**Location:**	UTM N-5525944, E-438807
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	392.03 m
Method:	125 mm Solid Stem Auger, Acker SX Track Mount	**Date Drilled:**	16 March 2016

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	SPT (N)
	0.0		CLAY (TOPSOIL) - silty, trace sand, trace gravel, trace rootlets, trace silt inclusions (<20 mm diam.) - black - moist, stiff - intermediate plasticity		G29	
	0.5					
	0.8		- stiff to very stiff below 0.8 m		G30	
390.8	1.0					
	1.2		CLAY (TILL) - silty, trace sand, trace gravel, trace oxidation - brown - moist, very stiff - intermediate to high plasticity		G31	
	1.5					
	2.0					
	2.5				T32	
	2.7		- 102 mm thick of pocket sand at 2.7 m			
	2.9		- firm below 2.9 m		G33	
	3.5					
	3.8		- stiff below 3.8 m		G34	
	4.0					
387.5	4.4		- firm to stiff below 4.4 m		G35	
	4.6		END OF TEST HOLE AT 4.6 m IN CLAY (TILL)			

Notes:
1. No seepage or sloughing observed.
2. Test Hole open to 4.6 m depth and dry.
3. Test Hole backfilled with bentonite to surface.

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21
Particle Size (%): 0 20 40 60 80 100
PL MC LL
Undrained Shear Strength (kPa): 0 50 100 150 200 250
Test Type: △ Torvane △ ✿ Pocket Pen. ✿ ☒ Qu ☒ ○ Field Vane ○

Logged By: Beta Taryana **Reviewed By:** Brent Hay **Project Engineer:** Brent Hay

PTH 83 TH LOGS MIT FONT LOGS 2016-07-05 MEADOWBROOK VILLAGE SEWAGE LAGOON 0_E_BT 0252 002 00.GPJ TREK GEOTECHNICAL.GDT 11/7/16

Sub-Surface Log

Test Hole TH16-05
1 of 1

Client:	G.D. Newton & Associates Inc.	**Project Number:**	0252 002 00
Project Name:	Meadowbrook Village Sewage Lagoon	**Location:**	UTM N-5525865, E-438814
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	391.49 m
Method:	125 mm Solid Stem Auger, Acker SX Track Mount	**Date Drilled:**	16 March 2016

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	MATERIAL DESCRIPTION	Sample Type	Sample Number	SPT (N)
	0	CLAY (TOPSOIL) - silty, trace sand, trace gravel, trace organics, trace rootlest - black - moist, stiff - intermediate plasticity		G36	
	0.5				
	0.8	- stiff to very stiff below 0.8 m		G37	
	1.0				
390.0	1.5			G38	
		SILT (TOPSOIL) - some clay, trace sand, trace gravel - black - moist to wet, firm - intermediate plasticity		G39	
389.4	2.0				
		SILT - trace clay - light grey - moist, firm - low plasticity		G40	
	2.5	- some sand, trace oxidation, brown, wet below 2.6 m		G41	
		- trace sand below 2.7 m			
	3.0				
387.8	3.5				
		CLAY (TILL) - silty, trace sand, trace gravel, trace oxidation - brown - moist, soft to firm - intermediate to high plasticity		G42	
	4.0				
386.9	4.5			G43	

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21
Particle Size (%): 0 20 40 60 80 100
PL MC LL
Undrained Shear Strength (kPa): 0 50 100 150 200 250
Test Type: △ Torvane △ ✪ Pocket Pen. ✪ ☒ Qu ☒ ○ Field Vane ○

END OF TEST HOLE AT 4.6 m IN CLAY (TILL)

Notes:
1. Seepage at 1.5 m depth in SILT (TOPSOIL) layer and at 2.6 m depth in SILT layer.
2. Sloughing observed at 1.5 m in SILT (TOPSOIL) layer.
3. Test Hole open to 1.5 m depth and water at 1.5 m depth fifteen minutes after drilling.
4. Test Hole backfilled with bentonite to surface.

Logged By: Beta Taryana **Reviewed By:** Brent Hay **Project Engineer:** Brent Hay

PTH 83 TH LOGS MIT FONT LOGS 2016-07-05 MEADOWBROOK VILLAGE SEWAGE LAGOON 0_E_BT 0252 002 00.GPJ TREK GEOTECHNICAL.GDT 11/7/16

Sub-Surface Log

Test Hole TH16-06

Client:	G.D. Newton & Associates Inc.	**Project Number:**	0252 002 00
Project Name:	Meadowbrook Village Sewage Lagoon	**Location:**	UTM N-5525934, E-438833
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	391.49 m
Method:	125 mm Solid Stem Auger, Acker SX Track Mount	**Date Drilled:**	16 March 2016

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	SPT (N)
391.0	0		CLAY (TOPSOIL) - silty, trace sand, trace gravel, trace organics, trace rootlets - black, moist, stiff - intermediate plasticity		G44	
	0.5		CLAY (TILL) - silty, trace sand, trace gravel, trace oxidation - brown - moist, stiff - intermediate to high plasticity		G45	
	1.0					
	1.5				G46	
	2.0					
	2.5				G47	
	3.0				G48	
	3.5					
	4.0				G49	
386.9	4.5		- firm below 4.4 m		G50	

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100 — PL MC LL — 0 20 40 60 80 100

Undrained Shear Strength (kPa): 0 50 100 150 200 250

Test Type: △ Torvane △ ✪ Pocket Pen. ✪ ☒ Qu ☒ ○ Field Vane ○

END OF TEST HOLE AT 4.6 m IN CLAY (TILL)

Notes:
1. No seepage or sloughing observed.
2. Test Hole open to 4.6 m depth and dry.
3. Test Hole backfilled with bentonite to surface.

Logged By: Beta Taryana **Reviewed By:** Brent Hay **Project Engineer:** Brent Hay

Sub-Surface Log

Test Hole TH16-07
1 of 1

Client:	G.D. Newton & Associates Inc.	**Project Number:**	0252 002 00
Project Name:	Meadowbrook Village Sewage Lagoon	**Location:**	UTM N-5525895, E-438857
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	391.33 m
Method:	125 mm Solid Stem Auger, Acker SX Track Mount	**Date Drilled:**	16 March 2016

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	SPT (N)
	0		CLAY (TOPSOIL) - silty, trace sand, trace gravel, trace organics, trace rootlets, trace silt inclusions (<10 mm diam.) - black - moist, stiff - intermediate plasticity		G51	
	0.5					
			- stiff below 0.8 m		G52	
390.1	1.0					
			SILT - trace to some clay, trace sand, trace oxidation - brown, moist to wet, soft, low plasticity		G53	
389.8	1.5		CLAY (TILL) - silty, trace sand, trace gravel, trace oxidation - brown - moist, stiff - intermediate to high plasticity		T54	
	2.0					
			- stiff below 2.3 m		G55	
	2.5					
388.3	3.0				G56	
			SILT - trace clay - brown - moist to wet, soft - low plasticity			
	3.5				G57	
387.5			CLAY (TILL) - silty, trace sand, trace gravel, trace oxidation - brown - moist, firm to stiff - intermediate to high plasticity			
	4.0					
386.8	4.5				G58	

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21
Particle Size (%): 0 20 40 60 80 100
PL MC LL
Undrained Shear Strength (kPa)
Test Type: △ Torvane △ ✪ Pocket Pen. ✪ ☒ Qu ☒ ○ Field Vane ○
0 50 100 150 200 250

END OF TEST HOLE AT 4.6 m IN CLAY (TILL)

Notes:
1. Seepage at 1.2 m and 3.0 m depth in SILT layer.
2. Sloughing observed at 1.2 m in SILT layer.
3. Test Hole open to 1.4 m depth and water at 1.4 m depth fifteen minutes after drilling.
4. Test Hole backfilled with bentonite to surface.

Logged By: Beta Taryana **Reviewed By:** Brent Hay **Project Engineer:** Brent Hay

Sub-Surface Log

Test Hole TH16-08

Client:	G.D. Newton & Associates Inc.	**Project Number:**	0252 002 00
Project Name:	Meadowbrook Village Sewage Lagoon	**Location:**	UTM N-5525945, E-438884
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	391.20 m
Method:	125 mm Solid Stem Auger, Acker SX Track Mount	**Date Drilled:**	16 March 2016

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	SPT (N)
390.9	0		CLAY (TOPSOIL) - silty, trace sand, trace gravel, trace organics, trace rootlets, mottled grey and black, moist, firm, intermediate plasticity		G59	
	0.5		CLAY (TILL) - silty, trace sand, trace gravel, trace oxidation - brown - moist, stiff to very stiff - intermediate to high plasticity		G60	
	1.0					
	1.5		- stiff below 1.4 m		G61	
	2.0					
	2.5				G62	
	3.0		- firm to stiff below 2.9 m		G63	
	3.5					
	4.0		- stiff to very stiff below 3.8 m - grey below 4 m		G64	
386.6	4.5				G65	

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100

PL MC LL: 0 20 40 60 80 100

Undrained Shear Strength (kPa): 0 50 100 150 200 250

Test Type: △ Torvane △ ✿ Pocket Pen. ✿ ☒ Qu ☒ ○ Field Vane ○

END OF TEST HOLE AT 4.6 m IN CLAY (TILL)

Notes:
1. No seepage or sloughing observed.
2. Test Hole open to 4.6 m depth and dry.
3. Test Hole backfilled with bentonite to surface.

Logged By: Beta Taryana **Reviewed By:** Brent Hay **Project Engineer:** Brent Hay

Sub-Surface Log

Test Hole TH16-09

Client:	G.D. Newton & Associates Inc.	**Project Number:**	0252 002 00
Project Name:	Meadowbrook Village Sewage Lagoon	**Location:**	UTM N-5525884, E-438891
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	390.69 m
Method:	125 mm Solid Stem Auger, Acker SX Track Mount	**Date Drilled:**	16 March 2016

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	SPT (N)
	0		CLAY (TOPSOIL) - silty, trace to some organics, trace rootlets - black - moist, soft - intermediate plasticity		G66	
	0.5					
	1.0		- soft below 0.8 m		G67	
389.5						
389.2	1.5		SILT - trace clay - light grey, moist to wet, soft, low plasticity		G68	
			CLAY (TILL) - silty, some sand to 1.8 m, trace sand below 1.8 m, trace gravel, trace oxidation - brown - moist to wet to 1.8 m and moist below 1.8 m, soft to firm - intermediate to high plasticity		G69	
	2.0					
	2.5				G70	
	3.0				G71	
	3.5					
386.9					G72	
	4.0		SILT - trace clay, trace sand - brown - moist to wet, soft - low plasticity			
386.1	4.5				G73	

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100

PL MC LL: 0 20 40 60 80 100

Undrained Shear Strength (kPa)

Test Type: △ Torvane △ ✿ Pocket Pen. ✿ ☒ Qu ☒ ○ Field Vane ○

0 50 100 150 200 250

END OF TEST HOLE AT 4.6 m IN SILT

Notes:

1. Seepage at 1.2 m depth in SILT layer and at 1.5 m depth in CLAY (TILL) layer.
2. Sloughing observed at 1.2 m in SILT layer.
3. Test Hole open to 1.4 m depth and water at 1.2 m depth fifteen minutes after drilling.
4. Test Hole backfilled with bentonite to surface.

Logged By: Beta Taryana **Reviewed By:** Brent Hay **Project Engineer:** Brent Hay

Sub-Surface Log

Test Hole TH16-10

Client:	G.D. Newton & Associates Inc.	**Project Number:**	0252 002 00
Project Name:	Meadowbrook Village Sewage Lagoon	**Location:**	UTM N-5525872, E-438827
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	391.17 m
Method:	125 mm Solid Stem Auger, Acker SX Track Mount	**Date Drilled:**	16 March 2016

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Backfill Legend: Bentonite | Cement | Drill Cuttings | Filter Pack Sand | Grout | Slough

Elevation (m)	Depth (m)	MATERIAL DESCRIPTION	Sample Type	Sample Number	SPT (N)
	0.0	CLAY (TOPSOIL) - silty, trace sand, trace gravel, some organics, trace rootlets, trace silt inclusions (<10 mm diam.) - black - moist, firm to stiff - intermediate plasticity		G74	
	0.5				
	1.0			G75	
390.0		SILT (TOPSOIL) - clayey, trace sand, trace organics, trace rootlets - black - moist, soft - low plasticity		G76	
	1.5				
	2.0	- trace to some sand, light grey, moist to wet below 1.7 m		G77	
388.9		SILT - trace clay, trace sand, trace oxidation - brown - wet, soft - low plasticity			
	2.5				
388.1	3.0			G78	
		CLAY (TILL) - silty, trace sand, trace gravel, trace oxidation - brown, moist, soft to firm - intermediate plasticity			
387.7	3.5			G79	
		SILT - trace to some clay, trace sand, trace oxidation - brown - moist, soft - low plasticity			
	4.0				
386.6	4.5			G80	

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100

PL MC LL: 0 20 40 60 80 100

Undrained Shear Strength (kPa): 0 50 100 150 200 250

Test Type: △ Torvane △ ✪ Pocket Pen. ✪ ☒ Qu ☒ ○ Field Vane ○

END OF TEST HOLE AT 4.6 m IN SILT

Notes:

1. Seepage at 1.7 m depth in SILT (TOPSOIL) layer and at 2.3 m in SILT layer.
2. Sloughing observed at 1.7 m in SILT (TOPSOIL) layer.
3. Test Hole open to 1.7 m depth and water at 1.5 m depth fifteen minutes after drilling.
4. Initial Test Hole backfilled with bentonite to surface.
5. Standpipe SP-01 installed in ground elevation of 391.36 m located 3.5 m west and 2.0 m north from TH16-10.
6. Top of pipe at elevation 392.2 m.
7. Water level measured at elevation 390.4 m on May 12, 2016.

Logged By: Beta Taryana **Reviewed By:** Brent Hay **Project Engineer:** Brent Hay

Sub-Surface Log

Test Hole TH16-11

Client:	G.D. Newton & Associates Inc.	**Project Number:**	0252 002 00
Project Name:	Meadowbrook Village Sewage Lagoon	**Location:**	UTM N-5525998, E-438788
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	392.19 m
Method:	125 mm Solid Stem Auger, Acker SX Track Mount	**Date Drilled:**	17 March 2016

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	SPT (N)
391.9	0.0		CLAY (TOPSOIL) - silty, trace sand, trace gravel, trace organics, trace rootlets, grey, moist, stiff to very stiff, intermediate plasticity		G81	
	0.5		CLAY (TILL) - silty, trace sand, trace gravel, trace oxidation, trace silt inclusions (<10 mm diam.) - brown, moist, firm - intermediate plasticity			
	1.0		- stiff below 0.8 m		G82	
	1.5		- firm to stiff below 1.4 m		G83	
	2.0					
	2.5				G84	
	3.0		- firm below 2.9 m		G85	
	3.5					
	4.0				G86	
387.6	4.5		- firm to stiff below 4.4 m		G87	

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100

PL MC LL: 0 20 40 60 80 100

Undrained Shear Strength (kPa): 0 50 100 150 200 250

Test Type: △ Torvane △ ✿ Pocket Pen. ✿ ☒ Qu ☒ ○ Field Vane ○

END OF TEST HOLE AT 4.6 m IN CLAY (TILL)

Notes:
1. No seepage or sloughing observed.
2. Test Hole open to 4.6 m depth and dry.
3. Test Hole backfilled with bentonite to surface.

Logged By: Beta Taryana **Reviewed By:** Brent Hay **Project Engineer:** Brent Hay

Sub-Surface Log

Test Hole TH16-12

Client:	G.D. Newton & Associates Inc.	**Project Number:**	0252 002 00
Project Name:	Meadowbrook Village Sewage Lagoon	**Location:**	UTM N-5526088, E-438794
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	392.52 m
Method:	125 mm Solid Stem Auger, Acker SX Track Mount	**Date Drilled:**	17 March 2016

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	SPT (N)
392.4	0		CLAY (TOPSOIL) - silty, trace sand, trace gravel, trace organics, trace rootlets, black, moist, firm, intermediate plasticity	G	G88	
				G	G89	
	0.5		CLAY (TILL) - silty, trace sand, trace gravel - light grey to 0.5 m, brown below 0.5 m - moist, stiff - intermediate plasticity			
391.6				G	G90	
	1.0		SILT - clayey, trace sand, trace oxidation - brown, moist, firm, intermediate to high plasticity	G	G91	
391.3			CLAY (TILL) - silty, trace sand, trace gravel, trace oxidation - brown, moist, firm - intermediate to high plasticity	G	G92	
	1.5					
390.8			SILT - trace clay, trace sand, trace oxidation - brown, moist to wet to 1.8 m, moist below 1.8 m, firm, low plasticity	G	G93	
390.5	2.0		CLAY (TILL) - silty, trace sand, trace gravel, trace oxidation - brown, moist, firm - intermediate to high plasticity			
			- firm to stiff below 2.3 m	G	G94	
	2.5					
	3.0		- grey, firm below 2.9 m	G	G95	
	3.5					
				G	G96	
	4.0					
388.0	4.5		- stiff to very stiff below 4.4 m	G	G97	

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100

PL MC LL

Undrained Shear Strength (kPa)

Test Type: △ Torvane △ ✿ Pocket Pen. ✿ ☒ Qu ☒ ○ Field Vane ○

0 50 100 150 200 250

END OF TEST HOLE AT 4.6 m IN CLAY (TILL)

Notes:

1. Seepage at 1.7 m depth in SILT layer.
2. Sloughing observed at 1.7 m in SILT layer.
3. Test Hole open to 4.3 m depth.
4. Unable to measure water level due to sloughing.
5. Test Hole backfilled with bentonite to surface.

Logged By: Beta Taryana **Reviewed By:** Brent Hay **Project Engineer:** Brent Hay

Sub-Surface Log

Test Hole TH16-13
1 of 1

Client:	G.D. Newton & Associates Inc.	**Project Number:**	0252 002 00
Project Name:	Meadowbrook Village Sewage Lagoon	**Location:**	UTM N-5526009, E-438738
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	392.06 m
Method:	125 mm Solid Stem Auger, Acker SX Track Mount	**Date Drilled:**	17 March 2016

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	MATERIAL DESCRIPTION	Sample Type	Sample Number	SPT (N)
391.5	0.5	CLAY (TOPSOIL) - silty, trace sand, trace gravel, trace organics, trace rootlets - black, moist to stiff - intermediate plasticity		G98	
390.8	1.0	SILT - trace to some sand, trace clay, trace gravel - light grey - moist, soft - low plasticity		G99	
	1.5	CLAY (TILL) - silty, trace sand, trace gravel, trace oxidation - grey - moist, stiff - intermediate to high plasticity		T100	
	2.0	- 152 mm thick SILT layer at 2.1 m - trace to some clay, moist to wet		G101	
	2.5				
	3.0	- firm to stiff below 2.9 m		G102	
	3.5				
	4.0	- stiff below 3.8 m		G103	
387.5	4.5			G104	

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100 — PL MC LL — 0 20 40 60 80 100

Undrained Shear Strength (kPa) — Test Type: △ Torvane △ ✪ Pocket Pen. ✪ ☒ Qu ☒ ○ Field Vane ○ — 0 50 100 150 200 250

END OF TEST HOLE AT 4.6 m IN CLAY (TILL)

Notes:
1. Seepage at 2.1 m in SILT layer.
2. Sloughing observed at 0.3 m in CLAY (TOPSOIL) layer.
3. Test Hole open to 4.0 m depth.
4. Unable to measure water level due to sloughing.
5. Test Hole backfilled with bentonite to surface.

Logged By: Beta Taryana **Reviewed By:** Brent Hay **Project Engineer:** Brent Hay

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Sub-Surface Log

Test Hole TH16-14

Client:	G.D. Newton & Associates Inc.	**Project Number:**	0252 002 00
Project Name:	Meadowbrook Village Sewage Lagoon	**Location:**	UTM N-5526003, E-438677
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	392.22 m
Method:	125 mm Solid Stem Auger, Acker SX Track Mount	**Date Drilled:**	17 March 2016

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	SPT (N)
391.9	0		CLAY (TOPSOIL) - silty, trace sand, trace gravel, trace organics, trace rootlets, black, moist, firm, intermediate plasticity		G105	
391.5	0.5		CLAY (TILL) - silty, trace sand, trace gravel - light grey, moist, stiff - intermediate plasticity		G106	
	1.0		SILT - trace to some sand, trace clay, trace gravel - brown - moist, firm - low plasticity		G107	
390.7	1.5		- soft to firm below 1.4 m		G108	
	2.0		CLAY (TILL) - silty, trace sand, trace gravel, trace oxidation, trace silt inclusions (<10 mm diam.) - brown - moist, stiff - intermediate to high plasticity			
	2.5		- firm to stiff below 2.3 m		G109	
	3.0		- soft to firm below 2.9 m - grey below 3 m		G110	
	3.5					
	4.0		- stiff below 3.8 m		G111	
387.7	4.5		- 50 mm thick of pocket sand, moist to wet at 4.4 m		G112	

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100 — PL MC LL — 0 20 40 60 80 100

Undrained Shear Strength (kPa) — Test Type: △ Torvane △ ✿ Pocket Pen. ✿ ☒ Qu ☒ ○ Field Vane ○ — 0 50 100 150 200 250

END OF TEST HOLE AT 4.6 m IN CLAY (TILL)

Notes:
1. Seepage at 4.4 m in CLAY (TILL) layer.
2. No sloughing observed.
3. Test Hole open to 4.6 m depth.
4. Unable to measure water level due to sloughing.
5. Test Hole backfilled with bentonite to surface.

Logged By: Beta Taryana **Reviewed By:** Brent Hay **Project Engineer:** Brent Hay

Sub-Surface Log

Test Hole TH16-15

Client:	G.D. Newton & Associates Inc.	**Project Number:**	0252 002 00
Project Name:	Meadowbrook Village Sewage Lagoon	**Location:**	UTM N-5525915, E-438624
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	392.25 m
Method:	125 mm Solid Stem Auger, Acker SX Track Mount	**Date Drilled:**	17 March 2016

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	SPT (N)
391.9	0		CLAY (TOPSOIL) - silty, some sand, trace gravel, trace organics, trace rootlets, black, moist, stiff, intermediate plasticity		G113	
	0.5		SILT AND CLAY - some sand - light grey - moist, firm - intermediate plasticity		G114	
	1.0		- trace sand, brown below 0.9 m			
390.7	1.5		CLAY (TILL) - silty, trace sand, trace gravel, trace oxidation - brown - moist, firm to stiff - intermediate plasticity		G115	
	2.0					
	2.5				G116	
	3.0				G117	
388.6	3.5					
388.3			SILT - some clay, trace sand, trace gravel, trace oxidation - brown, moist, firm, intermediate plasticity		G118	
	4.0		CLAY (TILL) - silty, trace sand, trace gravel - grey - moist, stiff - intermediate plasticity			
387.7	4.5				G119	

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100

PL MC LL: 0 20 40 60 80 100

Undrained Shear Strength (kPa)

Test Type: △ Torvane △ ✪ Pocket Pen. ✪ ☒ Qu ☒ ○ Field Vane ○

0 50 100 150 200 250

END OF TEST HOLE AT 4.6 m IN CLAY (TILL)

Notes:
1. No seepage or sloughing observed.
2. Test Hole open to 4.6 m depth and dry.
3. Test Hole backfilled with bentonite to surface.

Logged By: Beta Taryana **Reviewed By:** Brent Hay **Project Engineer:** Brent Hay

Sub-Surface Log

Test Hole TH16-16

Client:	G.D. Newton & Associates Inc.	**Project Number:**	0252 002 00
Project Name:	Meadowbrook Village Sewage Lagoon	**Location:**	UTM N-5525890, E-438611
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	391.91 m
Method:	125 mm Solid Stem Auger, Acker SX Track Mount	**Date Drilled:**	17 March 2016

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	SPT (N)
391.8	0		CLAY (TOPSOIL) - silty, trace sand, trace gravel, trace organics, trace rootlets, black, moist, firm to stiff, intermediate plasticity		G120	
	0.5		SILT - some clay, trace sand, trace gravel, trace oxidation - grey - moist, firm to stiff - low plasticity			
391.0					G121	
	1.0		CLAY (TILL) - silty, trace sand, trace gravel, trace oxidation - brown - moist, stiff - intermediate plasticity			
	1.5				G122	
389.8	2.0					
389.5			SILT - some clay, trace sand, trace gravel, trace oxidation - brown, moist, firm, intermediate plasticity		G123	
	2.5		CLAY (TILL) - silty, trace sand, trace gravel, trace oxidation - brown - moist, stiff - intermediate plasticity			
	3.0		- grey below 3 m		G124	
	3.5					
	4.0				G125	
387.3	4.5				G126	

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100

PL MC LL: 0 20 40 60 80 100

Undrained Shear Strength (kPa): 0 50 100 150 200 250

Test Type: △ Torvane △ ✿ Pocket Pen. ✿ ☒ Qu ☒ ○ Field Vane ○

END OF TEST HOLE AT 4.6 m IN CLAY (TILL)

Notes:
1. No seepage or sloughing observed.
2. Test Hole open to 4.6 m depth and dry.
3. Test Hole backfilled with bentonite to surface.

Logged By: Beta Taryana **Reviewed By:** Brent Hay **Project Engineer:** Brent Hay

Sub-Surface Log

Test Pit TP16-17

Client:	G.D. Newton & Associates Inc.	**Project Number:**	0252 002 00
Project Name:	Meadowbrook Village Sewage Lagoon	**Location:**	UTM N-5525894, E-438782
Contractor:	Trenchworks Excavating Ltd.	**Ground Elevation:**	390.36 m
Method:	Track Mounted Excavator - CAT 320 DL	**Date Drilled:**	3 June 2016

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	SPT (N)
390.1	0		CLAY - silty, trace organics, brown, moist to wet, firm to stiff, high plasticity		G-01	
	0.5		SAND - some gravel, trace silt - reddish brown - wet, loose to compact - fine sand to coarse gravel		G-02	
	1.0		- silty, brown below 1.1 m		G-03	
388.7	1.5				G-04	
	2.0		SILT - trace sand - brown - moist, loose to compact		G-05	
387.9	2.5		CLAY - silty, trace gravel - brown, moist, stiff, high plasticity		G-06	
387.6	3.0		CLAY (TILL) - some sand, some gravel - brown, moist, very stiff, high plasticity - grey below 3.0 m			
386.9	3.5		END OF TEST PIT AT 3.5 m IN CLAY (TILL)			

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100 — PL MC LL

Undrained Shear Strength (kPa) — Test Type: △ Torvane △ ✪ Pocket Pen. ✪ ☒ Qu ☒ ○ Field Vane ○

0 50 100 150 200 250

Notes:
1. Seepage between 1.5 m and 1.7 m below ground surface.
2. Sloughing between 1.5 m and 1.7 m below ground surface.
3. Test Pit backfilled with excavated material and tamped with bucket.

Logged By: Steven Harms **Reviewed By:** Brent Hay **Project Engineer:** Brent Hay

Sub-Surface Log

Test Pit TP16-18

Client:	G.D. Newton & Associates Inc.	**Project Number:**	0252 002 00
Project Name:	Meadowbrook Village Sewage Lagoon	**Location:**	UTM N-5525878, E-438799
Contractor:	Trenchworks Excavating Ltd.	**Ground Elevation:**	390.41 m
Method:	Track Mounted Excavator - CAT 320 DL	**Date Drilled:**	3 June 2016

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	SPT (N)
390.1	0		CLAY (TOPSOIL) - silty, trace sand, trace gravel, trace organics, trace rootlest, dark grey, wet, very soft, intermediate plasticity		G-07	
	0.5		CLAY - silty, trace organics - light brown - moist, firm, intermediate to high plasticity		G-08	
389.3	1.0		CLAY (TILL) - silty, trace silt inclusions (<50 mm diam.), trace sand, trace gravel - brown - moist, stiff to very stiff - intermediate to high plasticity		G-09	
	1.5					
	2.0				G-10	
	2.5					
387.4	3.0				G-11	

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100

PL MC LL: 0 20 40 60 80 100

Undrained Shear Strength (kPa)

Test Type: △ Torvane △ ✿ Pocket Pen. ✿ ☒ Qu ☒ ○ Field Vane ○

0 50 100 150 200250

END OF TEST PIT AT 3.1 m IN CLAY (TILL)

Notes:
1. Seepage at 0.9 m below ground surface.
2. Sloughing from 0.0 m to 0.9 m below ground surface.
3. Test pit backfilled with excavated material and tamped with bucket.

Logged By: Steven Harms **Reviewed By:** Brent Hay **Project Engineer:** Brent Hay

Sub-Surface Log

Test Pit TP16-19

Client:	G.D. Newton & Associates Inc.	**Project Number:**	0252 002 00
Project Name:	Meadowbrook Village Sewage Lagoon	**Location:**	UTM N-5525924, E-438764
Contractor:	Trenchworks Excavating Ltd.	**Ground Elevation:**	390.43 m
Method:	Track Mounted Excavator - CAT 320 DL	**Date Drilled:**	3 June 2016

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	SPT (N)
	0		CLAY - silty, brown, wet, very soft, high plasticity		G-12	
	0.5		- trace sand, trace gravel, firm below 0.3 m		G-13	
389.4	1.0		CLAY (TILL) - silty, trace silt inclusions (<50 mm diam.), trace sand, trace gravel - brown - moist, stiff to very stiff - intermediate to high plasticity		G-14	
	1.5					
	2.0					
	2.5					
387.4	3.0				G-15	

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100

PL MC LL: 0 20 40 60 80 100

Undrained Shear Strength (kPa)

Test Type: △ Torvane △ ✪ Pocket Pen. ✪ ☒ Qu ☒ ○ Field Vane ○

0 50 100 150 200 250

END OF TEST PIT AT 3.1 m IN CLAY (TILL)

Notes:
1. Seepage at 2.1 m below ground surface.
2. No sloughing observed.
3. Backfilled with excavated material and tamped with bucket.

Logged By: Steven Harms **Reviewed By:** Brent Hay **Project Engineer:** Brent Hay

Sub-Surface Log

Test Pit TP16-20
1 of 1

Client:	G.D. Newton & Associates Inc.	**Project Number:**	0252 002 00
Project Name:	Meadowbrook Village Sewage Lagoon	**Location:**	UTM N-5525870, E-438764
Contractor:	Trenchworks Excavating Ltd.	**Ground Elevation:**	390.42 m
Method:	Track Mounted Excavator - CAT 320 DL	**Date Drilled:**	3 June 2016

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	SPT (N)	Bulk Unit Wt (kN/m³) 16 17 18 19 20 21 / Particle Size (%) 0 20 40 60 80 100 / PL MC LL 0 20 40 60 80 100	Undrained Shear Strength (kPa) Test Type △ Torvane △ ✪ Pocket Pen. ✪ ☒ Qu ☒ ○ Field Vane ○ 0 50 100 150 200 250
390.1			CLAY - silty, trace organics - grey, wet, firm, high plasticity					
	0.5		SILT - clayey, trace sand - brown - moist, soft to firm, low to intermediate plasticity					
389.5	1.0		CLAY (TILL) - silty, trace sand, trace gravel, trace cobbles - brown - moist, stiff to very stiff - intermediate to high plasticity					
388.6	1.5							

END OF TEST PIT AT 1.8 m IN CLAY (TILL)

Notes:
1. Seepage at 1.5 m below ground surface.
2. Sloughing at 1.5 m below ground surface.
3. Test pit backfilled with excavated material and tamped with bucket.

Logged By: Steven Harms **Reviewed By:** Brent Hay **Project Engineer:** Brent Hay

Sub-Surface Log

Test Pit TP16-21

Client:	G.D. Newton & Associates Inc.	**Project Number:**	0252 002 00
Project Name:	Meadowbrook Village Sewage Lagoon	**Location:**	UTM N-5525918, E-438793
Contractor:	Trenchworks Excavating Ltd.	**Ground Elevation:**	390.49 m
Method:	Track Mounted Excavator - CAT 320 DL	**Date Drilled:**	3 June 2016

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	SPT (N)
389.9	0.5		CLAY - silty, trace organics - grey - moist to wet, firm - high plasticity			
	1.0		CLAY (TILL) - silty, trace silt inclusions (<50 mm diam.), trace sand, trace gravel - brown - moist, stiff to very stiff - intermediate to high plasticity		G-16	
388.7	1.5		END OF TEST PIT AT 1.8 m IN CLAY (TILL)			

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100

PL MC LL: 0 20 40 60 80 100

Undrained Shear Strength (kPa) — Test Type: △ Torvane △ ✪ Pocket Pen. ✪ ☒ Qu ☒ ○ Field Vane ○: 0 50 100 150 200 250

Notes:
1. No seepage or sloughing.
2. Test pit backfilled with excavated material and tamped with bucket.

Logged By: Steven Harms **Reviewed By:** Brent Hay **Project Engineer:** Brent Hay

Appendix A – Soils Laboratory Testing

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Winnipeg, MB R3H 0L3
Tel: 204.975.9433 Fax: 204.975.9435

Moisture Content Report
ASTM D2216-98

Project No. 0252 002 00
Client G.D. Newton & Associates
Project Meadowbrook Village Sewage Lagoon

Sample Date 04-May-16
Test Date 05-May-16
Technician LI/JB

Test Pit	TH16-16	TH16-16	TH16-16	TH16-16	TH16-16	TH16-16
Depth (m)	0.0 - 0.2	0.8 - 0.9	1.4 - 1.5	2.3 - 2.4	2.9 - 3.0	3.8 - 4.0
Sample #	G120	G121	G122	G123	G124	G125
Tare ID	F72	W75	N115	F33	P20	F6
Mass of tare	8.6	8.4	8.5	8.5	8.4	8.7
Mass wet + tare	256.7	246.4	324.1	469.0	465.0	435.3
Mass dry + tare	217.7	199.3	267.5	389.8	388.5	371.3
Mass water	39.0	47.1	56.6	79.2	76.5	64.0
Mass dry soil	209.1	190.9	259.0	381.3	380.1	362.6
Moisture %	18.7%	24.7%	21.9%	20.8%	20.1%	17.7%

Test Pit	TH16-16	TH16-15	TH16-15	TH16-15	TH16-15	TH16-15
Depth (m)	4.4 - 4.6	0.0 - 0.2	0.8 - 0.9	1.4 - 1.5	2.3 - 2.4	2.9 - 3.0
Sample #	G126	G113	G114	G115	G116	G117
Tare ID	AC07	W94	E22	N79	W19	E16
Mass of tare	6.7	8.5	8.6	8.7	8.5	8.7
Mass wet + tare	532.1	326.9	308	354.2	324.1	366.7
Mass dry + tare	456.6	270.9	255.9	291.1	250.0	289.3
Mass water	75.5	56.0	52.1	63.1	74.1	77.4
Mass dry soil	449.9	262.4	247.4	282.4	241.5	280.7
Moisture %	16.8%	21.3%	21.1%	22.3%	30.7%	27.6%

Test Pit	TH16-15	TH16-15	TH16-14	TH16-14	TH16-14	TH16-14
Depth (m)	3.8 - 4.0	4.4 - 4.6	0.0 - 0.2	0.3 - 0.5	0.8 - 0.9	1.4 - 1.5
Sample #	G118	G119	G105	G106	G107	G108
Tare ID	P37	F98	Z104	E28	H8	F146
Mass of tare	8.4	8.4	8.4	8.4	8.3	8.5
Mass wet + tare	410.3	383.8	256.5	308.9	271.0	398.5
Mass dry + tare	327.8	324.7	205.9	260.3	228.6	309.8
Mass water	82.5	59.1	50.6	48.6	42.4	88.7
Mass dry soil	319.4	316.3	197.5	251.9	220.3	301.3
Moisture %	25.8%	18.7%	25.6%	19.3%	19.2%	29.4%

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Moisture Content Report
ASTM D2216-98

Project No. 0252 002 00
Client G.D. Newton & Associates
Project Meadowbrook Village Sewage Lagoon

Sample Date 04-May-16
Test Date 05-May-16
Technician LI/JB

Test Pit	TH16-14	TH16-14	TH16-14	TH16-14	TH16-13	TH16-13
Depth (m)	2.3 - 2.4	2.9 - 3.0	3.8 - 4.0	4.4 - 4.6	0.0 - 0.2	0.8 - 0.9
Sample #	G109	G110	G111	G112	G98	G99
Tare ID	D29	C21	H56	AC33	K25	AB56
Mass of tare	8.2	8.3	8.4	6.7	8.6	6.6
Mass wet + tare	427.8	381.2	469.2	443.7	350.7	383.5
Mass dry + tare	357.4	315.3	397.2	374.3	297.4	313.9
Mass water	70.4	65.9	72.0	69.4	53.3	69.6
Mass dry soil	349.2	307.0	388.8	367.6	288.8	307.3
Moisture %	20.2%	21.5%	18.5%	18.9%	18.5%	22.6%

Test Pit	TH16-13	TH16-13	TH16-13	TH16-13	TH16-12	TH16-12
Depth (m)	2.1 - 2.3	2.9 - 3.0	3.8 - 4.0	4.4 - 4.6	0.0 - 0.2	0.2 - 0.3
Sample #	G101	G102	G103	G104	G88	G89
Tare ID	F109	AC15	Z47	AC39	E63	F9
Mass of tare	9.0	6.7	8.6	6.6	8.7	8.7
Mass wet + tare	303.8	399.7	414.9	389.2	348.3	356.3
Mass dry + tare	235.5	336.7	351.2	330.0	289.6	284.2
Mass water	68.3	63.0	63.7	59.2	58.7	72.1
Mass dry soil	226.5	330.0	342.6	323.4	280.9	275.5
Moisture %	30.2%	19.1%	18.6%	18.3%	20.9%	26.2%

Test Pit	TH16-12	TH16-12	TH16-12	TH16-12	TH16-12	TH16-12
Depth (m)	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8	2.3 - 2.4	2.9 - 3.0
Sample #	G90	G91	G92	G93	G94	G95
Tare ID	F48	E95	F27	F50	AC29	AC09
Mass of tare	8.4	8.4	8.3	8.6	6.6	6.6
Mass wet + tare	313.3	314.3	270.9	341.3	401.8	416.7
Mass dry + tare	248.1	245.4	211.6	261.9	313.2	334.4
Mass water	65.2	68.9	59.3	79.4	88.6	82.3
Mass dry soil	239.7	237.0	203.3	253.3	306.6	327.8
Moisture %	27.2%	29.1%	29.2%	31.3%	28.9%	25.1%

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Moisture Content Report
ASTM D2216-98

Project No. 0252 002 00
Client G.D. Newton & Associates
Project Meadowbrook Village Sewage Lagoon

Sample Date 04-May-16
Test Date 05-May-16
Technician LI/JB

Test Pit	TH16-12	TH16-12	TH16-11	TH16-11	TH16-11	TH16-11
Depth (m)	3.8 - 4.0	4.4 - 4.6	0.0 - 0.2	0.8 - 0.9	1.4 - 1.5	2.3 - 2.4
Sample #	G96	G97	G81	G82	G83	G84
Tare ID	AC12	AC13	N109	AB87	W27	D39
Mass of tare	6.5	6.7	8.7	6.6	8.3	8.3
Mass wet + tare	356.5	422.7	256.0	408.9	362.1	379.2
Mass dry + tare	294.4	360.2	209.1	344.9	305.7	316.9
Mass water	62.1	62.5	46.9	64.0	56.4	62.3
Mass dry soil	287.9	353.5	200.4	338.3	297.4	308.6
Moisture %	21.6%	17.7%	23.4%	18.9%	19.0%	20.2%

Test Pit	TH16-11	TH16-11	TH16-11	TH16-10	TH16-10	TH16-10
Depth (m)	2.9 - 3.0	3.8 - 4.0	4.4 - 4.6	0.0 - 0.2	0.8 - 0.9	1.4 - 1.5
Sample #	G85	G86	G87	G74	G75	G76
Tare ID	Z39	K20	F128	N44	E47	AB64
Mass of tare	8.5	8.5	8.5	8.4	8.6	6.6
Mass wet + tare	359.0	377.7	385.5	303.0	279.0	318.1
Mass dry + tare	303.6	316.4	322.7	238.8	208.7	231.9
Mass water	55.4	61.3	62.8	64.2	70.3	86.2
Mass dry soil	295.1	307.9	314.2	230.4	200.1	225.3
Moisture %	18.8%	19.9%	20.0%	27.9%	35.1%	38.3%

Test Pit	TH16-10	TH16-10	TH16-10	TH16-10	TH16-09	TH16-09
Depth (m)	2.0 - 2.1	2.9 - 3.0	3.4 - 3.5	4.4 - 4.6	0.0 - 0.2	0.8 - 0.9
Sample #	G77	G78	G79	G80	G66	G67
Tare ID	AA12	AB68	AB93	F47	Z12	N75
Mass of tare	6.8	6.7	6.6	8.5	8.5	8.5
Mass wet + tare	327.5	316.4	303.0	334.4	296.4	355.7
Mass dry + tare	251.9	239.8	224.9	255.1	235.0	253.8
Mass water	75.6	76.6	78.1	79.3	61.4	101.9
Mass dry soil	245.1	233.1	218.3	246.6	226.5	245.3
Moisture %	30.8%	32.9%	35.8%	32.2%	27.1%	41.5%

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Moisture Content Report
ASTM D2216-98

Project No. 0252 002 00
Client G.D. Newton & Associates
Project Meadowbrook Village Sewage Lagoon

Sample Date 04-May-16
Test Date 05-May-16
Technician LI/JB

Test Pit	TH16-09	TH16-09	TH16-09	TH16-09	TH16-09	TH16-09
Depth (m)	1.4 - 1.5	1.7 - 1.8	2.3 - 2.4	2.9 - 3.0	3.7 - 3.8	4.4 - 4.6
Sample #	G68	G69	G70	G71	G72	G73
Tare ID	H50	K4	E44	Z89	A17	F142
Mass of tare	8.4	8.4	8.5	8.3	8.65	8.5
Mass wet + tare	336.9	322.7	364.5	406.8	408.0	328.0
Mass dry + tare	248.8	245.4	270.7	304.2	307.0	246.2
Mass water	88.1	77.3	93.8	102.6	101.0	81.8
Mass dry soil	240.4	237.0	262.2	295.9	298.4	237.7
Moisture %	36.6%	32.6%	35.8%	34.7%	33.8%	34.4%

Test Pit	TH16-08	TH16-08	TH16-08	TH16-08	TH16-08	TH16-08
Depth (m)	0.0 - 0.2	0.8 - 0.9	1.4 - 1.5	2.3 - 2.4	2.9 - 3.0	3.8 - 4.0
Sample #	G59	G60	G61	G62	G63	G64
Tare ID	H10	H79	F64	AB16	W48	N85
Mass of tare	8.5	8.6	8.45	6.6	8.6	8.3
Mass wet + tare	309.5	313.1	329.3	430.2	374.3	385.3
Mass dry + tare	243.8	254.0	276.0	359.6	312.2	323.3
Mass water	65.7	59.1	53.3	70.6	62.1	62.0
Mass dry soil	235.3	245.4	267.6	353.0	303.6	315.0
Moisture %	27.9%	24.1%	19.9%	20.0%	20.5%	19.7%

Test Pit	TH16-08	TH16-07	TH16-07	TH16-07	TH16-07	TH16-07
Depth (m)	4.4 - 4.6	0.0 - 0.2	0.8 - 0.9	1.4 - 1.5	2.3 - 2.4	2.9 - 3.0
Sample #	G65	G51	G52	G53	G55	G56
Tare ID	F19	K13	AC03	H38	P08	E36
Mass of tare	8.5	8.5	6.5	8.5	8.4	8.5
Mass wet + tare	379.8	294.3	368.7	347.9	361.3	377.5
Mass dry + tare	322.6	239.6	291.0	280.7	297.8	300.9
Mass water	57.2	54.7	77.7	67.2	63.5	76.6
Mass dry soil	314.1	231.1	284.5	272.2	289.4	292.4
Moisture %	18.2%	23.7%	27.3%	24.7%	21.9%	26.2%

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Moisture Content Report
ASTM D2216-98

Project No. 0252 002 00
Client G.D. Newton & Associates
Project Meadowbrook Village Sewage Lagoon

Sample Date 04-May-16
Test Date 05-May-16
Technician LI/JB

Test Pit	TH16-07	TH16-07	TH16-06	TH16-06	TH16-06	TH16-06
Depth (m)	3.7 - 3.8	4.4 - 4.6	0.0 - 0.2	0.8 - 0.9	1.4 - 1.5	2.3 - 2.4
Sample #	G57	G58	G44	G45	G46	G47
Tare ID	E46	Z93	F86	Z103	C7	Z45
Mass of tare	8.45	8.4	8.35	8.3	8.4	8.4
Mass wet + tare	287.8	434.6	299.9	278.3	327.0	385.7
Mass dry + tare	226.4	360.8	227.2	221.0	253.3	322.7
Mass water	61.4	73.8	72.7	57.3	73.7	63.0
Mass dry soil	218.0	352.4	218.9	212.7	244.9	314.3
Moisture %	28.2%	20.9%	33.2%	26.9%	30.1%	20.0%

Test Pit	TH16-06	TH16-06	TH16-06	TH16-05	TH16-05	TH16-05
Depth (m)	2.9 - 3.0	3.8 - 4.0	4.4 - 4.6	0.0 - 0.2	0.8 - 0.9	1.4 - 1.5
Sample #	G48	G49	G50	G36	G37	G38
Tare ID	Z131	E134	E99	F116	H17	Z132
Mass of tare	8.4	8.4	8.5	8.3	8.3	8.5
Mass wet + tare	342.8	387.3	438.1	289.3	364.5	275.3
Mass dry + tare	285.5	326.8	366.9	239.7	296.9	208.3
Mass water	57.3	60.5	71.2	49.6	67.6	67.0
Mass dry soil	277.1	318.4	358.4	231.4	288.6	199.8
Moisture %	20.7%	19.0%	19.9%	21.4%	23.4%	33.5%

Test Pit	TH16-05	TH16-05	TH16-05	TH16-05	TH16-05	TH16-04
Depth (m)	1.7 - 1.8	2.1 - 2.3	2.6 - 2.7	3.8 - 4.0	4.4 - 4.6	0.0 - 0.2
Sample #	G39	G40	G41	G42	G43	G29
Tare ID	E143	N92	E66	AB78	F99	W20
Mass of tare	8.4	8.3	8.4	6.6	8.5	8.3
Mass wet + tare	290.3	284.8	302.8	325.0	364.9	232.7
Mass dry + tare	210.8	219.4	230.2	245.1	265.7	196.1
Mass water	79.5	65.4	72.6	79.9	99.2	36.6
Mass dry soil	202.4	211.1	221.8	238.5	257.2	187.8
Moisture %	39.3%	31.0%	32.7%	33.5%	38.6%	19.5%

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Moisture Content Report
ASTM D2216-98

Project No. 0252 002 00
Client G.D. Newton & Associates
Project Meadowbrook Village Sewage Lagoon

Sample Date 04-May-16
Test Date 05-May-16
Technician LI/JB

Test Pit	TH16-04	TH16-04	TH16-04	TH16-04	TH16-04	TH16-03
Depth (m)	0.8 - 0.9	1.4 - 1.5	2.9 - 3.0	3.8 - 4.0	4.4 - 4.6	0.0 - 0.2
Sample #	G30	G31	G33	G34	G35	G21
Tare ID	E2	N59	D3	K16	Z77	Z07
Mass of tare	8.4	8.3	8.2	8.45	8.3	9
Mass wet + tare	331.1	304.7	406.2	414.4	384.2	326.2
Mass dry + tare	273.5	255.9	356.7	348.1	321.6	277.8
Mass water	57.6	48.8	49.5	66.3	62.6	48.4
Mass dry soil	265.1	247.6	348.5	339.7	313.3	268.8
Moisture %	21.7%	19.7%	14.2%	19.5%	20.0%	18.0%

Test Pit	TH16-03	TH16-03	TH16-03	TH16-03	TH16-03	TH16-03
Depth (m)	0.8 - 0.9	1.2 - 1.4	1.5 - 1.7	2.3 - 2.4	2.9 - 3.0	3.8 - 4.0
Sample #	G22	G23	G24	G25	G26	G27
Tare ID	W46	W80	H15	N107	E31	H6
Mass of tare	8.5	8.4	8.4	8.4	8.4	8.5
Mass wet + tare	317.5	371.2	359.1	335.3	397.2	332
Mass dry + tare	266.1	302.7	283.6	258.7	315.3	279
Mass water	51.4	68.5	75.5	76.6	81.9	53.0
Mass dry soil	257.6	294.3	275.2	250.3	306.9	270.5
Moisture %	20.0%	23.3%	27.4%	30.6%	26.7%	19.6%

Test Pit	TH16-03	TH16-02	TH16-02	TH16-02	TH16-02	TH16-02
Depth (m)	4.4 - 4.6	0.0 - 0.2	0.8 - 0.9	1.4 - 1.5	1.5 - 2.0	2.0 - 2.1
Sample #	G28	G10	G11	G12	SS13	G14
Tare ID	Z66	F111	AB11	AA05	F149	H26
Mass of tare	8.4	8.25	6.6	6.55	8.6	8.3
Mass wet + tare	407.5	276.3	327.1	313.2	260.6	249
Mass dry + tare	343.8	230.9	265.7	248.3	211.4	202.8
Mass water	63.7	45.4	61.4	64.9	49.2	46.2
Mass dry soil	335.4	222.7	259.1	241.8	202.8	194.5
Moisture %	19.0%	20.4%	23.7%	26.8%	24.3%	23.8%

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Moisture Content Report
ASTM D2216-98

Project No. 0252 002 00
Client G.D. Newton & Associates
Project Meadowbrook Village Sewage Lagoon

Sample Date 04-May-16
Test Date 05-May-16
Technician LI/JB

Test Pit	TH16-02	TH16-02	TH16-02	TH16-02	TH16-02	TH16-01
Depth (m)	3.0 - 3.5	3.8 - 4.0	4.6 - 5.0	5.3 - 5.5	5.9 - 6.1	0.0 - 0.2
Sample #	SS16	G17	SS18	G19	G20	G01
Tare ID	E15	A27	N32	N90	H45	F46
Mass of tare	8.65	8.3	8.4	8.4	8.5	8.6
Mass wet + tare	269.1	375.6	315.85	312.8	344.6	307.2
Mass dry + tare	226.2	313.9	268.4	264	293.3	259.2
Mass water	42.9	61.7	47.5	48.8	51.3	48.0
Mass dry soil	217.6	305.6	260.0	255.6	284.8	250.6
Moisture %	19.7%	20.2%	18.3%	19.1%	18.0%	19.2%

Test Pit	TH16-01	TH16-01	TH16-01	TH16-01	TH16-01	TH16-01
Depth (m)	0.8 - 0.9	1.4 - 1.5	2.3 - 2.4	2.9 - 3.0	3.8 - 4.0	4.4 - 4.6
Sample #	G02	G03	G04	G05	G06	G07
Tare ID	W56	Z64	F90	N60	A101	W63
Mass of tare	8.6	8.4	8.4	8.5	8.7	8.4
Mass wet + tare	448.2	416.2	492	460.8	469.1	465.2
Mass dry + tare	378.6	345.8	406.5	386	392.2	389.5
Mass water	69.6	70.4	85.5	74.8	76.9	75.7
Mass dry soil	370.0	337.4	398.1	377.5	383.5	381.1
Moisture %	18.8%	20.9%	21.5%	19.8%	20.1%	19.9%

Test Pit	TH16-01	TH16-01				
Depth (m)	5.3 - 5.5	5.9 - 6.1				
Sample #	G08	G09				
Tare ID	E75	W51				
Mass of tare	8.5	8.5				
Mass wet + tare	480.6	472.8				
Mass dry + tare	408.3	399.3				
Mass water	72.3	73.5				
Mass dry soil	399.8	390.8				
Moisture %	18.1%	18.8%				

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Moisture Content Report
ASTM D2216-98

Project No. 0252-002-00
Client G.D. Newton & Associates
Project Meadowbrook Village Sewage Lagoon

Sample Date 03-Jun-16
Test Date 09-Jun-16
Technician LI/JB

Test Pit	TP16-17	TP16-17	TP16-17	TP16-17	TP16-17	TP16-17
Depth (m)	0.0 - 0.2	0.2 - 0.3	0.9 - 1.1	1.4 - 1.5	1.8 - 2.0	2.4 - 2.7
Sample #	G01	G02	G03	G04	G05	G06
Tare ID	Z106	C15	W15	Z91	F12	W50
Mass of tare	8.4	8.4	8.3	8.5	8.6	8.4
Mass wet + tare	445.4	311.9	349.8	346.0	326.3	346.8
Mass dry + tare	336.5	267.3	270.4	262.7	248.7	254.3
Mass water	108.9	44.6	79.4	83.3	77.6	92.5
Mass dry soil	328.1	258.9	262.1	254.2	240.1	245.9
Moisture %	33.2%	17.2%	30.3%	32.8%	32.3%	37.6%

Test Pit	TP16 - 18	TP16 - 18	TP16 - 18	TP16 - 18	TP16 - 18	TP16 - 19
Depth (m)	0.0 - 0.3	0.3 - 0.6	1.1 - 1.2	1.8 - 2.1	2.7 - 3.0	0.0 - 0.3
Sample #	G07	G08	G09	G10	G11	G12
Tare ID	F79	E27	H21	W10	AC22	H74
Mass of tare	9.0	8.5	8.3	8.6	6.8	8.5
Mass wet + tare	396.1	402.8	394.9	433.9	423.8	345.3
Mass dry + tare	294.6	301.3	321.7	353.1	352.2	249.8
Mass water	101.5	101.5	73.2	80.8	71.6	95.5
Mass dry soil	285.6	292.8	313.4	344.5	345.4	241.3
Moisture %	35.5%	34.7%	23.4%	23.5%	20.7%	39.6%

Test Pit	TP16 - 19	TP16 - 19	TP16 - 19	TP16 - 19		
Depth (m)	0.3 - 0.6	1.2 - 1.5	2.7 - 3.0	3.0 - 3.0		
Sample #	G13	G14	G15	G		
Tare ID	K10	E29	K32	Z105		
Mass of tare	8.4	8.7	8.8	8.7		
Mass wet + tare	372.9	342.2	418.9	410.4		
Mass dry + tare	275.4	251.1	346.8	346.9		
Mass water	97.5	91.1	72.1	63.5		
Mass dry soil	267.0	242.4	338.0	338.2		
Moisture %	36.5%	37.6%	21.3%	18.8%		

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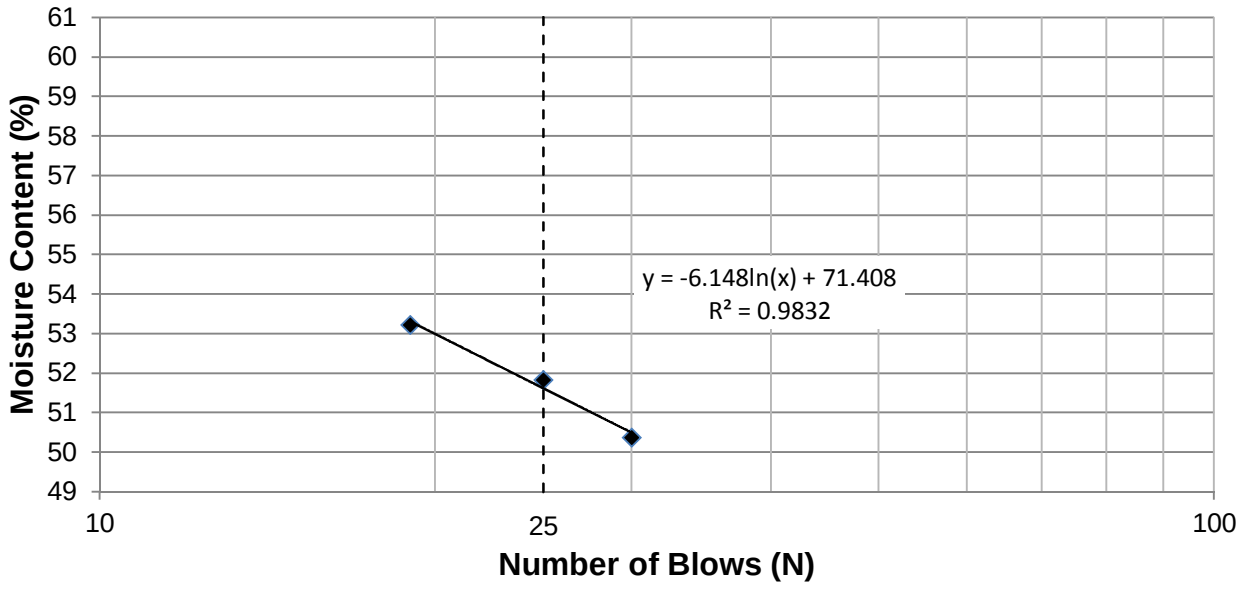
Atterberg Limits
ASTM D4318

Project No.	0252 002 00
Client	G.D. Newton and Associates
Project	Meadowbrook Village and Lagoon
Test Hole	TH16-01
Sample #	G03
Depth (m)	1.4-1.5
Sample Date	03-May-16
Test Date	13-May-16
Technician	LI

Liquid Limit	52
Plastic Limit	17
Plasticity Index	34

Liquid Limit

Trial #	1	2	3	4	5
Number of Blows (N)	30	25	19		
Mass Wet Soil + Tare (g)	27.551	27.149	27.283		
Mass Dry Soil + Tare (g)	22.992	22.702	22.706		
Mass Tare (g)	13.941	14.122	14.106		
Mass Water (g)	4.559	4.447	4.577		
Mass Dry Soil (g)	9.051	8.580	8.600		
Moisture Content (%)	50.370	51.830	53.221		



Plastic Limit

Trial #	1	2	3	4	5
Mass Wet Soil + Tare (g)	16.326	17.248			
Mass Dry Soil + Tare (g)	15.990	16.799			
Mass Tare (g)	14.021	14.209			
Mass Water (g)	0.336	0.449			
Mass Dry Soil (g)	1.969	2.590			
Moisture Content (%)	17.064	17.336			

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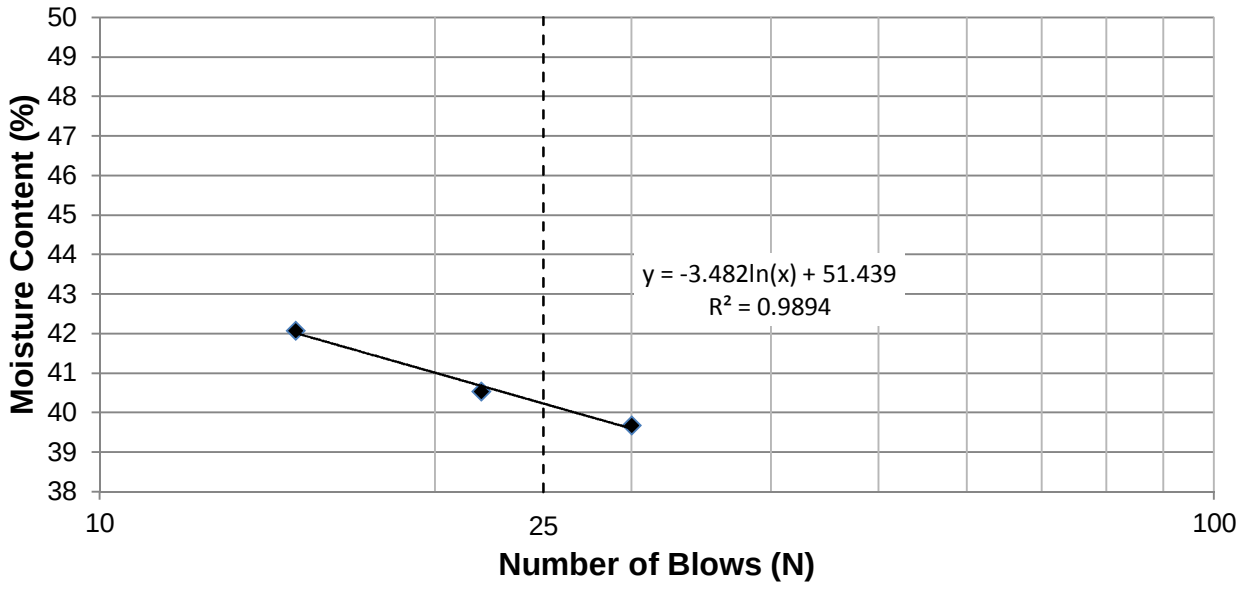
Atterberg Limits
ASTM D4318

Project No.	0252 002 00
Client	G.D. Newton and Associates
Project	Meadowbrook Village Sewage Lagoon
Test Hole	TH16-03
Sample #	G24
Depth (m)	1.5-1.7
Sample Date	03-May-16
Test Date	13-May-16
Technician	LI

Liquid Limit	40
Plastic Limit	19
Plasticity Index	21

Liquid Limit

Trial #	1	2	3	4	5
Number of Blows (N)	15	22	30		
Mass Wet Soil + Tare (g)	24.788	27.004	25.328		
Mass Dry Soil + Tare (g)	21.592	23.260	22.163		
Mass Tare (g)	13.996	14.023	14.186		
Mass Water (g)	3.196	3.744	3.165		
Mass Dry Soil (g)	7.596	9.237	7.977		
Moisture Content (%)	42.075	40.533	39.677		



Plastic Limit

Trial #	1	2	3	4	5
Mass Wet Soil + Tare (g)	17.546	17.224			
Mass Dry Soil + Tare (g)	16.992	16.711			
Mass Tare (g)	13.994	14.046			
Mass Water (g)	0.554	0.513			
Mass Dry Soil (g)	2.998	2.665			
Moisture Content (%)	18.479	19.250			

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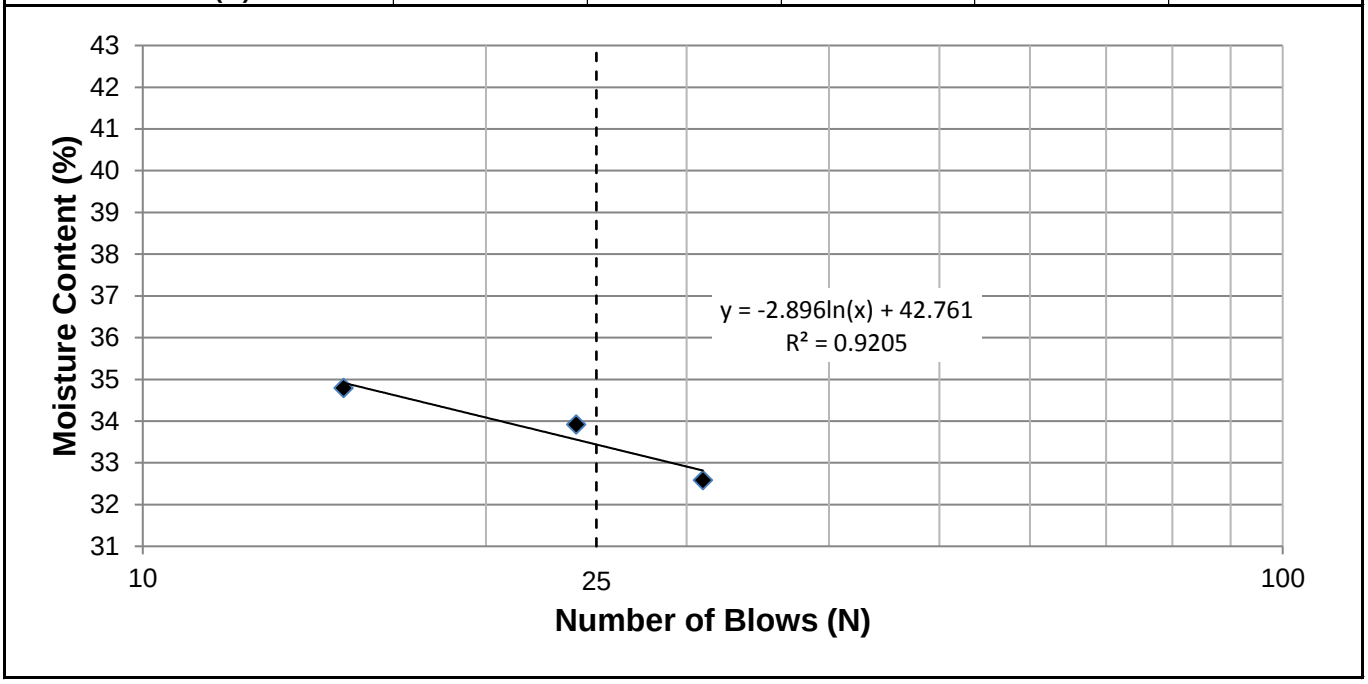
Atterberg Limits
ASTM D4318

Project No.	0252-002-00
Client	G.D. Newton and Associates
Project	Meadowbrook Village Sewage Lagoon
Test Hole	TH16-04
Sample #	T32
Depth (m)	2.1-2.7
Sample Date	03-May-16
Test Date	02-Jun-16
Technician	JB

Liquid Limit	33
Plastic Limit	18
Plasticity Index	16

Liquid Limit

Trial #	1	2	3	4	5
Number of Blows (N)	15	24	31		
Mass Wet Soil + Tare (g)	22.111	22.298	23.522		
Mass Dry Soil + Tare (g)	19.981	20.214	21.214		
Mass Tare (g)	13.859	14.069	14.131		
Mass Water (g)	2.130	2.084	2.308		
Mass Dry Soil (g)	6.122	6.145	7.083		
Moisture Content (%)	34.793	33.914	32.585		



Plastic Limit

Trial #	1	2	3	4	5
Mass Wet Soil + Tare (g)	25.471	22.201			
Mass Dry Soil + Tare (g)	23.746	20.946			
Mass Tare (g)	13.956	13.727			
Mass Water (g)	1.725	1.255			
Mass Dry Soil (g)	9.790	7.219			
Moisture Content (%)	17.620	17.385			

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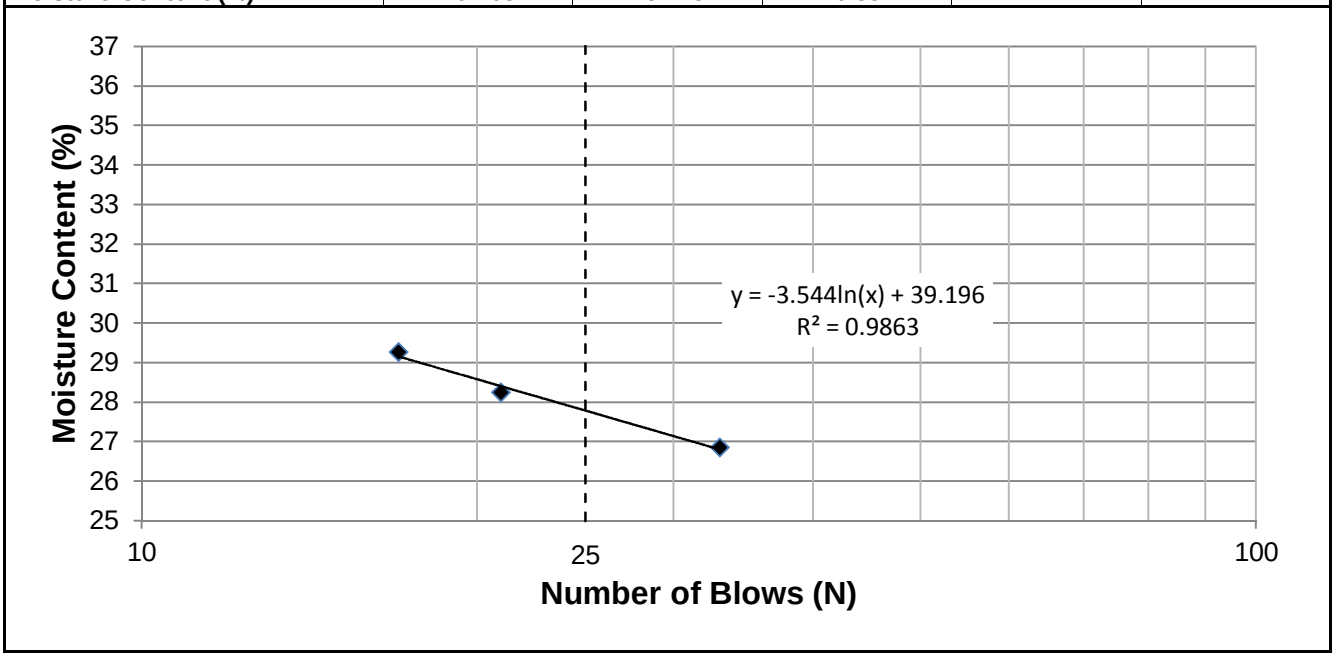
Atterberg Limits
ASTM D4318

Project No.	0252 002 00
Client	G.D. Newton and Associates
Project	Meadowbrook Village Sewage Lagoon
Test Hole	TH16-07
Sample #	G53
Depth (m)	1.4-1.5
Sample Date	03-May-16
Test Date	13-May-16
Technician	LI

Liquid Limit	28
Plastic Limit	13
Plasticity Index	15

Liquid Limit

Trial #	1	2	3	4	5
Number of Blows (N)	17	21	33		
Mass Wet Soil + Tare (g)	26.522	27.366	27.228		
Mass Dry Soil + Tare (g)	23.687	24.448	24.476		
Mass Tare (g)	13.999	14.117	14.228		
Mass Water (g)	2.835	2.918	2.752		
Mass Dry Soil (g)	9.688	10.331	10.248		
Moisture Content (%)	29.263	28.245	26.854		



Plastic Limit

Trial #	1	2	3	4	5
Mass Wet Soil + Tare (g)	17.110	17.345			
Mass Dry Soil + Tare (g)	16.762	16.967			
Mass Tare (g)	14.015	13.985			
Mass Water (g)	0.348	0.378			
Mass Dry Soil (g)	2.747	2.982			
Moisture Content (%)	12.668	12.676			

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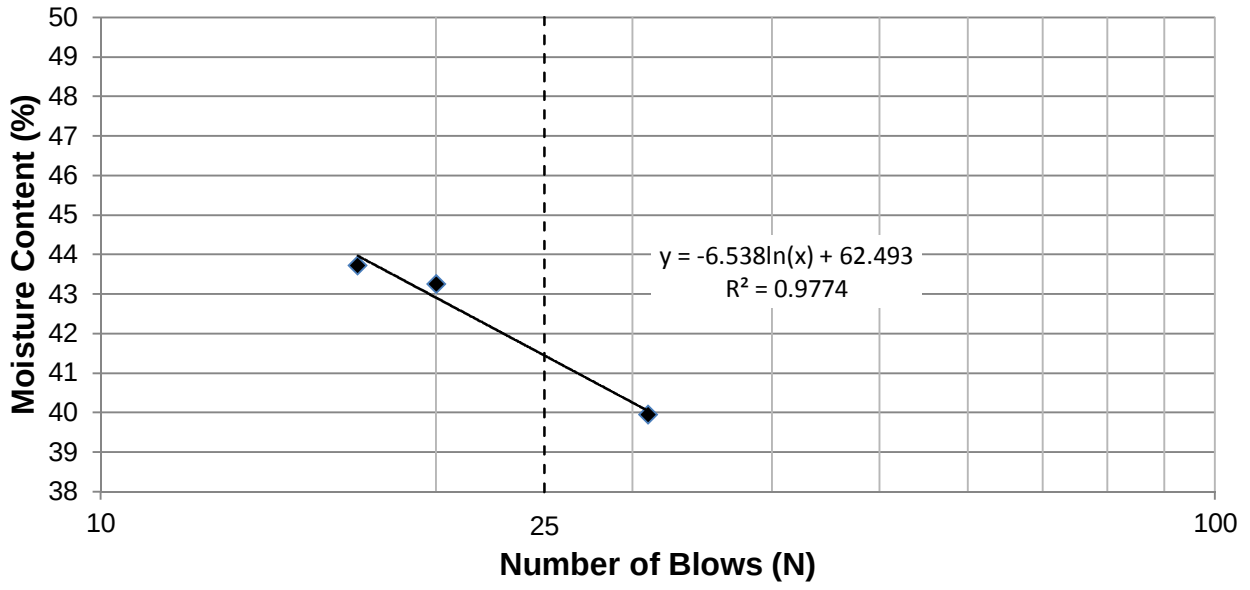
Atterberg Limits
ASTM D4318

Project No.	0252 002 00
Client	G.D. Newton and Associates
Project	Meadowbrook Village Sewage Lagoon
Test Hole	TH16-11
Sample #	G82
Depth (m)	0.8-0.9
Sample Date	03-May-16
Test Date	24-May-16
Technician	LI

Liquid Limit	41
Plastic Limit	16
Plasticity Index	26

Liquid Limit

Trial #	1	2	3	4	5
Number of Blows (N)	31	20	17		
Mass Wet Soil + Tare (g)	24.637	27.010	24.714		
Mass Dry Soil + Tare (g)	21.644	23.138	21.495		
Mass Tare (g)	14.152	14.186	14.132		
Mass Water (g)	2.993	3.872	3.219		
Mass Dry Soil (g)	7.492	8.952	7.363		
Moisture Content (%)	39.949	43.253	43.719		



Plastic Limit

Trial #	1	2	3	4	5
Mass Wet Soil + Tare (g)	16.765	16.064			
Mass Dry Soil + Tare (g)	16.429	15.815			
Mass Tare (g)	14.288	14.222			
Mass Water (g)	0.336	0.249			
Mass Dry Soil (g)	2.141	1.593			
Moisture Content (%)	15.694	15.631			

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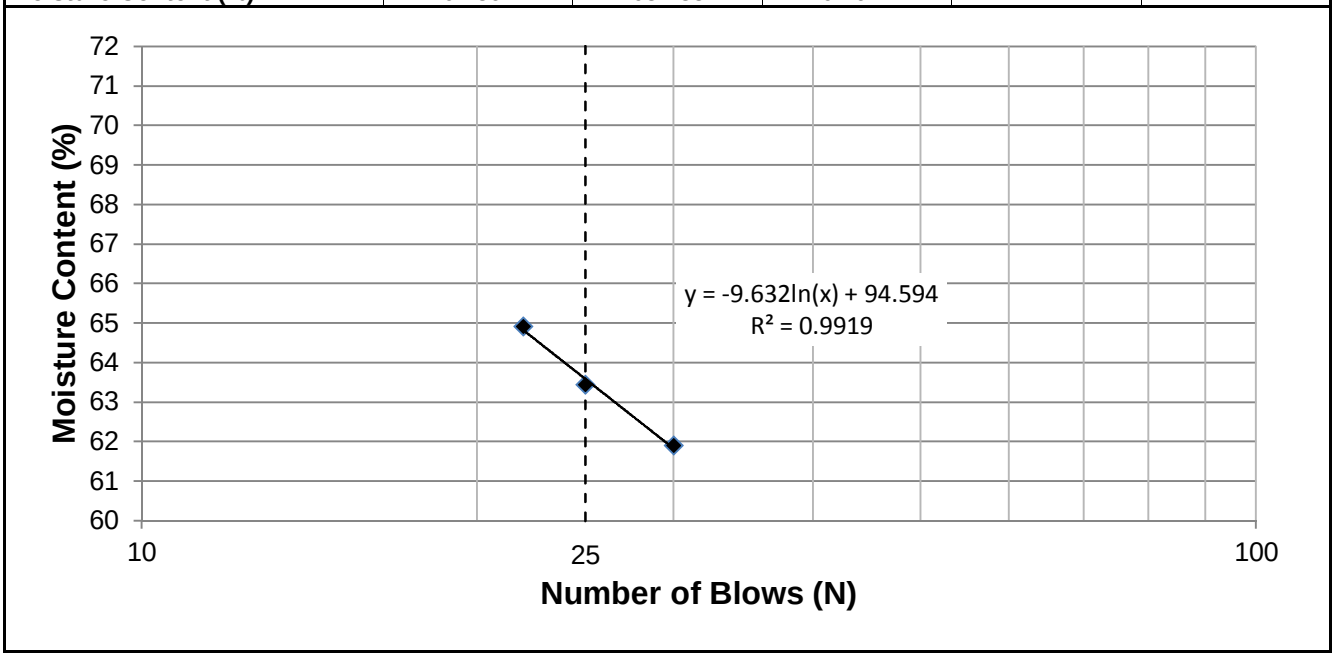
Atterberg Limits
ASTM D4318

Project No.	0252-002-00
Client	G.D. Newton and Associates
Project	Meadowbrook Village Sewage Lagoon
Test Hole	TH16-15
Sample #	G116
Depth (m)	2.3-2.4
Sample Date	03-May-16
Test Date	24-May-16
Technician	LI

Liquid Limit	64
Plastic Limit	20
Plasticity Index	44

Liquid Limit

Trial #	1	2	3	4	5
Number of Blows (N)	30	25	22		
Mass Wet Soil + Tare (g)	22.556	23.928	24.510		
Mass Dry Soil + Tare (g)	19.312	20.122	20.479		
Mass Tare (g)	14.071	14.122	14.269		
Mass Water (g)	3.244	3.806	4.031		
Mass Dry Soil (g)	5.241	6.000	6.210		
Moisture Content (%)	61.897	63.433	64.911		



Plastic Limit

Trial #	1	2	3	4	5
Mass Wet Soil + Tare (g)	16.741	17.350			
Mass Dry Soil + Tare (g)	16.336	16.845			
Mass Tare (g)	14.259	14.282			
Mass Water (g)	0.405	0.505			
Mass Dry Soil (g)	2.077	2.563			
Moisture Content (%)	19.499	19.703			

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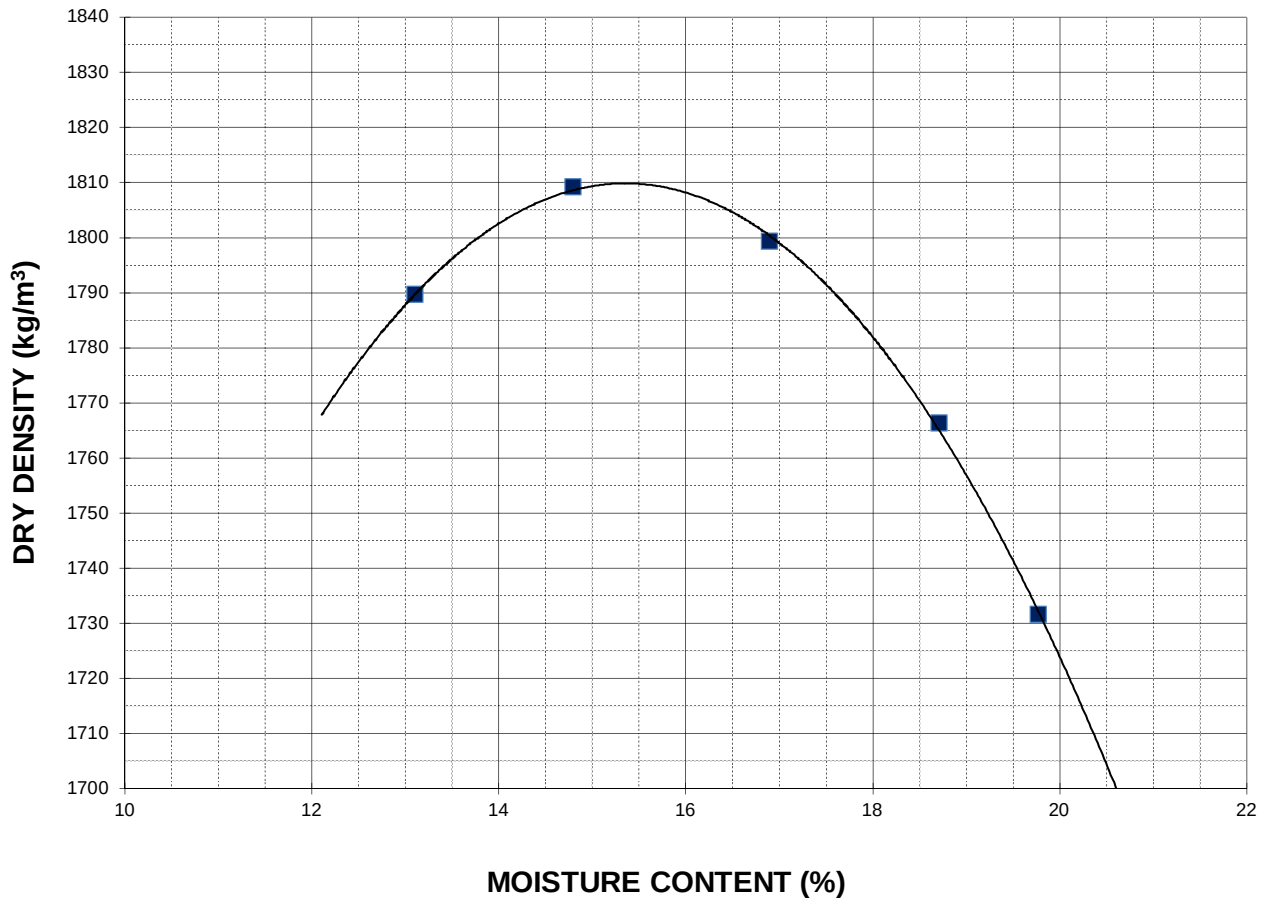
Standard Proctor Compaction Test
ASTM D698-10

Project No.	0252-002-00
Client	G.D. Newton and Associates
Project	Meadowbrook Village Sewage Lagoon
Sample #	G82,83,84
Source	-
Material	Grab Samples
Sample Date	08-May-16
Test Date	24-May-16
Technician	JB

Maximum Dry Density (kg/m3)	1810
Optimum Moisture (%)	15.4

Trial Number	1	2	3	4	5
Wet Density (kg/m^3)	2074	2097	2103	2077	2024
Dry Density (kg/m^3)	1732	1766	1799	1809	1790
Moisture Content (%)	19.8	18.7	16.9	14.8	13.1



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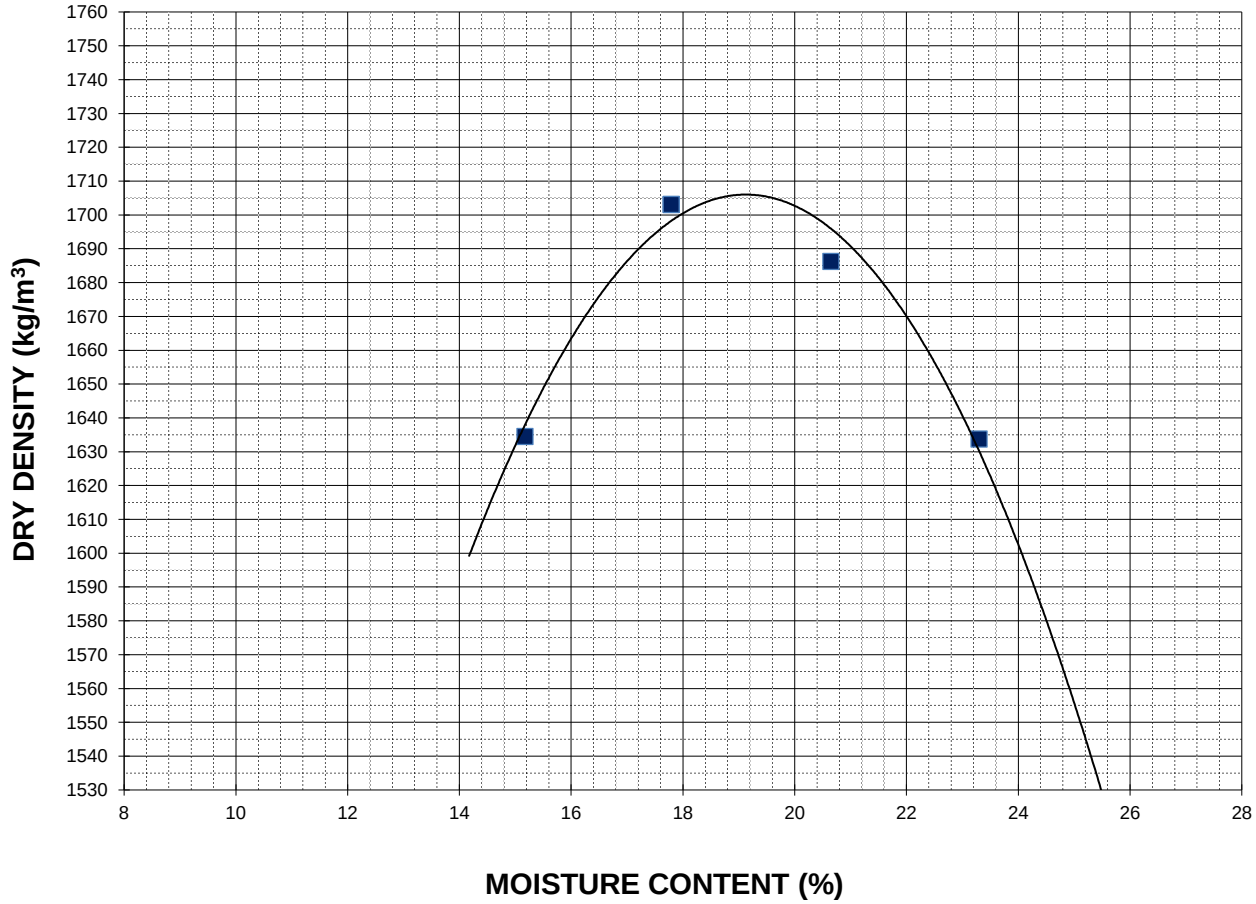
Standard Proctor Compaction Test
ASTM D698-10

Project No.	0252-002-00
Client	G.D. Newton and Associates
Project	Meadowbrook Village Sewage Lagoon
Sample #	G116, G117, G122, G124
Source	-
Material	Grab Samples
Sample Date	08-May-16
Test Date	24-May-16
Technician	JB

Maximum Dry Density (kg/m3)	1706
Optimum Moisture (%)	19.1

Trial Number	1	2	3	4	
Wet Density (kg/m^3)	2014	2034	1883	2006	
Dry Density (kg/m^3)	1634	1686	1635	1703	
Moisture Content (%)	23.3	20.6	15.2	17.8	



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Hydraulic Conductivity Determination (Flexible Wall)

ASTM D5084-10

Project No.	0252-002-00	**Test Hole**	TH16-04
Client	G.D. Newton Associates	**Trek Sample #**	T32
Project	Meadowbrook Village Sewage Lagoon	**Depth (m)**	2.2 - 2.8
		Sample Date	03-May-16
		Test Date	May 24, 2016 to June 06, 2016
		Technician	Paul Bevel

Specimen Details

Visual Classification Clay till, silty, trace sand, trace oxidation, brown, stiff, low plasticity

Comments The specific gravity of the soil was assumed to be 2.75.

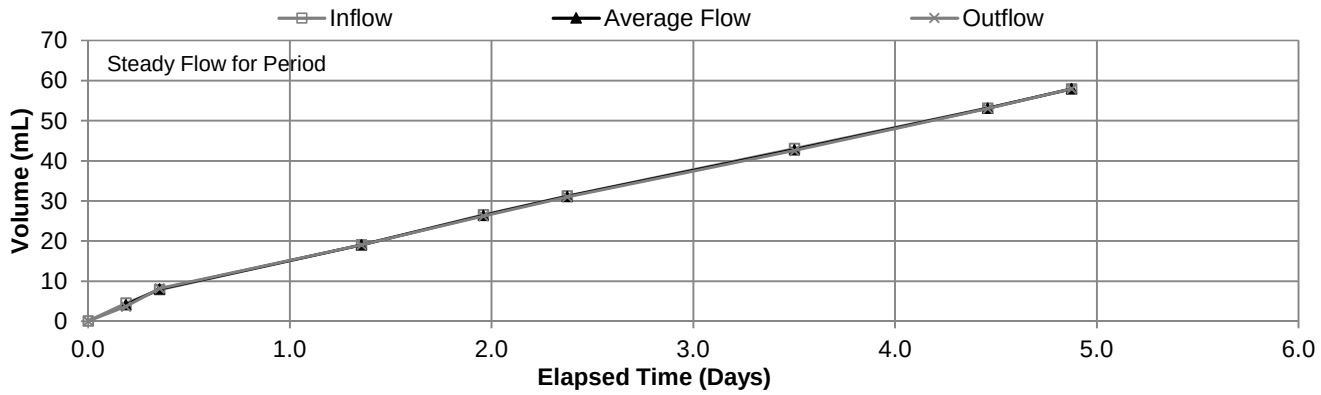
Atterberg Limits

Liquid Limit	33
Plastic Limit	18
Plasticity Index	16

Test Details

Permeant	Distilled, de-aired water
Method	Constant Head
Cell Pressure	140.3 kPa
Influent Pressure	110.3 kPa
Effluent Pressure	100.0 kPa
Gradient	12.96

Permeation Graph



Steady Flow Permeation Data

Time Increment (Days)	Elapsed Time (Days)	Flow (Q)		Inflow / Outflow Ratio	Average Flow (mL)	Temperature Correction	Corrected Hydraulic Conductivity, k_{20} (m/s)
		Influent (mL)	Effluent (mL)				
0.42	2.38	4.70	4.75	0.99	4.73	0.95	2.32E-09
1.13	3.50	11.80	11.55	1.02	11.68	0.94	2.10E-09
0.96	4.46	10.10	10.50	0.96	10.30	0.95	2.20E-09
0.42	4.88	4.78	4.98	0.96	4.88	0.96	2.43E-09

Average Temperature Corrected Hydraulic Conductivity, k_{20} (m/s) **2.26E-09** **(2.26×10^{-7} cm/s)**

Consolidation Data

	Average Height (m)	Average Diameter (m)	Moisture Content (%)	Dry Density (kN/m^3)	Degree of Saturation (%)	Cell Pressure	Back Pressure
Initial	0.082	0.073	19.2	17.3	97.6	140.7	110.3
Final	0.081	0.073	19.5	17.4	100.2	140.7	110.3

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Hydraulic Conductivity Determination (Flexible Wall)

ASTM D5084-10

Project No.	0252-002-00	**Test Hole**	TH16-11
Client	G.D. Newton & Associates	**Trek Sample #**	Remold using samples G82, G83 & G84
Project	Meadowbrook Village Sewage Lagoon	**Depth (m)**	N/A
		Sample Date	03-May-16
		Test Date	June 06, 2016 to June 10, 2016
		Technician	Paul Bevel

Specimen Details

Visual Classification Clay (till), silty, some sand, trace oxidation, brown, high plasticity

Comments The specific gravity of the soil was assumed to be 2.75.

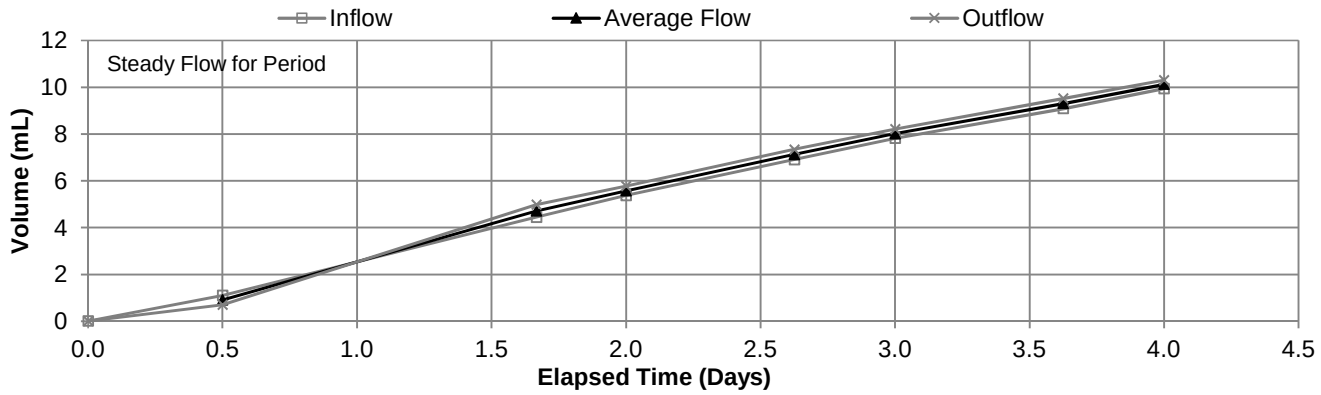
Atterberg Limits

Liquid Limit	Not Requested
Plastic Limit	Not Requested
Plasticity Index	Not Requested

Test Details

Permeant	Distilled, de-aired water
Method	Constant Head
Cell Pressure	140.0 kPa
Influent Pressure	110.3 kPa
Effluent Pressure	90.3 kPa
Gradient	27.55

Permeation Graph



Steady Flow Permeation Data

Time Increment (Days)	Elapsed Time (Days)	Flow (Q)		Inflow / Outflow Ratio	Average Flow (mL)	Temperature Correction	Corrected Hydraulic Conductivity, k_{20} (m/s)
		Influent (mL)	Effluent (mL)				
0.63	2.63	1.53	1.57	0.97	1.55	0.95	2.39E-10
0.38	3.00	0.91	0.87	1.05	0.89	0.98	2.34E-10
0.63	3.63	1.27	1.31	0.97	1.29	0.98	2.03E-10
0.38	4.00	0.86	0.78	1.10	0.82	0.95	2.10E-10

Average Temperature Corrected Hydraulic Conductivity, k_{20} (m/s) **2.22E-10** **(2.22×10^{-8} cm/s)**

Consolidation Data

	Average Height (m)	Average Diameter (m)	Moisture Content (%)	Dry Density (kN/m^3)	Degree of Saturation (%)	Cell Pressure	Back Pressure
Initial	0.075	0.073	19.5	16.4	82.8	140.0	110.3
Final	0.074	0.073	24.1	16.4	102.9	140.0	110.3

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Hydraulic Conductivity Determination (Flexible Wall)

ASTM D5084-10

Project No.	0252-002-00	**Test Hole**	TH16-04
Client	G.D. Newton Associates	**Trek Sample #**	T15
Project	Meadowbrook Village Sewage Lagoon	**Depth (m)**	2.2 - 2.8
		Sample Date	03-May-16
		Test Date	Jun 22, 2016 to Jul 09, 2016
		Technician	Paul Bevel

Specimen Details

Visual Classification Clay till, silty, trace sand, trace oxidation, brown, stiff, low plasticity

Comments The specific gravity of the soil was assumed to be 2.75.

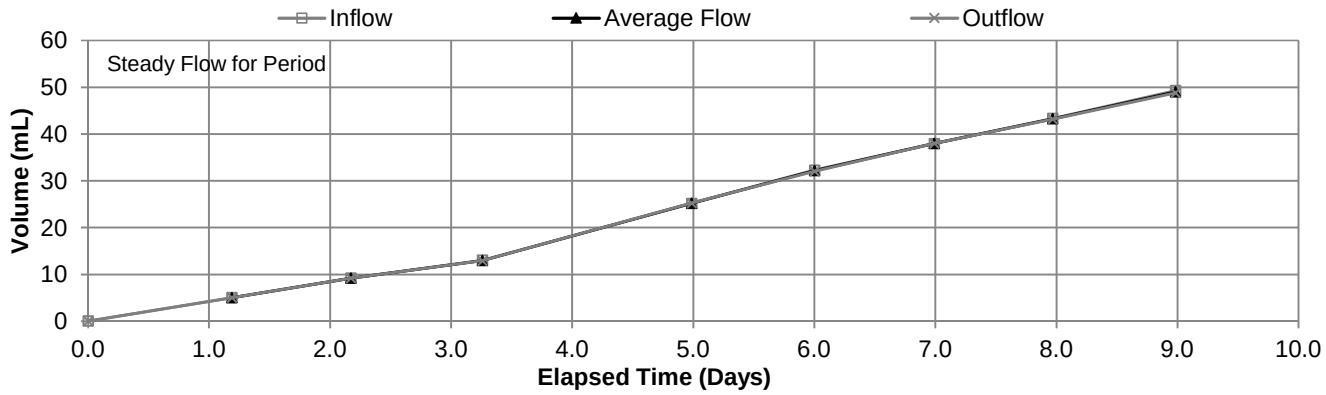
Atterberg Limits

Liquid Limit	Not Requested
Plastic Limit	Not Requested
Plasticity Index	Not Requested

Test Details

Permeant	Distilled, de-aired water
Method	Constant Head
Cell Pressure	140.3 kPa
Influent Pressure	115.1 kPa
Effluent Pressure	105.1 kPa
Gradient	10.51

Permeation Graph



Steady Flow Permeation Data

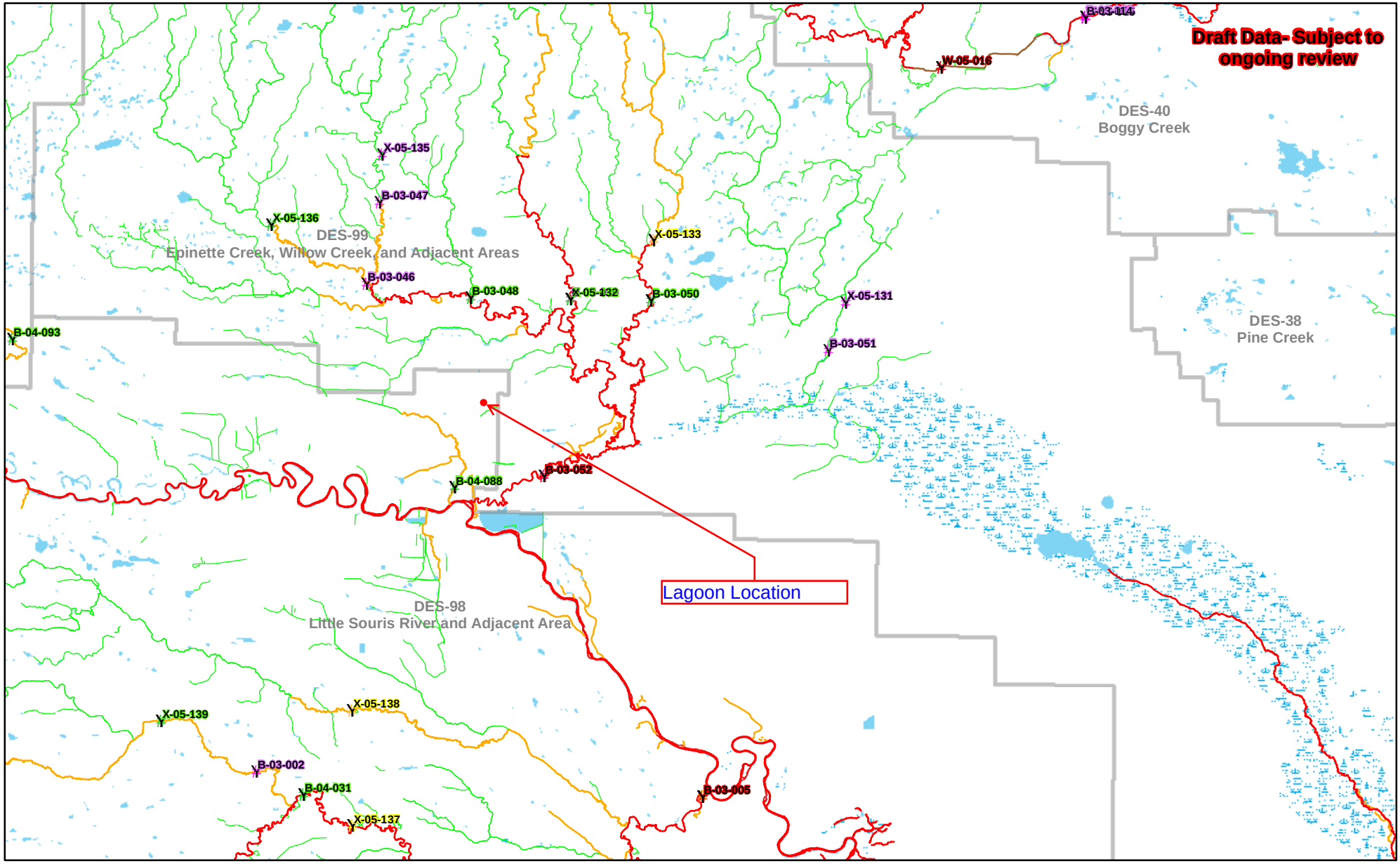
Time Increment (Days)	Elapsed Time (Days)	Flow (Q)		Inflow / Outflow Ratio	Average Flow (mL)	Temperature Correction	Corrected Hydraulic Conductivity, k_{20} (m/s)
		Influent (mL)	Effluent (mL)				
1.01	6.00	7.10	6.81	1.04	6.96	0.93	1.70E-09
0.99	6.99	5.68	5.96	0.95	5.82	0.94	1.47E-09
0.98	7.97	5.38	5.20	1.03	5.29	0.93	1.34E-09
1.01	8.98	5.94	5.61	1.06	5.78	0.94	1.42E-09

Average Temperature Corrected Hydraulic Conductivity, k_{20} (m/s) **1.49E-09** **(1.49×10^{-7} cm/s)**

Consolidation Data

	Average Height (m)	Average Diameter (m)	Moisture Content (%)	Dry Density (kN/m^3)	Degree of Saturation (%)	Cell Pressure	Back Pressure
Initial	0.097	0.072	19.2	17.4	98.8	140.7	110.3
Final	0.097	0.073	19.6	17.4	100.9	140.7	110.3

Appendix E – Fish Habitat



062K01	062J04	062J03
062F16	062G13	062G14
062F09	062G12	062G11

Habitat Classification

A
B
C
D
E

Fishing Results

Indicator Species
Non-Indicator Species
No Catch
No Fishing Effort

Appendix 9
Sampling sites, fish captures and habitat classification of streams and constructed drains throughout agricultural areas of Manitoba (2002 – 2006)

062G13

Produced April 2012