Application for an Environmental Act Licence for Two New Primary Cells at the Petersfield Truck Dump Lagoon in the Rural Municipality of St. Andrews







Prepared for: Manitoba Sustainable Development Environmental Assessment and Licencing Branch Suite 160, 123 Main Street Winnipeg, MB R2C 1A5

Proponent: The Rural Municipality of St. Andrews

Prepared by: Stantec Consulting Ltd. 500-311 Portage Avenue Winnipeg, MB R3B 2B9

Project No. 111215981



Stantec Consulting Ltd. 500–311 Portage Avenue, Winnipeg MB R3B 2B9

July 13, 2016 File: 111215981

Attention: Ms. Tracey Braun, M.Sc., Director

Environmental Assessment and Licencing Branch Manitoba Sustainable Development Suite 160, 123 Main Street Winnipeg, MB R3C 1A5

Dear Ms. Braun,

Reference: Application for an Environmental Act Licence for Two New Primary Cells at the Petersfield Truck Dump Lagoon in the Rural Municipality of St. Andrews

On behalf of the Rural Municipality of St. Andrews, we are submitting five (5) paper copies and one (1) electronic copy (CD) of the Application for a new Environmental Act Licence for an Alteration to existing Licence No. 2211 issued on September 10, 1996 for the existing Petersfield lagoon. The Alteration will include the construction of two new 1.3 hectare HDPE lined primary cells.

The \$7,500 Licence Application Fee, payable to the Minister of Finance, is enclosed and being sent by Stantec on behalf of the RM of St. Andrews. The undersigned is to be contacted regarding any questions that may arise.

Regards,

STANTEC CONSULTING LTD.

Tim Stratton, P.Eng., FEC Senior Engineer, Associate Phone: (204) 489-5900 Fax: (204) 453-9012 tim.stratton@stantec.com

Enclosures: 1. Five paper copies and one CD of the Application for a new Environmental Act Licence

2. \$7,500 cheque payable to the Minister of Finance

c. Andrew Weremy, CAO, RM of St. Andrews Nathan Wittmeier, P.Eng., MWSB

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Design with community in mind



Name of the development:			
Type of development per Classes of De	evelopment Reg	ulation (Manitoba	Regulation 164/88):
Legal name of the applicant:			
Mailing address of the applicant:			
Contact Person:			
City:	Province:		Postal Code:
Phone Number:	Fax:		email:
Location of the development:			
Contact Person:			
Street Address:			
Legal Description:			
City/Town:	Province:		Postal Code:
Phone Number:	Fax:		email:
Name of proponent contact person for	purposes of the	environmental as	sessment:
Phone:	Mailing address	5:	
Fax:			
Email address:			
Webpage address:			
Date:	Signature of pro proponent: Printed name:	1A	prate principal of corporate , P.Eng Stantec

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/conservation/eal

Table of Contents

EXECU	ITIVE SUMMARY	. I
1.0	DEVELOPMENT INFORMATION	1
2.0	DESCRIPTION OF DEVELOPMENT	2
2.1	CERTIFICATE OF THE TITLE AND LEGAL DESCRIPTION	2
2.2	OWNER	2
2.3	MINERAL RIGHTS	2
2.4	EXISTING LAND USE	2
2.5	LAND USE DESIGNATION	
2.6	PUBLIC MEETINGS OR HEARINGS	
2.7	DESCRIPTION OF THE PROPOSED DEVELOPMENT	
2.8	AGRICULTURAL OF INDUSTRIAL WASTES	
2.9	DOMESTIC WATER SUPPLY	
2.10	MANITOBA GUIDELINES, OBJECTIVES AND BULLETINS	
2.11	APPLICATION FOR WASTEWATER TREATMENT FACILITY CLASSIFICATION	
3.0	ENVIRONMENTAL IMPACT AND MANAGEMENT PRACTICES	4
3.0 3.1	ENVIRONMENTAL IMPACT AND MANAGEMENT PRACTICES INTRODUCTION AND BACKGROUND	
3.1 3.2	INTRODUCTION AND BACKGROUND	4 5
3.1 3.2 3.3	INTRODUCTION AND BACKGROUND DESCRIPTION OF THE ENVIRONMENT ENVIRONMENTAL IMPACTS	4 5 0
3.1 3.2	INTRODUCTION AND BACKGROUND DESCRIPTION OF THE ENVIRONMENT ENVIRONMENTAL IMPACTS	4 5 0 5
3.1 3.2 3.3	INTRODUCTION AND BACKGROUND DESCRIPTION OF THE ENVIRONMENT ENVIRONMENTAL IMPACTS 1 ENVIRONMENTAL MANAGEMENT PRACTICES 1 3.4.1 Operation 1	4 5 0 5 5
3.1 3.2 3.3 3.4	INTRODUCTION AND BACKGROUNDDESCRIPTION OF THE ENVIRONMENTENVIRONMENTAL IMPACTS1ENVIRONMENTAL MANAGEMENT PRACTICES3.4.1Operation3.4.2Maintenance1	4 5 5 5 6
3.13.23.33.43.5	INTRODUCTION AND BACKGROUND DESCRIPTION OF THE ENVIRONMENT ENVIRONMENTAL IMPACTS 1 ENVIRONMENTAL MANAGEMENT PRACTICES 1 3.4.1 Operation 1 3.4.2 Maintenance 1 LAGOON DETAILS	4 5 5 5 6 6
3.1 3.2 3.3 3.4 3.5 3.6	INTRODUCTION AND BACKGROUNDDESCRIPTION OF THE ENVIRONMENTENVIRONMENTAL IMPACTS1ENVIRONMENTAL MANAGEMENT PRACTICES3.4.1Operation3.4.2Maintenance1LAGOON DETAILS1MITIGATION OF SILT RUNOFF DURING CONSTRUCTION	4 5 5 5 6 6 6
3.1 3.2 3.3 3.4 3.5 3.6 3.7	INTRODUCTION AND BACKGROUNDDESCRIPTION OF THE ENVIRONMENTENVIRONMENTAL IMPACTS1ENVIRONMENTAL MANAGEMENT PRACTICES3.4.1Operation3.4.2Maintenance1LAGOON DETAILS1MITIGATION OF SILT RUNOFF DURING CONSTRUCTION1DISTANCE FROM EXISTING STRUCTURES1	4 5 0 5 5 6 6 7
3.1 3.2 3.3 3.4 3.5 3.6	INTRODUCTION AND BACKGROUNDDESCRIPTION OF THE ENVIRONMENTENVIRONMENTAL IMPACTS1ENVIRONMENTAL MANAGEMENT PRACTICES3.4.1Operation3.4.2Maintenance1LAGOON DETAILSMITIGATION OF SILT RUNOFF DURING CONSTRUCTION1DISTANCE FROM EXISTING STRUCTURES1SLUDGE DISPOSAL PLAN	4 5 0 5 5 6 6 6 7 7
3.1 3.2 3.3 3.4 3.5 3.6 3.7	INTRODUCTION AND BACKGROUND DESCRIPTION OF THE ENVIRONMENT. ENVIRONMENTAL IMPACTS	4 5 0 5 5 6 6 7 7 8
3.1 3.2 3.3 3.4 3.5 3.6 3.7 3.8	INTRODUCTION AND BACKGROUNDDESCRIPTION OF THE ENVIRONMENTENVIRONMENTAL IMPACTS1ENVIRONMENTAL MANAGEMENT PRACTICES3.4.1Operation3.4.2Maintenance1LAGOON DETAILSMITIGATION OF SILT RUNOFF DURING CONSTRUCTION1DISTANCE FROM EXISTING STRUCTURES1SLUDGE DISPOSAL PLAN	4 5 0 5 5 6 6 6 7 7 8 9

DRAWINGS

C-101 Site Plan

APPENDICES

Appendix 1 - Petersfield Truck Dump Wastewater Lagoon Expansion Study Appendix 2 - Certificate of Title Appendix 3 – Application for Wastewater Treatment Facility Classification



Executive Summary

The Petersfield Truck Dump Wastewater lagoon in the RM of St. Andrews (RM), constructed in 1996, and located on southwest Sec 36 Twp 15 Rge 4E, requires expansion to handle current organic overloading. This is a truck dump lagoon only and does not receive wastewater from any other sources. The existing lagoon consists of a 0.6 hectare primary cell, 0.55 hectare secondary cell, and a 1.75 hectare constructed wetland. The system has been organically overloaded in the past necessitating the RM to close the facility. The system is not hydraulically overloaded.

The design loading for this lagoon has been set at the 2013 measured truck dump hydraulic loading which was the highest recorded annual loading. The RM will monitor and control the number of loads in to the lagoon and will not accept additional trucked loading. Therefore, the design hydraulic and organic loading will be kept under control and the expanded lagoon will function to the design loading of 22, 644 m³.

The proposed expansion would be two 1.3 hectare primary cells lined with 60 mil HDPE as shown on the following Drawing No. C-101. The new primary cells will be interconnected with the existing primary cell, the secondary cell, and the constructed wetland. Two new truck dump structures will be constructed at the new primary cells and the existing truck dump structure will be decommissioned.

The proposed expansion will create a net environmental impact improvement as the system will provide enhanced organic treatment of the wastewater, to Provincial standards.

Stantec's opinion of estimated project cost including construction, engineering, administration and contingency, is \$2,610,000 in 2016 dollars. The wastewater treatment system will remain a "Small System" after expansion as it serves less than 500 persons (250), and has no mechanical treatment processes. The lagoon would be discharged in both spring and fall.



Development Information July 2016

1.0 **DEVELOPMENT INFORMATION**

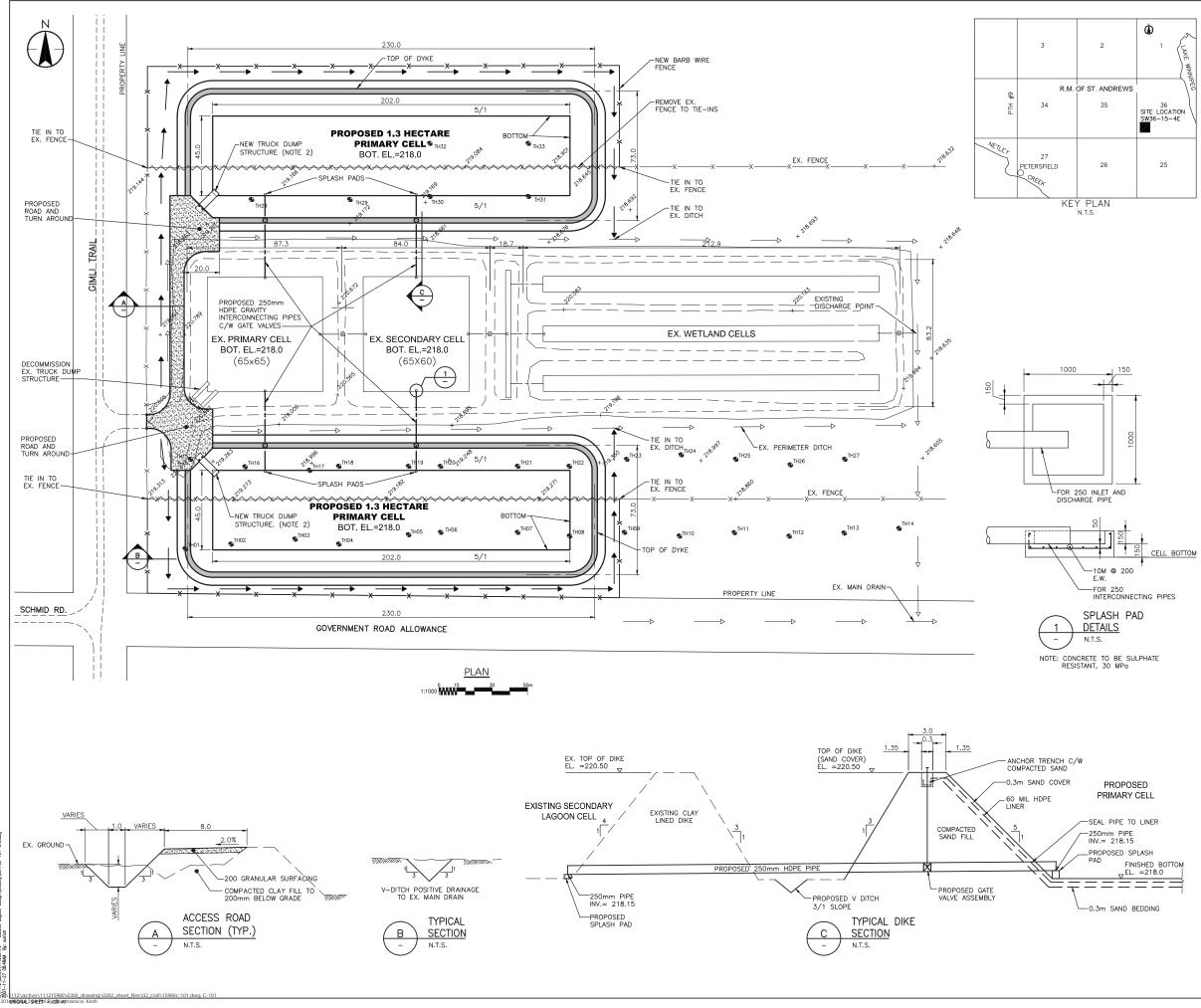
Stantec was retained in January, 2016 by the Manitoba Water Services Board (the Board), on behalf of the Rural Municipality of St. Andrews, to undertake the Petersfield Truck Dump Wastewater Lagoon Expansion Study and subsequent EAP Licence Application.

The existing lagoon is a truck dump facility only and was constructed in 1996. It accepts sewage and septage from holding and septic tanks throughout the RM. The lagoon system consists of a 0.6 hectare primary cell, 0.55 hectare secondary cell, and a 1.75 hectare constructed wetland. The wastewater lagoon system is classified as a "Small System" as it has less than 500 population served (250), and has no mechanical treatment processes. The existing lagoon is clay lined and has not shown signs of leakage.

The existing lagoon is organically overloaded due to over capacity truck dump loading. As a result the facility is closed for extensive periods of time. Additional primary cell treatment surface area is required to rectify this issue. The RM wishes to construct two new 60 mil HDPE lined 1.3 hectare primary cells, as shown on Drawing No. C-101, which would allow extensive domestic sewage truck dumping, and two truck loads of septage per day when septage dumping is permitted. The 20-year design of the expansion is to limit truck dumping to the 2013 truck dumping data, which was the maximum truck dumping year at the site. The RM will restrict dumping to 1915 truck loads of normal sewage, and two truck loads per day of septage between June 1 and October 15. Any design increase in septage dumping would not have been economically viable in terms of capital cost at this time.

The land adjacent to the existing lagoon, where the expansion would take place, is hayfield and grassland adjacent to Netley Marsh.







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Leaend

EXISTING	LEGEND-PLAN	PROPOSED
→	DITCH	\rightarrow
8	GATE VALVE	0
	CULVERT	
	FENCE	
	INTERCONNECTING PIPE	
	TEST HOLE	•
× 218.605	ELEVATION	
	ROADWAY	A STATISTICS

Notes

- 1. FOUR STRAND BARB WIRE FENCE AND GATE WILL BE AS PER MANITOBA WATER SERVICES BOARD STANDARD CONSTRUCTION SPECIFICATIONS, SECTION 027110
- 2. TRUCK DUMP TO BE "SEPTIC WASATE DUMP STATION" DRAWING AS DETAILED IN SECTION 025940 OF THE WATER SERVICES BOARD STANDARD CONSTRUCTION SPECIFICATIONS, SECTION 027110 EXCEPT WITH 5/1 SLOPE

METRIC

WHOLE NUMBERS INDICATE MILLIMETRES DECIMALIZED NUMBERS INDICATE METRES

5				
4				
3				
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Revision		By	Appd.	YY.MM.DD
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Issued		Ву	Appd.	YY.MM.DD
File Name: 15980c-101	K.R.	T.L.S.	T.L.S.	16.07.04
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal





Client/Proiect

Title

R.M. OF ST. ANDREWS

PROPOSED PETERSFIELD TRUCK DUMP WASTEWATER LAGOON EXPANSION STUDY - 2016 St. Andrews, MB Canada

SITE PLAN AND DETAILS

Project No. 111215980	Scale AS NOTED	
Drawing No.	Sheet	Revision
C-101	1 _{of} 1	0

Description of Development July 2016

2.0 DESCRIPTION OF DEVELOPMENT

2.1 CERTIFICATE OF THE TITLE AND LEGAL DESCRIPTION

The existing lagoon, and proposed two primary cell addition, are located on SW Sec 36 Twp 15 Rge 4E in the Rural Municipality of St. Andrews, Province of Manitoba. The owner of the land is the RM of St. Andrews Certificate of Title Number 1603055/1 is attached in Appendix 2.

2.2 OWNER

The land is owned by the Rural Municipality of St. Andrews in the Province of Manitoba.

2.3 MINERAL RIGHTS

The Province of Manitoba is the owner of mines and mineral rights.

2.4 EXISTING LAND USE

The existing land is used for a two cell wastewater treatment lagoon with constructed wetland. The proposed two primary cell expansion will be connected to the existing lagoon.

2.5 LAND USE DESIGNATION

The land is zoned A-80 – Agricultural General under RM of St. Andrews Zoning By-Law No. 4066.

2.6 PUBLIC MEETINGS OR HEARINGS

Public meetings or hearings have not been held for this project.

2.7 DESCRIPTION OF THE PROPOSED DEVELOPMENT

A complete engineering description of the design and operation of the proposed development is contained in Appendix 1 "Petersfield Truck Dump Wastewater Lagoon Expansion Study".

2.8 AGRICULTURAL OF INDUSTRIAL WASTES

No agricultural or industrial wastes, including petroleum products, will be put in the lagoon or stored on site.



Description of Development July 2016

2.9 DOMESTIC WATER SUPPLY

There are no domestic water supply sources in the vicinity of the lagoon, as detailed in Section 3.2 (d).

2.10 MANITOBA GUIDELINES, OBJECTIVES AND BULLETINS

The following Province of Manitoba Guidelines, Objectives and Bulletins will be adhered to in design and construction.

- a) Information Bulletin Environmental Act Proposal Report Guidelines
- b) Information Bulletin Design Objectives for Wastewater Treatment Lagoons
- c) Information Bulletin Facility Classification
- d) Wastewater Treatment Form Supplemental Information

2.11 APPLICATION FOR WASTEWATER TREATMENT FACILITY CLASSIFICATION

The completed form for the Application for Wastewater Treatment Facility Classification is attached in Appendix 3. The Petersfield Wastewater Treatment Lagoon is classified as a "Small System" as it treats wastewater for a population of less than 500 people and has no mechanical treatment processes, as per the "Wastewater Treatment Form Supplemental Information".



Environmental Impact and Management Practices July 2016

3.0 ENVIRONMENTAL IMPACT AND MANAGEMENT PRACTICES

3.1 INTRODUCTION AND BACKGROUND

The Project site is located in the RM of St. Andrews, located approximately 800 metres north and 3.3 km east of Petersfield, MB bordering on Netley Lake (Marsh). The Project involves the addition of two new primary cells to the existing wastewater lagoon that comprises an existing primary cell, a secondary cell and a constructed wetland. As part of the proposed lagoon expansion a road and turnaround will be extended along the west side of the lagoon site allowing access to both new primary cells (see Drawing No. C-101). A complete description of the proposed lagoon expansion is provided in Appendix 1 "Petersfield Truck Dump Wastewater Lagoon Expansion Study". The organic loading on the existing primary cell exceeds the allowable limit of 56 kg/day/ha and as a result the lagoon has had to be closed occasionally to allow for treatment in order for the lagoon to meet licenced discharge requirements.

The existing two-celled lagoon was constructed in 1996. The existing lagoon has a primary cell, secondary cell and a constructed wetland. Wastewater from the constructed wetland is discharged to existing marshland to the east along Netley Lake. The RM of St. Andrews decided to proceed with a two primary cell expansion to meet current truck dump needs. The existing discharge pipe, originating on the east side of the existing constructed wetland, will continue to be used for the expanded lagoon. The treated effluent will continue to flow into a marshy area east of the site, flowing downstream to Netley Creek located approximately 2.8 km to the south and ultimately to Netley Lake. Wastewater will only be discharged from the lagoon after it meets prescribed levels of treatment. The existing primary cell at the site will be connected to the two new primary cells. The two new primary cells will also connect to the existing secondary cell. The system is classified as a "Small System" as it has less than 500 population served (250) and has no mechanical treatment processes.

a) Ownership of Land and Material Rights

The owner of the land is the Rural Municipality of St. Andrews as registered in the Winnipeg Land Titles Office of the Property Registry as Certificate of Title (CT) Number 1603055/1 (Appendix A). Mineral rights are expected to be held by the Province of Manitoba.

b) Existing Land Use and Designation

The site contains an existing two-cell wastewater lagoon – an existing 0.6 ha primary cell, an existing 0.5 ha secondary cell and a constructed wetland. The proposed lagoon expansion locations are immediately north and south of the existing cells in an open grassed area. The Immediate adjacent neighboring properties consist of open agricultural land to the west, north



Environmental Impact and Management Practices July 2016

and south, with scattered pockets of forest cover, tree-lined dugout, shelterbelts, and marsh land to the east. The land for the existing lagoon and proposed expansion is designated as "Resource and Agriculture" under the Selkirk and District Planning Area Development Plan Bylaw No. 190/08 (Selkirk and District Planning Area 2011). The applicable zoning for the lagoon site is "A80 – Agricultural General" Zone under the RM of St. Andrews Zoning By-law No. 4066 (The Rural Municipality of St. Andrews 2002). Lagoons are a conditional use under Zoning By-law No. 4066 and require a licence or permit from the provincial government. The nearest residence to the site is a farm site located approximately 600 metres to the southwest.

c) Public Meetings or Hearings

No public consultation was undertaken for the project.

3.2 DESCRIPTION OF THE ENVIRONMENT

a) Terrestrial Vegetation

The lagoon site is located in the Interlake Plain Ecoregion, Gimli Ecodistrict, a level to depressional glaciolacustrine lowland and gently undulating lake terrace. Surficial materials are characterized by fluvioglacial, shallow glaciolacustrine deposits and water-worked glacial till. The southern portion of the ecodistrict is part of the Red River drainage division. The soils in the region south of Lake Winnipeg are predominantly poorly drained Peaty Gleysols and shallow organic soils. Lake terrace soils are dominantly Dark Gray Chernozems, well to imperfectly drained, on water-worked glacial till and shallow loamy, glaciolacustrine veneers (Matile and Keller 2004; Smith et al. 1998). A geotechnical soil assessment of the proposed north and south expansion site locations determined that surficial materials are clay and silt with till at depths below excavation limits (Stantec 2016).

Vegetation in the region is dominated by trembling aspen. Deciduous trees such as Manitoba maple, green ash elm and cottonwood are found along rivers, particularly the Red River. Sedges, meadow grasses and willow ring depressional areas. Marsh areas include reed, cattail and sedge species (Smith et al. 1998). Vegetation at the Project site consists of grass cover hayfields and shrub marshland (see Figure C-101).

b) Wildlife and Fish Species

Wildlife in the region has been affected by agricultural development. White-tailed deer, black bear, coyote, beaver and snowshoe hare are widespread throughout the area. Bird species are found in the region include ruffed grouse, raptors, songbirds and various species of waterfowl. The wetlands in the area serve as important waterfowl breeding and migratory bird staging areas (Smith et al. 1998). Various frogs, snakes, and turtles are also common, including northern leopard frog, wood frog, smooth green, plains and red-sided garter snakes, common snapping and western painted turtles, common mudpuppy, and blue-spotted salamander (NatureNorth



Environmental Impact and Management Practices July 2016

2016). Wildlife habitat at and immediately surrounding the Project site consists of grass covered hayfields, agricultural cropland and shrub marshland.

A search of the Manitoba Herp Atlas database found no records of amphibian or reptile species at the Project site (NatureNorth 2016). However, a record of a leopard frog was recorded at a marsh area along Wavey Creek approximately 6.0 km kilometres southwest of the site. This species is widespread and abundant in southern Manitoba (NatureNorth 2016).

Netley Creek supports several recreationally important species of fish, including: carp, channel catfish, goldeye, northern pike, sauger, walleye, white bass, white sucker, yellow perch and brook trout (North/South Consultants Inc. 2008). According to Milani (2013), Netley Creek is considered type A habitat (complex habitat, indicator species present).

According to the Manitoba Conservation Data Centre, rare, endangered or uncommon species of concern potentially found within the Lower Interlake Watershed, as listed in Table 1, include Chimney Swift, Piping Plover, Least Bittern, Red-headed woodpecker, Blue-spotted Salamander, Little Brown Bat, Chortjaw Cisco, and Mapleleaf Mussel (MBCDC 2013). A request submitted to the Manitoba Conservation Data Centre (MBCDC) for existing records of species of concern at the Project site indicated one occurrence – a Bobolink (Friesen 2016). The prevalence of grassed areas surrounding the lagoon site reduces the chances of rare and protected species being present in the Project site.

Species	Federal SARA / COSEWIC Species Status	MCWS Species at Risk Status	MBCDC Conservation Status Rank
Mapleleaf Mussel (Quadrala quadrala)	Endangered	Endangered	S2
Little Brown Bat (Myotis lucifugus)	Endangered	Endangered	S2N
Blue-spotted Salamander (Ambystoma laterale)	Special Concern	n/a	S3S4
Northern Leopard Frog (Lithobates pipiens)	Special Concern	n/a	S4
Shortjaw Cisco (Coregonus zenithicus)	Threatened	n/a	S3
Western Grebe (Aechmophorus occidentalis)	Special Concern	n/a	S4B
Chimney Swift (Chaetura pelagica)	Threatened	Threatened	S2B
Piping Plover (Charadrius melodus)	Endangered	Endangered	S1B
Common Nighthawk (Chordeiles minor)	Threatened	Threatened	S3B
Olive-sided Flycatcher (Contopus cooperi)	Threatened	Threatened	S3S4B
Yellow Rail (Coturnicops noveboracensis)	Special Concern	n/a	S3S4B
Bobolink (<i>Dolychonyx oryzivorus</i>)	Threatened	n/a	S4B
Least Bittern (Ixobfrychus exilis)	Threatened	Endangered	S2S3B
Red-headed Woodpecker (Melanerpes erythrocephalus)	Threatened	Threatened	S2B
Canada Warbler (Wilsonia candensis)	Threatened	Threatened	S4B
Source: MBCDC 2013; MCWS 2015a; SARA 2016 (Schedule 1) Notes: MBCDC conservation status ranks as follows: S1B – vary rare throughout its range or in the province (5 of fe	ewer occurrences), bre	eding status	

Table 1: Species of Concern in Lower Interlake Watershed



Environmental Impact and Management Practices July 2016

Species	Federal SARA / COSEWIC Species Status	MCWS Species at Risk Status	MBCDC Conservation Status Rank
 S2, S2B, S2N – rare throughout its range or in the province, (6 t of a migratory species S3, S3B – uncommon throughout its range or in the province (0	0
S4, S4B – widespread, abundant or apparently secure (>100 occurrences), breeding status			

c) Surface Water

The Project site is located within the East Interlake Conservation District (EICD). Streamflow in the Lower Interlake Watershed, including Netley Creek, peaks in spring but varies considerably due to daily, seasonal and annual changes (MCWS 2008a). In terms of water allocation, most surface water sourced allocations in the Netley – Grassmere Watershed are for irrigation and other uses. Most irrigators pump from Netley Creek or Wavey Creek (MCWS n.d.1). Approximately 96% of all water allocated under licence for irrigation purposes is from surface water sources. However, this represents only about 4% of the total volume of water allocated in the watershed (MCWS n.d.1). Over a 44 year period (1963-2007), daily streamflows from a monitoring station along Netley Creek were recorded in the northern portion of the Lower Interlake watershed. The streamflow ranged from a maximum daily discharge of approximately 70 m³/s to a minimum near zero over this period (MCWS 2008a).

Information on water quality in the Netley – Grassmere Watershed has been collected by the Province from a long-term water quality monitoring station on the Red River located at the PR 204 bridge in Selkirk, MB (MCWS 2008b). A wide range of water quality variables was recorded, including nutrients, general chemistry, bacteria, pesticides, and metals. Total phosphorus and total nitrogen concentrations at the long-term monitoring station were analyzed for trends based on variations in river flow over a period from 1978 to 2000. The analysis showed a trend of increasing total phosphorus and total nitrogen (MCWS 2008b).

Data from the long-term water quality monitoring station on the Red River at Selkirk, MB was used to calculate a Water Quality Index (WQI) based on The Canadian Council of Ministers of the Environment (CCME) Water Quality Index. The WQI ranges from 0 to 100 and is used to rank water quality ranging from poor to excellent. Water Quality for the Red River at this location was calculated for the period 1993 to 2007. In general, the WQI for the river ranged from "Marginal" to "Fair" (MCWS 2008b).

Water quality has been monitored in several regional creeks within the Lower Interlake Watershed. Netley Creek water quality was monitored in 2005 for *E.coli* and nutrients at a site at a crossing of PTH 8 (approximately 5.5 km upstream of Petersfield). Nutrients were found to be high in Netley Creek at PTH 8. Total phosphorus concentrations and ammonia levels at the PTH 8 site were also high (MCWS 2008b). Water quality monitoring along the main stem of Wavey Creek and agricultural drains was undertaken in 1995 (MCWS 2008b). Concentrations of total and dissolved phosphorus, ammonia, and nitrogen were collected at 10 sampling locations from



Environmental Impact and Management Practices July 2016

both upstream and downstream sites on Wavey Creek, including at the most downstream site east of PTH 9, approximately 4.0 km southeast of Petersfield. Total phosphorus concentrations at the mouth of Wavey Creek with Netley Creek were found to be the second highest following an agricultural drain further upstream west of PTH 9 when compared to eight other sampling locations (MCWS 2008b). Water quality sampling conducted by the East Interlake Conservation District for creeks in its watershed between 2007 and 2008 found lower concentrations of total phosphorus in Netley and Wavey creeks compared to other creeks sampled (MCWS 2008b).

d) Groundwater

Groundwater throughout the Interlake area is available from the major limestone and dolostone Carbonate aquifer as the primary water supply source in the region. Shales and sandstones forming the Winnipeg Formation underlie this major fresh water aquifer. The bedrock is overlain by clay and glacial till of variable thickness. The overburden layer in the watershed varies in thickness to approximately 40 metres (EICD 2011). Lenses of sand and gravel aquifers are located locally at contact points between the till and bedrock (MCWS n.d.2). Regional groundwater flow is primarily northwest to southeast across the watershed. Water quality is generally good with most sources of groundwater exceeding one or more aesthetic objectives for drinking water; water is often hard with iron and manganese also present. Trace metal concentrations have not been found to exceed drinking water guidelines, save for some slightly higher uranium concentrations in a few wells (MCWS n.d.2). There are numerous provincial observation wells in the watershed, including one on Netley Creek located west of Petersfield near PTH 8 (EICD 2010).

There are two groundwater-based public drinking water sources along Netley Creek at Petersfield in the form of seasonal wells. These private wells are located at Netley Resorts Ltd. and Chelsey's Family Resort and Campground and serve a population of approximately 480 (MCWS 2015b). Both well locations are identified as source water protection zones with an established 1.5 km buffer (EICD 2011). Groundwater is deemed sensitive to pollution in areas where the overburden thickness is less than 6 metres and can be impacted by quarries, gravel pits, and abandoned or poorly constructed wells that puncture an aquifer, and from septic systems and wastewater lagoons through the leaching of contaminants (EICD 2011). The area of the existing lagoon and proposed expansion sites has an overburden thickness of approximately 18 to 24 metres of clay and is not located within any source water protection zones (EICD 2010; 2011).

e) Land Use

Agriculture is the predominant land use within the Netley – Grassmere Watershed, almost half as annual cropland. Areas of grassland and wetlands are found in the vicinity of Netley Lake (Marsh). Rural residential subdivision development and seasonal recreational land development is evident along both Netley and Wavey creeks in the vicinity of Petersfield (EICD 2011). There



Environmental Impact and Management Practices July 2016

are a number of navigable recreational waterways in the watershed, including Netley Lake, Netley and Wavey creeks and the Red River. Netley Lake (Marsh) is located approximately 1.1 km to the east of the Project site. It is not designated a vulnerable water body under *The Water Protection Act*, Nutrient Management Regulations (62/2008) which stipulates nutrient buffer zones and sensitive lands that should not receive application of nutrients (MCWS 2015c). The Project site is not located within a vulnerable water body nutrient buffer zone.

According to the Canada Land Inventory (CLI) for Agricultural Land Capability (AAFC 2009; CLI 1968), land at and adjacent to the Project site is classified as follows:

- Classes 2W and 3W land with moderate to moderately severe limitations that restrict the range of crops with excess water as a factor.
- Classes 6 and 7 lands with very severe limitations that restrict the production of perennial forage crops, improvement practices not feasible and no capability for arable culture or permanent pasture.

Recreational activities in the vicinity of the Project site at Petersfield include a golf course, seasonal RV campsite-Trailer Park, anchorage, canoe access (put-in/take-out), paddling (canoe-kayak) and snowmobiling (Mussio Ventures Ltd. 2015). Access to the Project site is provided off of a north-south municipal road (Gimli Trail) allowance to the east of Petersfield (RM of St. Andrews 2015).

f) Heritage Resources

There is a large inventory of heritage resource sites (i.e., buildings) that have been documented in the RM of St. Andrews, principally along the Red River between the city of Winnipeg and Lake Winnipeg (SIPD 2011). There is one heritage site located along Netley Creek, the Netley River Cottage at NE22-15-4E, that is designated a municipal heritage site under *The Heritage Resources Act* (The RM of St. Andrews 2003). A review of the provincial Archaeological Sites Inventory Database revealed no records on the Project site; however, three records were within 5 km of the Project site, all along Netley Creek. The first site is a Late Precontact campsite (A.D. 750 to 1700) found in a cultivated field, approximately 3.6 km to the west of the Project site. The second, a surface collected bison bone, was recorded approximately 2.9 km to the southwest of the Project site. The third site consists of an early historic (A.D. 1721 to 1821) campsite and undated burial located approximately 3.3 km to the south (McLean 2016). All of the three recorded sites are considered to be of low heritage resource potential (McLean 2016).



Environmental Impact and Management Practices July 2016

3.3 ENVIRONMENTAL IMPACTS

a) Type, Quantity and Concentration of Pollutants to be Released into the Air, Water or on Land.

Wastewater from the existing Petersfield wastewater lagoon will be retained and treated using an expanded four-cell lagoon system, including two new primary cells combined with an existing primary and secondary cell and a constructed wetland. Current organic loading in the primary cell exceeds the allowable limit. The existing lagoon system does have adequate winter hydraulic storage and the additional storage created with the two new primary cells would be considered surplus. The new expanded lagoon cells will have 60 mil HDPE liners and will be properly sized to meet the maximum allowable primary cell loading (i.e., 56 kg/day). Winter design storage equal to 230 days is incorporated in the system design. Wastewater will be monitored to ensure effluent quality meets Licence requirements in terms of biological oxygen demand, fecal coliform content, total coliform content, total nitrogen and total phosphorus. The expanded wastewater treatment system will result in the improvement in organic loading and wastewater treatment compared to the current operation.

b) Effects on Wildlife

There is potential for disturbing or displacing wildlife species present in the general Project area via construction activities and noise generation from equipment and vehicles.

A request submitted to MBCDC for existing records of rare and protected wildlife species indicated no occurrences of such species in the Project area. Similarly, a search of the MHA database did not reveal the presence of amphibians or reptile species in the immediate area; however, the absence of data from either database does not confirm the absence of any listed species. The location of the treatment lagoon expansion in a grass covered hayfield area reduces the likelihood of species of concern being present in the Project footprint.

Project construction is anticipated to occur upon receipt of funding. Project-related disturbance activities to wildlife habitat will be reduced by avoiding the sensitive breeding window for migratory bird wildlife species – mid-April to end of August (Environment Canada 2014). To avoid potential disturbance to nesting migratory birds, if there is a need for any vegetation clearing it will be conducted prior to mid-April or after August 30. If clearing is to occur during the sensitive nesting period, a pre-construction nest survey to locate and buffer active bird nests will be completed.

Due to the presence of water bodies, mixed-wooded areas and open grassed areas, there is potential for amphibian and reptile species to occur in the general Project area. Species such as common snapping turtles are known to make seasonal movements between breeding and overwintering habitats in late May to late June, and again in mid- to late September (COSEWIC



Environmental Impact and Management Practices July 2016

2008). Construction workers should be aware of the potential for amphibian and reptile species to be present in the Project area and take caution to avoid harming a sensitive species.

It is expected that effects on wildlife as a result of the Project will be low as the proposed site for the new lagoons is a cleared, grassed and partially disturbed site.

c) Effects on Fisheries

Potential effects on fish and fish habitat are related to the release of sediments from construction activities associated with excavation work (i.e., blown dust, exposed surface runoff) and from lagoon effluent discharges into surface water bodies utilized by fish. However, silt fences and other silt collection means will be installed to trap silt during the entire construction operation.

The nearest water body to the Project site is Netley Lake (Marsh), some 1.1 km to the east. The new lagoon system will continue to discharge treated effluent via an existing discharge point to an existing marshy area that discharges via marshy ponds and paths to Netley Creek, which is considered type A habitat (Milani 2013) located approximately 2.8 km to the south, and ultimately to Netley Lake. The expanded lagoon system has been designed for annual winter storage of 230 days. It is expected that the lagoon system will discharge treated effluent between June 16 and October 31 of any given year. This discharge period avoids and protects common fish species found in Netley Creek (e.g., walleye, northern pike, yellow perch, sauger, and white sucker) during the springtime spawning period (i.e., April 1 to June 15). However, fish species may be present in Netley Creek, including channel catfish, freshwater drum, goldeye, and white bass during the summer spawning period (i.e., May 1 to June 30) and brook trout during the fall spawning period (i.e., September 15 to April 30) (DFO 2013).

The likelihood of erosion/deposition from construction activities directly affecting Netley Creek and downstream water bodies is considered low given the separation distance, and the presence of vegetation between the Project site in the receiving marshy area prior to Netley Creek. Additionally, as noted above, prior to construction, silt fences will be installed at the Project site to mitigate erosion and off-site deposition.

The proposed lagoon upgrade will provide long-term effluent improvements (i.e., 20 year design loading) at the Petersfield lagoon with the addition of two new properly sized primary cells. Effluent discharged into the existing receiving marshy area from the constructed wetland will meet Licence limits. Discharge of treated effluent will occur during the summer and fall spawning periods for fish. However, given the distance between the Project site and Netley Creek, and the presence of the intervening marshy receiving water body, the effects on fish from Project treated effluent are anticipated to be negligible.



Environmental Impact and Management Practices July 2016

d) Effects on Surface and Groundwater

The new cells will not be located within a vulnerable water body nutrient buffer zone. The existing discharge point to a receiving marshy area, system of existing ditches west of Netley Lake, down to Netley Creek approximately 2.8 km to the south, and ultimately flowing to Netley Lake will be used. The effluent will only be discharged according to licenced limits and timing restrictions. Erosion/deposition during construction activities at drainage locations will be mitigated by the installation of silt fencing and the vegetation along the discharge route prior to its discharge to Netley Creek. The potential for effect of the Project on surface water is anticipated to be negligible.

The new primary cells will be HDPE lined to provide groundwater protection at the site. As such, effects on groundwater from new lagoon construction are anticipated to be negligible.

e) Effects on Soils

During Project construction soils could be affected by compaction associated with equipment operating at the site. Any compaction of soils would be limited to the immediate cleared footprint for the Project and activities associated with the addition of a proposed road extension and turnaround. Project excavation at the site could result in some soil mixing. There is also the potential for soils to be contaminated due to accidental spills, leaks or releases of fuels, lubricants or other materials from construction equipment and activities at the Project site and from lagoon operation.

Disturbance of soils adjacent to the lagoon site and road turnaround will be minimized during construction by keeping heavy equipment operations limited to the Project site to the extent possible and using properly maintained equipment. As the Project site is primarily clay and silt with till at levels below excavation limits, there is some potential for minor compaction effects associated with lagoon construction. During excavation, topsoil will be stripped and stockpiled separately to avoid soil mixing with other subsurface materials. The upper soil deposits will be used to construct the new lagoon dikes at the site.

The potential adverse effects on soils from accidental spills would be limited to the period of construction, would be subject to remediation, and is considered negligible given the small amount of equipment and quantity of fuel, lubricants and materials that would be present at the Project site. An emergency spill kit to remediate accidental spills, leaks or releases will be maintained on the Project site during construction.

The new cells will be HDPE lined, with appropriate quality control measures implemented, to mitigate soils effects from lagoon operation on the Project site. The RM is currently undertaking a sludge reduction program. However, once the new cells are constructed, the existing primary cell can be desludged if required at a later date. Desludging of the existing cell would be



Environmental Impact and Management Practices July 2016

conducted in accordance with the applicable regulations in place at that time. As such, the potential effects from lagoon operation on soils in the area are anticipated to be negligible.

f) Vegetation Effects

There is potential for removal of vegetation species through construction work at the site. The proposed site for the new lagoon cells and road and turnaround is predominantly an existing grassed area that is already partially disturbed. Very minimal vegetation will be required at the Project site. Topsoil removed during lagoon excavation will be stockpiled separately for subsequent reuse in revegetating the lagoon berms. A request submitted to MBCDC for existing records of rare and protected wildlife species indicated no occurrences of such species in the Project area. As such, the effects on vegetation are anticipated to be negligible.

g) Forestry Related Effects

Existing grassed areas to the north and south of the existing lagoon site will be used for the new lagoon cells. No potential timber harvesting areas would be affected by the Project. A new road and turnaround is required for the new lagoon construction at the site. Existing roads will continue to provide access to the lagoon site. No Project related effects on forestry are anticipated.

h) Air Quality Effects

There is potential for emissions, including greenhouse gases (GHGs) and fugitive dust generation, from construction equipment and vehicles during construction works at the site. Localized increased volatile organic carbon (VOCs) levels could result from fuels used during construction. Fuel may be transported to the site to fuel equipment. Effects on air quality are expected to be low due to the short-term of construction (i.e., September to November) and the small construction workforce.

Nuisance odours can occur from lagoons that are not sized properly or are organically overloaded a short time in spring during the thawing period. However, the current expansion will be large enough to handle the organic loading which is the source of potential odors. Prevailing winds in southern Manitoba are principally northwest and southeast. A similar trend is likely at Petersfield, MB. Potential odours could be carried by variable winds and cause a nuisance to nearby residents. However, the closest residence/farmstead is located approximately 600 metres to the southwest of the site within a vegetation buffer. No prior odour complaints are known to have been registered with the RM of St. Andrews over lagoon operation.

Odour effects on air quality have been addressed through proper sizing of the two new primary cells to meet the 20 year design organic loading requirement of 56 kg/day. As such, nuisance odours as a result of organic overloading are expected to be low to negligible.



Environmental Impact and Management Practices July 2016

i) Noise Effects

There is some potential for noise effects in the immediate area during construction from the operation of construction equipment and vehicles. Noise effects could cause temporary disturbance to wildlife in the area. The nearest residence/farmstead is located to the southwest (approx. 600 metres) of the Project site within a vegetation buffer.

Construction noise effects are expected to be low and short-term in duration. Noise effects from maintenance vehicles (i.e., wastewater hauling trucks, grass mowers) operating at the site would only be intermittent in nature and limited in duration. As such, noise effects from the Project are anticipated to be negligible.

j) Heritage Resources

Heritage resources, and their associated artifacts and cultural data, are protected under *The Heritage Resources Act*. A desktop screening revealed three records within a 5 km radius of the Project site. All of the three recorded sites are along Netley Creek and are considered to be of low heritage resource potential (McLean 2016). The closest site is a surface collected bison bone, located approximately 2.9 km to the southwest of the Project site (McLean 2016).

The Heritage Resources Branch (HRB) was contacted to undertake a Heritage Screening for the proposed Project site. The HRB examined the applicable area proposed for development based on the Branch's records for areas of potential concern and identified no heritage concerns with the Project. In the event that heritage resources, or objects thought to be heritage resources, are exposed during construction, work at the site will cease until Historic Resources Branch authorities have been notified and the item investigated.

k) Socio-economic Effect

The proposed Project will create temporary construction employment and contribute to the local economy in the surrounding area through the purchase of goods and services during construction. The potential effects are considered positive but negligible.

In addition, it is expected that there will be an overall socio-economic benefit as a result of the improvement of treated effluent quality and elimination of organic overloading at the existing site. The proposed lagoon expansion will effectively address existing effluent quality issues related to septage hauling at the municipal lagoon and improve organic loading over a 20 year design period.

I) Visual Effects

The landscape will be altered by the construction of the new lagoon cells. Construction will occur in an area to the north and south of the existing lagoon cell in a predominantly grassed



Environmental Impact and Management Practices July 2016

area that is partially disturbed. The new lagoon cells will have a low profile earthen dike structure, approximately 1.4 metres above ground, with a fence approximately 2 metres high. The proposed lagoon expansion sites are located immediately adjacent to an existing lagoon approximately 45 metres to the east of an existing north-south municipal road. The nearest residence/farmstead to the Project site is located approximately 600 m to the southwest within a screened yardsite. Grass on the new earthen dikes will be mowed regularly during seasonal operation. The change in the visual viewscape would be incremental to existing facility effects at the site. As such, the Project's effect on area aesthetics is anticipated to be negligible.

3.4 ENVIRONMENTAL MANAGEMENT PRACTICES

Proposed environmental management practices will be undertaken in accordance with recommended "Operation and Maintenance of Sewage Lagoons" manual and Environment Act Licence, both as issued by Manitoba Conservation.

3.4.1 Operation

The RM of St. Andrews operates the existing wastewater lagoon and has a trained operator under the training program for a "Small System" sewage treatment facility. Normally, the lagoon would be discharged twice per year, between June 15 and October 31. The maximum water level in the cells is 1.5 m. The following procedure would be followed with respect to discharging the lagoon.

Step 1: Close the valves between the primary cells and secondary cell and wetland two weeks before sampling.

Step 2: Sample the secondary cell and wetland after the connecting valve between the primary cells and secondary cell has been closed for two weeks. Sample bottles and sample preservation and submission procedures can be obtained from accredited laboratories.

Step 3:

- a) If the samples tested meet criteria, open the discharge valve from the secondary cell and wetland, and discharge the contents. Discharge would be completed within two weeks.
- b) If the samples tested do not meet criteria, it is necessary to repeat the sampling until bacteriological criteria are met. Once met, discharge can take place.

Step 4: When the secondary cell is drained, the discharge valves would be closed.

Step 5: Open the valves between the primary cells and the secondary cell and control the water levels in the cells such that there is a minimum of 0.30 m.



Environmental Impact and Management Practices July 2016

3.4.2 Maintenance

Spring, Summer and Fall Maintenance

The majority of maintenance is carried out in the spring, summer and fall of each year as weather permits. Typical maintenance tasks include:

- Grass on the dykes of the lagoon should be cut on a regular basis. The grass should not exceed 0.3 meters in length. Deep rooted weeds should be removed to prevent deterioration of the dykes and liner system.
- Inspect fence and gate for damage and repair as required.
- Gate valves should be operated in spring, summer and fall to ensure they are in proper working order.
- If encountered, animals burrowing on the dykes of the lagoon should be removed and the holes filled. If assistance in animal control is required, contact Manitoba Conservation.
- Check for erosion on the dykes. If erosion is present, erosion repairs should be undertaken.
 This may include re-grading, grass planting or stone rip-rap.
- Regular road and turn around maintenance should be undertaken to ensure access to the site at all times. Culverts should be cleared of blockage.
- Ensure the discharge value is closed when not draining.
- Inspect and maintain drainage.
- Monitor sewage dumping to allowable loads.

Winter Maintenance

Monitor sewage dumping to allowable loads.

3.5 LAGOON DETAILS

The lagoon details are described and shown in the appended Study Drawing C-101.

3.6 MITIGATION OF SILT RUNOFF DURING CONSTRUCTION

Silt fences and/or straw wattles will be placed around the construction area as required to protect the adjacent lands from silt.



Environmental Impact and Management Practices July 2016

3.7 DISTANCE FROM EXISTING STRUCTURES

The existing and proposed new lagoon cells are approximately 600 m from the nearest residence.

3.8 SLUDGE DISPOSAL PLAN

The Sludge Disposal Plan is as follows:

- Sludge in the primary cells would be monitored on an annual basis and removed when a significant accumulation occurs (300-400 mm). With respect to the two new primary cells, sludge likely won't require removal for perhaps 25 years. The RM is currently undertaking a chemical sludge reduction program on the existing primary cell.
- At removal time, the sludge would be dewatered on site, removed from site, and applied to agricultural land or an appropriate landfill in accordance with disposal methods approved by the Province of Manitoba. An EAP Licence would be required.



Schedule July 2016

4.0 SCHEDULE

Construction of the proposed wastewater lagoon is tentatively scheduled to start upon receipt of funding and approvals. The completed lagoon upgrade would commence operation, upon approval by Manitoba Conservation.



Funding July 2016

5.0 FUNDING

This project will apply for funding from the Province of Manitoba.



References June 2016

6.0 **REFERENCES**

Agriculture and Agri-Food Canada. 2009. Netley-Grassmere Study Area IWMP: An Analysis of the Agricultural Change in the Netley-Grassmere Study Area Using Land Cover, Soils and Ag-Profiling. Prairie Farm Rehabiliation Administration and Manitoba Agriculture Food and Rural Initiatives. Winnipeg, MB.

Canada Land Inventory. 1968. Land Capability for Agriculture, Selkirk 62I, 1:250,000. Lands Directorate, Environment Canada. Ottawa, ON.

East Interlake Conservation District. 2010. Netley – Grassmere Integrated Watershed Management Plan, Watershed Characterization. Prepared for East Interlake Conservation District. Gimli, MB.

East Interlake Conservation District. 2011. Netley – Grassmere Integrated Watershed Management Plan. Prepared by the East Interlake Conservation District. Gimli, MB.

Fisheries and Oceans Canada. 2013. Projects Near Water – Manitoba Restricted Timing Windows for the Protection of Fish and Fish Habitat. Government of Canada. Available at: <u>http://www.dfo-mpo.gc.ca/pnw-ppe/timing-periodes/mb-eng.html</u>. Accessed March 18, 2016.

Friesen, Chris. Coordinator, Manitoba Conservation Data Centre, Manitoba Conservation and Water Stewardship. Email correspondence with Bill Krawchuk, Stantec Consulting Ltd., March 21, 2016.

Government of Canada. 2016. Species at Risk Public Registry, Schedule 1 A to Z Species Index. Available at: <u>http://www.registrelep-sararegistry.gc.ca/sar/index/default_e.cfm</u>. Accessed March 10, 2016.

McLean, Heather. Heritage Resources Registrar. Archaeological Site Inventory Database. Historical Assessment Services, Historic Resources Branch. Email correspondence with David McLeod, Stantec Consulting Ltd., March 10, 2016.

Manitoba Conservation Data Centre. 2013. Occurrence of Species by Ecoregion – Interlake Plain. Available at: <u>http://www.gov.mb.ca/conservation/cdc/ecoreg/interlake.html</u>? Accessed March 10, 2016.

Manitoba Conservation and Water Stewardship (MCWS). n.d.1. Water Use Licensing Report: Netley – Grassmere Watershed. Prepared for East Interlake Conservation District. Winnipeg, MB.



References June 2016

Manitoba Conservation and Water Stewardship (MCWS). n.d.2. Netley-Grassmere Watershed – Groundwater Input to Technical Process. Prepared for the East Interlake Conservation District. Winnipeg, MB.

Manitoba Conservation and Water Stewardship (MCWS). 2008a. Lower Interlake Basin – Hydrology. Watershed Planning – Surface Water. July 2008. Winnipeg, MB.

Manitoba Conservation and Water Stewardship (MCWS). 2008b. 05OJ Grassmere and Netley Creek Watershed – Water Quality Component, State of the Watershed Report. Prepared by Manitoba Water Stewardship. Winnipeg, MB.

Manitoba Conservation and Water Stewardship (MCWS). 2015a. Manitoba Species at Risk. Wildlife Branch. Available at: <u>http://www.manitoba.ca/conservation/wildlife/sar/sarlist.html</u>. Accessed March 10, 2016.

Manitoba Conservation and Water Stewardship (MCWS). 2015b. Manitoba Water Stewardship, Public Water Systems. Available at: <u>https://www.gov.mb.ca/waterstewardship/odw/public-info/general-info/compliance_data/seasonal_pws_may_29_2015.pdf</u>. Accessed March 9, 2016.

Manitoba Conservation and Water Stewardship (MCWS). 2015c. Nutrient Buffer Zone. Available at: <u>http://www.gov.mb.ca/conservation/waterstewardship/wqmz/nutrientbufferzones.html</u>. Accessed March 9, 2016.

Matile, G.L.D and G.R. Keller. 2004. Surficial Geology of the Selkirk Map Sheet (NTS 62I), Manitoba. Surficial Geology Compilation Map Series SG-62I. Manitoba Industry, Economic Development and Mines, Manitoba Geological Survey. Winnipeg, MB.

Milani, D.W. 2013. Fish Community and Fish Habitat Inventory of Streams and Constructed Drains throughout Agricultural Areas of Manitoba (2002-2006). Canadian Data Report of Fisheries and Aquatic Sciences 1247. Fisheries Protection Program, Central and Arctic Region, Fisheries and Oceans Canada. Winnipeg, MB.

Mussio Ventures Ltd. 2015. Manitoba Backroad Mapbook – Outdoor Recreation Guide. 2nd Edition. Editor, Russell Mussio. Coquitlam, BC.

NatureNorth. 2016. The Manitoba Herps Atlas. Available at: <u>http://www.naturenorth.com/Herps/MHA_Frogs.html</u>. Accessed March 8, 2016.

Nesbitt, Christina. Impact Assessment Archaeologist, Historic Resources Branch. Email correspondence with David McLeod, Stantec Consulting Ltd., March xx, 2016.



References June 2016

North/South Consultants Inc. 2008. East Interlake Conservation District: Watershed 05OJ Riparian Assessment Survey – with Emphasis on Third Order Drains and Higher – 2007 and 2008. Prepared for the East Interlake Conservation District. Winnipeg, MB.

Selkirk and District Planning Area. 2011. The Selkirk and District Development Plan By-law No. 190/08. The Selkirk and District Planning Area Board. Selkirk, MB.

Smith, R.E., H. Veldhuis, G.F. Mills, R.G. Eilers, W.R. Fraser and G.W. Lelyk. 1998. Terrestrial Ecozones, Ecoregions and Ecodistricts of Manitoba, An Ecological Stratification of Manitoba's Natural Landscapes. Research Branch Technical Bulletin 1998-9E. Land Resource Unit, Brandon Research Centre, University of Manitoba, Research Branch, Agriculture and Agri-Food Canada. Winnipeg, MB.

Stantec Consulting Ltd. 2016. Petersfield Truck Dump Wastewater Lagoon Expansion Study. Prepared for The Manitoba Water Services Board and Manitoba Conservation and Water Stewardship. Winnipeg, MB.

The Rural Municipality of St. Andrews. 2002. An Office Consolidation of The R.M. of St. Andrews Zoning By-law No. 4066. The Rural Municipality of St. Andrews. Clandeboye, MB.

The Rural Municipality of St. Andrews. 2003. Rural Municipality of St. Andrews By-law No. 4085. The Rural Municipality of St. Andrews. Clandeboye, MB.

The Rural Municipality of St. Andrews. 2010. Municipal Road Map. Available at: http://www.rmofstandrews.com/assets/maps/map_road.pdf. Accessed March 9, 2016.



APPENDIX 1

Petersfield Truck Dump Wastewater Lagoon Expansion Study

Petersfield Truck Dump Wastewater Lagoon Expansion Study





Prepared for: RM of St. Andrews 500 Railway Avenue, Box 130 Clandeboye MB R0C 0P0

Prepared by: Stantec Consulting Ltd. 500-311 Portage Avenue Winnipeg MB R3B 2B9



Project No. 111215981

June 24, 2016

Table of Contents

1.0		1
2.0	SCOPE OF WORK	2
3.0	EXISTING LAGOON AND WASTEWATER TRUCK DUMP DATA	3
4.0	GEOTECHNICAL INVESTIGATION	4
5.0	TOPOGRAPHIC SURVEYS OF SITES	5
6.0 6.1 6.2 6.3	LAGOON DESIGN HYDRAULIC AND ORGANIC LOADING REQUIRED WINTER HYDRAULIC STORAGE HYDRAULIC STORAGE MAXIMUM DAY ORGANIC LOADING REQUIRED PRIMARY CELL SIZE	6 6 6
6.4	REQUIRED PRIMART CELL SIZE	0
6.4 7.0	LAGOON CELL EXPANSION OPTIONS AND COSTS	
		8
7.0	LAGOON CELL EXPANSION OPTIONS AND COSTS	8 0
7.0 8.0 9.0	LAGOON CELL EXPANSION OPTIONS AND COSTS	8 0
7.0 8.0 9.0 LIST O Prelim	LAGOON CELL EXPANSION OPTIONS AND COSTS	8 0 1

APPENDIX A – Annual Truck Dumping Data APPENDIX B – Geotechnical Data



PETERSFIELD TRUCK DUMP WASTEWATER LAGOON EXPANSION STUDY

Introduction June 24, 2016

1.0 INTRODUCTION

Stantec was retained by the Manitoba Water Services Board in January, 2016 to undertake the "Petersfield Truck Dump Wastewater Lagoon Expansion Study", as the basis for an Environmental Act Proposal Application for the addition of two new primary cells to the existing lagoon. The existing lagoon, located on Section 36, Township 15, Range 4E, has a primary cell, secondary cell, and a constructed wetland which borders on Netley marsh. The existing lagoon expansion areas are generally grass with marsh to the east. The lagoon is not near any centre of development and the nearest residence is a farm 600 m to the southwest.

Stantec had completed a Preliminary Assessment of the proposed lagoon expansion in November, 2015 for the RM of St. Andrews. At that time, assessments were made of the loadings and a one primary cell expansion option was considered. Test hole drilling was undertaken directly south of the existing lagoon. In order to increase the capacity for septage dumping, the RM of St. Andrews later decided to proceed with a two primary cell expansion, one cell south and one cell north of the existing lagoon. This current Study will assess the two cell expansion which will include additional test holes on the north side of the lagoon, and a topographic survey.

The existing two cell lagoon was constructed in 1996. It is lined with clay taken from adjacent borrow pits. The organic loading on the primary cell exceeds the allowable limits of 56 kg/day/ha and as a result the lagoon has been closed from time to time in order to allow treatment to meet discharge requirements. The RM provided operational data for wastewater truck dumping as detailed in Appendix A. The maximum loading year was 2013. The RM has decided not to exceed this loading for the next 20 years and therefore the 2013 loading will be the 20 year design loading. The RM will carefully monitor truck dumping to ensure that lagoon loading does not exceed the design capacity.



PETERSFIELD TRUCK DUMP WASTEWATER LAGOON EXPANSION STUDY

Scope of Work June 24, 2016

2.0 SCOPE OF WORK

The scope of work includes the following tasks:

- Liaison with MWSB and the RM of St. Andrews
- Test holes north of the lagoon
- Topographic survey north and south of the lagoon
- Confirm 20 year design period hydraulic and organic loading
- Desktop preliminary assessment of potential environmental issues
- Determine size of proposed two new primary cells
- Assess feasibility of using sporadic clay deposits for lagoon construction
- Assess the use of a synthetic liners such as 60 mil HDPE
- Assess construction and quantity issues related to "perching" the lagoon cells to match existing cell bottom and wetland elevations
- Assess interconnecting and discharge piping arrangements
- Assess expected high groundwater table to determine elevation of a synthetic liner
- Review existing discharge configurations from wetland
- Determine feasible alternatives
- Determine preliminary construction quantities
- Prepare preliminary opinion of cost estimates
- Prepare and submit a draft Study
- Review comments from MWSB and RM of St. Andrews
- Prepare and submit Final Study



PETERSFIELD TRUCK DUMP WASTEWATER LAGOON EXPANSION STUDY

Existing Lagoon and Wastewater Truck Dump Data June 24, 2016

3.0 EXISTING LAGOON AND WASTEWATER TRUCK DUMP DATA

The following assessment is based on the 2013 truck dump wastewater loading data which is the 20-year design loading year.

- a) The existing primary cell has a full supply hydraulic operating level (FSL) surface area of 0.6 hectare.
- b) The allowable hydraulic storage in the primary cell for winter storage is 3,025 m³.
- c) The secondary cell has an FSL area of 0.55 hectare.
- d) The allowable hydraulic winter storage in the secondary cell is 5,625 m³.
- e) The winter hydraulic storage in the wetland is 8,094 m³. Manitoba Conservation advised that, on a preliminary assessment, the wetland can be included in the storage calculations.
- f) The total annual hydraulic loading from truck dumping was 22,644 m³ which will be the design hydraulic loading.
- g) The total truck loads were 2,059.
- h) Of the 2,059 truckloads, 142 loads were septage.
- i) The average daily summer hydraulic loading was 80 m³.
- j) The maximum daily summer hydraulic loading was 100 m³.
- k) The winter average daily hydraulic loading was 60 m³.



Geotechnical Investigation June 24, 2016

4.0 GEOTECHNICAL INVESTIGATION

Maple Leaf Drilling undertook the drilling of 27 test holes on July 9 and 10, 2015 on the proposed lagoon expansion site directly south of the existing lagoon and wetland. The test hole log information, and test hole location plan, Figure 3.1, are in Appendix B.

A second test drilling was undertaken on January 28, 2016 on the north side of the lagoon. This test hole information is also in Appendix B.

In conclusion, the site soils are clay and silt with till at depths below excavation limits. Suitable clay for lagoon construction is very difficult and expensive to access. Stantec has the experience of having designed and provided construction resident and non-resident inspection on the original lagoon and wetland. The construction of clay lined new cells meeting the required 1 x 10⁻⁷ cm/sec hydraulic conductivity is considered high risk as suitable clay may be difficult to find and require more than expected excavation of unsuitable material to access.

The second option would be to construct lagoon cells using easily accessible silt lined with 60 mil HDPE.



Topographic Surveys of Sites June 24, 2016

5.0 TOPOGRAPHIC SURVEYS OF SITES

A topographic survey of both the south and north sites was done on February 26, 2016. The survey went as far east as the cattail lines which had ice at ground level which was considered to be the marsh water level.

The expansion site ground levels are approximately .5 m above ice level. Therefore, it is recommended to place the synthetic liner no lower than that level to prevent "bubbles" popping up in to the cell bottom. Assuming .15 m stripping, this allows a clay/silt cut of .65 m below ground which allow for a .3 m sand bedding below the liner. The elevation of the liner with respect to ground and surface water will be further assessed in the design phase.



Lagoon Design Hydraulic and Organic Loading June 24, 2016

6.0 LAGOON DESIGN HYDRAULIC AND ORGANIC LOADING

6.1 REQUIRED WINTER HYDRAULIC STORAGE

The required winter hydraulic storage is 230 days x 60 m³/day = 13,800 m³.

6.2 HYDRAULIC STORAGE

Manitoba Conservation and Water Stewardship, Environmental Assessment and Licensing Branch have advised that a well-managed wetland can be used in hydraulic storage calculations. Therefore, the calculated winter hydraulic storage including the wetland is as follows:

Primary Cell		3,025 m ³
Secondary Cell		5,625 m ³
Wetland		8,094 m ³
	Total	16,744 m ³

Therefore the existing lagoon system has adequate winter storage, and the additional storage created with the two new primary cells, estimated at 13,900 m³, is surplus. The existing lagoon is hydraulically capable of handling domestic sewage of approximately 250 persons annually and 350 persons with expansion. However, the disposal of septage from septic tanks is the limiting factor due to its high organic loading.

6.3 MAXIMUM DAY ORGANIC LOADING

Domestic sewage organic loading is hydraulically based and has been set at 250 mg/L BOD₅ for domestic sewage. Septage, from septic tank solids compartments, is set at 7,000 mg/L BOD₅. The RM of St. Andrews has requested that the lagoon expansion allow for two full truck loads of septage per day.

The maximum day organic loading is:

1.	Trucked sewage;	100,000 L (maximum day) @ 250 mg/L	= 25 kg/day BOD ₅

2. Trucked septage; 2 loads @ 11,000 l @ 7,000 mg/L = 154 kg/day BOD₅

Total Maximum Day Loading 179 kg/day BOD5

6.4 REQUIRED PRIMARY CELL SIZE

The maximum allowable primary cell loading is 56 kg/day/hectare. Therefore, the minimum required primary cell size is $179 \div 56 = 3.2$ hectares. Therefore, the existing 0.60 ha primary cell is inadequate for two truck load of septage per day and additional primary cell area is required.



Lagoon Design Hydraulic and Organic Loading June 24, 2016

The required additional primary cell size at full supply liquid level would be 3.2 - 0.6 = 2.6 hectares. The organic loading requirements would be met by constructing two new primary cells of 1.3 hectares each. Total phosphorus levels will be monitored and treatment provided if required.



Lagoon Cell Expansion Options and Costs June 24, 2016

7.0 LAGOON CELL EXPANSION OPTIONS AND COSTS

a) Option 1 - Two New 1.3 Hectare 60 mil HDPE Lined Primary Cells

Two new primary cells could be constructed using the shallow primarily silt soil and then lining with a 60 mil high density polyethylene liner. This method of construction minimizes time of construction, has low risk, and is economical.

Our preliminary opinion of capital cost is as follows. Cost subtotals are rounded to the nearest \$5,000:

Preliminary Quantities and Opinion of Capital Cost Estimate for Two New 60 mil HDPE Lined Primary Cells

		Unit	Quantity	ι	Jnit Price		Amount
1	Topsoil Stripping, Stockpiling and Replacement	C.M.	15,000	\$	10	\$	150,000
2	Common Excavation	C.M.	15,500	\$	10	\$	155,000
3	Borrow Excavation	C.M.	15,000	\$	15	\$	225,000
4	60 mil HDPE Liner	S.M.	37,000	\$	12	\$	445,000
5	Sand Bedding/Cover	C.M.	22,000	\$	25	\$	550,000
6	Interconnecting Pipe Systems	L.S.	4	\$	40,000	\$	160,000
7	Gas Release Piping	L.S.	2	\$	25,000	\$	50,000
8	Decommission Existing Truck Dump	L.S.	1	\$	5,000	\$	5,000
9	Truck Dump Structure	L.S.	2	\$	40,000	\$	80,000
10	Granular Material for Roads	C.M.	200	\$	50	\$	10,000
11	Culverts	L.S.	2	\$	5,000	\$	10,000
12	Ditching	L.S.	1	\$	30,000	\$	30,000
13	Seeding	L.S.	1	\$	25,000	\$	25,000
14	Fence and Gate	L.S.	1	\$	40,000	\$	40,000
	Sub-Total Construction Cost					\$1	,935,000
	Engineering, Administration, and Construction Cos	t Contingen	су (35%)			\$	675,000
	TOTAL ESTIMATED OPINION OF CAPITAL COST (to nearest \$10,000) (not including GST or land costs)						2,610,000



Lagoon Cell Expansion Options and Costs June 24, 2016

b) Option 2 - Two New 1.3 Hectare Clay Lined Primary Cells

Two new clay primary cells could potentially be constructed which would allow the lagoon system to meet the overall hydraulic and organic loading requirements. However, suitable clay is very difficult to access. The average depth from ground level to clay is approximately 1.3 m. Above the clay is approximately 0.2 m of topsoil overburden and 1.1 m of silt. Therefore, in order to access the good clay, extensive and expensive excavation of unsuitable silt material is required.

Our preliminary opinion of capital cost is as follows. Cost subtotals are rounded to the nearest \$5,000.

Preliminary Quantities and Opinion of Capital Cost Estimate for Two New Clay Lined Primary Cells

		Unit	Quantity	Unit Price	Amount	
1	Topsoil Stripping, Stockpiling and Replacement	C.M.	20,000	\$ 10	\$ 200,000	
2	Clay Borrow	C.M.	40,000	\$ 10	\$ 400,000	
3	Common Excavation	C.M.	110,000	\$ 10	\$1,100,000	
4	Interconnecting Pipe Systems	L.S.	4	\$ 35,000	\$ 140,000	
5	Compact Lagoon Floor	L.S.	1	\$ 10,000	\$ 10,000	
6	Decommission Existing Truck Dump	L.S.	1	\$ 5,000	\$ 5,000	
7	New Truck Dump Structure	L.S.	2	\$ 40,000	\$ 80,000	
8	Granular Material for Roads	C.M.	200	\$ 50	\$ 10,000	
9	Culverts	L.S.	2	\$ 5,000	\$ 10,000	
10	Ditching	L.S.	1	\$ 30,000	\$ 30,000	
11	Seeding	L.S.	1	\$ 25,000	\$ 25,000	
12	Fence and Gate	L.S.	1	\$ 40,000	\$ 40,000	
13	Post Construction Testing	L.S.	1	\$ 10,000	\$ 10,000	
	Sub-Total Construction Cost				\$2,060,000	
	Engineering, Administration, and Construction Cost Contingency (35%)					
	TOTAL ESTIMATED OPINION OF CAPITAL COST (to the nearest \$10,000) (not including GST or land costs)					

c) Opinion of Capital Cost Estimate Summary

Option 1 – Two New 60 mil HDPE Lined Primary Cells	\$2,610,000
(Low Risk Construction)	
Option 2 – Two New Clay Lined Primary Cells	\$2,780,000
(High Risk Construction)	



Conclusions June 24, 2016

8.0 CONCLUSIONS

- a) In order to meet Manitoba Conservation requirements, two new 1.3 hectare primary cells are required for two truck loads of septage per day. The RM would need to control dumping to limit septage dumping. Control of septage dumping is the key to controlling the organic loading on the lagoon.
- b) There are two options for this new primary cell construction:
 - 1. Option 1 60 mil HDPE lined cells Estimated Opinion of Capital Cost \$2,610,000
 - 2. Option 2 Clay lined cells Estimated Opinion of Capital Cost \$2,780,000
- c) The clay lined cell Option 2 requires very extensive unsuitable material excation to get down to suitable clay. There is high risk in this method as the lower clay may be discontinuous necessitating more extensive silt removal. Depending upon the year, there may also be water issues in deep borrow excavations. Due to the high risk, and higher cost, we do not recommend this option.
- d) The 60 mil HDPE lined Option 1 is low risk and has the lower cost. The upper silt soil deposits can be used to construct the dikes.
- e) The combination of two new primary cells, the existing primary cell, the existing secondary cell, and the existing wetland, provides large winter hydraulic storage surplus.
- f) Aeration was assessed as an option and the RM decided not to pursue aeration due to the estimated capital cost and maintenance requirements.
- g) The existing truck dump would be removed once the new primary cell truck dumps become operational and are approved.
- h) The treated effluent discharging procedure would be to close off the primary cells from the secondary cells and wetland, hold for two weeks or until it is acceptable to discharge, test/retest, then discharge the secondary cell and wetland, maintaining a minimum .3 m deep liquid residual in all cells. This procedure would be undertaken in the spring and fall.
- i) The RM is currently undertaking a biological sludge decomposition program on the existing primary cell. The sludge decomposition will be measured by the RM upon completion.
 Further sludge removal is likely not necessary upon completion of the two new primary cells.

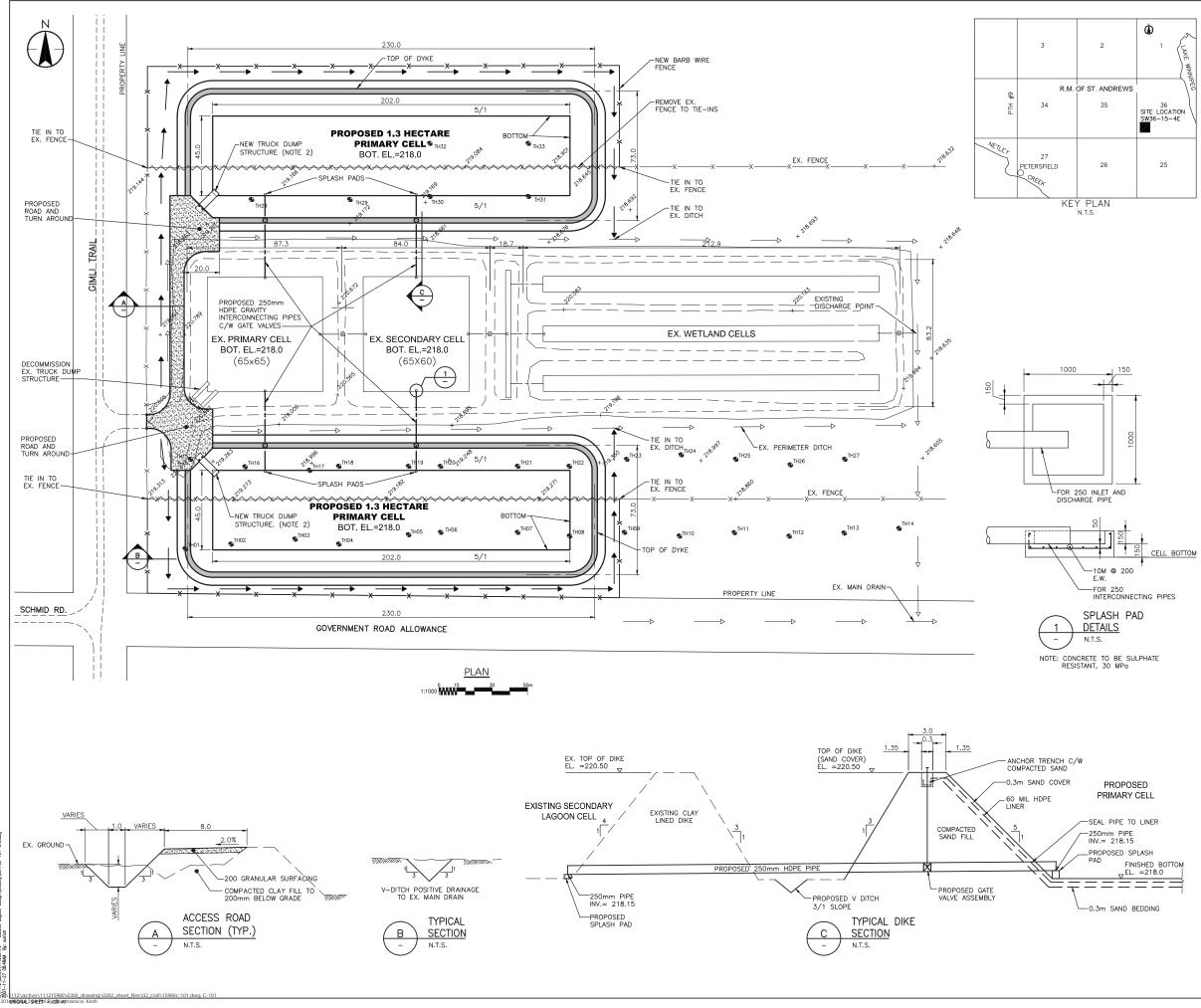


Recommendations June 24, 2016

9.0 **RECOMMENDATIONS**

- a) We recommend the construction of Option 1 with two new 1.3 hectare 60 mil HDPE lined primary cells at an opinion of estimated capital cost of \$2,610,000 including construction, engineering, administration, licencing, and construction contingency. The expansion details are shown on Drawing No. C-101.
- b) The RM will carefully control the dumping of septage into the primary cells.







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Leaend

EXISTING	LEGEND-PLAN	PROPOSED
→	DITCH	\rightarrow
8	GATE VALVE	0
	CULVERT	
	FENCE	
	INTERCONNECTING PIPE	
	TEST HOLE	•
× 218.605	ELEVATION	
	ROADWAY	10000000000

Notes

- 1. FOUR STRAND BARB WIRE FENCE AND GATE WILL BE AS PER MANITOBA WATER SERVICES BOARD STANDARD CONSTRUCTION SPECIFICATIONS, SECTION 027110
- 2. TRUCK DUMP TO BE "SEPTIC WASATE DUMP STATION" DRAWING AS DETAILED IN SECTION 025940 OF THE WATER SERVICES BOARD STANDARD CONSTRUCTION SPECIFICATIONS, SECTION 027110 EXCEPT WITH 5/1 SLOPE

METRIC

WHOLE NUMBERS INDICATE MILLIMETRES DECIMALIZED NUMBERS INDICATE METRES

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	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal





Client/Proiect

Title

R.M. OF ST. ANDREWS

PROPOSED PETERSFIELD TRUCK DUMP WASTEWATER LAGOON EXPANSION STUDY - 2016 St. Andrews, MB Canada

SITE PLAN AND DETAILS

Project No. 111215980	Scale AS NOTED	
Drawing No.	Sheet	Revision
C-101	1 of 1	0

APPENDIX A Annual Truck Dumping Data

Intake
Lagoon
Annual
for
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57V101 GWV99 J3G-EI 13-OC4	218 281 182 185 2,059	9 6 7 67	55 70 46 53 43	632,440 468,000 442,550 4,976,675	20,401 15,097 15,983 164,476	158,110 117,000 123,300 1,245,353	176,650 80,400 35,250 685,625	451,550 386,400 407,000 4,277,100	4,240 1,200 300 22,450	
dəs-EI Bny-EI	231	7	58	534,430 479,230	17,240 15,974	133,608 119,808	65,200 115,850	466,000 363,850	3,230 5,030	
Inf-EI	169	S	42	475,800	15,348	118,950	39,100	434,250	2,450	
unr-EI	233	00	58	527,100	17,570	131,775	46,400	477,550	3,150	
VEM-EL	162	IJ	41	381,575	12,309	95,394	43,000	337,250	1,325	
13-Apr	105	4	26	260,250	8,675	65,063	21,100	238,900	250	
13-W ^{3L}	108	m	27	294,000	9,484	73,500	10,550	283,300	150	
13-Feb	94	3	24	251,700	8,989	62,925	34,000	219,650	1,050	
13-Jan	91	3	18	229,600	7,406	45,920	18,125	211,400	75	
2013	Total Loads	Loads per day	Loads per week	Total Gallons	Gallons per day	Gallons per week	Total Septic Field (gl)	Total Holding Tank (gl)	Total Other (portables) (gl)	

Total Holding Tank (gl)	211,400	219,650	283,300	238,900	337,250	477,550	434,250	466,000	363,850	451,550	386,400	407,000	4,277,100
Total Other (portables) (gl)	75	1,050	150	250	1,325	3,150	2,450	3,230	5,030	4,240	1,200	300	22,450
					5.								
2014	VARUNAL	YARUAB ³⁴	MARCH	JINGA	1 PM	3Nnr	AINI	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	anard 21A707
Fotal Loads	141	138	132	144	217	206	191	165	225	260	183	115	2,117
Loads per day	4.55	4.93	4.26	4.80	7.00	6.87	6.16	5.32	7.50	8,39	6.10	3.71	70
Loads per week	31	35	33	36	54	52	48	41	56	65	46	29	44
Fotal Gallons	317,300	338,050	351,800	425,750	416,265	425,370	441,425	309,825	496,425	551,700	399,745	312,825	4,786,480
Gallons per day	10,235	12,073	11,348	15,205	13,428	15,192	14,240	11,065	16,014	19,704	12,895	11,172.32	162,571
Gallons per week	70,511	84,513	87,950	106,438	104,066	106,343	110,356	77,456	124,106	137,925	98,936	78,206	1,187,806
rotal Septic Field (gl)	11,650	14,450	41,675	62,150	99,750	88,875	92,350	22,050	94,950	175,900	98,720	12,350	814,870
Total Holding Tank (gl)	305,350	323,300	310,125	362,500	314,325	334,575	346,900	284,200	398,800	374,550	300,850	300,000	3,955,475
Total Other (portables) (gl)	300	300	2,150	1,100	2,190	1,920	2,175	3,575	2,675	1,250	175	475	18,285

Intake
Lagoon
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Report
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S

57V101 GWV99 J3G-EI 13-OC4	218 281 182 185 2,059	9 6 7 67	55 70 46 53 43	632,440 468,000 442,550 4,976,675	20,401 15,097 15,983 164,476	158,110 117,000 123,300 1,245,353	176,650 80,400 35,250 685,625	451,550 386,400 407,000 4,277,100	4,240 1,200 300 22,450	
dəs-EI Bny-EI	231	7	58	534,430 479,230	17,240 15,974	133,608 119,808	65,200 115,850	466,000 363,850	3,230 5,030	
Inf-EI	169	S	42	475,800	15,348	118,950	39,100	434,250	2,450	
unr-EI	233	00	58	527,100	17,570	131,775	46,400	477,550	3,150	
VEM-EL	162	IJ	41	381,575	12,309	95,394	43,000	337,250	1,325	
13-Apr	105	4	26	260,250	8,675	65,063	21,100	238,900	250	
13-W ^{3L}	108	m	27	294,000	9,484	73,500	10,550	283,300	150	
13-Feb	94	3	24	251,700	8,989	62,925	34,000	219,650	1,050	
13-Jan	91	3	18	229,600	7,406	45,920	18,125	211,400	75	
2013	Total Loads	Loads per day	Loads per week	Total Gallons	Gallons per day	Gallons per week	Total Septic Field (gl)	Total Holding Tank (gl)	Total Other (portables) (gl)	

Total Holding Tank (gl)	211,400	219,650	283,300	238,900	337,250	477,550	434,250	466,000	363,850	451,550	386,400	407,000	4,277,100
Total Other (portables) (gl)	75	1,050	150	250	1,325	3,150	2,450	3,230	5,030	4,240	1,200	300	22,450
					5.								
2014	VARUNAL	YARUAB ³⁴	MARCH	JINGA	1 PM	3Nnr	AINI	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	anard 21A107
Fotal Loads	141	138	132	144	217	206	191	165	225	260	183	115	2,117
Loads per day	4.55	4.93	4.26	4.80	7.00	6.87	6.16	5.32	7.50	8,39	6.10	3.71	70
Loads per week	31	35	33	36	54	52	48	41	56	65	46	29	44
Fotal Gallons	317,300	338,050	351,800	425,750	416,265	425,370	441,425	309,825	496,425	551,700	399,745	312,825	4,786,480
Gallons per day	10,235	12,073	11,348	15,205	13,428	15,192	14,240	11,065	16,014	19,704	12,895	11,172.32	162,571
Gallons per week	70,511	84,513	87,950	106,438	104,066	106,343	110,356	77,456	124,106	137,925	98,936	78,206	1,187,806
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Total Holding Tank (gl)	305,350	323,300	310,125	362,500	314,325	334,575	346,900	284,200	398,800	374,550	300,850	300,000	3,955,475
Total Other (portables) (gl)	300	300	2,150	1,100	2,190	1,920	2,175	3,575	2,675	1,250	175	475	18,285

APPENDIX B Geotechnical Data

See Drawing C-101 for Hole Locations JULY 2015 Test Holes

×			-	RECORD OF					(ntec
TH N	0.	THI		Logged by:	,	vestor		_ C	orill Date:	9 <	July	2015-
Clien	t:			Project:	tersfield	ld Lagoon	Expans	nons	itart Time		End Time:	
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Locat	tion: P	krfield	, Mr	3 GPS Coordina	647	492 E.S.	5756	6 SI, EI	evation :_		m Sheet	of
Туріса	al Soil Ci	assifications	Clay / (Clay Fill / Silt / Sand / G	Bravel / Glaci	ial Till / Granular B	ase or Fill	/ Topsoil /	Peat or (Organics /	Bedrock	
Color	ır	Consistenc	у	Compactness	Water Content	Plasticity		Part	icle Size		Qu	uantity
Black Grey Brown Tan	Stit Fin Sot	rd >200 rySliff 100-200 f 50-100 m 25-50	kPa kPa kPa kPa	Very loose0-4Loose4-10Compact10-30Dense30-50Very Dense>50	Dry Moist Saturated	Non Plastic (NP) Low Plasticity (LP) Int Plasticity (IP) High Plasticity (HP) Coarse) Fine G	m Sand e Sand Gravel e Gravel es	075 - 0 42 0 425 - 2. 2 0 - 4 7 4 75 - 1 19 - 7 75 - 30 >30	0 mm 5 mm 9 mm 5 mm		0-20% ≥ 20-35% yey/sandy)
De	pth						So	il Sample	s		Field Tes	ts
from	to	Soil Type		Soil Des	cription		Туре	De from	pth to	Test	Depth	Test Result
6	3"	top soi	1				AC	5				
								7.5				
3″	4'	5.17	ter	n, soft, m	pist, l	IP		10				
4'	12.5	clay	bro	wn, stiff, , where siff be m below	moist,	HP						
			fro	ce sift be	100 4	2 - 3 / 3						
		- 11	fr.	m below	no - L	P						
12,5	20	SIT Fill		, soft, m		1						
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> 9 • Yes> 9 > 9 • Yes> 9	ghing Source (soil Source (dep Source (soil Source (soil Source (soil Source (dep	(h):/2_15 (type): (h): (type):	₩ 	None None Minor Moderale Heavy Depth of Seepage:	• R	Auger Refusal • Bedrock • Dense Till • Boulders • Other Refusal Depth:	AC - Auger C ST - Shelby S - Shil Sp C - Core JS - Waler S Content	Tube oon ample for Sul		PP - Po TV - To Note: re torvane	acord correction	ralion Test eter n factor for
Comme	ents:											

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			E	RECORD OF	SOIL	PROFILE			(Sta	ntec
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				Project:	fersfield	d Cagaon	Syms	ton s	Start Time		End Time	:
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Locat	ion:Pe	terfield	MI	3 GPS Coopding	tes: <u>647</u>	517 E. S	5756	64N, EI	evation :_	·	n Sheet	of
Typica	I Soii C	lassifications	Clay / (Clay Fill / Silt / Sand / G	Gravel / Glaci	ial Till / Granular B	ase or Fill	/ Topsoil /	Peat or C	Organics /	Bedrock	
Colou	17	Consistenc	y	Compactness	Water Content	Plasticity		Part	icle Size		٩	uantity
Black Grey Brown Tan	Ve SI Fi So	ard >200 ery Sliff 100-200 iiff 50-100 rm 25-50 oft 12-25	kPa kPa kPa	SPT Very loose 0-4 Loose 4-10 Compact 10-30 Dense 30-50 Very Dense >50	Dry Moist Saturated	Non Plastic (NP) Low Plasticity (LP) Int: Plasticity (IP) High Plasticity (HP) Coars	im Sand e Şand Gravel e Gravel es	.075 - 0.425 0.425 - 2.0 2.0 - 4.75 4.75 - 1 19 - 75 75 - 300 >300	1 mm 5 mm 9 mm 5 mm 5 mm	Some 1 Adjectiv	(e 20-35% ayey/sandy)
De	pth						Sc	il Sample	s		Field Te	sts
from	to	Soil Type		Soil Des	cription		Туре	De from	pth to	Test	Depth	Test Result
e.	211	BIG CIA					AC	5'		2		
							st	5'	7.5'	(1.5	ft re	covery
31	2,5	' cult	from	, soft, mus	st, Lt	2	AC	ティ				
				, , , ,	-		AC	10				
2.5	14	clay	bro	wan firm,	moist, 1	tP	AC	12.5	1			
5			\$1/	iven, firm, 1 It varve be	1000 2,	stos'						
141	20	silt Till	ton	, soft, moi	st, LF	>						
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								Samala Turre			Field Te	
> 9 • Yes> 9 -> 9 • Yes> 9	Source (se Source (de Source (se Source (de	apih): all type): apth): all type):	_	roundwater Seepage None Minor Moderate Heavy Depth of Seepage: Final Groundwater depth:	F	Auger Refusal • Bedrock • Dense Till • Boulders • Other Refusal Depth:	AC - Auger ST - Shelby SS - Split Sp C - Core	Tube boon Sample for Su		PP - Po TV - To Note: re torvane	landard Pene cket Penetror rvane cord correctio tests	neter
Comme	ents:											

			F	RECORD OF	SOIL	PROFILE			(Star	ntec
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		krfield				545_E,S						of
Туріса	I Soil C	lassifications:	Clay / C	Clay Fill / Silt / Sand / G	raver / Glaci					Jiganica /		
Colou	ır	Consistenc	y	Compactness	Water Content	Plasticity		Parti	cle Size		Qu	uantity
Black Grey Brown Tan	Sti Fir So	rd >200 ry Stiff 100-200 ff 50-100 m 25-50	kPa kPa kPa kPa	Very loose0-4Loose4-10Compact10-30Dense30-50Very Dense>50	Dry Moist Saturated	Non Plastic (NP) Low Plasticity (LP) Int. Plasticity (IP) High Plasticity (HP) Coars	m Sand e Şand Əravel e Gravel es	075 - 0.423 0.425 - 2.1 2.0 - 4.75 4.75 - 1 19 - 75 75 - 300 >300	0 mm 5 mm 9 mm 5 mm)-20% e 20-35% /ey/sandy)
De	pth						Sa	il Sample:	5		Field Tes	its
from	to	Soit Type	_	Soil Des	cription		Туре	Dep	oth to	Test	Depth	Test Result
Ð	3"	top soil					K	7.5	10			
	>	19. 5011						10				
3"	5'	51/7	from	saft, mois:	I.LP			12.5				e.
					2			15				
5'	16'	Clay	brow	wn, firm, m	wist,	HP						
16'	20'	5.1 <i>f</i> +11	fre	is soft, mo	ist, L	P						
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> 5 • Yes> 5 > 9 • Yes> 5	Source (soi Source (dep Source (soi Source (dep	bih): I type): eih): I type):	·// /	oundwater Seepage • None • Monor • Moderate • Heavy Depth of Seepage: Final Groundwater depth:	,	Auger Refusal • Bedrock • Dense Till • Boulders • Other telusal Depth:	AC • Auger C ST • Shelby SS • Split Sp C • Core	Tube boon Sample for Sulp	-	PP - Po TV - To Note: re torvane	cord correction	alion Test ater) factor for
Comme	ents: e 7	I did i easured and	not fhe	racover fl e water c water is	e 5:5 " /10 #1	' depth on after below	on a 2 h	day ours 4	they , so	toss or 1 s	it a	way h

			F	RECORD OF	SOIL I	PROFILE				(Star	ntec
TH No	0.1	7774		Logged by: Project/P Drill Rig:: B GPS Coord/na		Nestor	/		« Di	rill Date:	90	fully	2015
Client	2			Project	krspiel	Id Lagoon	EX	ms	lon si	art Time		End Time:	
O llock		Maroli	60		MP	5 Acke	r				/	25 m	m sol
Drill C	ontracto	hartald	m	Drill Rig:	1 rd	KTC ST	75	66	4	niing we	unoa:	01	
ocati	ion:	opela	1	GPS Coordina Clay Fill / Silt / Sand / G	tes:		200.00	Eill /	N, Ele	Peat or (n Sheet	0/
/pica	I Soil Cla	assifications:	Clay / C	Jiay Fill / Silt / Sand / G	raver / Glaci					reactore		T	
Colou	ır	Consistenc	у	Compactness	Water Content	Plasticity			Parti	cle Size		Q	antity
ack rey rown an	Stiff Firm Soft	d >200 y Sliff 100-200 50-100 n 25-50	kPa kPa kPa kPa	SPT Very loose 0-4 Loose 4-10 Compact 10-30 Dense 30-50 Very Dense >50	Dry Molst Saturated	Non Plastic (NP) Low Plasticity (LP Int. Plasticity (IP) High Plasticity (HP) N C) F C	oarse ine G	n Sand Sand ravel Gravel s	075 - 0.429 0.425 - 2 (2 0 - 4 75 4 75 - 19 19 - 75 75 - 300 >300	0 mm 5 mm 9 mm 5 mm)-20% 20-35% /ey/sandy)
Dep	pth							Soi	l Samples	5		Field Tes	ts
om	to	Soil Type		Soll Des	cription		Тур	e	Dep	oth	Test	Depth	Test
UIII		,	,						from	to			Result
,	3″	top son	/				A	0	5		-		
11			1.4	1		AND		-	7.5				
,"	1.5	clay	66	nek, fim,	morst	1011		-	10				
_		2	501	ne organi	e			-	12.5				
_			1	2 (1	. 1	D	1.00		15				
5	3	\$1/t	fa	, soft, mo	IST /	9							
1	and a	day		1	10/0 10	LIP							
/	14	any	bre	own, fim,	mors	7, 170							
1	-	dayey 1	bre	why and a	Mart	MP							
-	D D	m/ + m//	ha	i hi to co	orse si	incl		-					
-		2114	fra	a fine gra	vel nout			-		-			
-	10	HT Ju	10	"Ipopt	-15/-	-							
	hing		Gn	oundwater Seepage		Auger Refusal		s	ample Types		1	Field Tes	
-> S(s -> S(-> S(s -> S(ource (soil ource (depti ource (depti ource (depti ource (depti	ype):7		None Minor Moderale Heavy Depth of Seepage: Final Groundwater depth:	R	Bedrock Dense Till Boulders Other Refusal Depth:		uger Ö nelby T plit Spo pre	ulling ube		PP - Po TV - Tor Note: re torvane	cord correction lests	eter
mmer	nts:												
miner													

			F	RECORD OF	SOIL	PROFILE			(Star	ntec
TH N	0.:	THS		Logged by:		Nestor		C	rill Date:	9	In le	1 2015
				Project:	tersfi	Nestor Id Logiern 5 Acker	(Apr	scon				
	11121	5980 m: maple	4		MP	5 Acker	-		villing Me	/	25 mm	solig
Dnill C		techila	1. M	B GPS Coordina	1.1.47	605 = t	5756	6 Car El	avation :		m Sheat	of
		/		Clay Fill / Silt / Sand / G								
Colou	ır	Consistenc	y	Compactness	Water Content	Plasticity		Part	icle Size		Qu	antity
Black Grey Brown Tan	Stil Fir So	rd >200 ry Stiff 100-200 if 50-100 m 25-50	kPa kPa kPa kPa	SPT Very loose 0-4 Loose 4-10 Compact 10-30 Dense 30-50 Very Dense >50	Dry Moist Saturated	Non Plastic (NP) Low Plasticity (LP Int. Plasticity (IP) High Plasticity (HP	Coars) Fine (im Sand e Şand Gravel e Gravel es	075 - 0.42 0.425 - 2. 2.0 - 4.75 4.75 - 1 19 - 7 75 - 30 >30	0 mm 5 mm 9 mm 5 mm)-20% 9 20-35% /ey/sandy)
De	pth						So	il Sample	s		Field Tes	ts
from	to	Soil Type		Soil Des	cription		Туре	De	pth	Test	Depth	Test Result
								from	to			Kesult
0	3"	topsoil	-				Ac	3.5				
	. 1				nou I	1417		7.5				
3"	4'	clay	6000	ion, firm, r	worst ,	A		10				
11	1	Silt	1.			D						
4'	6	5117	on	-1 soft, nu	5151 0							
	17		1.~	- Andrea		412						
6	17	clay	510	own, firm,	murs)	, 0,						
17	w	clayer Enlt f	112	nown soft, m	vist	MAP	_					
			fn	ica fine to a	werse	send						
			.pr	ace, pre gre	and							
										_		
→ S • Yes → S -> S • Yes → S	ource (soil ource (soil ource (soil ource (soil ource (depl ource (depl	h): ////////////////////////////////////	<i>h</i>	None None Minor Moderate Heavy Depth of Seepage:		Auger Refusal Bedrock Dense Till Boulders Other efusal Depth:	AC - Auger (ST - Shelby SS - Split Sp C - Core	Tube oon ample for Sul		PP - Po TV - Tor Note: re torvane	cord correction	ation Test ter factor for
Comme	nts:											
	8											

TH No.:	THE		Logged by: Project:	/	Vestor		D	rill Date:	90	Inly i	2015
Client:			Project:	tersfield	d Lagoon	Expres	un s	tart Time		End Time:	
ĪŢ	1215980	/	1	in the second se	ec brie	2.5-	_		1	25 m#	506
Drill Cont	ractor: maple	lea	Drill Rig::	1.1.1	S ACM		. D	rilling Me	thod:	spen	- ung
Location:	Peterfield	M	B GPS Coordiga	es: <u>647</u>	639 E, S	5756	67. Ele	evation :_		m Sheet	of
Typical So	il Classifications:	Clay / C	Clay Fill / Silt / Sand / G	iravel / Glaci	ial Till / Granular B	ase or Fill /	/ Topsoil /	Peat or (Organics /	Bedrock	
Colour	Consistency	,	Compactness	Water Content	Plasticity		Parti	icle Size		Qu	antity
Black Grey Brown Tan	Torv Hard >200 I Very Stiff 100-200 I Stiff 50-100 I Firm 25-50 I Soft 12-25 I Very Soft <12-10 I	(Pa (Pa (Pa (Pa (Pa	Very loose0-4Loose4-10Compact10-30Dense30-50Very Dense>50	Dry Moist Saturated	Non Plastic (NP) Low Plasticity (LP) Int. Plasticity (IP) High Plasticity (HP)	Coarse Fine G	m Sand e Şand iravel e Gravel es	075 - 0.42 0.425 - 2.4 2.0 - 4.7 4.75 - 1 19 - 7 75 - 300 >300	0 mm 5 mm 9 mm 5 mm		-20% 20-35% /ey/sandy
Depth						So	il Sample	s		Field Tes	ts
1	Soil Type		Soil Des	cription		_	De	pth	Test	Darth	Test
from	0					Туре	from	to	Test	Depth	Resu
06	" topsoil					qc	5				
					_		10				
8" 4	· silt	far	, soft, m	oist, L	P		15			a.	
7			1 1 1								
dlu	5 clay	In	, firm, 1	noist	HP						
4' 15			11-1		/						
	clayer	, gr	non int	the the	NJ CA						
15.5	w silt fill	- Fall	a, soft, me	157,14							
		The	ace for to	ware	e sind						
		m	ace for given	vel_							
	-										
Soll Sloughing • None	Clay=	g, -	None Minor		Auger Refusal • Bedrock • Dense Till	AC - Auger C ST - Shelby SS - Split Sp	Tube	£	PP - Po TV - To	Fleid Test tandard Panatr cket Panatrome rvane cord correction	alion Test eter
• Yes> Source • Yes> Source > Source • Yes> Source			 Moderate Heavy Depth of Seepage: Final Groundwater depth: 		Boulders Other Refusal Dapth:	C - Core JS - Water S Content	ample for Sul	phale	torvane		
		-					-		_		

			F	RECORD OF	SOIL I	PROFILE			(Stai	ntec
TH N	0.:	TH	7	Logged by:		Nestor Id Lagoon	D .		Drill Date:	9 0	faly	2015
Clien	t: /// 2	15980		Project:	krsfield	o lagoon	Expansi		Start Time	12	End Time:	solio
Drill (Contrac	stor: <u>mapp</u> Referfield	, MI	Drill Rig:: 3GPS coordyha	ites:647	664 E.S.	5756	- с <u>7</u> Л, еі	Drilling Me	ethod:	m Sheet	of
Typica	I Soil	Classifications:	Clay / C	Clay Fill / Silt / Sand / G	Gravel / Glaci	ial Till / Granular B	ase or Fill	/ Topsoil /	Peat or C	Organics /	Bedrock	
Color	ır	Consistenc	у	Compactness	Water Content	Plasticity		Part	icle Size		Q	uantity
Black Grey Brown Tan	N S F S	Ton land >200 /ery Sliff 100-200 Sliff 50-100 Firm 25-50 Soft 12-25 /ery Soft <12	kPa kPa kPa kPa	SPT Very loose 0-4 Loose 4-10 Compact 10-30 Dense 30-50 Very Dense >50	Dry Moist Saturated	Non Plastic (NP) Low Plasticity (LP) Int. Plasticity (IP) High Plasticity (HP) Coars	m Sand e Şand Gravel e Gravel es	075 - 0.42 0.425 - 2.0 2.0 - 4.7 4.75 - 1 19 - 7 75 - 300 >300	0 mm 5 mm 9 mm 5 mm		0 -20% a 20-35% yey/sandy)
De	pth	_					So	il Sample			Field Tes	its
from	to	Soil Type		Soil Des	cription		Туре	De from	pth to	Test	Depth	Test Result
0	3"	top soil					Ac	5				
3"	1.5	clay	670	at from a	monst	MP	AC	10	155	(tra	Irec	very
3	115	Cury	80	me organ	IC I		3/	10	1000	0.		<u> </u>
1.5	2.5	- silt	Jan	ck, firm, r me organ , soft, m	oist,	cr						
215	13,9	clay	610	wn, shift, n m below	wist,	HP						
135	15	Clayery Silt Till		is soft, mo is fre to ca ee fre gra								
			tra	el fre gra	wil	8.ñ 1						
> 9 • Yes> 9 -> 9 • Yes> 9	Source (s Source (d Source (s Source (d Source (s	oil (ype): spth): oil (ype): oil (ype): oil (ype): apth):		Dundwater Seepage Nona Minor Moderate Heavy Depth of Seepage: Final Groundwater depth:	R	Auger Refusai • Bedrock • Dense Till • Bouiders • Other efusel Depth:	AC - Auger C ST - Sheiby SS - Spili Sp C - Core JS - Water S Content	rube oon		PP - Poo TV - Ton Note: red torvane (cord correction	ation Test eler I factor for
Comme	nts:							1				

			F	RECORD OF	SOIL	PROFILE		1.5	(Star	ntec
TH No	J.;	THE	•	Logged by:	_	Nestor		_ 0	rill Date:	9	Suly	2015
Client	1/12	15980		Logged by: Project: 2 Drill Rig:: _ B GPS Coording	BERSFI	Id Lagoon	Ap	sur s	tart Time		End Time:	" soluc
Drill C	ontracto	maple	lea	Drill Rig::_	MP	5 Acke	er		rilling Me	thod:	tem c	anger
Locati	ion: <u>Pe</u>	krfield	,m	B GPS Coording	65: <u>647</u>	1692 E.S.	5750	670 E	evation :_		m Sheet	of
Туріса	I Soil Cli	assifications:	Clay / C	Clay Fill / Silt / Sand / G	Favel / Glac	ial Till / Granular B	ase or Fil	I / Topsoil /	Peat or (Organics /	Bedrock	
Colou	ır	Consistenc	У	Compactness	Water Content	Plasticity		Part	icle Size		Q	uantity
Black Grey Brown Tan	Stiff Firm Soft	d >200 y Stiff 100-200 f 50-100 n 25-50	kPa kPa kPa kPa	Very loose0-4Loose4-10Compact10-30Dense30-50Very Dense>50	Dry Moist Saturated	Non Plastic (NP) Low Plasticity (LP) Int. Plasticity (IP) High Plasticity (HP) Medi Coar) Fine	um Sand se Şand Gravel se Gravel bles	075 - 0.42 0.425 - 2. 2.0 - 4.7 4.75 - 1 19 - 7 75 - 30 >30	0 mm 5 mm 9 mm 5 mm		0-20% ə 20-35% yey/sandy)
Dej	pth						S	oil Sample	\$		Field Tes	its
from	to	Soil Type		Soil Des	cription		Туре	-	pth	Test	Depth	Test Result
		1.00		and the state of t				from	to			
0	3 "	topsoil										
3″	1.5	chang	66	ne organi	noist,	M/2						12
		,	50	me organi	e ma	terial						
1	28	GIF	lan	, soft me	oxtl	P			3			
1.5	4	911	p	1 2011	13.			1				
4	12'	day	bra	nuo, stiff,	mist,	HP						
		(Va	rve with	frace	silt.						
12'	15'	的开始	fun	n, sott, mu	0185,	4						
			tre	ace for to	cont	e send						
			fri	all fri go	ane-l							
-> 5 • Yes -> 5 -> 5 • Yes -> 5	Source (soil Source (dep Source (soll Source (dep Source (soil	type); h); type); type); h);		oundwher Seepage None Minor Moderate Heavy Depth of Seepage: Final Groundwater depth:	F	Auger Refueal • Bedrock • Dense Till • Boulders • Other Refusal Depth:	AC - Auger ST - Shelb SS - Split S C - Core JS - Water Conter	y Tube Spoon Sample for Sui		PP - Por TV - Tor Note: re Iorvane	cord correction	ralion Test eter 1 factor for
Comme	ents:											

tractor: Map	le lea 1, MI	Logged by: Project: Drill Rig:: GPS Coordina Clay Fill / Silt / Sand / G			CX from.	S	tart Time		End Time:	
tractor: Map Peterfield oll Classification	le lea 1, MI	Drill Rig::_ GPS Coordina								
oll Classification			4.647				rilling Me	thod:		
	s: Clay / C	Clay Fill / Silt / Sand / G								of
Consister	1	-	Gravel / Glaci	ial Till / Granular B	ase or Fill	/ Topsoil /	Peat or C	Organics /	Bedrock	
	су	Compactness	Water Content	Plasticity		Parti	Icle Size		Qu	antity
Hard >20 Very Stiff 100-20 Stiff 50-10 Firm 25-5 Soft 12-2	0 k Pa 0 k Pa 5 k Pa	Very loose0-4Loose4-10Compact10-30Dense30-50Very Dense>50	Dry Moist Saturated	Non Plastic (NP) Low Plasticity (LP) Int. Plasticity (IP) High Plasticity (HP	Coars) Fine C	m Sand e Şand iravel e Gravel es	075 - 0.42 0.425 - 2.0 2.0 - 4.75 4.75 - 19 19 - 75 75 - 300 >300	0 mm 5 mm 9 mm 5 mm 0 mm)-20% e 20-35% /ey/sandy
1	T				So	il Sample	S		Field Tes	ts
		Soll Des	cription		Type	De	pth	Test	Depth	Tes
						from	to			Rest
3 top sol	1				AC					
U silt	tin	, soft, more	+ LP			14				
15 clay	600	way shift,	muist	, 197-						
	-		-	0						
1.5 817	pri	, soft, moi	57, 0							
3	-	cl.		100						
the clay	500	wn, shff,	morst	HI						2.4.0
dayey	60	wn		M12					-	
5 8/11	1	Soft, mi	<i>J I S S I S S I S I S I S S I S I S S I S S I S S I S I S S I S S I S I S S I S S S</i>	4						
	fra	ce fre to i	coarge	. smel						
	Tro	nce fre gr	avo.1						Eigld Tag	
bit 51 ce (soil type): 51 ce (depih): 13 ce (soil type): 13 ce (soil type): 23 ce (soil type): 23 ce (soil type): 23 ce (soil type): 23		None Minor Moderate Heavy Depth of Seepage:	R	 Bedrock Danse Till Boulders Other 	AC - Auger (ST - Shelby SS - Split Sp C - Core JS - Water S	Cutting Fube con ample for Sul		PP - Po TV - To Nole: re torvane	itandard Penetr cket Panetrome rvane loord correction tests	ation Test ster 1 factor for
	Very Soft <1 Soil Type Soil Typ	Very Soft <12 kPa Soil Type Soil Type Soi	Very Soft <12 kPa Soil Type Soll Des Soil Type Soll Soil Type Soll Soil Type Soll Soll Des Soll Des	Very Soft <12 kPa Soil Type Soll Description Soil Type Soll Description Soil Desc	Very Soft <12 kPa Soil Type Soil Description Soil Type Soil Description Soil Type Soil Soil Type Soil Soil Type Soil Soil Description Soil Descriptio	Very Soft <12 kPa	Very Soft <12 kPa Boulders to Soil Type Soil Description Type Del 1 fop Soil AC S 1 fop Soil AC S 1 soil Type Soil Description I/O 1 soil Type AC S 1 soil type Soil Description I/O 1 soil type AC S 1 soil type Soil Description I/O 1 soil type AC S 1 soil type Soil Description I/O 1 soil type Soil type I/O 1 soil type Soil type I/O 3 soil type Soil type I/O 3 soil type soil type Soil type 4 two for type two for type I/O 5 Sulthive two for type I/O 6 two for type two for type Soil type I/O 1 two for type two for type two for type	Very Soit <12 kPa	Very Soit <12 kPa	Very Sot <12 kPa Soil Description Soil Samples Field Tes Soil Type Soil Description Type Depth Test Depth 1' pop Soil Acc S I/O I/O I/O I/O 1' pop Soil Acc S I/O I/O I/O I/O I/O 1' pop Soil Acc S I/O I/O I/O I/O I/O 1' soilt fam soft fam soft fam I/O I/O I/O I/O I/O 1' soilt fam soft fam soft fam I/O <

			F	RECORD OF					(ntec
TH N	D.:	TH IC	Ð	Logged by:		Nestor Id Lagoon		- (D	rili Date:	9	July	2015
				Project;	fersfal	1 Lagoon	Expres S	ions	art Time		End Time:	
	111	215980	1 100		/		/					
Drill C		r. mapl	1 m	B GPS Coord	647	745.0	7567					
				Clay Fill / Silt / Sand / G								
	Т				Water	Plasticity	1		cle Size		1	antity
Colou		Consistenc	У	Compactness	Content		Fine P		075 - 0,42		Trace	
Black Grey Brown Tan	Stif Firr Sol	rd >200 y Stiff 100-200 f 50-100 n 25-50	kPa kPa kPa kPa	SPT Very loose 0-4 Loose 4-10 Compact 10-30 Dense 30-50 Very Dense >50	Dry Moist Saturated	Non Plastic (NP) Low Plasticity (LP) Int, Plasticity (IP) High Plasticity (HP) Coars	m Sand e Şand Bravel e Gravel es	0.425 - 2.0 2.0 - 4.75 4.75 - 1 19 - 75 75 - 3 0	0 mm 5 mm 9 mm 5 mm	Some 10 Adjective)-20% 20-35% (ey/sandy)
De	pth						So	il Sample	5		Field Tes	its
from	to	Soil Type		Soil Des	cription		Туре	Dej	oth	Test	Depth	Test Result
× Nom			7				1.	from	to			Nosuit
0	3"	top 501,	/ ·				he	5				
						40		10				
3"	21	clay	bro	wh, firm, ace orga , soft, m	morst	, AP		184				
		12	tr	all orga	me							
2'	3	sulf	ta	-, saft, m	orst, c						-	
3	8	clay	bro	wn, stiff, n	wist,	HP						
		chargen			-	-						
8'	8,5	silf	ta	firm, mo,	st, M	4						
8,5	14.5	chang	bro	wn, firm,	moist	HP						
			hours	n								
14.5	15	clayey,	fra	1 soft, moi	st, M	P,		9		L		
> 9 • Yes> 9 -> 9 • Yes> 9	Source (soil Source (dep Source (soil Source (dep Source (soil	type): (h);		None 7 Anno 7 An	f	Auger Refusal Bedrock Dense Till Boulders Other Refusal Depth:	AC - Auger (ST - Shelby SS - Split Sp C - Core	Tube poon Sample for Sul		PP - Po TV - To Note: re torvane	acord correction	rallon Test eter 1 factor for
Comme	ents:											

			RECORD C	OF SOIL	PROFILE					Sta	ntec
TH N	lo.:	TH	Logged	by:	Nestor			Drill Date:	90	July	2015
			Project	Pekospill	Nestor d Lagoon	byms.	ion	Start Time	e	End Time:	
	111	215980 mart		/		1					
Dhii C		lect d	MB GPS Coord		7776-5	5 76	_	-	_	- 05	
1		/	: Clay / Clay Fill / Silt / Sand								10
					1						
Colou	л г	Consistenc	cy Compactness	Water Content	Plasticity	_	Part	Icle Size		Q	uantity
Black Grey Brown Tan	Stil Fin Sol	rd >200 ry Stiff 100-200 f 50-100 m 25-50 ft 12-25	kPa Loose 4- kPa Compact 10-3 kPa Dense 30-5	-4 Moist 10 Saturated 30 50	Non Plastic (NP) Low Plasticity (LP Int. Plasticity (IP) High Plasticity (HP	Coars) Fine C	m Sand e Şand Gravel e Gravel es	.075 - 0.42 0.425 - 2. 2.0 - 4.7 4.75 - 1 19 - 7 75 - 30 >30	0 mm 5 mm 9 mm 5 mm		0-20% ə 20-35% yey/sandy)
De	pth					So	il Sample	s		Field Tes	ts
from	to	Soil Type	Soli (Description		Туре	De	pth to	Test	Depth	Test Result
0	3″	100 801	/			K	5				
							10				
3"	3'	chang	black, form, r	noist, m	1P		15	1			
			some organi	e							
3	4	silt	fam, soft, m	wist, L	P						
			trace clay								
4	15.5	chang	black, form, r some organi fam, soft, m frace clay brown, stiff	, moist	,HP						
15.5	20	silt fill	the soft m	oist, L	9						
			trace for to	ware	end						
			trace for to trace for to	avol							
> So •Yes> So -> So •Yes> So	ource (soil (ource (dept) ource (soil t ource (dept) ource (soil t); be); be); be); be); be); be); be); be	Depth of Seepage:	Re	uger Refusal • Bedrock • Dense Till • Boulders • Other afusal Depth:	9 AC - Auger C ST - Shelby T SS - Spilt Spo C - Corie JS - Water Sa Content	ube ion		PP - Poc TV - Ton Note: rec torvane to	ord correction	ilion Test ter factor for
Commer	nts:			4							_

			F	RECORD OF	SOIL	PROFILE		ÿ			Star	ntec
тн м	lo.:	TH 12	-	Logged by:		Nastor		(Drill Date:	9	dan	
		215980		Project:	eferspiol	Nastor 1d Lagoon	Gypan (sin	Start Time		End Time:	
		Magdy	1. 0	1								
Drift		fre la	m	Drill Rig::_ GPS Coord	11.43	15075	5756	72.			- Oh a st	
C				lay Fill / Silt / Sand / G								
Typica						1	1				Т	
Colo	ur	Consistenc	У	Compactness	Water Content	Plasticity		Parl	ticle Size		Q	uantity
Black Grey Brown Tan	Sti Fir So	rd >200 ry Sliff 100-200 ff 50-100 m 25-50	kPa kPa kPa kPa	SPTVery loose0-4Loose4-10Compact10-30Dense30-50Very Dense>50	Dry Moist Saturated	Non Plastic (NP) Low Plasticity (LP Int. Plasticity (IP) High Plasticity (HP) Coars	ım Sand se Şand Gravel se Gravel les	0.075 - 0.42 0.425 - 2. 2.0 - 4.7 4.75 - 1 19 - 7 75 - 30 >30	0 mm 5 mm 9 mm 5 mm		0-20% ∋ 20-35% yey/sandy)
De	pth						Sc	oil Sample	es		Field Tes	ts
from	to	Soil Type		Soil Des	cription		Туре	De	opth to	Test	Depth	Test Result
0	3"	top 401/					K	5				
							K	10				
3"	IS.S	chuy	610	ck, tim	moist	Mr.h21	ST	10	125	-		
			50-	ne organ	1C 5	tores'	K	15				
			bro	wn below	3'sh	ift						
			firi	m below	12'							
			lander	141								
15.5	20	silt fill	An	, soft, mo.	ist, r	1P						
			hau	122 from to	worse	e and						
			fra	a for gro	nel							
				×.								
• Yes> S • Yes> S > S • Yes> S	ource (soil ource (depi ource (soil ource (depi	type): h): type):	م ر بر بر بر	ndweter Seepage None Minor Moderate Heavy spih of Seepage: al Groundwater depih:	Re	uger Refusal • Bedrock • Dense Till • Boulders • Other afusal Depth:	AC - Auger C ST - Shelby SS - Split Sp C - Core JS - Water S Content	Tube con ample for Sul	_	PP - Poo TV - Ton Note: red torvane t	cord correction	allon Test ter factor for
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				Project:	ferspiel	ld Lagoon	Expo	nsions	tart Time		End Time:	
			hel	D ill Cierr	M	PS Ac	kir		rilling Ma	thodi	sten	anger
Drili (Contracto D	tersfield	d Mr		C.d.	7577 E.S	5757	- 103. 51			T Shoot	
				/ Fill / Silt / Sand / G								
Colo	ur	Consistenc	y	Compactness	Water Content	Plasticity		Parti	cle Size		Qu	uantity
Black Grey Brown Tan	Ve Sti Fir So	m 25-50	kPa kPa kPa kPa kPa	SPT Very loose 0-4 Loose 4-10 Compact 10-30 Dense 30-50 Very Dense >50	Dry Moist Saturated	Non Plastic (NP) Low Plasticity (LP) Int. Plasticity (IP) High Plasticity (HP) Coars) Fine G	m Sand e Şand Gravel e Gravel es	075 - 0.42 0.425 - 2.0 2.0 - 4.7 4.75 - 1 19 - 7 75 - 300 >300) mm 5 mm 9 mm 5 mm 0 mm		0-20% e 20-35% yey/sandy)
De	opth					-	So	il Sample	s		Field Tes	its
from	to	Soil Type		Soil Des	cription		Туре	De	oth I	Test	Depth	Test Result
		1						from	to			Result
0	3"	top soil										
04		0/10	110	1 Com A	10101	MP			-			
3"	1.5	clay	640	11-1	ionst 1							
1.5	2	silly	Som	te organ	more	LMP						
10	6	Clay	000	11-1		1						
2	4	s11+	fen	soft m	orst,	LP						
	/											
4	14	clay	bro	wo, stiff	1, mo19	st, APP						
			Arm	n below	11							
		classes				1						
14	15	silf 11	bro	won soft	aparse	mj						
			pra	ci pe gr	one/							
• Yes -> • Yes ->	Source (soi Source (deg Source (deg Source (soi Source (soi Source (deg	bith):	// · N · N · H Depl	donter Seepage Alnor Aoderate Heavy th of Seepage: Il Groundwater depth:	R	Auger Refusal Bedrock Cense Till Boulders Other Refusal Depth:	AC - Auger C ST - Shelby SS - Spilt Sp C - Core	Tube		PP - Poo TV - Tor Note: rea torvane	cord correction	ation Test eler I factor for
Comme	ents:			<i>v</i>								
							_					

				CORD OF					(Star	
тн м	No.:	Tt 1	9	Logged by	r:	Nostor eblicagoon 5 Acka 7608 E.S.		, ا	Drill Date:	10	Auly	15-
Clier	nt:			Project:	Petersfi	ell ingcon	EXP	ansio	Lan Time		End Time:	
Drillu	Contra	Maple	leaf	Drill Ria	MP	5 Acks	er	ſ	Drilling Me	thod:	skn.	sol
Loca	tion:	Peterspiolo	d MB	GPS Coordina	ates: 64	7608 E.S.	5757	074N, E	levation :		m Sheet	of
Туріса	al Soil	Classifications:	Clay / Clay F	Fill / Silt / Sand / (Gravel / Glac	ial Till / Granular E	ase or Fill	/ Topsoil /	Peat or (Organics /	Bedrock	
Colo	ur	Consistenc	y C	ompactness	Water Content	Plasticity		Part	ticle Size		Q	uantity
Black Grey Brown Tan	F	Tor Hard >200 Very Stiff 100-200 Stiff 50-100 Firm 25-50 Soft 12-25 /ery Soft <12	kPa Lo kPa C kPa D kPa V	SPT ery loose 0-4 bose 4-10 ompact 10-30 ense 30-50 ery Dense >50	Dry Moist Saturated	Non Plastic (NP) Low Plasticity (LP Int. Plasticity (IP) High Plasticity (HF) Mediu Coars) Fine (um Sand se Sand Gravel se Gravel les	075 - 0 42 0 425 - 2 1 2 0 - 4 75 4 75 - 1 19 - 7 75 - 300 >300	0 mm 5 mm 9 mm 5 mm		0-20% e 20-35% yey/sandy)
De	apth						Sc	oil Sample	es.		Field Tes	its
from	to	Soil Type		Soil Des	scription		Туре		pth	Test	Depth	Test Resul
Ø	3"	fop soil						from	to			
		11										
3″	4.5	5 clay	brow	n, Arm	mois	1, HP						
4.5	6.5	silly clay	brow	n, firm	mols	+, MP.						
5	16	Clay	brow	below	mois	t, HP						
			firm	below	12'							
16	20	silt fil	brow	fri to c	mois	mp						
			frace	fini to c	cara	sound						
			frace	fui gra	mel							
> S Yes> S > S Yes> S	Source (Source	bil type): pil(type): pil(type): pol(t):	• Non • Min • Min • Hea • Hea • Depth o Final G	or Herate ivy of Seepage: roundwater depth:		Auger Refusai	AC - Auger C ST - Shelby SS - Split Sp C - Core	Tube oon ample for Sul		PP - Po TV - To Note: re torvane	cord correction	alion Test eler faclor for
omme	nts:	first ri pral n If mo	eading	for pr	e wo	fer 16 grade	1 be , ft	low	gra en hi	aly 1 I	call	
	,	If mo	A	1 1			_					

			RECORD OF	SOIL I	PROFILE			(Star	ntec
TH No	D.	T7+ 20	D Logged by		Neetor Id Lagoon		D	rill Date:	10	July	2015-
			Project:	tersfie	ld Lagoon	BX12	usions	tart Time		End Time:	
Drill C	ontracto	m Mayle	liaf Drill Rig:	M	PS Ack	r					
Locati	on: A	tersfield	MB GPS Coordina	ates: <u>647</u>	7635 E. S	5757	OSN, ER	evation :_		m Sheet	of
			Clay / Clay Fill / Silt / Sand / (
Colou	r	Consistency	Compactness	Water Content	Plasticity		Parti	cle Size		QI	uantity
Black Grey Brown Tan	Sti Fir So	ry Stiff 100-200 k ff 50-100 k m 25-50 k	KPa Very loose 0-4 KPa Loose 4-10 KPa Compact 10-30 KPa Dense 30-50 KPa Very Dense >50	Dry Moist Saturated	Non Plastic (NP) Low Plasticity (LP Int. Plasticity (IP) High Plasticity (HP) Coars	m Sand e Sand Gravel e Gravel es	075 - 0 425 0 425 - 2 0 2 0 - 4 75 4.75 - 19 19 - 75 75 - 300 >300) mm 5 mm 9 mm 5 mm) mm		0-20% e 20-35% yey/sandy)
Dej	oth					So	il Sample	s		Field Tes	its.
from	to	Soil Type	Soil De	scription		Туре	De from	oth to	Test	Depth	Test Result
0	311	107 5011						10			
0	3	19									
3"	3.5	Silty	brown, fina	mois	d, mp						
3.5	14	cley	brown shift	moi	st, HP						
-			from below	12'							
11	16	clayer	brown, firm	n	of MP						
14	/3	511551									
			frace fi fo	onel							
→ S •Yes → S	ource (soil ource (dep ource (soil	(h) <u><u><u></u></u> (type) <u></u><u></u></u>	Grounderflor Seepage None • Minor • Moderale • Heavy		Auger Refusal • Bedrock • Dense Till • Boulders • Other Patienal Depth:	AC - Auger C ST - Shelby SS - Splil Sp C - Core	Tube oon ample (or Su)		PP - Po TV - To Note: re torvane	cord correction	ralion Test eter n factor for
• Yes> S > S	purce (dep	lype): (h):	Depth of Seepage: Final Groundwater depth		Refusal Depih:						
4					2						

			RECO		FSOIL	PROFILE					Star	ntec
THN	10.	THZI		Logged b	v:	Nostor			Drill Date:	10	July	15
				Project	ofersfield	Nostor Id Lagoor	ET	yansiv	Start Time	e	End Time:	
Drill	Contracto	or: Maple	leaf			5 Acker						
Loca	tion: Por	lersf ald	, MB a	PS Coordin	nates: 64	7668 E. S	575	707	Elevation :		m Sheet	of
		/				ial Till / Granular B						
Colo	ur	Consistenc	y Com	actness	Water Content	Plasticity		Pa	article Size		Q	uantity
Black Grey Brown Tan	Sti Fir So	rrd >200 rry Stiff 100-200 ff 50-100 m 25-50	kPa Loose kPa Compa kPa Dense kPa Very D	4-10 ict 10-30 30-50	Moist Saturated	Non Plastic (NP) Low Plasticity (LP Int. Plasticity (IP) High Plasticity (HF	r) N C P) F C	fine Sand Medium Sand Coarse Şand Fine Gravel Coarse Gravel Cobbles Houlders	75 - 30	0 mm 5 mm 9 mm 5 mm		0-20% e 20-35% yey/sandy)
De	pth	-				-		Soil Sam	oles		Field Tes	its
from	to	Soil Type		Soil De	escription		Тур	e	Depth	Test	Depth	Test Result
0	34	top soil		2				from	i to			
-		10/										
3"	1.5	clay	black,	firm	moisi	MP						
			some o	orgai	nic							
1.5	4.5	salt	black, some a fun, s	oft,	moist	, LP						
			trace	clay								
	11			- 1		1				а — — — — — — — — — — — — — — — — — — —		
4.5	11.5	clay	brown,	shift	, mois	1, 150			-			
							2					
11.5	15	sittill	Jun, se	off 1	moist	, LP			-			
			pro, so frace p	a to	ocars	e sud						
			proce A	2 9r	mel							
> S • Yes> S -> S • Yes> S	ource (soil ource (dept ource (soil ource (dept ource (soil	h) H-S		eepage_ bage: walar deplh:	Re	Auger Refusal • Bedrock • Dense Till • Boulders • Other elusal Depth:	ST - Sh SS - Sp C - Co JS - Wa	Sample Tv ger Cutting elby Tube lit Spoon re lier Sample for S htent		PP - Poo TV - Tor Notel re torvane	cord correction	alion Test ller factor for
Commei	nts:									_		
							7.0		5			

			F	RECORD OF	SOIL	PROFILE			ļ		Sta	ntec
TH N	lo.:	TH27	2	Logged by		Nos for			Drill Date:	_/0	July	K
Clier	nt:			Project:	etersfie	Nestor Id Lagoon	nQ	yan510	Start Time	9	End Time:	
Drill	Contract	or: Maple	e lea		MPS	5 Acker						
Loca	tion: Pe	terspiela	1, m	B GPS Coordina	tes: <u>64</u>	7693 E. S	575	708 N. E	levation :		m Sheet	of
Туріса	al Soil C	lassifications:	: Clay / C	lay Fill / Silt / Sand / G	Gravel / Glac	ial Till / Granular E	lase or l	Fill / Topsoil	/ Peat or (Organics /	Bedrock	
Colo	ur	Consistenc	y	Compactness	Water Content	Plasticity		Par	ticle Size		٩	uantity
Black Grey Brown Tan	Sti Fir So	rd >200 ry Sliff 100-200 ff 50-100 m 25-50	kPa kPa kPa kPa	SPT Very loose 0-4 Loose 4-10 Compact 10-30 Dense 30-50 Very Dense >50	Dry Moist Saturated	Non Plastic (NP) Low Plasticity (LP Int, Plasticity (IP) High Plasticity (HP) Me Co) Fir Co Co	ne Sand (cdium Sand aarse Sand ne Gravel aarse Gravel bbles ulders	0 075 - 0.42 0.425 - 2 2.0 - 4 7 4.75 - 1 19 - 7 75 - 30 >30	0 mm 5 mm 9 mm 5 mm		0-20% e 20-35% yey/sandy)
De	p t h	_						Soil Sample	es		Field Tes	sts
from	to	Soil Type		Soil Des	cription	0	Туре		epth to	Test	Depth	Test Result
0	3"	107 501						Irom	10			
3"	1	duy	bla	ck, firm,	noist	, MP		_			-	
		silly	801	ck, firm, ne organi rwn, firm,	C	1.4.0		_	-			_
/	3	Clay	010	ion, firm,	1015	J M F						
3	125	clay	600	own shift	mois	+ HP						
		- /	f.	m below	101	-						
		C. J. marked										
1215	15	51/ Kill	bre	a fre to	1001	st, Mp		_				
			trai	ce fre to	war	se send		-				
			Trac	i pre gra	mer			-				
> S Yes> S -> S Yes> S	hing ource (soil ource (dept ource (soil ource (dept ource (soil ource (dept	h) /3/ h): //3/ h):		None Minor Moderale Heavy apth of Seepage: nal Groundwater depth:	Re	uger Refusal • Bedrock • Dense Till • Boulders • Other efusal Depth:	AC - Aug ST - Shel SS - Split C - Core JS - Wate Conte	by Tube Spoon r Sample for Sul		PP - Poo TV - Tor Note: re- torvane	cord correction	ation Test Per factor for
Commer	nts:											

			۶		SOIL	PROFILE					Star	nteo
TH N	lo.;	77+27	3	Logged by		Nestor			Drill Date:	10	Sul	115
				Project:	efersfi	Nestor Id Lagoo	nex	Pensilo	Start Time		End Time:	
Drill (Contract	or: Maple	(lea									
Loca	tion:	terspile	d, Mi	Drill Rig:: GPS Coordina	iles: <u>647</u>	17/8 E.S.	5757	40 N. E	ilevation :		m Sheet	of
		1		lay Fill / Silt / Sand / G								
Color	ur	Consistenc	;y	Compactness	Water Content	Plasticity		Par	ticle Size		Q	Jantity
Black Grey Brown Tan	ey Hard >200 kPa Very loose own Very Stiff 100-200 kPa Loose				Dry Moist Saturated	Non Plastic (NP) Low Plasticity (LP Int. Plasticity (IP) High Plasticity (HP) Meo Coa) Fine Coa Cob	e Sand (lium Sand rse Sand Gravel rse Gravel bles Idérs	0 075 - 0 42 0.425 - 2 2.0 - 4 7 4 75 - 1 19 - 7 75 - 30 >30	0 mm 5 mm 9 mm 5 mm)-20% 20-35% /ey/sandy)
De	pth							Soil Sampl	05		Field Tes	ts
from	to	Soil Type		Soil Des	cription		Туре		epth	Test	Depth	Test Result
ô	3" fopsoil							from	to			
		-										
3"	1	clay	66	ne organ	moisi	I, MP						
		atti	50.	ne organ	ie							
/	2	sity	bre	was firm	mon	t MP						
2	in r	alma	hor	wo shift	mon	I HP						
5		cury	fu	wo, shift m below	10'	/						
2,5	K	silt f.W	fra	1 soft 1	moist	, LP						
			fro	ce fine to	ware	a such						
			fro	a pri g	ravel							
> So Yes> So > So Yes> So	ource (soil ource (dept ource (soil ource (dept ource (soil			Indeventer Seepage None Minor Moderate Heavy apth of Seepage: nail Groundwater depth:	Re	Auger Refusal • Bedrock • Dense Tili • Boulders • Other afusal Depth;	AC - Auger ST - Shelb SS - Split S C - Core JS - Water Conter	y Tube ipoon Sample for Su		PP - Poo TV - Tor Note: red torvane l	cord correction	ition Test ler laclor for
ommer	nts:											

			F	RECORD OF							Sta	
TH N	lo.:	THZ	4	Logged by	r:	Nostor			Drill Date	/0	Jul	1 15
Clien	it:			Project	fersfin	Nostor lol Cagoo	10	pensie	Start Tim	e	End Time	
Drill (Contract	or: maple	i ha						Drilling M	othod:		
L.ocat	tion: Pe	tersfield	,mi	3 GPS Coordina	ates: 647	744 E. S	57	5712	Elevation :		m Sheet	of
				lay Fill / Silt / Sand / G					Contraction of the local distance of the loc			
Colou	ır	Consistenc	y I	Compactness	Water Content	Plasticity		Pa	article Size	9	Q	uantity
Black Grey Brown Tan	Sli Fir So	ard >200 rrySliff 100-200 ff 50-100 ∣ m 25-50 ∣	kPa kPa kPa kPa	SPTVery loose0-4Loose4-10Compact10-30Dense30-50Very Dense>50	Dry Moist Saturated	Non Plastic (NP) Low Plasticity (LP Int. Plasticity (IP) High Plasticity (HF) (() F	Fine Sand Medium Sand Coarse Sand Fine Gravel Coarse Gravel Cobbles Boulders	75 - 30	0 mm 75 mm 19 mm 75 mm		0-20% e 20-35 yey/sand
Dej	pth							Soil Sam	oles		Field Tes	sts
from	to	Soil Type		Soil Des	cription		Тур	pe	Depth	Test	Depth	Te: Res
0	3"	heart						from	to			
0	5	109 501/			-				-			_
54	1	alus	bla	ck. Lrm	mart	MP		-	-			
>	/	Cary	SA	Ne araan	10	/						
1	2.5	sit	fre	ok, frm, ne organ , soft,	mais	+ cP	-	-				
				1-1-1		1-1						
2.5	11.5	clay	bro	wn, stift	t, moo	st, HD			1			
1.5	15	ctuyen si A fill	600	wn, stiff	mois	7 mp						
			fra	ce fue to a	coars	e and						
			tra	a for gre	nuel							
> So 'es> So > So 'es> So	hing burce (soil t burce (depth burce (depth burce (soil t burce (depth	ype). 14		Induelter Seepage None Minor Moderale Heavy upth of Seepage: nal Groundwater depth:	Re	uger Refusal Bedrock Dense Till Boulders Other fusal Depih	ST Sh SS - Sp C - Co JS Wa	Sample Tyj iger Culling lelby Tube viit Spoon ore aler Sample for S nient		PP - Poo TV - Tor Note: red Iorvane t	cord correction	ilion Test ter faclor for
	ts:					I				1		
ommen												,

			F	RECORD OF					(ntec
TH N	0.1	THZS	-	Logged by:		Nestor	-		rill Date:	/0	Sal	y 15
				Project:	e fersfi	Nostor ald Lagoo	n Ey	asus	art Time		End Time:	
		Mo Dly	116	(villing Mo	thed		
Local	ion: Pa	fers field	1, M	Drill Rig:: _ <u>13</u> GPS Coordina	tes: <u>64</u>	7775 5.5	757	12N. ER	evation :_		m Sheet	of
				Clay Fill / Silt / Sand / G								
Colou	ır	Consistenc	у	Compactness	Water Content	Plasticity		Part	icle Size		Q	uantity
Black Grey Brown Tan	Ve Sti Fir	rd >200 ry Stiff 100-200 ff 50-100 m 25-50	kPa kPa kPa kPa	Very loose0-4Loose4-10Compact10-30Dense30-50Vary Dense>50	Dry Moist Saturated	Non Plastic (NP) Low Plasticity (LP) Int. Plasticity (IP) High Plasticity (HP	Coars) Fine G	m Sand e Şand Gravel e Gravel es	075 - 0.425 0.425 - 2.0 2.0 - 4.75 4.75 - 19 19 - 75 75 - 300 >300) mm 5 mm 9 mm 5 mm) mm)-20% 9 20-35% yey/sandy)
De	pth	-					So	il Sample			Field Tes	its
from	to	Soil Type		Soil Des	cription		Туре	De	pth to	Test	Depth	Test Result
0	3"	fop soil										
3"	3'	Clary	610	wer form	mois	t, MP						
			-			1 110						
3'	14	clay	bi	own, shif	1, nu	ist HI						
Id	15	clayery silf til	h	with firm	mis	et np				·		
14	13	SI 11 71 11	fre	own, firm	coarg	e soud						
				ay fre gre	1							
									•			
Soil Sloughing Groundwater Seepage Auger Refusal Sample Types Field 3 • None • Bedrock • Bedrock • C - Auger Cutting ST - Shelby Tube SPT - Standard Per PP - Pocket Penetr • None • Minor • Dense Till • C - Care ST - Shelby Tube T - Torvane Not: Feocord corrector Not: Feocord corrector Not: Feocord corrector Note: If sloughing, U • Yes -> Source (depth):										cket Penetrom vane cord correction tests	alion Test eter I factor for	
-> 9	Source (dep	olh):	_		_				st.	<u> </u>		

											0		ntec
тн	No.:	ר אר	6	Logged by	<i>ı</i> :	Nesto	/			Drill Date	. 10	Jul	1 15
Cile	ent:			Project:	eferst	eld Lago	01	exj.	larea	Start Tim	ie	_End Time	et t
Dril	Contr	actor Mapl	i ha							Drilling M	lathort:		
Loc	ation:	Refersfiel	d n	1B GPS Coordina	ates: 64	7804 E.	55	757	12N. 6	evation		_m Sheet	of
Typic	al Soi	Il Classification	: Clay / Cl	ay Fill / Silt / Sand / (Gravel / Glad	al Till / Granula	r Base	e or Fill	/ Topsoil	/ Peat or	Organics	/ Bedrock	
Cold	our	Consisten	cy	Compectness	Water Content	Plasticity			Per	ticle Siz	•	0	uentity
Black Grey Brown Ten		Hard >200 Very Stiff 100-200 Stiff 50-100 Firm 25-50 Soft 12-25	kPe kPe	SPT Very loces 0-4 Locas 4-10 Compact 10-30 Dense 30-50 Very Dense >50	Dry Moist Seturated	Non Plastic (NF Low Plasticity (I int. Plasticity (IF High Plasticity (F	LP) P)	Coers Fine (im Send le Sand Gravel le Gravel es	75 - 30	.0 mm 75 mm 19 mm 75 mm		0-20% 20-35% mm/sendy)
De	epth							50	il Sample			Field Te	its.
from	to	Soil Type		Soil Des	cription		T	уре	De	pth to	Teet	Depth	Test Result
0	34	top soil											
3 "	1.5	Clay	blac	L, firm, m	roist	, NIP							
			50.	ne organ	ie		-						
1.5	4	\$14	far	, soft, 1	moist	P							
4	17	day	bro	wn, shift	moi	st HP							
			fire	m to sof		010 111							
17	20	Clayey 51/1 +11	bro	wn, soft,	mors	1 MP							
			frac	ce prie to o	warse	soul							
			frank	fri gra	~e.l								
Yes -> 90 -> 80 Yes -> So	urce (soi urce (dep urce (dep	pth): <u>17.5'</u> il type): <u>17.5'</u> xth): il type):		water Bespage pre joor oderate servy 1 of Seepage: Groundwater Gepth:	•	ger Refused Bedrock Dense TH Bouldans Other sall Depth;	ST - S SS - S C - C 48 - W	uger Cut helby Tul plit Spoo			PP - Poole TV - Torve Note: recor Iorvene tes	d connection fer	stor for
Comment	28:	first no final r	ead.	ng open	17.5	5 wat 5 mat	er u	de,	oth	17 14	fro fro	- 9n	ound
	/	_		/							1	_/	- 1

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				RECORD OF	SOIL							Sta	ntec
		THE				Contraction of the second	-						
тн і	No.:	INL	r	Logged by	lont	1d laco		200	-	Drill Date		July	2015
Clier	nt:			Project/	Heispie	Ta Layou	2 6	4-	nyur	Start Tim	e	End Time	:
Drill	Contrat	ctor: <u>maple</u>	1 40	Drill Rig:: B GPS Coordina	6.47	10210	2	(7		Drilling M	ethod:		
				GPS Coordina Xay Fill / Silt / Sand / C									of
		Giesenicevone	I City / C	Any Fin / Sit / Garker C			Delaid		7 тораон	/ Feat of	Organics	Bedrock	
Colo	ur	Consistence	a l	Compectness	Water Content	Plasticity			Par	ticle Sine	•	Q	uentity
Black Grey Brown Tan	S	Tor fand >200 /ery Stiff 100-200 Stiff 50-100 Stiff 25-50 Soft 12-25 Soft 12-25	kPa kPa kPa kPa	SPT Very loces 0-4 Loces 4-10 Compact 10-30 Dense 30-50 Very Dense >50	Dry Moist Seturnted	Non Plastic (NP) Low Plasticity (Li int. Plasticity (IP) High Plasticity (Hi)	Coers Fine C	m Sand e Sand Gravel e Gravel es	0.075 - 0.42 0.425 - 2 2.0 - 4.7 4.75 - 1 19 - 7 75 - 30 >30	0 mm 5 mm 19 mm 5 mm		0-20% e 20-35% ywy/sendy)
De	pth							80	il Sample			Field Tes	ta
from	to	Soll Type		Solt Dee	cription		т	уре	De from	pth to	Test	Depth	Test Result
U	3"	top soil		anta di la composicione di la compo		and the state of the							
~ 4					n								
3"	4'	silt	pu	r, soft, m	0157	, U ^s							
4	16	alay	br	own, shift	- mo	ist HP	1						
					/								
16	20	5.1+ 1:11	bro	own, soft,									
			fre	rce fue to	coars	u smet							
			fra	a fre q'	ave/								
								-					
Yes> Sou > Sou Yes> Sou	urce (soli t irce (depii irce (soli t irce (depii	ype): h): ype):	/ ·	dwater Boepage Ngpan Minor MGBinate feevy In of Seepage: M Groundwater depth:)	Dense Till Bouiders	8T - S 86 - S C - C 46 - W	uger Cut helby Tul plit Spool ore	be]	PP - Pocks TV - Torve Note; reco torvene ter	rd correction te	ctor far
ommenti	∎j 4	first r	ead	ing 3.5		non g	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	ing	1				_
	1			1	/		_						

JANUARY 2016 Test Holes

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APPENDIX 2

Certificate of Title

STATUS OF TITLE

Title Number1603055/1Title StatusAcceptedClient FileLDIAZ

The Property Registry A Service Provider for the Province of Manitoba



1. REGISTERED OWNERS, TENANCY AND LAND DESCRIPTION

RURAL MUNICIPALITY OF ST. ANDREWS

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

SW 1/4 36-15-4 EPM EXC ALL MINES AND MINERALS SET FORTH IN THE CROWN LANDS ACT

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 ;	2315311/1
Instrument Status:	Accepted
Registration Date:	1998-10-21
From/By:	HER MAJESTY THE QUEEN (MANITOBA)
To:	AS AGENT: HARLEY S. JONASSON
Amount:	

No notes

3.	ADDRESSES FOR SERVICE

RURAL MUNICIPALITY OF ST. ANDREWS GENERAL DELIVERY CLANDEBOYE MB ROC 0P0

4. TITLE NOTES

Notes:

Description:

No title notes

5. LAND TITLES DISTRICT

Winnipeg

Title Number 1603055/1

AGREEMENT OF SALE (RE: FLOOD COMPENSATION ETC.)

Page 1 of 2

6. DUPLICATE TITLE INFORMATION

Duplicate not produced

7, FROM TITLE NUMBERS

B67799/1 Partial

8. REAL PROPERTY APPLICATION / CROWN GRANT NUMBERS No real property application or grant information

9. ORIGINATING INSTRUMENTS

Instrument Type:	Transfer Of Land
Registration Number:	2315310/1
Registration Date:	1998-10-21

From/By: To: Consideration: HER MAJESTY THE QUEEN (MANITOBA) RURAL MUNICIPALITY OF ST. ANDREWS \$33,300.00

10. LAND INDEX

SW 36-15-4E EX RES

CERTIFIED TRUE EXTRACT PRODUCED FROM THE LAND TITLES DATA STORAGE SYSTEM OF TITLE NUMBER 1603055/1

True Number 1603052/1

APPENDIX 3



Please print clearly or type and follow the instructions on the application form. NOTE: If using Adobe Reader text can be inserted into form and tab between fields.

This application is pursuant to the Water and Wastewater Facility Operators Regulation issued under The Environment Act.

Name of Facility:

Name of Facility Owner: (Municipality/Commission/ Company/Individual/etc)

Civic Address of Facility:

Mailing Address of Owner:

Postal Code:		Telep	phone:
Contact Person:		Positi	ion:
Cell or Pager: Fax:			Email:

Please complete the following. The information provided will be used to classify the wastewater treatment facility under the Water and Wastewater Facility Operators Regulation. In some cases actual numbers or answers must be supplied, but in most cases it will only be necessary to check the appropriate criteria.

Forward the completed form to:	Please direct questions to:
Director Environmental Assessment & Licensing Branch Manitoba Conservation 160 – 123 Main Street Winnipeg MB R3C 1A5 Mike	Certification Program Coordinator Phone: (204) 945-7065 Fax: (204) 945-5229

SYST	SYSTEM (choose all that apply)		
	New or proposed Facility seeking classification		
1	Proposed start of operations (month / year)		
1.	Existing Facility seeking classification (in operation prior to December 31, 2005)		
	Facility has been in operation since (approximate month/year)		
2	The facility WILL employ mechanical treatment processes		
2.	The facility WILL NOT employ mechanical treatment processes		

SIZE	E (refer to Supplemental Information for point designation) (2 point minimum to 20 point maximum)				
1.	Maximum population or part ser	ved, peak day	#	1-10	
2.	Design flow average day (Circle volume option & units) OR Peak month's flow average day	Estimated or Actual Estimated or Actual	m ³ /day gal/day m ³ /day gal/day	1-10	

VAR	VARIATION IN RAW WASTE ¹ (choose all that apply) (0 point minimum to 6 point maximum)		
1.	Variations do not exceed those normally or typically expected	0	
	Recurring deviations or excessive variations of 100-200% in strength		
2.	Recurring deviations or excessive variations of 100-200% in flow	2	
	Recurring deviations or excessive variations of 100-200% in strength and flow		
3.	Recurring deviations or excessive variations of more than 200% in strength		
	Recurring deviations or excessive variations of more than 200% in flow	4	
	Recurring deviations or excessive variations of more than 200% in strength and flow		
4.	Raw wastes subject to toxic waste discharges	6	
5.	Septage or truck-hauled waste discharge is accepted at the facility.	0 - 4	
	Estimated number of loads per day in peak haul times	0-4	

PREL	PRELIMINARY TREATMENT (choose all that apply)		
1.	Facility pumping of main flow		3
2.	Screening or comminution		3
3.	Grit removal		3
4.	Equalization		1

PRIM	PRIMARY TREATMENT (choose all that apply)		
1.	Clarifiers		5
2.	Anaerobic treatment with biogas flare		10
3.	Anaerobic treatment with biogas utilization facility		15

SECO	SECONDARY TREATMENT (choose all that apply)		
1.	Fixed-film reactor		10
2.	Activated sludge		15
3.	Stabilization ponds without aeration (ie: sewage lagoon)		5
4.	Stabilization ponds with aeration		8

TERT	TERTIARY TREATMENT (choose all that apply)		
1.	Polishing ponds for advanced waste treatment		2
2.	Chemical / physical advanced waste treatment without secondary treatment		15
3.	Chemical / physical advanced waste treatment following secondary treatment		10
4.	Biological or chemical / biological advanced waste treatment		12
5.	Nitrification by designed extended aeration only		5
6.	Ion exchange for advanced waste treatment		10
7.	Reverse osmosis, electrodialysis and other membrane filtration techniques		10
8.	Advanced waste treatment chemical recovery, carbon regeneration		4

9.	Media filtration		5
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ADDITIONAL TREATMENT PROCESSES (choose all that apply)			
1.	Chemical addition: (Please list chemicals used, 2 pts per chemical to max. of 6)		0 - 6
2.	Dissolved air floatation (other than for sludge thickening)		8
3.	Intermittent sand filter		2
4.	Recirculating intermittent sand filter		3
5.	Microscreens		5
6.	Generation of oxygen		5

SOLIDS HANDLING (choose all that apply)		
1.	Storage (other than for stabilization)	2
2.	Stabilization by storage (including any storage afterwards)	4
3.	Gravity thickening	2
4.	Mechanical dewatering	8
5.	Anaerobic digestion of solids	10
6.	Utilization of digester gas for heating or cogeneration	5
7.	Aerobic digestion of solids	6
8.	Air-drying of sludge	2
9.	Solids reduction (including incineration and wet oxidation)	12
10.	Disposal in landfill	2
11.	Solids composting	10
12.	Land application of biosolids by contractor	2
13.	Land application of biosolids by facility personnel	10

DISINFECTION (choose all that apply) (0 point minimum to 10 point maximum)			
1.	Chlorination		F
	Ultraviolet irradiation		5
2.	Ozonization		10

EFFLUENT DISCHARGE (choose all that apply) (0 point minimum to 10 point maximum)			
1.	Discharge to surface water (constructed wetland and then to Netley Marsh)		0
2.	Mechanical post-aeration		2
3.	Direct recycling and reuse		6
4.	Land treatment and surface or subsurface disposal		4

INSTRUMENTATION (choose one) (0 point minimum to 6 point maximum)			
1.	SCADA or similar instrumentation systems are used to provide:		
	Data with no process operation		0
	Data with limited process operation		2
	Data with moderate process operation		4
	Data with extensive or total process operation		6

LABORATORY CONTROL ² (choose all that apply) (0 point minimum to 15 point maximum)		
1.	Bacteriological / Biological (0 point minimum to 5 point maximum)	
	Lab work done outside the facility	0
	Membrane filter procedures	3
	Use of fermentation tubes or any dilution method of fecal coliform determination	5
2.	Chemical / Physical (0 point minimum to 10 point maximum)	
	Lab work done outside the facility	0

(List tests	 Push button or visual methods for simple tests such as pH or settleable solids 	3
(List tests	 Additional procedures such as DO, COD, BOD, gas analysis, titration, solids content or volatile content 	5
(List tests	 More advanced determinations such as specific constituents, nutrients, total oils or phenols 	7
(List tests	 Highly sophisticated instrumentation such as atomic absorption or gas chromatograph 	10

APPLICANT VERIFICATION

I HEREBY DECLARE THAT ALL INFORMATION IN THIS APPLICATION IS TRUE.	
Name of Applicant ³ : (Print)	

Title:	
Telephone:	Fax:
Email:	
Signature of Authorized Representative:	Date:

¹The key concepts are frequency or intensity of deviation, or excessive variation from normal or typical fluctuations. The deviations in strength, toxicity, ratio of infiltration to inflow, or shock loads.

² The key concept is to credit laboratory analyses done on-site by facility personnel under the direction of an operator-in-charge with points from 0-15.

³ Applicant must be an authorized representative of the owner/operating authority (i.e. manager, P. Eng., or overall responsible operator).



Wastewater Treatment Form Supplemental Information

This is supplemental information for completing the Application for Wastewater Treatment Facility Classification Form only.

For exact definitions and text refer to Manitoba Regulation 77/2003, Water and Wastewater Facility Operators Regulation and amendment M.R. 162/2005, under The Environment Act (C.C.S.M. c E125).

A copy of the regulation is available by following the link for Manitoba Regulations at: http://www.gov.mb.ca/conservation/envapprovals/publs/index.html

Facilities are classified as follows:

Small system class

A wastewater treatment facility that otherwise meets the criteria of a class 1 wastewater treatment facility shall be classified in the small system class if

- a) it treats wastewater from a population of no more than 500; and
- b) no mechanical treatment processes are employed at the facility.

Classes 1 to 4

Wastewater treatment facilities shall be classified in classes 1 to 4 in accordance with the following table, on the basis of the number of classification points assessed under the classification point system set out in the Water and Wastewater Facility Operators Regulation.

Range of Classification Points	Classification
0 to 30	Class 1
31 to 55	Class 2
56 to 75	Class 3
76 or more	Class 4

Size

Points for size: (2 point minimum to 20 point maximum)

Maximum population or part served, peak day (1 point minimum to 10 point maximum). Points are assigned at 1 point per 10,000 population or part.

Design flow average day or peak month's flow average day, whichever is larger (1 point minimum to 10 point maximum). Points are assigned at 1 point per 4.5 megalitres per day or part.

Authorized Representative

Signatures for the Applicant Verification section must be an individual recognized by the Owner of the facility as able to sign official documentation (i.e. P.Eng., Manager, CAO, etc).