


Environment Act Proposal Form



Name of the development: RM of Gimli Evaporative Pond Facility	
Type of development per Classes of Development Regulation (Manitoba Regulation 164/88): Class 2	
Legal name of the applicant: Rural Municipality of Gimli	
Mailing address of the applicant: Box 1246 - 62 2nd Ave	
Contact Person: Mr. Dick Menon, P.Eng.	
City: Gimli	Province: MB Postal Code: R0C 1B0
Phone Number: (204) 424-5251 Fax: (204) 424-5193 email: dmenon@rmgimli.com	
Location of the development: SW 10-21-3 EPM (RM of Gimli)	
Contact Person: Mr. Dick Menon, P.Eng.	
Street Address:	
Legal Description: Southwest quarter of 10-21-3 EPM	
City/Town: Gimli	Province: MB Postal Code: R0C 1B0
Phone Number: (204) 396-1000 Fax: email: dmenon@rmgimli.com	
Name of proponent contact person for purposes of the environmental assessment: Dana Bredin	
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Date: 2020-11-10	Signature of proponent, or corporate principal of corporate proponent: 
	Printed name: Dana Bredin



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RESET

RM OF GIMLI

ENVIRONMENT ACT PROPOSAL

RM OF GIMLI WASTEWATER EVAPORATION POND FACILITY

NOVEMBER 2020

ORIGINAL



ENVIRONMENT ACT PROPOSAL WASTEWATER EVAPORATION POND FACILITY

RM OF GIMLI

ENVIRONMENT ACT PROPOSAL REPORT
ORIGINAL

PROJECT NO.: 181-03988-00
DATE: NOVEMBER 2020

WSP
1600 BUFFALO PLACE
WINNIPEG, MB, CANADA R3T 6B8

WSP.COM



November 13, 2020

Manitoba Conservation and Climate
Environmental Approvals
1007 Century Street
Winnipeg, MB R3H 0W4

Attention: Shannon Kohler – Director, Environmental Approvals

Dear Ms. Kohler:

**Subject: Environment Act Proposal – RM of Gimli
Wastewater Evaporation Pond Facility**

The RM of Gimli is contemplating accepting and storing industrial wastewater generated by Diageo in an evaporative pond that the existing wastewater treatment plant currently cannot accept. The Arnes Waste Disposal Ground site was selected as a desirable location to construct an evaporative pond for this purpose.

The existing wastewater treatment plant currently operates under Environment Act Licence No. 2587.

The enclosed Environment Act Proposal report (2 copies, 1 CD) provides the details and information on the proposed development. It is accompanied by the signed application form and a cheque in the amount of \$7,500.00. We request the opportunity to review the draft Environment Act Licence when it is issued. Please contact the undersigned if further information is required.

Kind regards,

A black rectangular redaction box covers the signature of Dana Bredin. The box is positioned below the 'Kind regards,' text and above the printed name and title.

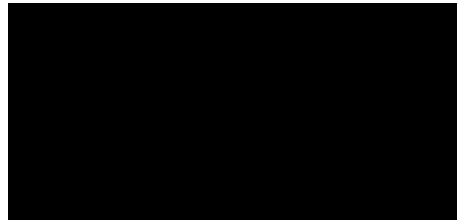
Dana Bredin, P.Eng.
Project Engineer, Water & Wastewater Infrastructure

SIGNATURES

PREPARED BY



Dana Bredin, P.Eng.
Project Engineer, Water & Wastewater Infrastructure



REVIEWED BY



Justin Rak-Banville, M.Sc.,



	ENGINEERS GEOLOGISTS MANITOBA
Certificate of Authorization	
WSP Canada Inc.	
No. 5750	Date: 

EXECUTIVE SUMMARY

The Diageo Gimli distillery is a significant industry within the RM of Gimli and produces three distinct types of wastewater, two of which are not accepted at the RM of Gimli Wastewater Treatment Plant. These two streams of wastewater are currently being collected and trucked to the City of Winnipeg North End Pollution Control Centre for treatment at a considerable cost. Diageo currently produces approximately 620 m³ combined of this wastewater annually. Both Diageo and the RM Gimli are seeking an alternative solution for the treatment of this wastewater, which has led to the development of this proposal for an evaporative pond facility.

The RM of Gimli desires to construct a new evaporative pond facility adjacent to the Arnes Waste Disposal Ground site within SW 10-21-3 EPM. The proposed development involves the construction of three evaporative ponds. Each pond will have the capacity for one year of storage, including any precipitation that is captured in each pond. The wastewater will be managed in each pond on a rotation, whereby each pond will accept wastewater for one year, followed by two years of evaporation. The ponds are designed without a piped discharge to the environment, as the wastewater is anticipated to evaporate during the two-year period.

Natural (passive) processes will account for most of the evaporation of the wastewater captured in the pond, but an active supplemental process will be required to completely evaporate the wastewater contained during their two-year evaporative period. This supplemental process consists of the utilization of an evaporator manufactured by Slimline Manufacturing, the “Ecomister”. The Ecomister evaporator draws wastewater from the pond through a turbine, and sprays small water droplets back over the pond area, significantly increasing the evaporation rate.

Upon approval from Manitoba Conservation and Climate and the issuance of an Environment Act Licence, construction of the proposed facility will begin in the spring/summer of 2021.



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1 DEVELOPMENT INFORMATION

Rural Municipality of Gimli Wastewater Evaporation Pond

Name of development

Rural Municipality of Gimli

Legal name of the proponent of the development

Southwest Quarter of 10-21-3 EPM

Location of development

Contact Person for Proponent:

Mr. Dick Menon, P.Eng.
Project Manager
RM of Gimli
Box 1246 – 62nd Avenue
Gimli, MB R0C 1B0

Contact Person for Environmental Assessment:

Mr. Dana Bredin, P.Eng.
WSP Canada Inc.
1600 Buffalo Place
Winnipeg, MB R3T 6B8

Table 1-1: Proposal Contents

Section of Environment Act Proposal Form		Section Number in Report
DESCRIPTION OF DEVELOPMENT:		
(i)	Legal description and map of development	2.1
(ii)	Mineral rights	2.2
(iii)	Existing land use	2.3
(iv)	Land use designation	2.3
(v)	Previous studies	2.4
(vi)	Proposed development	5.0
(vii)	Storage of gasoline or associated products	5.3.1
(viii)	Potential impacts	5.0
(ix)	Proposed environmental management	6.0
SCHEDULE:		7.0
FUNDING:		7.0

1.1 CANADIAN ENVIRONMENTAL ASSESSMENT INFORMATION

Table 1-2: CEEA Proposal Contents

Screening Report Outline		Section Number in Report
1.	Assessment Responsibility - Funding	7.0
2.	Project Description	
	2.1 General	2.0, 3.0, 4.0
	2.2 Project Components	4.2
	2.3 Construction Details	4.3.2
	2.4 Project Scoping	4.0
3.	Description of Environment	
	3.1 Land Uses and Ownership	2.1, 2.2, 2.3
	3.2 Local Soils, Topography, Geology	4.1
	3.3 Hydrology / Hydrogeology	5.3, 5.4
	3.4 Vegetation Communities	5.2
	3.5 Fish, Wildlife, and Habitat	5.5, 5.6
	3.6 Endangered or Threatened Species	5.5
	3.7 Historic and Cultural Sites	5.8
4.	Environmental Impacts and Mitigation	
	4.1 Water Quality	5.3
	4.2 Odour	5.1
	4.3 Fisheries	5.5, 5.6
	4.4 Wetland / Wildlife Habitat	5.2
	4.5 Soils and Vegetation	4.1.2, 5.2
	4.6 Heritage Resources	5.8
	4.7 Navigable Waters	5.3
5.	Cumulative Effects	5.0
6.	Public Involvement	5.10
7.	Follow-Up	6.0
8.	Contacts	1.0
9.	Personal Communication	Appendix F
10.	Attachments	Appendix A, B, C, D, E, F

2 DESCRIPTION OF DEVELOPMENT

2.1 LEGAL DESCRIPTION AND OWNERSHIP

The existing Arnes solid waste disposal ground is located in the southwest quarter of section 10-21-3 EPM. The RM of Gimli is the registered owner of the existing site, as identified in Certificate of Title 533897 ([Appendix A](#)).

The new development is to be located within this same quarter section, as shown in [Figure 2-1](#).



Figure 2-1: Location Map of the Existing Waste Disposal Ground and Proposed Development

2.2 MINERAL RIGHTS

The Crown Lands and Property Agency – Lands Branch was contacted to provide information on the mines & minerals and sand & gravel ownership of the applicable land discussed in the previous section. It was confirmed that the RM of Gimli owns the sand and gravel whereas the mines and minerals remain with the Crown. Correspondence is included in [Appendix F](#).

2.3 DESCRIPTION OF EXISTING LAND USE

The land proposed for the construction of an evaporation pond facility is currently a mixed wood area bordered on the west by Road 15E, on the south by Ridge Road and on the east by the newly constructed biosolids storage facility. The land is zone AG, “Agriculture General”.

2.4 PREVIOUS STUDIES

2018 “Geotechnical Site Review for the Proposed Sludge Storage Facility at the Arnes Waste Disposal Ground” prepared by WSP for the RM of Gimli

This letter report provides the details of the geotechnical investigation at the proposed sludge storage facility site. The investigation included test hole drilling, sample collection and laboratory analysis. The clay material identified at the site will meet the Provincial regulation for clay liners, but the clay material is limited in availability. Therefore, it is proposed to use the in-situ till material, which also passed a consolidation test, as a liner on the bottom of the ponds and the suitable clay in the dykes above.

1997 “Groundwater Analysis for Arnes Waste Site at SW 10-21-3 EPM” prepared by Cochrane Environmental Consultants for the RM of Gimli

This document satisfies the request of Manitoba Environment to provide laboratory analysis on the six monitoring wells on the property in question. The analysis concluded that the testing was consistent with the baseline sampling conducted in the previous year.

1997 “Rural Municipality of Gimli – Closure Plan and Groundwater Analysis – Arnes Waste Disposal Site” prepared by Cochrane Engineering

This document outlines the closure of the existing Arnes Waste Disposal Site which had operated for over twenty-five years and was nearing capacity. Both the Arnes Waste Disposal site and the Foley site were being replaced by a new regional waste disposal site located to the south of the Arnes existing site (current site location).

1994 “Geotechnical Investigation – Interlake Development Corporation – Rural Municipality of Gimli – Site 1 Arnes Waste Disposal Ground – SW 10-21-3EPM – Site 2 Foley Waste Disposal Ground – SW 26-18-3EPM” prepared by Poetker MacLaren Limited

This geotechnical investigation was conducted to satisfy the requirements for the renewal of an expiring operating permit at the Arnes Waste Disposal Ground. The investigation included monitoring well installation, test hole drilling, sample collection and laboratory testing. As well, a vertical seepage analysis was conducted.

3 DIAGEO WASTEWATER

3.1 DESCRIPTION

The Diageo Gimli Plant, operated by Diageo Canada Inc. (Diageo), is located in Gimli, MB, and manufactures and distributes Crown Royal Canadian Whiskey. The plant currently operates under Environment Act Licence (EAL) no. 778 R.

Diageo generates three (3) different wastewater sources as follows:

- 1) Normal operation wastewater
- 2) Dry house cleaning wastewater
- 3) Annual maintenance shutdown wastewater

The typical operation wastewater is sent to the existing Gimli Wastewater Treatment Plant (WWTP) for treatment. The WWTP is located in the Gimli Business Park in the west half of section 18-9-4 EPM. The WWTP treats this wastewater source within the requirements as agreed upon in the Industrial Service Agreement (ISA) between the RM of Gimli (RM) and Diageo. The WWTP currently operates under EAL no. 2587.

The dry house cleaning wastewater is presently collected onsite at the Gimli Plant and is hauled by Miller Environmental to the City of Winnipeg North End Pollution Control Centre for treatment. Previously, the Gimli WWTP received this wastewater, but when it resulted in significant treatment process upsets, it was redirected. The dry house cleaning wastewater is produced every 6 to 7 weeks (or up to 8 times per year) when Diageo changes batches of their product, generating approximately 70,000 L each time. The total volume generated annually is estimated at 560,000 L. WSP sampled the dry house cleaning wastewater on May 31, 2018, and it was submitted for laboratory analysis at ALS Environmental (Winnipeg). The following **Table 3-1** summarizes the results of the analysis:

Table 3-1: Summary of Dry House Cleaning Wastewater Analysis Results

Parameters	Result
Ammonia, Total (as N)	1.64 mg/L
Biochemical Oxygen Demand	2,570 mg/L
Chemical Oxygen Demand	4,810 mg/L
Phosphorus, Total	4.62 mg/L
Sulfate (SO ₄)	647 mg/L
Total Kjeldahl Nitrogen	83 mg/L
Total Suspended Solids	886 mg/L
pH	6.04
Ethanol	236 mg/L
Oil and Grease – Gravimetric	208 mg/L

The results of the dry house cleaning wastewater are provided in full in [Appendix E](#), which include total metals and microtox analysis results.

Similar to the dry house cleaning wastewater, the annual maintenance shutdown wastewater is presently collected onsite at the Gimli Plant and is hauled by Miller Environmental to the City of Winnipeg North End Pollution Control Centre for treatment. Diageo’s annual maintenance shutdown occurs once per year and lasts approximately four weeks. It generates an estimated 60,000 L of wastewater.

Accordingly, when these two streams of wastewater are redirected to the proposed Arnes evaporation pond facility, the total amount of wastewater anticipated annually from Diageo is 620,000 L or **620 m³**.

The following [Table 3-2](#) details several parameters of the annual maintenance shutdown wastewater, as provided by Diageo.

Table 3-2: Annual Maintenance Shutdown Wastewater Quality Results Provided by Diageo.

Parameters	Result
Ammonia, Total (as N)	52.0 mg/L
Phosphorus, Total	27.5 mg/L
Nitrogen, Total	60.0 mg/L
Total Suspended Solids	858 mg/L
pH	4.04
Dissolved oxygen	1.23 mg/L
Dry matter (%)	8.23

4 PROPOSED DEVELOPMENT

The proposed development involves the construction of three new ponds to provide storage for the wastewater generated by the Diageo Gimli Plant that cannot be treated at the Gimli WWTP, which includes the dry house cleaning wastewater and the annual maintenance shutdown wastewater as described in the previous section. Each pond will have enough storage for one year's worth of the wastewater generated by Diageo. The wastewater will be truck hauled from Diageo and deposited in the designated pond via a truck dump ramp. Each pond will have two years where no wastewater will be deposited. During this time, the wastewater is expected to evaporate through natural (passive) and active supplemental processes. The supplemental process will consist of an Ecomister evaporator (model HD19 supplied by Slimline Manufacturing), whereby the liquid in the pond is pumped through a turbine creating small water droplets that are sprayed back over the pond, enabling active evaporation of the wastewater from the pond.

The Arnes waste disposal ground site was selected as the location for the biosolids storage facility for the following reasons: (1) The area already supports a waste disposal ground (WDG) and therefore, the RM residents should have no objections to the proposal; (2) The RM of Gimli has ownership of this property; and (3) Site conditions are favorable for a lined lagoon pond.

The EAP design drawings are appended ([Appendix C](#)). The construction associated with this work will not affect the operation of either the biosolids storage facility or the WDG.

4.1 SITE CONDITIONS

On September 30, 2015, WSP conducted a site investigation at the Arnes WDG for the design and construction of the biosolids storage facility, which is located directly adjacent to the proposed development. An excavator was used to excavate a total of four test pits (TP1-TP4) to 3.0 m below grade.

Additionally, on October 29, 2020, WSP completed two additional test pits (TP5-TP6) to a depth of 3.0 m below grade within the proposed footprint of the evaporative pond facility.

The test pit locations and detailed descriptions of the soil profiles are included in the Geotechnical Report in [Appendix B](#).

This information is supplemented by a geotechnical investigation conducted in 1994 for the design and construction of the Arnes WDG. On June 14, 1994, Cochrane Engineering conducted a site investigation at the RM property within SW 10-21-3 EPM. The investigation consisted of auguring eight test holes, TH 101 to TH 108 over an 8.1-hectare area. The test holes were excavated using a truck-mounted drill rig with 125 mm diameter continuous flight, solid stem augers. Drilling depths were between 9.2 m and 12.0 m below grade. The test hole logs from the 1997 Groundwater Analysis Report are included in the appended Geotechnical Report.

4.1.1 LOCAL TOPOGRAPHY

The site is located in the Interlake Till Plain landscape feature area. The topography varies from low ridge and swale to depressional. The land slopes gently towards Lake Winnipeg. The soil survey maps indicate that the surficial soils consist of Inwood-Meleb Complex (silt till), Leary Complex loamy sand, and Chatfield Complex peat deposits, developed over strongly calcareous till, sand and gravel outwash and beach deposits, and undifferentiated materials, respectively.

4.1.2 SOIL CONDITIONS

The six test pits excavated to a depth of 3.0 m revealed a general soil profile consisting of a layer of peat moss/topsoil underlain by a clayey-silt or sandy-silt layer over a till with a sandy-silt matrix which extended to the depth explored. The exception is at TP1, where a thin sand layer was encountered below the topsoil/peat moss layer. The till was found to be dense at 1.2 m to 1.8 m below grade within all test pits. Based on the soil conditions from the available information, the till layer extends to a depth of between 36 m and 49 m, where the limestone bedrock aquifer is encountered.

4.1.3 GROUNDWATER

At present, there is a preliminary groundwater report prepared by the Planning Branch of the Water Resources Division on Eastern Interlake where the proposed site is located. Based on the report and groundwater availability maps, groundwater bearing formations or aquifers at the proposed site are formed by an extensive carbonate rock. This aquifer is almost continuous throughout the area. The depth to the aquifer ranges from less than 36 m to 49 m below grade. The potential yield around this area is approximately in the range of 1 to 100 L per second. The water quality for the upper part of carbonate aquifer is of good quality. The apparent groundwater flow is towards the east.

A review of the Groundwater Pollution Hazard Map – Selkirk Area shows that the proposed site is not located inside a groundwater pollution hazard area.

4.1.4 LABORATORY RESULTS

Select samples from the biosolids storage facility site investigation (September 2015) were submitted to a laboratory for moisture content, Atterberg limits and hydraulic conductivity analysis. As classified during the field investigation, the clay soil at TP1 (0.9-1.5 m) and TP2 (0.3-1.2 m) was classified as CH (high plasticity) material while the clay soil at TP3 (0.3-1.5 m) was determined to be CL (low plasticity) with similar material at TP4. The hydraulic conductivity test result of the remoulded sample of sandy clay material (TP3@0.3 to 1.2 m) is 2.54×10^{-8} cm/s.

No sampling was conducted on TP5 or TP6, as the material was consistent with what was found during the excavation and construction of the biosolids storage facility (a thin sandy silt layer followed by a dense till of a sandy-silt matrix). Furthermore, the clayey material found on-site within TP1, TP2 and TP3, was limited to the south and eastern areas of the biosolids storage facility footprint and was used for a clay core around the perimeter dykes. This material has been exhausted, and there is no indication that this clayey material extends into the footprint of the proposed evaporative pond facility. As such, a high plasticity clay material will be sourced from a large stockpile (approximately 3,000 cu.m) located at the former Gimli lagoon site (SW 9-19-4 EPM). The hydraulic conductivity of the stockpiled clay material is assumed to range from 1×10^{-7} to 1×10^{-8} cm/s based upon test results that were completed in November 2012 by The National Testing Laboratories for the RM at the former Gimli lagoon site.

Additionally, several block samples were obtained of the dense till from the Arnes WDG site in order to determine the material's hydraulic conductivity. The first block sample of the till was obtained from TP3 in late 2016 and a one-dimensional consolidation test was completed on this sample. The material's hydraulic conductivity was calculated to range from 2.6×10^{-8} to 2.9×10^{-11} cm/s.

Three other block samples (i.e. samples 2 to 4) were recovered during the liner testing of a new refuse pond constructed on the east side of the Arnes WDG site, approximately 600 m east of the proposed evaporative pond facility. One sample was used to complete a one-dimensional consolidation test, and the other samples were combined, remoulded

and used to complete a rigid wall permeability test. The consolidation test results on the second block sample indicate that the material's hydraulic conductivity ranges from 1.2×10^{-9} cm/s to 4.4×10^{-12} cm/s. It is important to note that the hydraulic conductivity values show a relatively high degree of variability due to the material's heterogeneity. For the third and four samples, their bulk densities were measured and then samples were combined and remoulded to the material's approximate dry density. Subsequently, the rigid wall permeability test was completed on the combined sample, and the result of this test was a hydraulic conductivity of 1.71×10^{-8} cm/s.

A fifth sample was recovered from the liner of the biosolids storage facility and a rigid wall permeability test is currently being completed. The results of this test will be submitted at a later date.

The laboratory test results are included in the Geotechnical Report in [Appendix B](#).

4.1.5 GEOTECHNICAL RECOMMENDATIONS

It is proposed that the evaporative pond facility be constructed with a perimeter clay core, using imported clay from the former Gimli lagoon site, and excavated a minimum of 0.3 m into the dense in-situ till material, which ranges from 1.2 to 1.8 m below grade. The clay core is expected to be subject to sampling (Shelby tube) and material testing (falling head permeability test) to determine the material's hydraulic conductivity. Moreover, the in-situ till material is expected to be subject to sampling (block sample) and material testing (rigid wall permeability test on a remoulded sample) to determine the material's hydraulic conductivity.

4.2 EVAPORATION

Evaporation from an open water source is generally influenced by two main factors: the supply of energy to provide the latent heat of vaporization, and the ability for air to transport the vapor away from the water surface. There are several methods that can be used to calculate and estimate the daily evaporation rate using daily weather and solar radiation data. The *combined aerodynamic and energy balance method* was chosen to calculate a daily evaporation rate as it represented the most accurate method when all the meteorological data required is available. The meteorological data collected and recorded by Environment and Climate Canada in Gimli and Winnipeg was used for the combined method.

The following section summarizes the applied methodology to determine the estimated daily evaporation rate expected, the net evaporation of the proposed evaporative facility, as well as detailing the proposed Ecomister evaporator to be used to supplement the natural evaporative process. The raw daily weather data, the daily evaporation calculations, and the Ecomister evaporator proposal are presented in [Appendix D](#).

4.2.1 WEATHER DATA

Daily recorded weather data from the Gimli weather station (Gimli Climate) [1], supplemented by Winnipeg Airport weather station (Winnipeg A CS) [2], from April 2018 to October 2020 was used to estimate the daily evaporation rate. This data set was selected as solar radiation was observed and recorded for Winnipeg in 2018 and part of 2019, which is important when calculating the daily evaporation rate using the energy balance method. Additionally, Gimli weather data was supplemented by the Winnipeg weather data when the data was found missing or not recorded at the Gimli weather station for a particular day. The following parameters were used to calculate a daily evaporation rate:

- Average daily temperature (°C)
- Average daily relative humidity (%)

- Average daily wind speed (m/s)
- Average daily atmospheric pressure (kPa)

The entire raw daily weather dataset is presented in [Appendix D](#).

Precipitation data was also required in order to determine the overall annual net evaporation for the proposed evaporative facility. Annual average precipitation (rain and snow) for the site was estimated based on the 1981-2010 Canadian Climate Normals, published by Environment and Climate Change Canada [3]. [Table 4-1](#) summarizes the annual average precipitation for nearby weather stations.

Table 4-1: Annual Average Precipitation for Nearby Weather Stations

Weather Station	Annual Average Precipitation (1981-2010)
Arborg	499.4 mm
Fisher Branch South	515.3 mm
Lundar	480.2 mm
Narcisse	497.6 mm
Stony Mountain	550.1 mm
Winnipeg Airport	521.1 mm

Furthermore, the annual average precipitation for the Gimli weather station is found to be 532.5 mm/year, based on the 1971-2000 Canadian Climate Normals published by Environment and Climate Change Canada [4].

For the purposes of determining the annual net evaporation for the proposed evaporative facility, the annual average precipitation value selected was **532.5 mm/year**, which is a slightly more conservative value than other nearby weather stations.

4.2.2 SOLAR RADIATION DATA

Daily solar radiation (kJ/m² per day) was observed and recorded at the Winnipeg Airport weather station from July 4, 2018 to October 31, 2019 [2]. Solar radiation is crucial when determining the estimated daily evaporation rate. [Table 4-2](#) presents the collected daily solar radiation, which was averaged for each month, as well as the average daily net radiation, which was calculated by multiplying the average daily solar radiation by 1,000 and dividing by 86,400 seconds per day.

Table 4-2: Average daily solar radiation and net radiation per month of the year

Month	Average Daily Solar Radiation [kJ/m ² per day]	Average Daily Net Radiation [W/m ²]
April	16,830.73	194.80
May	22,181.97	256.74
June	22,436.57	259.68
July	23,259.68	269.21
August	19,025.16	220.20
September	11,814.23	136.74
October	6,019.60	69.97

As the daily solar radiation data was only collected for part of 2018 and 2019, the average daily solar radiation was applied where no solar radiation data was available.

4.2.3 DAILY EVAPORATION RATES

ENERGY BALANCE METHOD [5]

The energy balance method when used to determine an evaporation rate relies on the supply of energy to provide the latent heat of vaporization. The equation used for this method to determine an evaporation rate is as follows:

$$E = \frac{1}{l_v \rho_w} (R_n - H_s - G)$$

The latent heat of vaporization (l_v) is determined based on the following equation, where T is the air temperature in °C:

$$l_v = 2.501 \times 10^6 - 2370T \text{ (J/kg)}$$

Assuming that both the sensible heat flux (H_s) and ground heat flux (G) are both negligible, then an evaporation rate (E_r) can be calculated as the rate at which all the incoming net radiation is absorbed by evaporation, which produces the following equation, where the evaporation rate, R_n is the net radiation flux measured in W/m² and ρ_w is the density of water (assumed to be 997 kg/m³):

$$E_r = \frac{R_n}{(2.510 \times 10^6 - 2370T)\rho_w}$$

AERODYNAMIC METHOD [5]

The aerodynamic method when used to determine an evaporation rate relies on the ability to transport the vapor away from the evaporative surface. The equation used for this method to determine an evaporation rate is as follows:

$$E_a = B(e_{as} - (R_n e_{as}))$$

where, B is defined from the following equation:

$$B = \frac{0.622k^2 \rho_a u_2}{p \rho_w [\ln(z_2/z_0)]^2}$$

The von Karman constant (k) is generally defined as 0.4, ρ_a is the density of air (assumed to be 1.19 kg/m³), u_2 is the wind speed, p is the air pressure, ρ_w is the density of water (assumed to be 997 kg/m³), z_2 is the height above the water surface where the wind speed and air pressure is measured (assumed to be 2 m), z_0 is the roughness height (ranges from 0.01 cm to 0.06 cm, assumed to be 0.03 cm), e_{as} is the saturated vapor pressure of water vapor over liquid (ranges from 611 Pa at 0°C to 4,248 Pa at 30°C), and R_h is the relative humidity.

COMBINED METHOD [5]

The combined method is a combination of the energy balance method and the aerodynamic method for calculating the evaporation rate, using a weighted estimate of evaporation. This method is most accurate as long as the meteorological data is available (net radiation, air temperature, humidity, wind speed and air pressure), and the assumption of a steady-state energy flow prevails and that the change in the heat storage over time in the water body are not significant. This assumption limits the application of the method to daily time intervals or longer, and to situations not involving large lake processes, which meets our application of the proposed evaporative pond facility.

The equation used for this method to determine an evaporation rate is as follows:

$$E = \frac{\Delta}{\Delta + \gamma} E_r + \frac{\Delta}{\Delta + \gamma} E_a$$

where

$$\gamma = \frac{C_p K_h p}{0.622 K_w l_v}$$

and

$$\Delta = \frac{4098 e_{as}}{(237.3 + T)^2}$$

C_p is assumed to be 1,005 J/kg·K for air, and K_h/K_w is assumed to equal to 1.

The following tables (4-3, 4-4 & 4-5) summarize the estimated evaporative rates using the combined method for April through to October for the years 2018, 2019 and 2020 respectively. It is assumed that no evaporation takes place when the average daily mean temperature is less than 0°C, and the monthly evaporation is the summation of the calculated daily evaporation rate.

Table 4-3: Total Evaporation per Month in 2018

Month (2018)	Total Evaporation (mm)
April	68.39
May	195.24
June	220.53
July	231.13
August	187.90
September	105.52
October	38.06
TOTAL	1,046.78

Table 4-4: Total Evaporation per Month in 2019

Month (2019)	Total Evaporation (mm)
April	95.25
May	183.82
June	235.46
July	239.01
August	200.34
September	107.57
October	41.77
TOTAL	1,103.22

Table 4-5: Total Evaporation per Month in 2020

Month (2020)	Total Evaporation (mm)
April	66.49
May	181.20
June	220.50
July	238.29
August	190.62
September	112.45
October	30.53
TOTAL	1,040.08

The average annual evaporation from 2018-2020 is 1,061 mm. This value will be applied when determining the net evaporation from the proposed ponds.

4.2.4 ANNUAL NET EVAPORATION

In order to determine the annual net evaporation, precipitation must be accounted for. As discussed in Section 4.2.1, the average annual precipitation for the proposed evaporative facility is 532.5 mm. The value cannot simply be subtracted from the total annual evaporation value to determine the net evaporation, as the size of the pond, from the top edge of dyke to top edge of dyke, will influence how much precipitation is captured. This precipitation volume of water collected annually in the pond is added to the annual volume of wastewater dumped into the pond, and a depth of the liquid in the pond can be calculated based on this total volume. The annual evaporation can be subtracted from the depth of the pond to determine a net depth of liquid in the pond after one year.

Table 4-6 summarizes the expected volume of wastewater received annually, the volume of precipitation collected annually in the pond, depth of the liquid in the pond, net depth of the liquid in the pond after evaporation. See Table 4-7 in Section 4.3.1 for preliminary design specifications.

Table 4-6: Annual Net Evaporation from Evaporative Pond

PARAMETER	EVAPORATIVE PONDS
Top of Dyke Dimensions	45 m x 45 m
Top of Dyke Area	2,025 m ²
Annual Average Precipitation	532.5 mm
Volume of Precipitation Captured in Pond	1,078 m ³
Volume of Wastewater	620 m ³
Total Volume of Liquid	1,698 m ³
Depth of Liquid in Pond	1.43 m
Annual Average Evaporation	1.06 m
Net Depth of Liquid Remaining in Pond	0.37 m

As Table 4-6 suggests, there is an amount of liquid in the pond that is unable to be completely evaporated year-over-year. Over time, even with the annual dumping of the wastewater rotating between ponds, there will be a net increase in volume in the ponds. The annual volume of precipitation that is collected in the ponds tends to be more-or-less evaporated year-over-year. During normal precipitation years, the net reduction in the depth of the pond is approximately 0.06 m if no wastewater is added. Thus, supplemental evaporation will be required to fully evaporate the liquid contained in the ponds.

4.2.5 ECOMISTER EVAPORATOR

The Ecomister evaporator, manufactured and supplied by Slimline Manufacturing, is proposed to supplement the natural evaporation process. The Ecomister pumps the liquid from the pond through a turbine which sprays water droplets back over the pond area. The evaporation process is increased substantially, as the Ecomister is designed to maximize the time that the water droplets are suspended over the pond. The proposed Ecomister unit for the evaporative pond facility is designed to have a maximum throw distance of 15 m, as well as automated wind controls which shut the equipment off when the wind speed and direction prevents the water droplet plume from spraying over the pond area. It is also designed to be portable and will be moved from pond to pond on an annual basis.

The Ecomister is anticipated to be operated 8 hours a day, 5 days a week during the months of June and July. During this period, the additional volume that is expected to be evaporated is approximately 400 m³ per month. Thus, utilizing the Ecomister allows for the entire amount of wastewater collected annually to evaporate year-over-year. Additional information regarding the Ecomister is provided in Appendix D.

4.3 DESCRIPTION OF PROPOSED DEVELOPMENT

The following sections describe the construction and modifications proposed for the development. To be clear, no changes are proposed for the existing Arnes WDG.

4.3.1 PROPOSED NEW EVAPORATIVE POND FACILITY

The new evaporative pond facility will be constructed as illustrated in the EAP design drawings (Appendix C) and will be located in the southwest quarter of section 10-21-3 EPM.

Each pond will have a storage capacity of 1,795 m³, for a total of 5,385 m³ of storage capacity for the entire three pond facility. The proposed facility is designed with a 2.0 m (min.) wide clay core situated centrally within the perimeter dyke. The finished clay core will be continuous and will have a permeability of 1x10⁻⁷ cm/s or less, meeting Manitoba Conservation and Climate guidelines. The remainder of the dykes will be constructed with in-situ material. All embankments will be constructed in 150 mm lifts compacted to 95% Standard Proctor Maximum Dry Density.

The proposed ponds will be constructed with 3:1 interior side slopes and 4:1 exterior side slopes and will have a maximum operating depth of 1.5 m with a minimum 1.0 m freeboard. Table 4-7 provides the details for the preliminary design specifications for the new ponds.

Table 4-7: Preliminary Design Specifications for each Proposed Evaporative Pond

PARAMETER	EVAPORATIVE POND
Pond Bottom Dimensions	30 m x 30 m
Top of Dyke Dimension	45 m x 45 m
Maximum Operating Depth	1.5 m
Minimum Freeboard Height	1.0 m
Interior Side Slope	3 horizontal : 1 vertical
Exterior Side Slope	4 horizontal : 1 vertical
Total Volume	1,795 m ³
Liner System	Clay core

Each pond will have its own 200 mm wastewater sewer pipe connected to a manhole. Floats will be installed in each manhole in order to automatically shutoff the pump system for the Ecomister evaporator if the water level in the pond reaches the minimum height for pump operation.

There is no ability for the ponds to discharge to the environment, as the wastewater collected in each pond is expected to be evaporated through natural (passive) and supplemental active means.

4.3.2 CONSTRUCTION DETAILS

The evaporative pond facility construction is based on the information and recommendations provided in the Geotechnical Report. According to the subsurface profiles in the Geotechnical Reports, the depth of topsoil in the proposed area is approximately 150 - 200 mm. Organic soil from the development area will be stripped, stockpiled and reapplied on the dykes and applicable disturbed areas as shown in the drawings.

The new facility will be constructed as detailed in the drawings. The interior side slopes of the constructed ponds will be 3:1 (horizontal : vertical) while the exterior slopes will be 4:1. The proposed ponds will have a 2.5 m dyke height as measured from the interior finished pond bottom. For construction, the proposed pond bottom will be the in-situ

dense till and the perimeter dyke will contain a 2.0 m (min.) wide clay core that ties into the in-situ dense till, creating a continuous liner. The proposed development location has limited clay material present, but the RM has stockpiled a significant amount of clay material from the former Gimli lagoon site, which can be transported for use in the clay core. The clay material will be placed in 150 mm lifts and compacted to 95% Standard Proctor Maximum Dry Density. The remainder of the dykes will be constructed with in-situ material in 150 mm lifts compacted to 95% Standard Proctor density. The moisture content of the material should be -2% to 3% of optimum moisture as determined by the Standard Proctor test. Any unsuitable material such as coarse gravel and boulders are to be removed. The top of the dykes will be 3.0 m wide.

Each pond will have its own truck dump ramp. A perimeter drainage ditch will be constructed around the new facility to allow surface water drainage. A perimeter fence and access gate will surround the new facility, complete with signage. For disturbed areas where sediment or erosion control is deemed necessary, the contractor will be required to employ appropriate measures.

4.3.3 BIOSOLIDS MANAGEMENT

The accumulation of biosolids (sludge) is anticipated to be minimal over the facility's lifecycle. However, if the ponds require the removal of accumulated sludge, it is proposed that the sludge be removed and hauled to the adjacent biosolids storage facility for future land application by the RM.

5 ENVIRONMENTAL IMPACTS

5.1 ODOUR CONSIDERATIONS

It is expected that the wastewater received at the proposed evaporative pond facility will generate some odours, particularly during the spring while the ice thaws. During the winter, ice cover largely prevents free oxygen from entering the water. This condition leads to the production of hydrogen sulphide gas (H₂S) during the winter by bacteria that do not require free oxygen. The accumulated gases dissipate quickly into the atmosphere when the ice breaks.

The closest residence to the proposed storage ponds is located approximately 1.5 kilometres away (to the north), and the evaporative pond facility is located adjacent to an active waste disposal site. As such, it is anticipated that the proposed evaporative pond facility will operate without causing any significant odour problems.

5.2 LAND IMPACT

The land proposed for the construction of the evaporative pond facility is currently a mixed wood area that will be cleared and grubbed. This land slated for construction is RM land that continues to be developed for the intent of a waste type facility.

Section 2.3 Description of Existing Land Use should be consulted for additional information.

5.3 SURFACE WATER

There is no discharge from the proposed facility into ditching or surface watercourses. Any water collected within the facility will be evaporated.

A perimeter drainage ditch (< 0.3 m in depth) will be constructed around the new facility.

The existing Arnes WDG is situated in the Lower Interlake Area Watershed (No. 31).

The water licensing branch of Manitoba Water Stewardship was consulted to provide a list of water users within a 1-kilometre radius of the site. There are no licensed water users within this area ([Appendix F](#)).

5.3.1 FUEL STORAGE ON SITE

The proposed facility does not require the onsite storage of gasoline or diesel fuel. During construction and upgrading, the contractor will be required to ensure that all equipment is properly maintained to prevent leaks and spills of fuel and motor fluids. Refuelling of equipment will not be within 100 m of a water body, stream or wetland.

5.4 GROUNDWATER

Refer to Section 4.1.3 for information relating to groundwater.

5.5 SPECIES IMPACT

A file search with the Wildlife and Fisheries Branch of Manitoba Sustainable Development resulted in one occurrence in the nearby area of SE 9-21-3 EPM. The occurrence was:

- Bank Swallow (*Riparia riparia*), S5B, SARA: Threatened, COSEWIC: Threatened

The Bank Swallow areas have a restricted activity period between May 15-July 31. Correspondence is included in [Appendix F](#).

5.6 FISHERIES

Based on the fact that no discharge is occurring from the proposed facility to surface watercourses, fisheries will not be impacted.

5.7 FORESTRY

The Forestry and Peatlands Branch were contacting regarding forestry in the proposal area. The following information was supplied by the Regional Forester for the Central Region.

The Province of Manitoba is responsible for managing the forested crown lands within the proposal area. This includes the allocation of areas for timber harvesting and the subsequent renewal activities of those areas (i.e. tree planting). The general trees species that are harvested include spruce, jack pine, balsam fir, poplar and white birch. The uses of wood products that are commercial harvested include both lumber and firewood. The closest sawmill is located north of Arborg and the firewood is distributed within the region. There are also areas designated for obtaining personal use permits where the public harvest their own wood products. One of these areas is located in there Rembrandt Wildlife Management Area.

5.8 HERITAGE RESOURCES

From an email dated June 4, 2018 from the Historic Resources Branch ([Appendix F](#)), it was stated that there are no concerns at this time. It is understood that if heritage resources or human remains are encountered during any phase of development, work is to stop, and the Manitoba Historic Resources Branch is to be contacted immediately. In the case of human remains, the RCMP will be notified.

5.9 SOCIO-ECONOMIC IMPACTS

The facility construction will result in a short-term boost to the construction industry in the area.

5.10 PUBLIC INVOLVEMENT

Comments from concerned members of the public will be solicited as part of Manitoba Conservation and Climate review prior to issuing a licence.

6 MANAGEMENT PRACTICE

The RM will be responsible for maintaining the evaporative pond facility during operation. The proposed management and operation of the facility is discussed in the following sections.

6.1 OPERATION

Operation of the proposed evaporative pond facility must comply with the specifications, limits, terms and conditions of the existing Environment Act Licences.

The facility is designed to provide 3 years’ worth of storage based on the anticipated Diageo wastewater generation and well as the average annual precipitation collected within the open pond area. **Figure 6-1** details the wastewater acceptance and Ecomister usage periods.

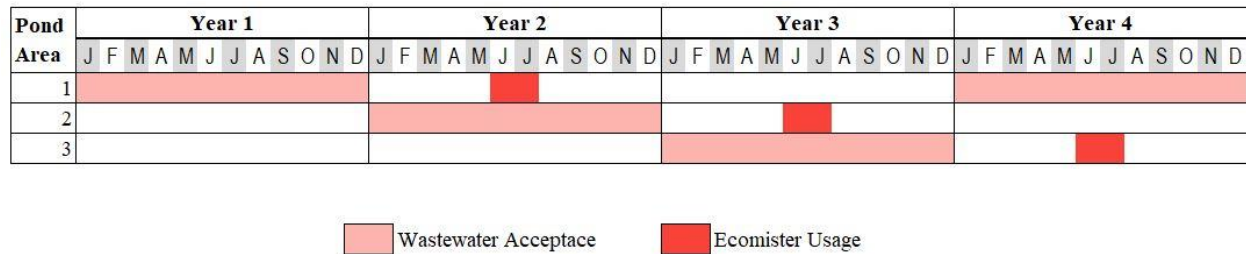


Figure 6-1: Evaporation Pond Facility Operations Schedule

6.1.1 MAINTENANCE, RECORD KEEPING AND INSPECTION

The record-keeping and inspection list will include but is not limited to:

- 1 Daily Records – Wastewater hauling records (dates and volumes) from Diageo and Ecomister runtime;
- 2 Weekly Records – Recording liquid depths in each pond and maintenance of the Ecomister evaporator when in use;
- 3 Periodic summer activities would consist of noting and recording any changes to the pond dykes, grass cutting on the dykes, extermination of burrowing animals, repair of the dykes, and;
- 4 Periodic winter activities involve snow removal to maintain access to the facility.

7 SCHEDULE AND FUNDING

It is anticipated that the Environment Act Licence process will be finalized by the spring of 2021 and the project will begin immediately upon receiving the licence (Figure 7-1). Construction is proposed for the summer of 2021.

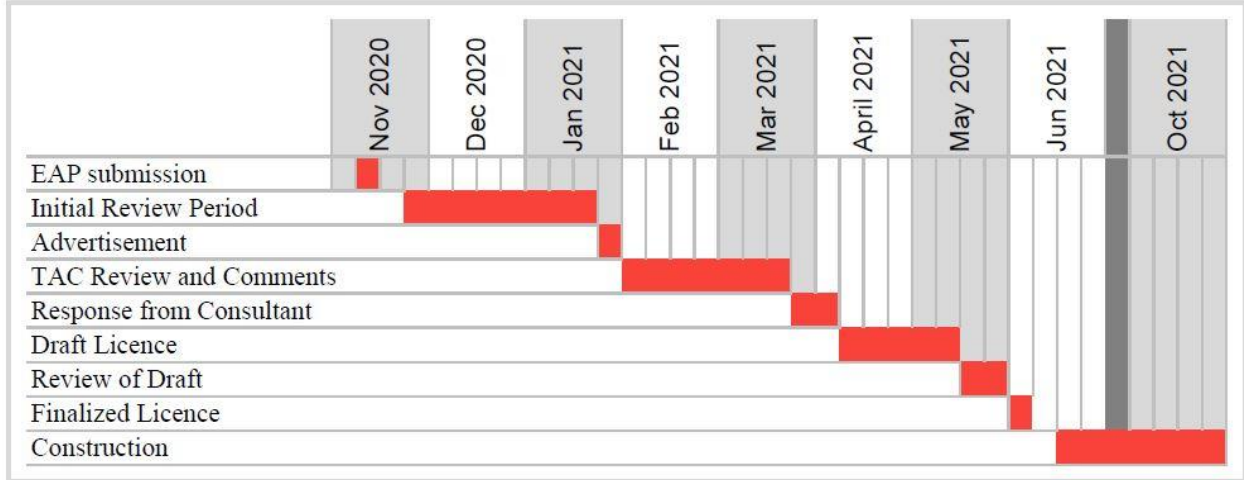


Figure 7-1: Schedule - EAP Submission to End of Construction

8 REFERENCES

- [1] weatherstats.ca based on Environment and Climate Change Canada data, "gimli.weatherstats.ca," 12 November 2020. [Online]. Available: gimli.weatherstats.ca/download.html. [Accessed 31 October 2020].
- [2] weatherstats.ca based on Environment and Climate Change Canada data, "winnipeg.weatherstats.ca," 12 November 2020. [Online]. Available: winnipeg.weatherstats.ca/download.html. [Accessed 31 October 2020].
- [3] Environment and Climate Change Canada, "Station Results - 1981-2010 Climate Normals and Averages," 12 November 2020. [Online]. Available: climate.weather.gc.ca/climate_normals/station_select_1981_2010_e.html?searchType=stnProv&lstProvince=MB. [Accessed 31 October 2020].
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- [5] V. T. Chow, D. R. Maidment and L. W. Mays, Applied Hydrology (McGraw-Hill series in water resources and environmental engineering), New York: McGraw-Hill Inc., 1988, pp. 80-91.

APPENDIX

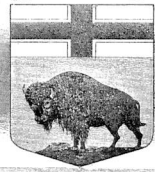
A

CERTIFICATE OF
TITLE



MANITOBA

Cert. No. 533897:



Certificate of Title

UNDER "THE REAL PROPERTY ACT"

THE RURAL MUNICIPALITY OF GIMLI,

is now seized of an estate in fee simple in possession subject to such encumbrances liens and interests as are notified by memorandum underwritten (or endorsed hereon) in all that piece or parcel of land known and described as follows

THE SOUTH-WEST QUARTER OF SECTION TEN IN THE TWENTY-FIRST TOWNSHIP AND THIRD RANGE EAST OF THE PRINCIPAL MERIDIAN IN MANITOBA, EXCEPTING THEREOUT THAT PORTION TAKEN FOR A PUBLIC ROAD AS SAME IS SHEWN ON A PLAN FILED IN THE WINNIPEG LAND TITLES OFFICE, AS NO. 3339, SUBJECT TO THE RESERVATIONS AND PROVISOS CONTAINED IN THE GRANT FROM THE CROWN.



The instrument has been lost
been lost
Certificate of
Property
Dated

IN WITNESS WHEREOF

affixed my Seal of office this

I have hereunto signed, my name, and

TWENTY-SECOND day of DECEMBER

One thousand nine hundred and

THIRTY-NINE

Signed in the presence of

W. V. Knud

Maundy

Deputy District Registrar
for Winnipeg

MANITOBA



Certificate of Title UNDER "THE REAL PROPERTY ACT"

THE RURAL MUNICIPALITY OF GIMLI,

is now seized of an estate in fee simple in possession such encumbrances liens and interests as are notified to *dum* underwritten (or endorsed hereon) in all that *pi* of land known and described as follows THE SOUTH-WEST QU.

TEN IN THE TWENTY-FIRST TOWNSHIP AND THIRD RANGE EAST OF THE PRINCIPAL MERIDIAN IN I THEREOUT THAT PORTION TAKEN FOR A PUBLIC ROAD AS SAME IS SHEWN ON A PLAN FILED IN T TITLES OFFICE, AS NO. 3339, SUBJECT TO THE RESERVATIONS AND PROVISIOES CONTAINED IN CROWN.

No. 77213 T

VIDE CERT. C 872

expressly declared, be deemed to be subject to:
(a) Any subsisting reservation contained in the original grant of the land from the Crown.
(b) Any municipal charge, rate or assessment existing at the date of the certificate, or subsequently imposed on the land.
(c) Any right-of-way or other easement, howsoever created, upon, over or in respect of the land.
(d) Any subsisting lease or agreement for a lease for a period not exceeding three years, where there is actual occupation of the land thereunder.
(e) Any drainage levy or mechanics' lien affecting the land.
(f) Any order of attachment, judgment or order for the payment of money against the registered owner of the land, registered since the date of the certificate of title, and which has been maintained in force under the provisions of any Act of the province relating thereto.
(g) Any certificate of its pendency issued out of a court in the province and registered since the date of the certificate of title.
(h) Any right of appropriation by statute.
(i) The title of a person adversely in actual occupation of and rightly entitled to the land at the time it was brought under the Act, and who continues in such occupation: See R.S.M. c. 171, s. 82.
(j) Caveats affecting the land registered since the date of the certificate, and
(k) Any town planning scheme or by-law authorized under "The Town Planning Act" or under the provisions of the charter of any city and any by-law passed by any municipal corporation under "The Municipal Act" or the charter of any city relating to residential areas or zoning.

COLLECT		
DEFERRED FEES \$ 21.00		
UNDER II, CAP. 103, 87, SEC. 21.		
DATE PAID	AMOUNT	
22/7/65	C 10.50	
	R 10.50	
	21.00	

IN WITNESS WHEREOF I have hereunto signed my name, affixed my Seal of office this TWENTY-SECOND day of DECEMBER One thousand nine hundred and THIRTY-NINE Signed in the presence of

W. V. hand

Maudry
Deputy District Registrar
for Winnipeg

APPENDIX

B

GEOTECHNICAL
REPORT



GEOTECHNICAL LETTER REPORT

DATE: June 12, 2018

FILE: #181-03988-00

TO: **RM of GIMLI**
62-2nd Avenue
Box 1246
Gimli, Manitoba
R0C 1B0
ATTN: DICK MENON, P.ENG.

FROM: SILVESTRE S. URBANO JR., P.ENG.
Senior Geotechnical Engineer
WSP Canada Inc.
1600 Buffalo Place
Winnipeg, Manitoba R3T 6B8
Tel: (204) 477 6650

PHONE: 204-396-1000

**RE: GEOTECHNICAL SITE REVIEW FOR THE PROPOSED SLUDGE STORAGE FACILITY
AT THE ARNES WASTE DISPOSAL GROUND**

A total of four testpits (TP1 to TP4) were excavated on September 30, 2015 for the proposed Sludge Storage Facility at the existing Arnes Waste Disposal Ground in the RM of Gimli. The intention is to build two pits, each having approximate dimensions of 114.0 m x 74.0 m x 2.0 m (deep). The dewatered sludge from the RM's wastewater treatment facility will be transferred and stored in these proposed pits. This letter report deals with the determination of the soil conditions of the proposed pits with respect to the 2003 Gimli Wastewater Treatment Plant licence, # 2587. Manitoba Sustainable Development requires that the inside and the bottom of any "pond" for sludge be provided with a layer consisting of at least one metre of soil having a permeability of 1×10^{-7} cm/s or equivalent.

The four testpits excavated to a depth of 3.0 m revealed a general soil profile consisting of a layer of peat moss/topsoil underlain by a clay layer over a till with a silty-clay matrix which extended to the depth explored. The exception is TP1 where a thin SAND layer was encountered below the topsoil/peatmoss layer. Also attached are the testhole logs drilled by Cochrane at the existing waste disposal ground in June 1994 and well logs near the proposed site. Based on the soil conditions from the additional logs and well logs, the till layer extends to a depth of 36 m to 49 m, where the limestone bedrock aquifer is encountered. These testhole logs also indicate occasional wet lenses within the till layer between 5.5 m and 6.4 m below grade.

Slight seepage was noted at a depth of 2.4 m in TP2 only after completion of the excavation. Seepage from surface overburden was also noted from the additional testhole logs (Cochrane). It is understood that the static groundwater from the testhole logs came from the surface overburden and should not be considered as an aquifer.

An additional sample from TP3, at a depth of 1.5 m, was obtained on October 14, 2016 to determine the in-situ hydraulic conductivity of the dense till material. Due to the density of the till layer (dense to very dense), a block sample was collected rather than a Shelby tube sample. A block sample of the dense till was acquired using a backhoe and was submitted to TREK Geotechnical to complete a consolidation test to determine the hydraulic conductivity of the in-situ till.



GEOTECHNICAL LETTER REPORT

At present, there is a preliminary groundwater report prepared by the Planning Branch of the Water Resources Division for the Eastern Interlake where the proposed site is located. Based on the report and groundwater availability maps, groundwater bearing formations or aquifers at the proposed site are formed by an extensive carbonate rock. This aquifer is almost continuous throughout the area. The depth to the aquifer ranges from less than 36 m to 49 m below grade. The potential yield around this area is approximately in the range of 13-13000 gallons per minute (1 to 100 litres per second). The water quality for the upper part of carbonate aquifer is good.

Detailed descriptions of the subsurface conditions are attached including the testpit location plan. The additional testhole logs and a site plan from Poetker MacLaren Ltd., well logs near the site and a groundwater report are also attached. Note that these testhole logs and site plan were obtained from "COCHRANE GROUNDWATER ANALYSIS REPORT FOR ARNES WASTE SITE", dated November 1997.

LABORATORY TEST RESULTS

Select samples from the four testpits completed in 2015 were submitted for moisture content, Atterberg limits for classification and one hydraulic conductivity analysis of the remoulded sandy clay material and compacted to at least 97% STD proctor density (TP3 @ 0.3 to 1.2 m). As classified during our field investigation, the clay soil at TP1 (0.9 m - 1.5 m) and TP2 (0.3 m - 1.2 m) was classified as CH (high plasticity) material while the clay soil at TP3 (0.3m - 1.5m) was determined to be CL (low plasticity) with similar material at TP4. The hydraulic conductivity test result of the remoulded sample from TP3 was determined to be 2.54×10^{-8} cm/sec.

For the till layer the hydraulic conductivity of the block soil sample obtained in 2016 at TP3 at a depth of 1.5 m was determined to be approximately 2.99×10^{-8} cm/s. This hydraulic conductivity value was calculated based on a consolidation test, as permeability testing was not feasible for a block sample of the in-situ till material. The calculated hydraulic conductivity is below the sludge liner criteria of 1×10^{-7} cm/s.

The full laboratory test results are attached at the end of this letter, which includes the hydraulic conductivity test results of the remoulded clay and the consolidation test results of the block sample.

DESIGN CONSIDERATIONS

The two anticipated sludge pit dimensions are each approximately 114.0 m x 74.0 m x 2.0 m (deep) and both pits are approximately 1,500 m from the nearest residence. The sludge storage ponds should be designed such that the inside slopes are at minimum 3H:1V and where the hauling trucks enter and exit to dump and pick-up sludge, the slopes are at minimum 9H:1V.

For the sludge pond construction, Manitoba Sustainable Development's guidelines require that the inside and bottom of the ponds should be provided with a layer consisting of at least one metre of soil having a permeability of 1×10^{-7} cm/s or equivalent. Based on the testpit logs, the clay soil near TP1 (0.9 m - 1.5 m) and TP2 (0.3 m - 1.2 m) consists of CH material that has an approximate hydraulic



GEOTECHNICAL LETTER REPORT

conductivity of 1×10^{-9} cm/s to 1×10^{-11} cm/s. This meets the current guideline of 1×10^{-7} cm/s, if remoulded and compacted to at least 95% standard proctor density and plus or minus 2% of optimum moisture content.

Unfortunately, the extent and thinness of this clay material will likely not be sufficient to line the entirety of both pits. There is most likely enough clay material to line the inside slopes of the cells above the till layer, but not for the dykes below the till layer. Thus, it is proposed that the in-situ till be used as a liner for the bottom of the ponds.

Note that the hydraulic conductivity of the till layer should be tested using a consolidation test. The dykes below the till layer, including the floor of the cells, will act as an in-situ liner. Since the density is too great to recover Shelby tubes samples, a block sample of the till material should be obtained.

ADDITIONAL CONSIDERATIONS (SITE DEVELOPMENT)

The surface drainage at the proposed site is very poor. *If extensive surface water is encountered, it is expected that significant site access problems (construction traffic) and surface groundwater problems may occur during the construction for the proposed pits.*

To minimize construction problems relative to the surface water and soft soil conditions, it is strongly recommended that prior to construction, a system of perimeter ditches leading to a lower spot (retention pond) be installed to drain surface water. These ditches should be provided with an adequate gradient to drain the water away from the site through a positive drainage outlet such as the drainage ditch to the northeast of the site.

The site development should also adopt measures such as providing a working platform for the construction on anticipated soft areas.

Finally, topsoil and grass seed should be placed on the exterior slopes (minimum slope of 4H:1V) to finish the pits.

CLOSURE

The findings and geotechnical recommendations provided in this report were prepared by WSP Canada Inc. (the Consultant) in accordance with generally accepted professional engineering principles and practices. The recommendations are based on the results of field and laboratory investigations and are reflective only of the actual testhole(s) and/or excavation(s) examined. Environmental Site Assessment (ESA) is not included in our scope of work. If conditions encountered during construction appear to be different than those shown by the testhole(s) and/or excavation(s) at this site, the Consultant should be notified immediately in order that the recommendations can be reviewed and modified as necessary to address actual site conditions.

This report is limited in scope to only those items that are specifically referenced in this report. There may be existing conditions that were not recorded in this report. Such conditions were not apparent to



GEOTECHNICAL LETTER REPORT

the Consultant due to the limitations imposed by the scope of work. The Consultant, therefore, accepts no liability for any costs incurred by the Client for subsequent discovery, manifestation or rectification of such conditions.

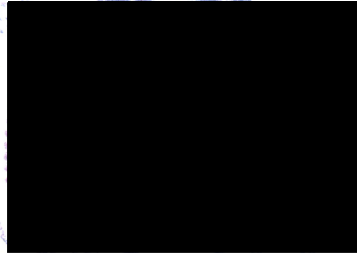
This report is intended solely for the Client named as a general indication of the visible or reported physical condition of the items addressed in the report at the time of the geotechnical investigation. The material in this report reflects the Consultant's best judgment in light of the information available to it at the time of preparation.

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The report has been written to be read in its entirety, do not use any part of this report as a separate entity.

All files, notes, source data, test results and master files are retained by the Consultant and remain the property of the Consultant.

Silvestre S. Urbano Jr., P.Eng.
Senior Geotechnical Engineer





REVISION:	
DRAWING NO:	GT-01

SCALE:	1:2000
DATE:	2018/06/12
PROJECT NO:	181-03988-00

TITLE:

RM OF GIMLI - SLUDGE STORAGE PONDS
TESTPIT LOCATIONS

1600 BUFFALO PLACE
WINNIPEG, MANITOBA
CANADA R3T 6R8
PHONE: 204-477-6650 FAX: 204-474-2864
WWW.WSPGROUP.COM

STAMP

J38F

Project No: 151-09378-00

Client: RM of Gimli

TP1

Project: PROPOSED SLUDGE PONDS

Location: Arnes WDG (Waste Disposal Ground)



Enclosure:

Engineer: SSU

SUBSURFACE PROFILE				SAMPLE		
Depth	Symbol	Description	Depth/Elev., m	PP(kPa)	SPT, N	Water Content %
0		Ground Surface	100			
0		TOPSOIL 450mm thick; 150mm of ROOTLETS over 300mm of SANDY LOAM, black	99.5			
2		SAND loose, fine to medium grained sand, fine to coarse gravel	99.1	200		
4		CLAY stiff, brown, fractured	98.5	200		
6		TILL soft, beige, SILTY, trace of fine gravel; DENSE below 1.8m, trace of clay; CLAYEY below 2.9m. EOTH AT 3M. TESTPIT IS DRY AFTER COMPLETION OF EXCAVATION.			400	
10			97		300	
10			End of Testpit			
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

Drill Method: Backhoe

WSP Canada Inc.
1600 Buffalo Place
Winnipeg, MB.
R3T 6B8

Elevation: 100.0m (Assumed)

Drill Date: 09/30/15

Checked by: SSU

Hole Size: 1.2m W x 3.6m L

Sheet: 1 of 1

Project No: 151-09378-00

Client: RM of Gimli

TP2

Project: PROPOSED SLUDGE PONDS

Location: Arnes WDG (Waste Disposal Ground)



Enclosure:

Engineer: SSU

SUBSURFACE PROFILE				SAMPLE		
Depth ft m	Symbol	Description	Depth/Elev.,m	PP(kPa)	SPT, N	Water Content % ● Wp -----0----- Wl ● 10 30 50 70 90
				50 150 250 350		
0		Ground Surface	100			
0		TOPSOIL 300mm thick; 150mm of ROOTLETS over 150mm of CLAY LOAM, black	99.7			
1		CLAY firm to stiff, tan-brown, silty		150		
2			98.8			
3					400	
4		TILL medium dense, beige, SILTY, trace of fine gravel; DENSE below 1.5m, trace of clay. EOTH AT 3M. SLIGHT SEEPAGE AT 2.4M AFTER COMPLETION OF EXCAVATION.			400	
5						
6						
7						
8						
9						
10			97		400	
11		End of Testpit				
12						
13						
14						
15						
16						
17						
18						
19						
20						

Drill Method: Backhoe

WSP Canada Inc.
1600 Buffalo Place
Winnipeg, MB.
R3T 6B8

Elevation: 100.0m (Assumed)

Drill Date: 09/30/15

Checked by: SSU

Hole Size: 1.2m W x 3.6m L

Sheet: 1 of 1

Project No: 151-09378-00

Client: RM of Gimli

TP3

Project: PROPOSED SLUDGE PONDS

Location: Arnes WDG (Waste Disposal Ground)



Enclosure:

Engineer: SSU

SUBSURFACE PROFILE				SAMPLE		Water Content %
Depth	Symbol	Description	Depth/Elev., m	PP(kPa)	SPT, N	
0		Ground Surface	100			
0		TOPSOIL 300mm thick; 150mm of ROOTLETS over 150mm of CLAY LOAM, black	99.7			
1		CLAY firm, tan-brown, SILTY, trace of fine grained SAND	98.8	150		
2						
3		TILL medium dense, beige, SILTY, trace of fine gravel; DENSE below 1.5m, trace of clay. EOTH AT 3M. TESTPIT IS DRY AFTER COMPLETION OF EXCAVATION.	97	400		
4						
5						
6						
7		End of Testpit				
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

Drill Method: Backhoe

WSP Canada Inc.
1600 Buffalo Place
Winnipeg, MB.
R3T 6B8

Elevation: 100.0m (Assumed)

Drill Date: 09/30/15

Checked by: SSU

Hole Size: 1.2m W x 3.6m L

Sheet: 1 of 1

Project No: 151-09378-00

Client: RM of Gimli

TP4

Project: PROPOSED SLUDGE PONDS

Location: Arnes WDG (Waste Disposal Ground)



Enclosure:

Engineer: SSU

SUBSURFACE PROFILE				SAMPLE		Water Content %
Depth	Symbol	Description	Depth/Elev., m	PP(kPa)	SPT, N	
0		Ground Surface	100			
0		TOPSOIL 300mm thick; 150mm of ROOTLETS WITH PEAT MOSS over 150mm of CLAY LOAM, black	99.7			
1		CLAY firm, tan-brown, SILTY, trace of fine grained SAND	98.8	150		
2		TILL medium dense, beige, SILTY, trace of fine gravel; DENSE below 1.5m, trace of clay. EOTH AT 3M. TESTPIT IS DRY AFTER COMPLETION OF EXCAVATION.			400	
3		End of Testpit	97		400	
4					400	
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

Drill Method: Backhoe

WSP Canada Inc.
1600 Buffalo Place
Winnipeg, MB.
R3T 6B8

Elevation: 100.0m (Assumed)

Drill Date: 09/30/15

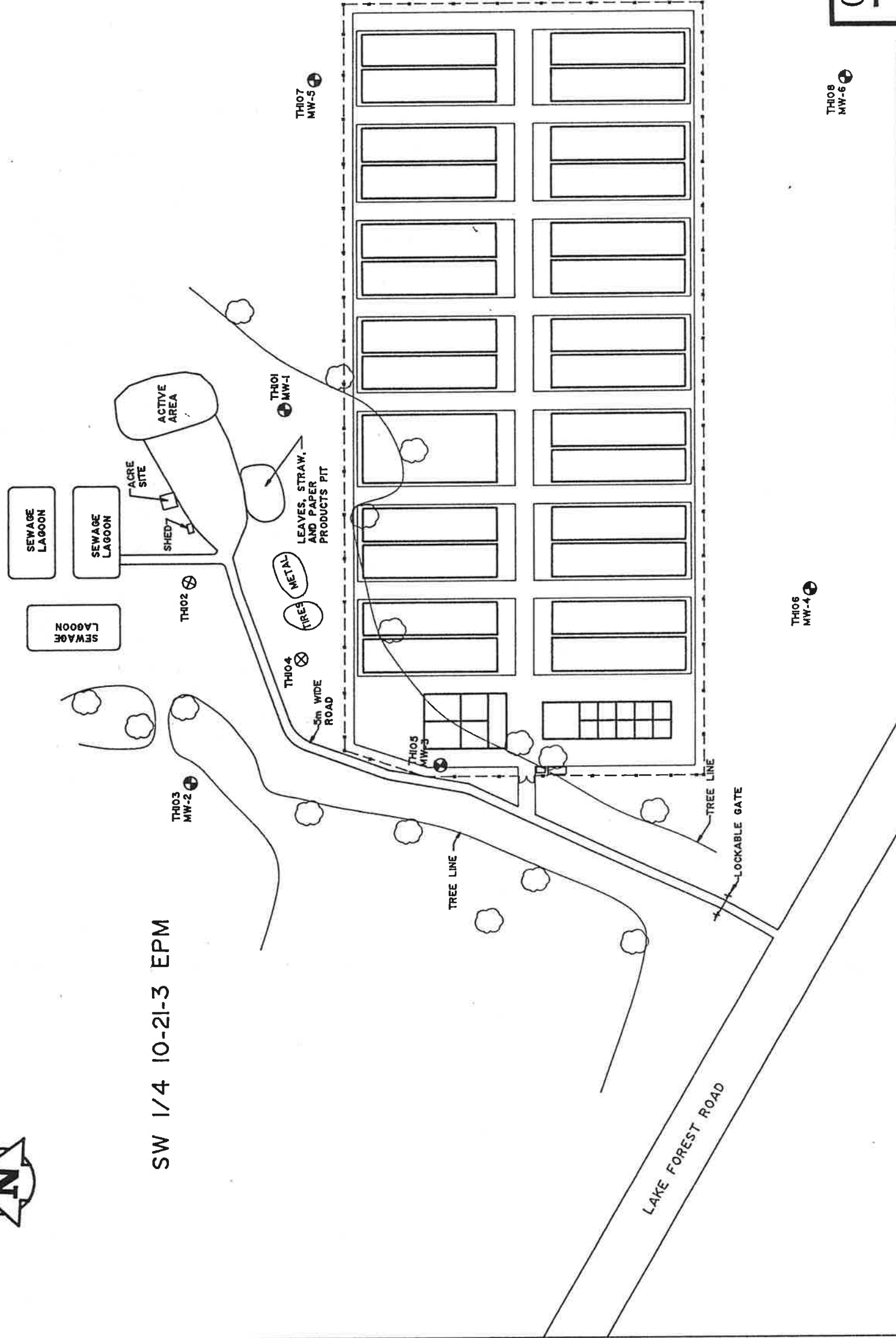
Checked by: SSU

Hole Size: 1.2m W x 3.6m L

Sheet: 1 of 1



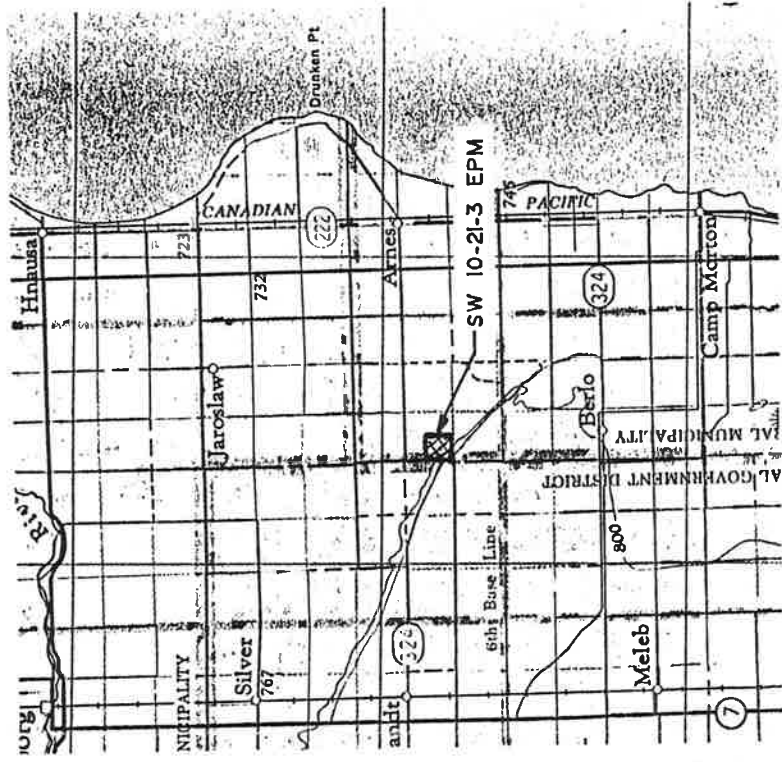
SW 1/4 10-21-3 EPM



SITE I

- NOTES**
1. TEST HOLES LOCATED IN AREAS WHERE ACCESSIBLE TO THE DRILL RIG AND ARE ASSUMED REPRESENTATIVE OF THE SOIL BELOW THE SITE.
 2. TEST HOLES TH01 THRU TH05 EXCAVATED AND MONITORING WELLS MW1 THRU MW3 INSTALLED ON JUNE 14, 1994.
 3. TEST HOLES TH06 THRU TH08 AND MONITORING WELLS MW4 THRU MW6 INSTALLED ON DECEMBER 18, 1996.
- LEGEND**
- ⊗ TEST HOLES
 - ⊕ MONITORING WELL

LOCATION PLAN



COCHRANE ENGINEERING

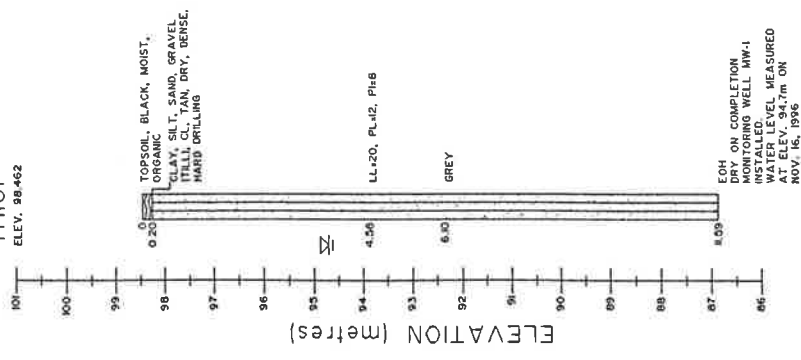
CONSULTING ENGINEERS • PROJECT MANAGERS
 CALGARY, EDMONTON, REGINA, SASKATOON, WINNIPEG

PROJECT TITLE
 R.M. OF GIMLI, ARNES WASTE DISPOSAL SITE,
 OPERATING PLAN

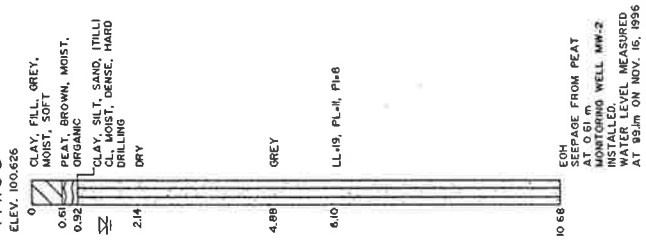
DRAWING TITLE
 SW 1/4 10-21-3 EPM
 LOCATION PLAN

DRAWING	SCALE	DATE	DRAWING No.	REVISION
G.R.A.	1 : 2500	01/06/97	FIGURE 1	

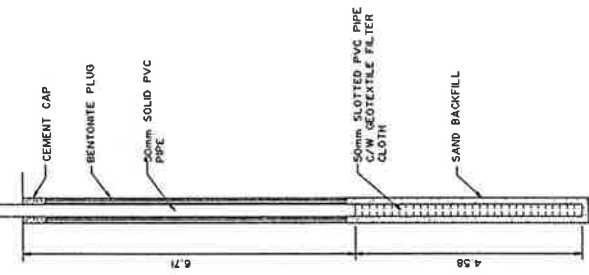
TH101
ELEV. 98.462



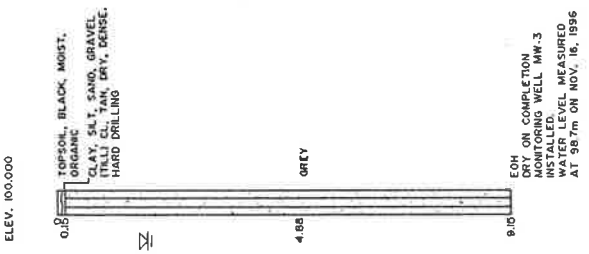
TH103
ELEV. 100.626



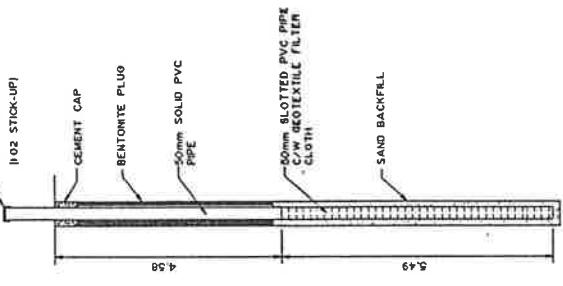
MW 2
STEEL COVER (ELEV. 101.770)



TH105
ELEV. 100.000



MW 3
STEEL COVER (ELEV. 101.021)



ELEVATION (metres)

- NOTES
1. TEST HOLE ELEVATIONS BASED ON LOCAL DATUM ESTABLISHED AT THE SITE.
 2. TEST HOLE FINISHED ON JUNE 14, 1994 USING TRACK-MOUNTED DRILL RIG WITH CONTINUOUS FLIGHT SOLID STEM AUGERS.
 3. MONITORING WELLS INSTALLED ON JUNE 14, 1994. WATER LEVELS RECORDED BY COCHRANE ENGINEERING ON NOV. 16, 1996.

COCHRANE ENGINEERING
CONSULTING ENGINEERS • PROJECT MANAGERS
CALGARY, EDMONTON, REGINA, SASKATOON, WINNIPEG

PROJECT TITLE
R.M. OF GIMLI, ARNES WASTE DISPOSAL SITE,
GEOTECHNICAL INVESTIGATION

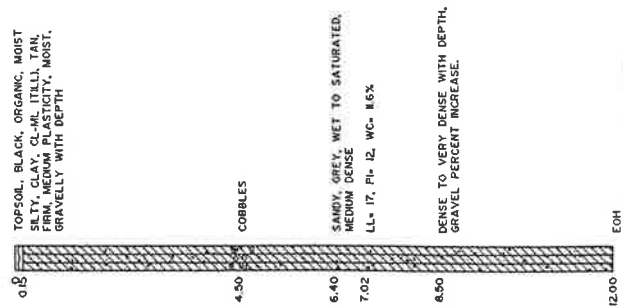
DRAWING TITLE
SW 1/4 10-21-3 EPM
SITE PLAN AND TEST HOLE LOCATIONS

DRAWING SCALE
G.R.A. 1:100

DATE
07/21/97

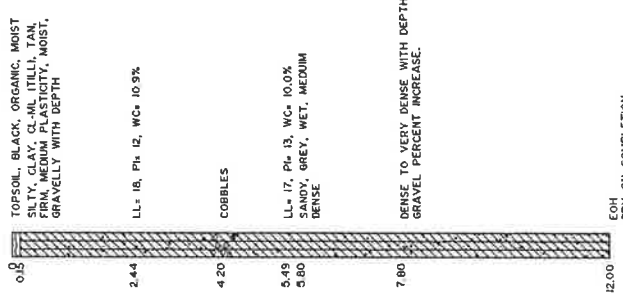
REVISION
DRAWING No. FIGURE 2
REVISION 0

THIO6
MW-4



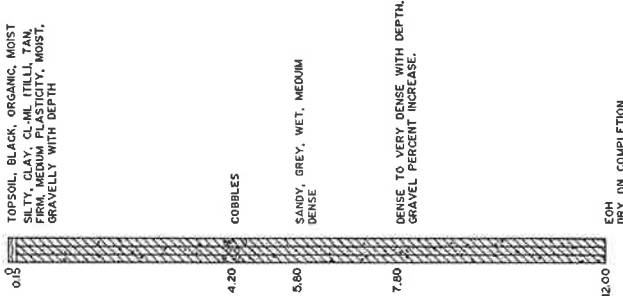
EOH ON COMPLETION
DRY MONITORING WELL MW-4 INSTALLED.
1986

THIO7
MW-5



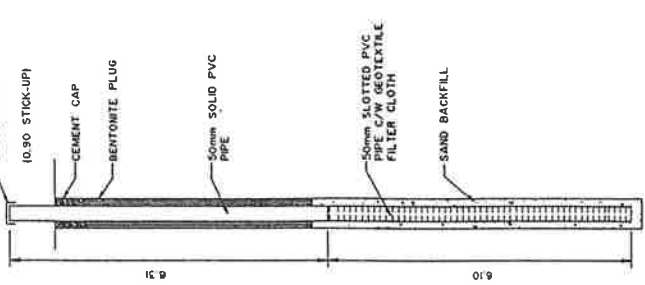
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THIO8
MW-6

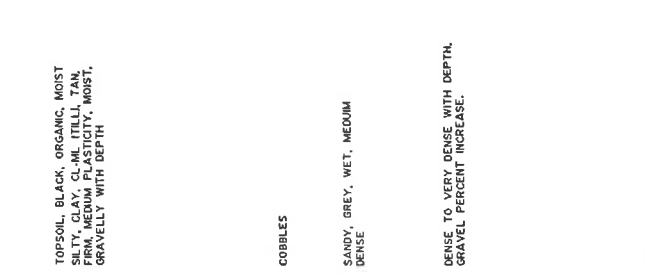


EOH ON COMPLETION
DRY MONITORING WELL MW-6 INSTALLED.

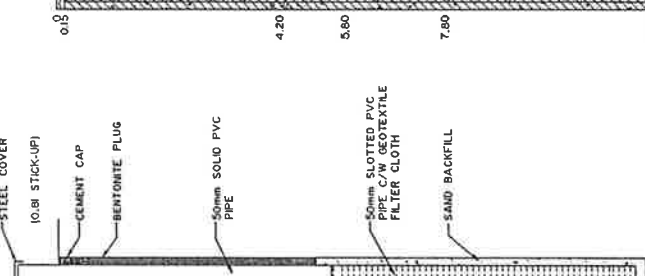
MW-4



MW-5



MW-6



COCHRANE ENGINEERING
CONSULTING ENGINEERS • PROJECT MANAGERS
CALGARY, EDMONTON, REGINA, SASKATOON, WINNIPEG

PROJECT TITLE
R.M. OF GIMLI, ARNES WASTE DISPOSAL SITE,
GEOTECHNICAL INVESTIGATION

DRAWING TITLE
SW 1/4 10-21-3 EPM
SOIL LOGS & MONITORING WELLS

DRAWING G.R.A. SCALE 1 : 100 DATE 12/20/96 DRAWING No. FIGURE 3 REVISION

- NOTES
1. TEST HOLES LOCATED IN AREAS WHERE ACCESSIBLE TO THE DRILL RIG AND ARE ASSUMED REPRESENTATIVE OF THE SOIL BELOW THE SITE.
 2. TEST HOLES THIO1 THRU THIO6 EXCAVATED AND MONITORING WELLS MW1 THRU MW3 INSTALLED ON JUNE 14, 1994.
 3. TEST HOLES THIO6 THRU THIO8 AND MONITORING WELLS MW4 THRU MW6 INSTALLED ON DECEMBER 14, 1996.

LOCATION: SW3-21-3E

Owner: A LESTER
Driller: AQUARIUS WELL DRILLING
Well Name:
Well Use: PRODUCTION
Water Use: Domestic, Livestock
Date Completed: 1976 May 26

WELL LOG

From (ft.)	To (ft.)	Log
0	4.0	CLAY
4.0	169.9	HARDPAN
169.9	174.9	LAYER OF LIMESTONE & HARDPAN
174.9	202.9	BROWN LIMESTONE

WELL CONSTRUCTION

From Material (ft.)	To (ft.)	Casing Type	Inside Dia. (in)	Outside Dia. (in)	Slot Size (in)	Type
0	184.9	casing	4.00			INSERT
BLACK IRON	184.9	open hole	4.00			

Top of Casing: ft. below ground

PUMPING TEST

Date:
Pumping Rate: 20.0 Imp. gallons/minute
Water level before pumping: 94.9 ft. below ground
Pumping level at end of test: ?? ft. below ground
Test duration: 1 hours, minutes
Water temperature: ?? degrees F

LOCATION: NW9-21-3E

Owner: A J CHIBORAK
Driller: KARL STASIUK AND SON
Well Name:

Well Use: PRODUCTION
Water Use: Domestic
Date Completed: 1970 Jan 23

WELL LOG

From (ft.)	To (ft.)	Log
0	13.0	GRAVEL AND SAND
13.0	94.9	LIGHT GREY STONY TILL
94.9	143.9	LIGHT GREY STONY TILL AND PEBBLES
143.9	148.9	GRAVEL AND SAND
148.9	153.9	LIGHT BROWN LIMESTONE, WATER AT 154 FEET

WELL CONSTRUCTION

From Material (ft.)	To (ft.)	Casing Type	Inside Dia. (in)	Outside Dia. (in)	Slot Size (in)	Type
0	149.2	casing	4.00			
149.2	153.9	open hole				

Top of Casing: ft. below ground

PUMPING TEST

Date: 1970 Jan 23
Pumping Rate: 8.0 Imp. gallons/minute
Water level before pumping: 80.9 ft. below ground
Pumping level at end of test: 82.9 ft. below ground
Test duration: 4 hours, minutes
Water temperature: ?? degrees F

REMARKS

30 FT N OF PR #324 + 300 FT W OF 1/2 MI LINE, GROUND LEVEL ELFV
EST
800 FT

LOCATION: NE11-21-3E

Owner: E MARKS/S PISBROWE
Driller: Ford Drilling Ltd.
Well Name:
Well Use: PRODUCTION
Water Use: Domestic, Livestock
Date Completed: 1997 Oct 14

WELL LOG

From (ft.)	To (ft.)	Log
0	12.0	CLAY
12.0	90.0	SILTY TILL WITH RUBBLE ZONES
90.0	125.0	SANDY TILL
125.0	130.0	BROKEN LIMESTONE
130.0	145.0	LIMESTONE

WELL CONSTRUCTION

From Material (ft.)	To (ft.)	Casing Type	Inside Dia.(in)	Outside Dia.(in)	Slot Size(in)	Type
0	132.0	CASING	5.30			T & C
GALVANIZED						
132.0	145.0	OPEN HOLE		4.50		
		CASING GROUT				

Top of Casing: 1.0 ft. above ground

PUMPING TEST

Date: 1997 Oct 14
Pumping Rate: 75.0 Imp. gallons/minute
Water level before pumping: 34.0 ft. below ground
Pumping level at end of test: ?? ft. below ground
Test duration: 1 hours, minutes
Water temperature: ?? degrees F

REMARKS

ARNES

LOCATION: NE12-21-3E

Owner: A CHAMBERS
Driller: Ford Drilling Ltd.
Well Name:
Well Use: PRODUCTION
Water Use: Domestic
Date Completed: 1982 Jul 08

WELL LOG

From (ft.)	To (ft.)	Log
---------------	-------------	-----

0	119.9	TILL
119.9	136.9	LIMESTONE

WELL CONSTRUCTION

From Material (ft.)	To (ft.)	Casing Type	Inside Dia.(in)	Outside Dia.(in)	Slot Size(in)	Type
0	121.9	casing	4.00			INSERT
GALVANIZED						
121.9	136.9	open hole	3.90			

Top of Casing: 2.0 ft. below ground

PUMPING TEST

Date: 1982 Jul 08
Pumping Rate: 12.0 Imp. gallons/minute
Water level before pumping: 52.0 ft. below ground
Pumping level at end of test: ?? ft. below ground
Test duration: 1 hours, minutes
Water temperature: ?? degrees F

REMARKS

WATER FOUND AT 131 FT.

LOCATION: SW12-21-3E

Owner: HENRY JONASSON & FRANK DOTTAVIO
Driller: Ford Drilling Ltd.
Well Name:
Well Use: PRODUCTION
Water Use: Livestock
Date Completed: 2003 Jul 31.

WELL LOG

From (ft.)	To (ft.)	Log
0	5.0	TILL
5.0	12.0	CLAY
12.0	70.0	SILTY TILL
70.0	135.0	TILL WITH RUBBLE AND BOULDERS
135.0	148.0	BROKEN LIMESTONE
148.0	200.0	LIMESTONE

WELL CONSTRUCTION

From Material (ft.)	To (ft.)	Casing Type	Inside Dia. (in)	Outside Dia. (in)	Slot Size (in)	Type
0	150.0	CASING	5.25			
GALVANIZED						
150.0	200.0	OPEN HOLE		4.50		

Top of Casing: 2.0 ft. above ground

PUMPING TEST

Date: 2003 Jul 31
Pumping Rate: 20.0 Imp. gallons/minute
Water level before pumping: ?? ft. below ground
Pumping level at end of test: 40.0 ft. below ground
Test duration: ??? hours, ?? minutes
Water temperature: ?? degrees F

REMARKS

CASING GROUTED

LOCATION: 13-21-3E

Owner: D BERGMAN
Driller: AQUARIUS WELL DRILLING
Well Name:
Well Use: PRODUCTION
Water Use: Domestic
Date Completed: 1977 Mar 31

WELL LOG

From (ft.)	To (ft.)	Log
0	148.9	TILL WITH SAND, GRAVEL & BOULDERS
148.9	158.9	BROKEN LIMESTONE
158.9	189.9	SOLID LIMESTONE

WELL CONSTRUCTION

From Material (ft.)	To (ft.)	Casing Type	Inside Dia. (in)	Outside Dia. (in)	Slot Size (in)	Type
0	161.9	casing	2.00			T & C
GALVANIZED						
161.9	189.9	open hole	2.00			

MANITOBA
DEPARTMENT OF NATURAL RESOURCES
WATER RESOURCES BRANCH

GROUNDWATER RESOURCES IN THE
EASTERN INTERLAKE
PLANNING DISTRICT

February, 1981
Winnipeg, Manitoba

Prepared by:
M. Rutulis, P. Eng.
Groundwater Section
Water Investigations Service

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SUMMARY

- * Groundwater is readily available throughout the District. The total supply is adequate for present requirements and considerable new development.
- * Well yield generally is adequate to abundant for domestic and farm requirements. In several areas groundwater conditions are favourable for very high capacity wells.
- * In most of the District groundwater under natural conditions is of good quality.
- * Groundwater pollution hazard exists in fairly extensive areas in the northern part of the District where the carbonate bedrock (limestone and dolostone) is at or near ground surface. Groundwater pollution also is possible in areas where sand and gravel deposits are at ground surface.
- * Extensive flowing well areas exist in the area along the shore of Lake Winnipeg, Washow Bay area and along the Icelandic River. In the flowing well areas it would be advisable to construct wells so that discharge could be controlled.

I INTRODUCTION

The purpose of this report is to provide an assessment of groundwater resources in the Eastern Interlake Planning District.

The assessment is based on available information consisting of geological maps, soil reports and groundwater investigations carried out by this Branch and groundwater data in the files of this Branch.

This report is intended to provide general information on groundwater resources in the District and some guidance with respect to the development of water supplies for rural residential use. More specific information regarding groundwater conditions and development considerations can be obtained from the Water Resources Branch of the Department of Natural Resources.

The International System of Units (SI), commonly referred to as the metric system, and the following symbols of the SI units are used in this report:

metre	m
square metre	m ²
cubic metre	m ³
kilometre	km
square kilometre	km ²
litre	L
second	s
litres per second	L/s
cubic metres per year	m ³ /a (annum)
milligrams per litre	mg/L

All dimensions and quantities are also shown in commonly used Imperial units in parentheses.

2 PHYSIOGRAPHY

The District can be divided into very flat lake plain areas that occupy the lower part of the Icelandic River Watershed and most of the southern part of the District and a slightly undulating till plain in the northwestern and northern parts of the District.

3 GEOLOGY

3.1. General Comments

Openings in rocks and in the unconsolidated deposits overlying them form the conduits through which groundwater flows and in which it is stored. Consequently the geology of an area has a significant bearing on groundwater resources in it. Hence, the main geological features of the District are described. The general geological setting of the District is schematically depicted in Figure 1.

3.2. Bedrock

The bedrock, that is the rock that underlies the surficial deposits, in the District consists of carbonate rock (limestone and dolostone) or carbonate rock interbedded with thin shale beds. In a few small and isolated areas the carbonate rock is overlain by shale and other rocks which appear to fill narrow valleys and sinkholes in the carbonate rock surface. Indications are that one of these valleys exists at Arborg.

The carbonate bedrock contains fractures and other openings that make it permeable and, therefore, capable of transmitting and storing water.

The carbonate rock is underlain by an interbedded shale and sandstone formation that, in turn, is underlain by granite and other hard rocks. The depth to the shale and sandstone formation ranges

from about 25 m (80 ft.) near the northeast corner to some 150 m (500 ft.) in the southwest corner of the District. The thickness of the shale and sandstone formation is around 30 m (100 ft.)

The sandstone beds are permeable and can transmit and store water. The granite and the other hard rocks are impermeable and for practical purposes the surface of these rocks is the base of groundwater movement in the area.

3.3. Depth to Bedrock

The bedrock surface topography in the District is considerably more uneven than the ground surface topography; valleys of various sizes and escarpments are common features of the bedrock surface. Hence, the depth to bedrock, which is an important factor in respect to well depth, varies considerably from place to place and it ranges from zero to more than 50 m (165 ft.). The depth to bedrock in the area is indicated on the map in Figure 2. Because the topography of the District is flat or only slightly undulating, the valleys and other features in the bedrock surface show up on the depth to bedrock map as variations in the depth to bedrock.

In most of the southern part of the District (R.M. of Gimli) the depth to bedrock is more than 30 m (100 ft.), although in a few areas the bedrock surface is less than 20 m (65 ft.) below ground level.

In several areas of the northwestern and northern parts of the District the bedrock is near ground surface. Consequently outcrops and areas covered with only a thin layer of rock rubble are common.

No doubt the bedrock surface is even more complex than indicated by the depth to bedrock map because there are fairly large areas where information is scarce and, therefore, it is very likely that not all such minor features as narrow valleys and depressions are indicated on the map.

3.4. Surficial Deposits

The bedrock is overlain by till, which is a mixture of clay, silt, sand, gravel and boulders deposited by glaciers during the Ice Age. The till is exposed or is near ground surface in most of the area.

In the lake plain areas along the Icelandic River and in the southern part of the District the till is overlain by extensive clay and silt lake deposits. The thickness of the lake deposits generally ranges from 3 m to 8 m (10 - 25 ft.). The lake deposits reach a maximum thickness of 15 m (50 ft.) in the vicinity of Arborg.

Surface sand and gravel deposits in the District occur mainly as long narrow ancient beach ridges that overlie the till. A few more extensive sand deposits overlie till or clay along the eastern edge of the till area northwest of Gimli, Figure 3. Buried sand and gravel deposits are not common and occur mainly in the form of isolated lenses within or at the base of the till.

The total thickness of the surficial deposits in the District ranges from zero to 50 m (165 ft.) and, as indicated on the depth to bedrock map, they are generally thicker in the southern part than in the rest of the District.

In general, the permeability of till is low and it retards groundwater movement. In some parts of the District, the till, however, is very gritty because of high crushed carbonate rock content and its permeability is high enough to allow significant percolation of precipitation to the bedrock.

The clay and silt deposits have very low permeability and for all practical purposes are impermeable.

The sand and gravel deposits are permeable and can transmit and store water in appreciable quantities.

4 GROUNDWATER

4.1. Aquifers

4.1.1. Definition and Classification:

In the discussion about the geology of the District it was pointed out that some of the rock formations and some of the surficial deposits can transmit groundwater at an appreciable rate. The rocks and surficial deposits that are saturated and can transmit groundwater in significant quantities for practical use are called aquifers.

Based on the materials forming them the aquifers in the District can be classified as follows:

1. Carbonate rock,
2. Sand and gravel,
3. Sandstone.

4.1.2. Carbonate Rock Aquifer

The carbonate rock that underlies the entire District (Figure 1) and, in fact, the entire Interlake Region constitutes an extensive aquifer. Sand and gravel beds deposited directly on the carbonate rock formation and hydraulically connected to it are considered as part of the carbonate aquifer.

The depth to the aquifer in most of the District is equal to the depth to the carbonate bedrock as indicated on the depth to bedrock map (Figure 2). However, in a few small areas in the northwestern part of the District, the water level is at a greater depth than the bedrock surface and wells must be drilled through dry rock before reaching water.

The main water bearing zone commonly is in the upper part of the carbonate rock, if the rock is saturated to its surface. In some areas, however, in addition to the upper water bearing zone, other significant water bearing zones exist deeper in the rock.

The water bearing properties of the carbonate rock can vary greatly within short distances. The yield of similar wells, i.e., ~~wells of similar depth, dimensions of casing, and elevation, can range~~ from 1 L/s to 100 L/s (13 - 1300 IGPM) within a distance of a few hundred metres (yards). Consequently, despite the fact that some very

be assumed that high pumping rates could be easily obtained at every location.

4.1.3. Sand and Gravel Aquifers

Some of the sand and gravel beach ridges and most of the sand and gravel deposits interbedded in or underlying the till or clay are likely water bearing. The sand and gravel aquifers, however, generally are not used for water supply because it is technically simpler and, in most cases, less expensive to drill a well into the carbonate aquifer. In areas where the bedrock is at more than 30 m (100 ft.) and shallow sand and gravel aquifers exist, it may be economically advantageous to develop the sand and gravel aquifers.

4.1.4. Sandstone Aquifers

The sandstone aquifers are formed by the sandstone beds of the shale and sandstone formation that underlies the carbonate rock. Because in most of the District the sandstone aquifers are at considerable depth and several water bearing zones exist in the carbonate rock, no attempts have been made to explore the sandstone aquifers.

4.2. Supply

4.2.1. Recharge

Ultimately the groundwater supply in the District would depend on the recharge of the groundwater flow system in the District. Hence an estimate of recharge would indicate the potential total supply.

The recharge area for the flow system in the District is about 500 km^2 (200 square miles) or $500 \times 10^6 \text{ m}^2$. The recharge rate is assumed to be about 0.03 m (0.1 ft.) of water per year over the recharge area,

which is the usual observed recharge rate in Manitoba in areas of fairly good recharge conditions. The total recharge per year then is $15.0 \times 10^6 \text{ m}^3$ (12,000 acre-feet), which is equal to a sustained pumping rate of 475 L/s (6300 I.G.P.M.).

4.2.2. Total Supply

Based on the estimated recharge the total groundwater supply in the District is about $15.0 \times 10^6 \text{ m}^3$ a year (12,000 acre feet). The supply, for example, would be adequate for a city of 50,000 assuming a fairly high water consumption of 450 L (100 gallons) per person per day. This indicates that the groundwater resources in the District are abundant for present requirements and extensive new development.

Because groundwater supply in the District would be affected by groundwater consumption in adjacent areas, the total quantity of groundwater available for development in the District depends on groundwater development in adjacent planning districts or municipalities.

4.2.4. Well Yield

The potential yield of wells in the District ranges from 1.0 L/s (13 I.G.P.M.), which is adequate for domestic and farm requirements, to more than 100 L/s (1300 I.G.P.M.). It seems that a minimum of 1.0 L/s can be readily obtained at almost any location in the District. Well yield in the 10 L/s to 100 L/s (130 - 1300 I.G.P.M.) range likely can be obtained in most parts of the District but not necessarily at every point. Hence, in some areas several test holes may be required to find a site for a high capacity well.

4.3. Quality

In general, groundwater in the upper part of the carbonate aquifer and in the sand and gravel aquifers above it in most of the Dis-

trict is of good quality. (See Appendix "A" for explanation of quality descriptions).

Groundwater temperature in the upper part of the carbonate aquifer in the District under natural conditions usually is between 5.0 and 6.1°C (41 - 43° F).

4.4. Availability

Groundwater for domestic and farm requirements is readily available throughout the District.

In most of the District groundwater is also available for municipal, industrial and other requirements that require larger quantities of water. However, to find a suitable well site, i.e., aquifer conditions favourable for the required yield, some test drilling may be necessary, particularly if the required well capacity is very high.

In general, the groundwater supply in the District is abundant and large quantities are available for development.

5 POLLUTION

5.1. General Comments

Two basic kinds of groundwater pollution can be discerned - aquifer pollution and well pollution. Aquifer pollution occurs when pollutants affect water quality in a whole aquifer or a significant part of an aquifer. In the case of well pollution only water in the well and in the immediate vicinity of it is affected.

Aquifer pollution can be caused by pollutants that percolate to the aquifer from the ground surface through the overlying soil or that are introduced into the aquifer through artificial openings in a low permeability protective layer above an aquifer, e.g., quarries, pits, abandoned wells and test holes. Aquifer pollution also may be caused by improperly constructed production wells, if the quantity of pollutants that enters the wells is larger than the quantity of polluted water that is pumped out.

Well pollution usually is caused by poor well construction that allows pollutants such as debris, small animals, sewage effluents, barnyard runoff, etc. to enter the well. If the quantities of pollutants entering the well are small and the well is used, the pollution is not likely to spread throughout an aquifer. Pumping of the well draws unpolluted water towards the well and, consequently, the pollution remains confined to the well and a narrow zone around it. Well pollution is much more common than aquifer pollution. Well pollution can be prevented by proper well design.

5.2. Pollution Hazard Areas

Groundwater pollution hazard in the District exists in areas where the carbonate rock or sand and gravel deposits are at or near ground surface. In these areas seepage from septic drain fields, leachates from waste disposal grounds and spilled toxic substances could readily percolate to the water bearing zone and cause groundwater pollution. The groundwater pollution hazard areas are indicated on the

map in Figure 4.

The areas where sand and gravel deposits are at surface (Figure 4) are classified as groundwater pollution hazard areas because the deposits may contain aquifers. It is likely that some of the surface sand and gravel deposits or parts of them are dry and therefore no pollution hazard exists. The available information, however, is not adequate to differentiate sand and gravel that forms aquifers from dry deposits. Consequently, all surface sand and gravel areas have been classified as pollution hazard areas. Which surface sand and gravel deposits are dry and which form aquifers can be determined only by detailed field investigation.

In some areas the surface sand and gravel deposits may form shallow aquifers that are not used for water supply, because the carbonate rock aquifer is a better source. If these shallow aquifers are isolated from the carbonate aquifer by a sufficiently thick till or clay layer, pollution of the sand and gravel aquifers is not likely to pollute the carbonate rock aquifer.

5.3. Pollution Prevention

To prevent groundwater pollution the activities or facilities that cause serious groundwater pollution under normal operating conditions, or are likely to cause it by accident, should not be permitted in the groundwater pollution hazard areas.

The common facilities that are likely to cause groundwater pollution under normal operating conditions are waste disposal grounds, sewage lagoons, feed lots, and septic tank drain fields. It should be noted that a single residential septic tank drain field located on a fairly large property, e.g., a farm, is not likely to cause widespread aquifer pollution, but, on the other hand, if numerous septic tank drain fields are allowed in a densely populated area, e.g., a town, a village or a subdivision, located in a groundwater pollution hazard area, serious groundwater pollution is almost inevitable.

The most common facilities that are likely to cause groundwater pollution by accident or because of improper or careless handling of toxic

substances are bulk fuel stations, bulk liquid fertilizer distribution centres, and service stations. Fuel spills at bulk fuel storage tanks and leaky fuel tanks at service stations are not unknown, and the only fool-proof way to prevent aquifer pollution by accidental spills of liquid fuels and fertilizers is to prohibit bulk storage in groundwater pollution hazard areas. In general, industries or facilities handling potential pollutants that could under normal operating conditions or by accident cause groundwater pollution preferably should be located outside the groundwater pollution hazard areas. The best areas for storing or manufacturing toxic substances are groundwater discharge areas underlain by thick clay and till deposits.

It is not likely that it will be practically possible to eliminate all the potential pollutants from the groundwater pollution hazard areas; e.g., such sources of pollution as septic tank drain fields, manure piles, fertilizers and fuels found on farms would be difficult to prohibit. The prohibition of activities and facilities which are potential major sources of groundwater pollution from groundwater pollution hazard areas, however, seems to be feasible and should be implemented to prevent groundwater pollution in the District.

6 WELL CONSTRUCTION IN SHALLOW BEDROCK AREAS

In areas where the carbonate rock is near ground surface, it is common practice to install only enough casing to reach the rock surface and then drill an open hole (uncased hole) through the rock until a satisfactory water bearing zone is found. Where this kind of well construction is used polluted water that flows through the upper fractured zone of the rock can flow into the open hole and pollute water in the well and in the deeper water bearing zones that are used for water supply as illustrated in Figure 5.

To prevent the flow of polluted water into the deeper water bearing zones it is advisable to install grouted-in well casing through the low permeability zone as shown in Figure 5.

It should be noted that in an area where the conditions illustrated in Figure 5 exist and well density is high, such as in a town or settlement, all wells should be properly constructed to prevent aquifer pollution. Single wells located a fair distance from other wells, e.g., on farms, should be properly constructed mainly to prevent pollution of the well itself. Due to dilution effect, a single well is not likely to cause widespread pollution unless the pollutant is a very toxic substance or large quantities of pollutants are flowing into the well.

7 FLOWING AND HIGH WATER LEVEL WELLS

Flowing and high water level well areas are common in the District. The areas in which flowing wells occur are indicated on the map in Figure 6. The high water level wells occur in the vicinity of flowing wells and in low lying areas adjacent to flowing well areas. Improperly constructed flowing and high water level wells can cause a number of problems. The problems are discussed in Appendices "C" and "D" and the suggested basic well design to prevent the problems is depicted in Figure 6.

REFERENCES

Manitoba Mineral Resources Division, 1979. Geological Map of
Manitoba, Map 79-2.

Pratt, L.E., W.A. Ehrlich, F.P. Leclaire and J.A. Barr. 1961.
Detailed - Reconnaissance Soil Survey of Fisher and Teulon
Map Sheet Areas. Manitoba Soil Survey, Soils Report No.
12.

APPENDIX A
GROUNDWATER QUALITY DESCRIPTION

To describe groundwater quality the terms excellent, good, fair, poor and combinations and modifications of them are used in this report. Unless other uses are specified these terms indicate how acceptable the water is for domestic use. The quality description is based on the total dissolved solids, the concentration of the common ions that affect quality, hardness, appearance, taste and odour of the water.

The meaning of the terms used for groundwater quality description is as follows:

1. Excellent: The water has no objectionable properties and treatment of it to improve quality is not necessary; the total dissolved solids concentration is less than 500 mg/L and hardness less than 250 mg/L.
2. Good: The water has higher mineral concentration than the excellent water and is rated less than excellent mainly because of higher hardness; the total dissolved solids concentration ranges from 500 to 1000 mg/L and hardness is from 250 to 500 mg/L. The hardness is likely to cause incrustation of kitchen utensils. The water can be used without treatment or, if desired, the hardness can be readily reduced.
3. Fair: The water has one or more objectionable properties and fairly commonly may require treatment to improve quality. The most common undesirable property is high hardness; it ranges from 500 to 1000 mg/L. The hardness can be reduced to acceptable level with conventional water softeners. The water may have high enough sulphate, iron and chloride ion concentration to slightly impair the taste or, in the case of sulphates, have a laxative effect on persons not used to it. The total dissolved solids of the water is from 1000 to 2000 mg/L.
4. Poor: The water has one or more serious undesirable properties and it is difficult to impossible to improve the water quality by conventional water treatment. The water commonly is very hard (more than 1000 mg/L) and it may be difficult (also expensive) or impractical to reduce the hardness with conventional water softeners. The water may also have a very high sulphate

ion concentration (500 to 2500 mg/L). In some places the water may be rated as poor quality because of high sodium chloride (salt) concentration, which makes it taste salty. The water may be also less than desirable in appearance and may have an unpleasant odour.

5. Very Poor: The undesirable properties of the water are just below a tolerable maximum limit.

APPENDIX B
FLOWING WELLS

Numerous flowing well areas exist in Manitoba. Extensive flowing well areas are common in the Interlake region and in the southeastern part of the Province. In the flowing well areas the water level in most wells rises above ground level and in others it is near ground level. Some of the wells may flow when groundwater levels are high and stop flowing during periods of low levels.

Uncontrolled discharge from flowing wells may cause some of the following problems:

1. Icing up of drains, that, in turn, results in ice covered roads and flooding during spring runoff;
2. Damage to roads, bridges and drains;
3. Damp basements;
4. Damage to buildings due to excessive soil moisture or ice;
5. Wet and swampy yards and fields;
6. Flooding of septic tank drain fields.

In view that the above problems caused by uncontrolled flowing wells are likely to affect the well owner, his neighbours and public property in the vicinity, wells in flowing well areas should be constructed so that discharge can be controlled.

The discharge from flowing wells can be brought under control by proper well construction. A basic design for controlled flowing wells is shown in Figure 7.

APPENDIX C
HIGH WATER LEVEL WELLS

In high water level wells the water level is below ground level but above or near the basement floor level.

If high water level wells are not properly designed they may cause problems similar to some of those caused by flowing wells, such as:

1. Damp basements,
2. Flooding of septic tank drain fields,
3. Unnecessary pumping from sumps,
4. Damage to foundations and basement floors.

The problems are caused by water seeping or flowing up outside the well casing and then flowing through the backfill of water pipe excavations towards the building. If well pits are used to make connections between the well and the water pipe these problems may be caused by water flowing from the well into the pit and thence to the basement.

To prevent the above problems wells in high groundwater level areas should be constructed in the same manner as controlled flowing wells. The basic design for high water level wells is shown in Figure 7.

WELL POLLUTION

Well pollution is caused by pollutants entering the well directly via the well casing or the annulus outside the well casing. Well pollution is limited to the water in the well and in the aquifer within a metre or so (a few feet) of the well.

Well pollution usually is caused by faulty design and construction of wells, water systems, and sewage systems. In some areas well pollution has been caused by failure to adopt well design to special aquifer conditions, because well design that is good for one area may not be acceptable in another area where conditions are considerably different.

If well pollution continues over extended periods of time and the quantities and concentrations of the pollutants are high, the pollution is likely to spread and cause widespread pollution of the aquifer, particularly if a number of polluted wells are concentrated in a small area such as a settlement or a town.

If the inflow of pollutants to the well is slow, i.e., less than the quantity that is pumped out, most of the polluted water is likely to remain in the well and the immediate vicinity of it and the highest concentration of the pollutants is likely to be in the well. Because the pollutants enter the well directly, bacteria is not filtered out as is the case where pollutants enter aquifers by seepage through clay, silt or sand. Hence, well pollution presents a high health hazard.

Well pollution caused by faulty water supply and sewage disposal systems can happen in all areas where non-pumping or static water level is below ground level. Well pollution is not likely in flowing well areas unless pumping level falls below ground level and the flow from the wells is reversed.

To prevent well pollution wells and all connections to the wells should be designed and constructed so that surface water, effluent from septic tanks drain fields and other pollutants cannot enter the well. Because one of the most common causes of well pollution seems to be seepage of pollutants into well pits and from there into wells, pitless connections are preferable to well pits.

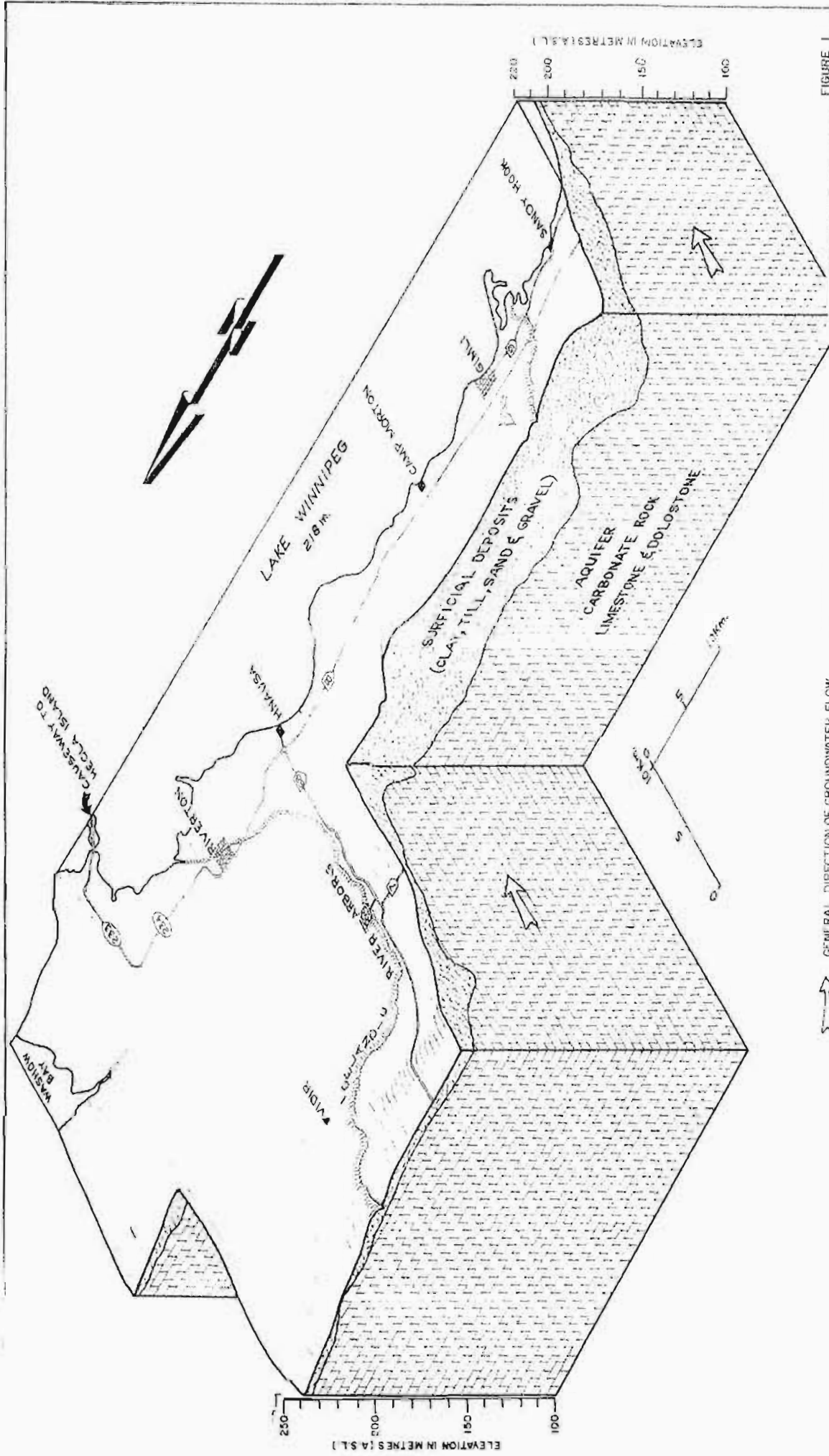


FIGURE 1
 EASTERN INTERLAKE PLANNING DISTRICT
**TOPOGRAPHIC AND SUBSURFACE
 FEATURES**

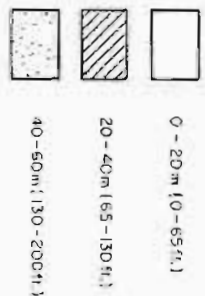
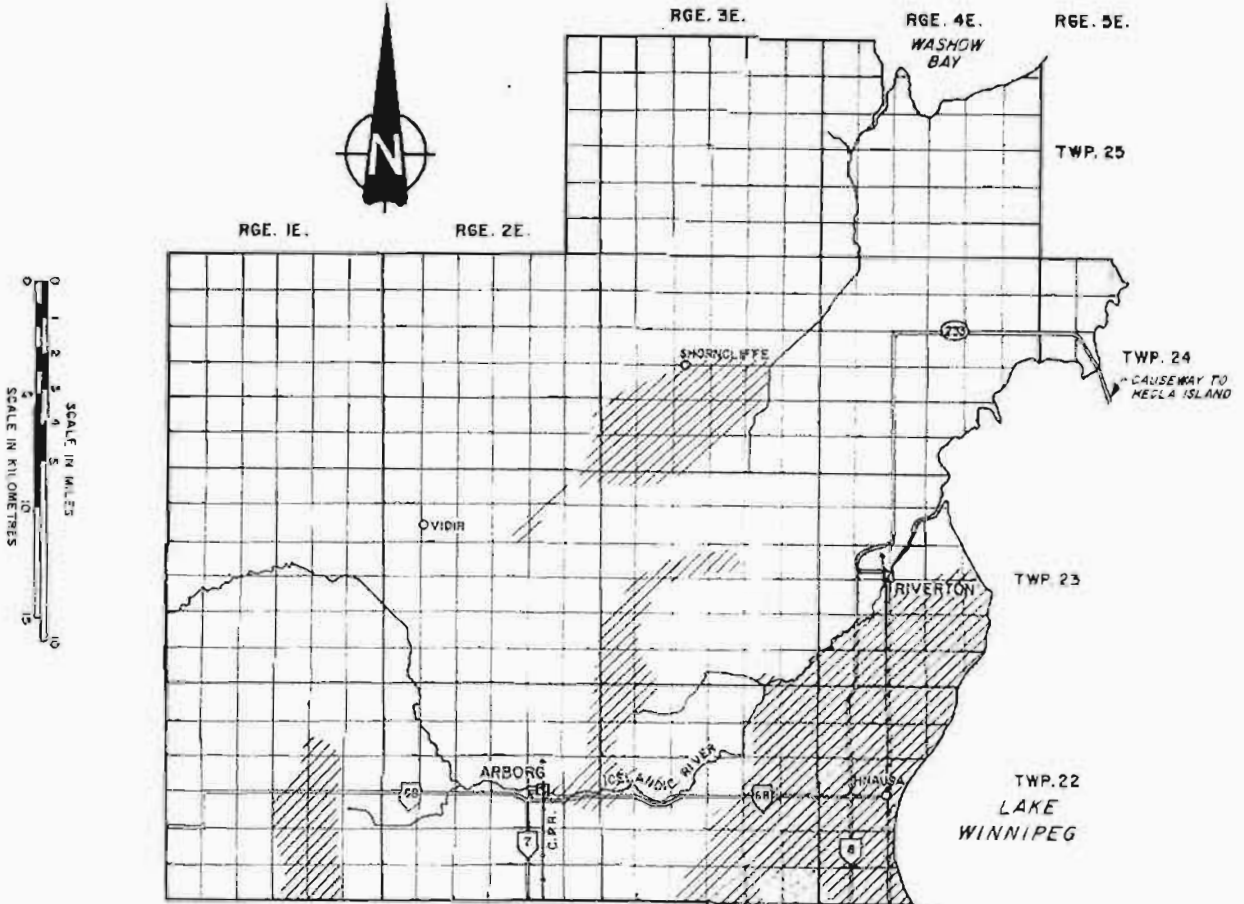
PROJECT NO. 100000000
 REGIONAL WATER RESOURCES BRANCH
 WATER RESOURCES BRANCH

GENERAL DIRECTION OF GROUNDWATER FLOW

10 KM
 5
 0
 5
 10 KM

ELEVATION IN METRES (A.S.L.)
 250
 200
 150
 100

ELEVATION IN METRES (A.S.L.)
 220
 200
 150
 100



LEGEND

0 - 20m (0 - 65ft.)

20 - 40m (65 - 130ft.)

40 - 50m (130 - 200ft.)

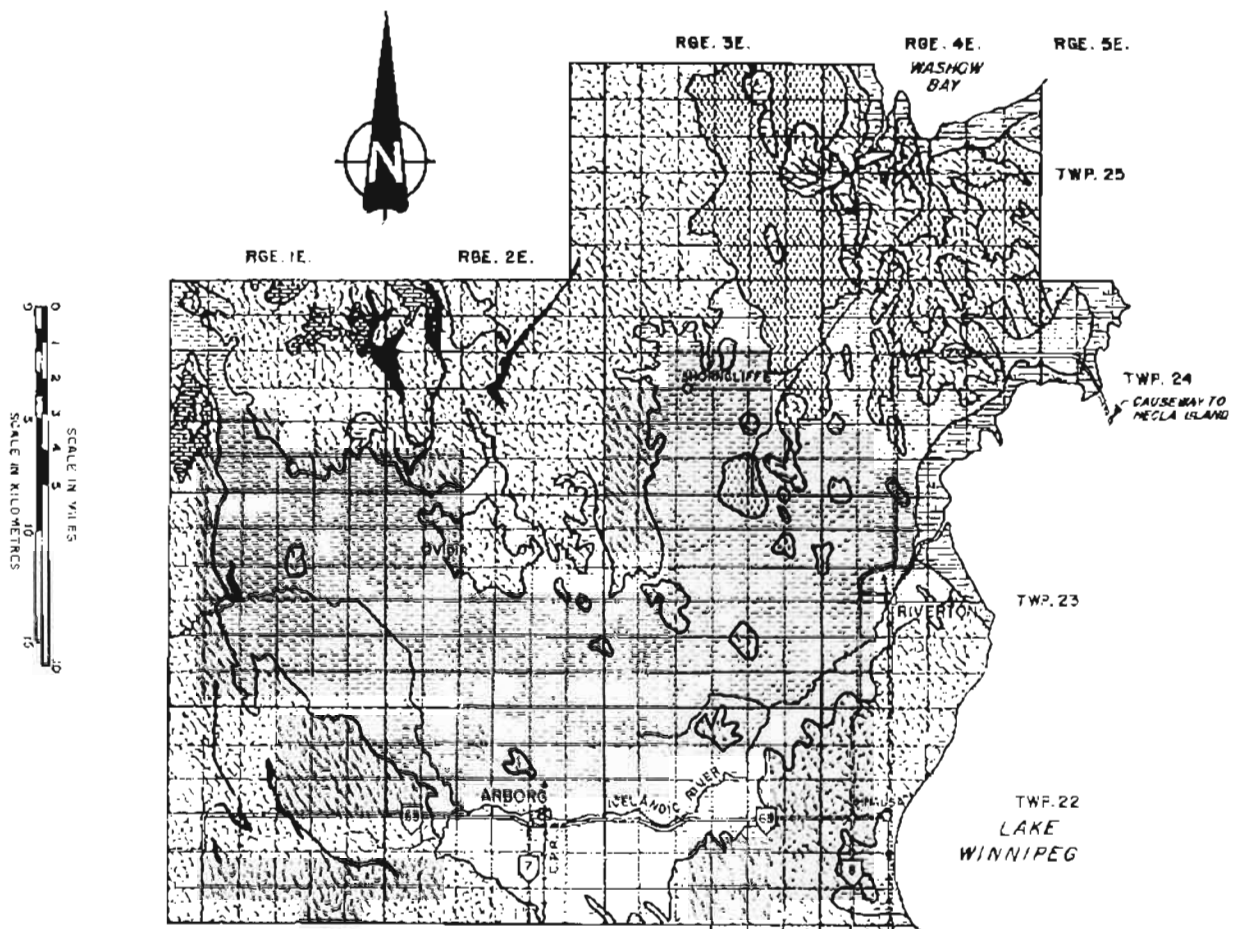
PROVINCE OF MANITOBA
 DEPARTMENT OF NATURAL RESOURCES
 WATER RESOURCES BRANCH

EASTERN INTERLAKE PLANNING DISTRICT








DEPTH TO BEDROCK

FIGURE 2

DATE: 1982
 DRAWN BY: [Signature]
 CHECKED BY: [Signature]

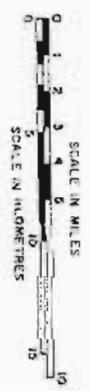
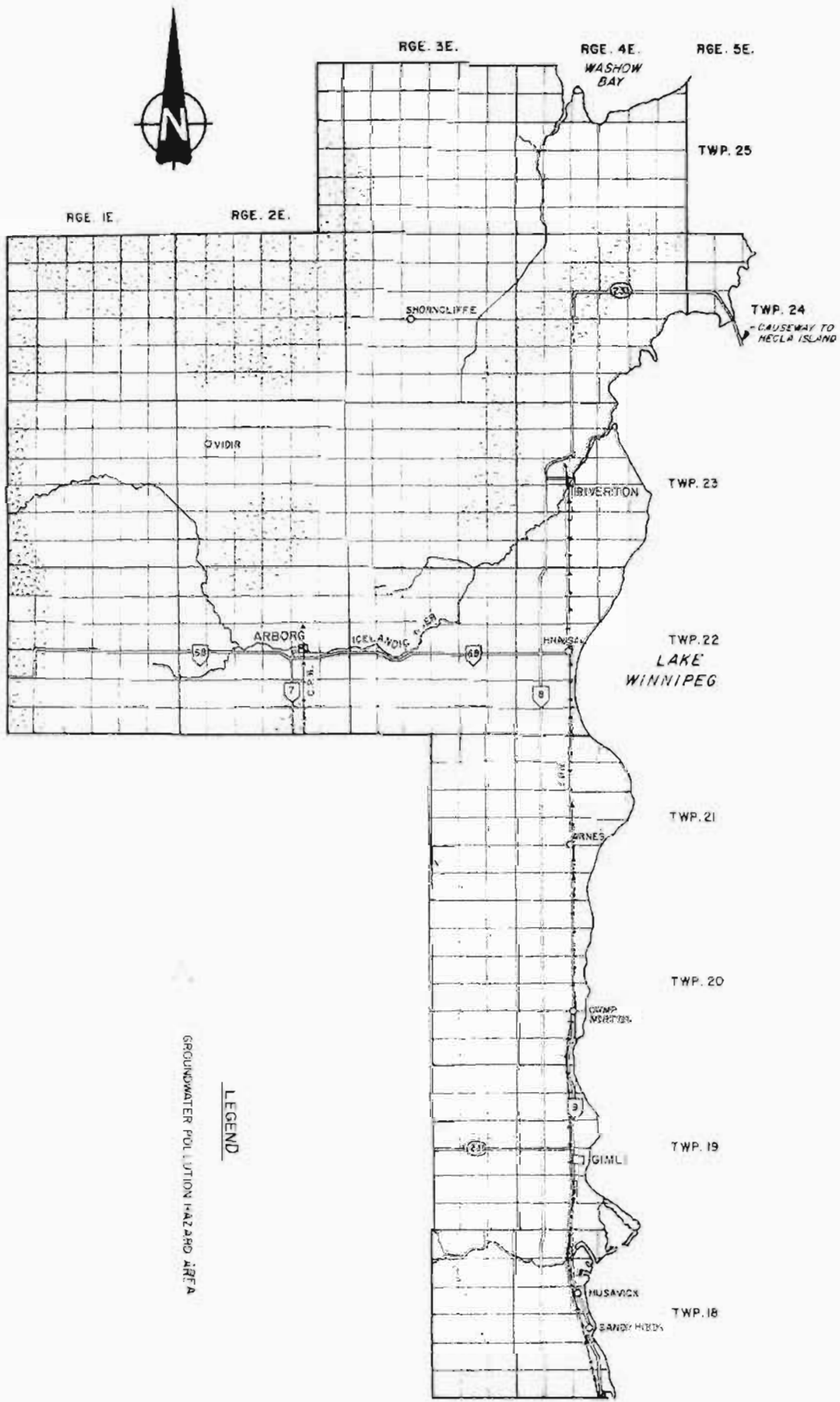


LEGEND

-  SAND AND GRAVEL
-  SAND AND SILTY SAND
-  CLAY, SILTY CLAY AND SILT
-  TILL - INCLUDES TILL OVERLAIN BY VERT. THIN CLAY, SILT AND PEAT DEPOSITS
-  PEAT MORE THAN ONE METRE THICK
-  ROCK OUTCROP
-  MARSH, USUALLY UNDERLAIN BY CLAY

Modified after Manitoba Soil Survey Report No. 12

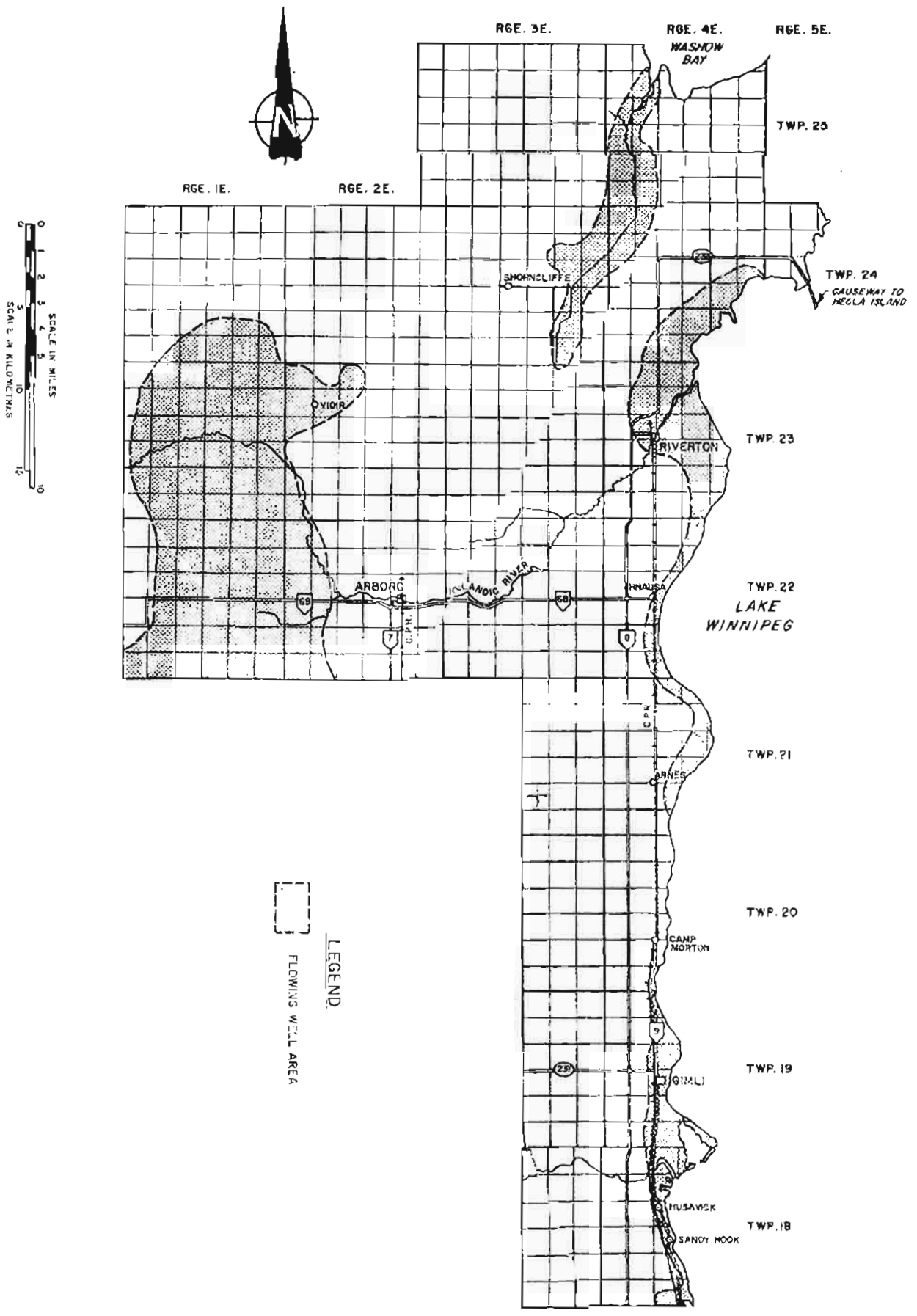
PROVINCE OF MANITOBA DEPARTMENT OF NATURAL RESOURCES WATER RESOURCES BRANCH	EASTERN INTERLAKE PLANNING DISTRICT SURFACE DEPOSITS
PROJECT: 02/01/82 DRAWN BY: M. RUTUIS CHECKED BY: [Signature] DATE: 01/02/83 SCALE: 1:50,000	FIGURE 3



PREPARED BY: M. RUTHERFORD		APPROVED BY: 	
PROVINCE OF MANITOBA DEPARTMENT OF NATURAL RESOURCES WATER RESOURCES BRANCH			
EASTERN INTERLAKE PLANNING DISTRICT		FIGURE 4	
GROUNDWATER POLLUTION HAZARD AREA			
DATE:	SCALE:	SHEET:	OF:

GROUNDWATER POLLUTION HAZARD AREA

LEGEND



PROVINCE OF MANITOBA DEPARTMENT OF NATURAL RESOURCES WATER RESOURCES BRANCH		EASTERN INTERLAKE PLANNING DISTRICT FLOWING WELL AREAS	
PREPARED BY: M. RUTLAND	DRAWN BY: <i>[Signature]</i>	DATE: 1973	SCALE: 1:50,000

FIGURE 6



Quality Engineering | Valued Relationships

January 13, 2016

Our File No. 1000 004 03

Silvestre Urbano
WSP Canada Inc.
1600 Buffalo Place
Winnipeg, Manitoba
R3T 6B8

RE Arnes Lab Results

Attached are the results of the lab tests requested. The remolded hydraulic conductivity test was conducted on material from TP3, 1'-4' which appeared to be the siltiest material compared to the other samples submitted. There was insufficient material to complete a full proctor, it was agreed to us an estimate proctor density of 1950 kg/m³, and target to have a remolded sample about 97%.

If you have any questions or require additional information or clarifications please contact the undersigned at 204.975.9433.

Kind Regards,

TREK Geotechnical

Per:



Paul Bevel, B.Sc.
Lab and Field Services Manager



Project No. 1000 004 03
Client WSP Canada Inc.
Project Arnes

Sample Date 09-Oct-15
Test Date 13-Oct-15
Technician Junhui Wu

Test Pit	TP1	TP1	TP1	TP1	TP1	TP2
Depth (m)	0.8 - 0.8	0.9 - 1.5	1.5 - 1.8	2.3 - 2.3	3.0 - 3.0	0.3 - 0.9
Sample #						
Tare ID	N26	P12	F71	Z114	F3	P36
Mass of tare	8.4	8.5	8.6	8.3	8.5	8.6
Mass wet + tare	351.5	406.2	420.6	381.3	367.8	407.5
Mass dry + tare	333.0	321.8	376.7	353.5	289.8	352.1
Mass water	18.5	84.4	43.9	27.8	78.0	55.4
Mass dry soil	324.6	313.3	368.1	345.2	281.3	343.5
Moisture %	5.7%	26.9%	11.9%	8.1%	27.7%	16.1%

Test Pit	TP2	TP2	TP3	TP3	TP4	TP4
Depth (m)	0.3 - 1.2	2.3 - 2.3	0.3 - 1.2	1.2 - 3.0	0.3 - 1.2	1.2 - 3.0
Sample #						
Tare ID	N48	N99	D19	H12	K13	P03
Mass of tare	8.5	8.3	8.3	9.1	8.3	8.6
Mass wet + tare	425.2	511.5	419.6	454.2	430.4	439.6
Mass dry + tare	315.2	468.6	362.9	414.1	376.3	399.1
Mass water	110.0	42.9	56.7	40.1	54.1	40.5
Mass dry soil	306.7	460.3	354.6	405.0	368.0	390.5
Moisture %	35.9%	9.3%	16.0%	9.9%	14.7%	10.4%

Test Pit						
Depth (m)						
Sample #						
Tare ID						
Mass of tare						
Mass wet + tare						
Mass dry + tare						
Mass water						
Mass dry soil						
Moisture %						



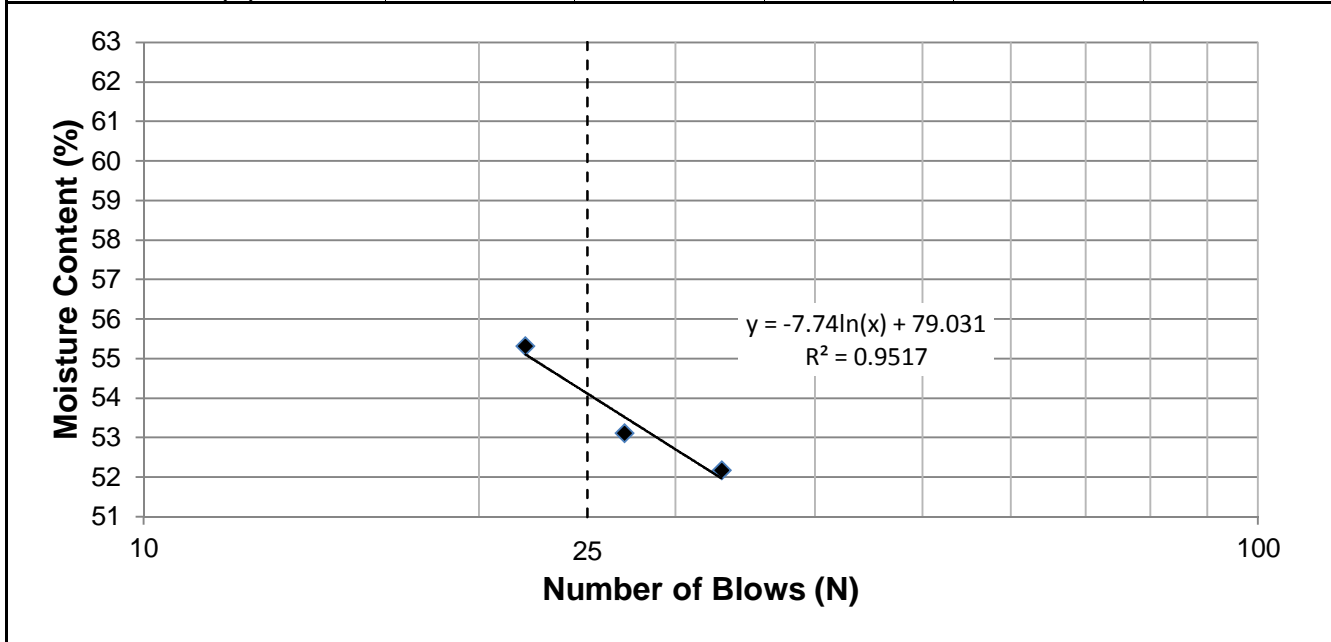
Project No. 1000 004 03
Client WSP Canada Inc.
Project Arnes

Test Hole TP1
Sample #
Depth (m) 0.9 - 1.5
Sample Date
Test Date 23-Oct-15
Technician Daniel Wiebe

Liquid Limit	54
Plastic Limit	19
Plasticity Index	35

Liquid Limit

Trial #	1	2	3	4	5
Number of Blows (N)	33	27	22		
Mass Wet Soil + Tare (g)	35.931	37.284	35.990		
Mass Dry Soil + Tare (g)	28.542	29.275	28.265		
Mass Tare (g)	14.380	14.196	14.298		
Mass Water (g)	7.389	8.009	7.725		
Mass Dry Soil (g)	14.162	15.079	13.967		
Moisture Content (%)	52.175	53.114	55.309		



Plastic Limit

Trial #	1	2	3	4	5
Mass Wet Soil + Tare (g)	20.444	20.544			
Mass Dry Soil + Tare (g)	19.441	19.496			
Mass Tare (g)	14.157	14.080			
Mass Water (g)	1.003	1.048			
Mass Dry Soil (g)	5.284	5.416			
Moisture Content (%)	18.982	19.350			



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**Atterberg Limits
 ASTM D4318**

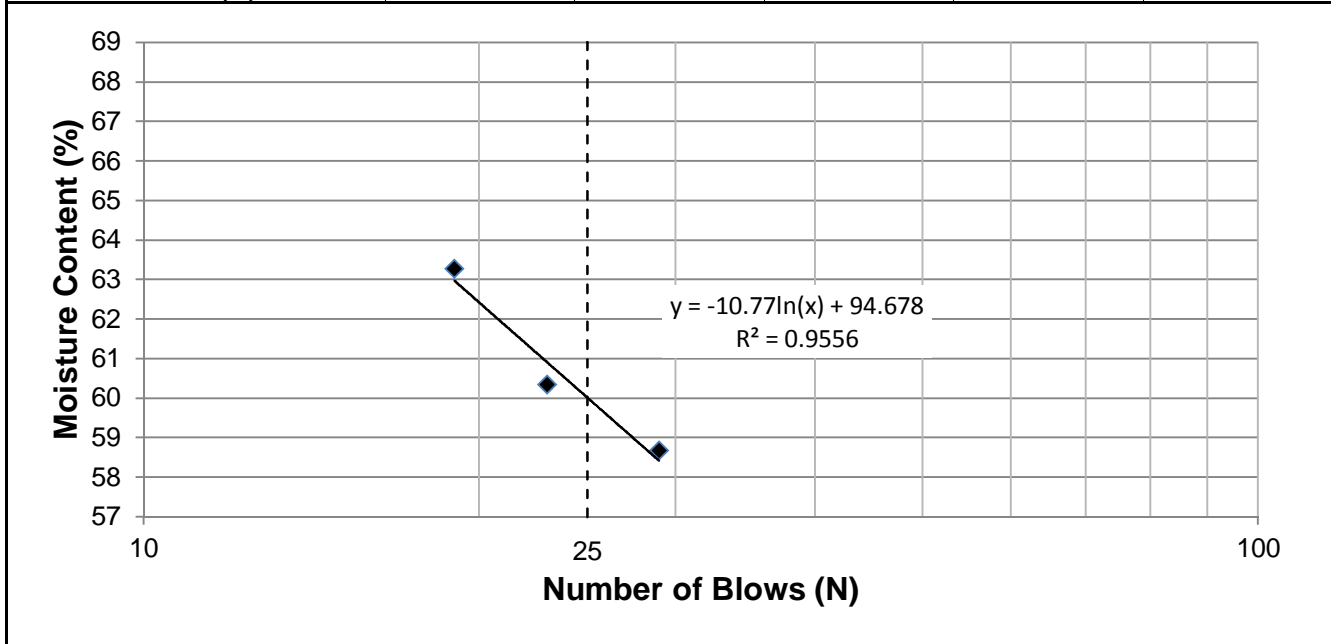
Project No. 1000 004 03
Client WSP Canada Inc.
Project Arnes

Test Hole TP2
Sample #
Depth (m) 0.3 - 1.2
Sample Date
Test Date 23-Oct-15
Technician Daniel Wiebe

Liquid Limit	60
Plastic Limit	22
Plasticity Index	38

Liquid Limit

Trial #	1	2	3	4	5
Number of Blows (N)	23	29	19		
Mass Wet Soil + Tare (g)	34.202	36.110	35.479		
Mass Dry Soil + Tare (g)	26.649	27.955	27.198		
Mass Tare (g)	14.133	14.056	14.112		
Mass Water (g)	7.553	8.155	8.281		
Mass Dry Soil (g)	12.516	13.899	13.086		
Moisture Content (%)	60.347	58.673	63.281		



Plastic Limit

Trial #	1	2	3	4	5
Mass Wet Soil + Tare (g)	20.362	21.047			
Mass Dry Soil + Tare (g)	19.262	19.822			
Mass Tare (g)	14.154	14.150			
Mass Water (g)	1.100	1.225			
Mass Dry Soil (g)	5.108	5.672			
Moisture Content (%)	21.535	21.597			



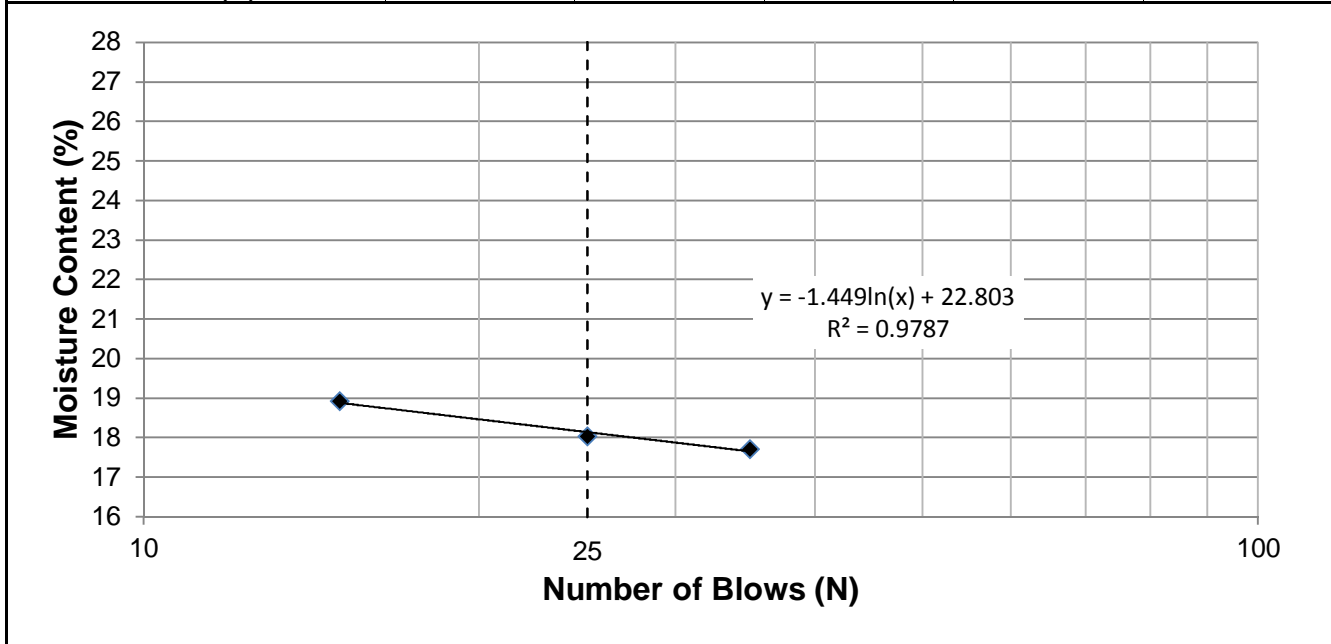
Project No. 1000 004 03
Client WSP Canada Inc.
Project Arnes

Test Hole TP3
Sample #
Depth (m) 0.3 - 1.2
Sample Date
Test Date 26-Oct-15
Technician Junhui Wu

Liquid Limit	18
Plastic Limit	14
Plasticity Index	4

Liquid Limit

Trial #	1	2	3	4	5
Number of Blows (N)	35	25	15		
Mass Wet Soil + Tare (g)	24.643	24.860	25.815		
Mass Dry Soil + Tare (g)	23.049	23.230	23.977		
Mass Tare (g)	14.051	14.192	14.263		
Mass Water (g)	1.594	1.630	1.838		
Mass Dry Soil (g)	8.998	9.038	9.714		
Moisture Content (%)	17.715	18.035	18.921		



Plastic Limit

Trial #	1	2	3	4	5
Mass Wet Soil + Tare (g)	27.093	27.136			
Mass Dry Soil + Tare (g)	25.449	25.507			
Mass Tare (g)	13.861	14.022			
Mass Water (g)	1.644	1.629			
Mass Dry Soil (g)	11.588	11.485			
Moisture Content (%)	14.187	14.184			

Project No.	1000-004-03	Test Hole	TP3
Client	WSP Canada Inc.	Trek Sample #	L265
Project	Arnes	Depth (m)	1-4'
		Sample Date	
		Test Date	Dec 16, 2015 to Jan 11, 2016
		Technician	Paul Bevel

Specimen Details

Visual Classification Silt and Clay, trace to some gravel, trace sand, light grey, Remolded sample

Comments The specific gravity of the soil was assumed to be 2.70.
 Proctor density was estimated to be 1950, based on this, remolded density was about 98%

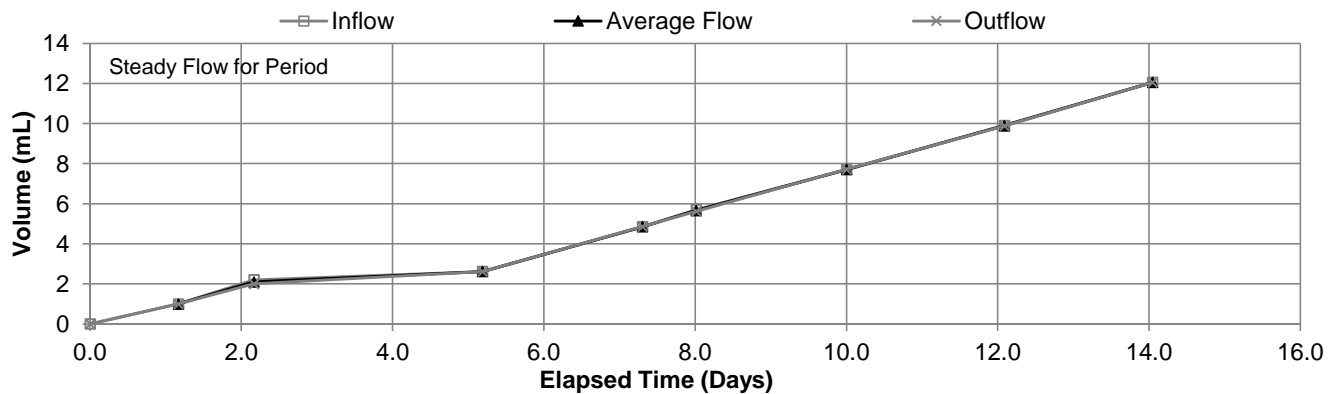
Atterberg Limits

Liquid Limit	18
Plastic Limit	14
Plasticity Index	4

Test Details

Permeant	Distilled, de-aired water
Method	Constant Head
Cell Pressure	100.7 kPa
Influent Pressure	60.0 kPa
Effluent Pressure	50.3 kPa
Gradient	11.24

Permeation Graph



Steady Flow Permeation Data

Time Increment (Days)	Elapsed Time (Days)	Flow (Q)		Inflow / Outflow Ratio	Average Flow (mL)	Temperature Correction	Corrected Hydraulic Conductivity, k_{20} (m/s)
		Influent (mL)	Effluent (mL)				
0.71	8.01	0.85	0.76	1.12	0.81	0.95	2.66E-10
1.99	10.00	2.00	2.10	0.95	2.05	0.95	2.41E-10
2.08	12.08	2.20	2.16	1.02	2.18	0.95	2.45E-10
1.96	14.04	2.15	2.17	0.99	2.16	0.98	2.64E-10

Average Temperature Corrected Hydraulic Conductivity, k_{20} (m/s) **2.54E-10** (2.54×10^{-8} cm/s)

Consolidation Data

	Average Height (m)	Average Diameter (m)	Moisture Content (%)	Dry Density (kN/m^3)	Degree of Saturation (%)	Cell Pressure	Back Pressure
Initial	0.091	0.073	14.7	18.8	97.3	100.0	50.0
Final	0.088	0.073	14.0	19.6	106.5	100.0	50.0

Consolidation Results



TREK GEOTECHNICAL
 1712 St. James Street
 Winnipeg, Manitoba R3H 0L3
 tel 204.975.9433 fax 204.975.9435

Client: WSP
 Project: RM of Arnes, Gimli
 Job No: 1000-043-09
 Date: 09-May-17

Hole No. TP3 Bulk Sample
 Sample No. L447
 Depth: N/A
 Sample Description: SILT TILL, clayey, trace sand, trace gravel, moist, low plastic

Sample Height: 21.58 mm
 Ring Size: 63.52 mm Φ
 Initial Dial Reading: 21.238



D ₀	D ₁₀₀	D ₅₀	Load (lb)	P (kPa)	ΔP (kPa)	H ₅₀ (mm)	T ₅₀ (s)	c _v (mm ² /s)	e _{start}	e _{finish}	Δe	M _v	k (cm/s)	c _v (cm ² /s)
22.36	22.23	22.29	2	30.9		22.64	124.6	2.02E-01	1.06	1.05	-0.01			2.02E-03
22.21	21.96	22.09	3.5	54.2	23.2	22.43	502.0	4.91E-02	1.05	1.02	-0.03	5.37E-04	2.59E-08	4.91E-04
21.97	21.61	21.79	6	92.8	38.7	22.13	326.3	7.36E-02	1.02	0.99	-0.03	4.15E-04	2.99E-08	7.36E-04
21.60	21.27	21.44	12	185.7	92.8	21.78	621.4	3.74E-02	0.99	0.95	-0.04	1.99E-04	7.29E-09	3.74E-04
21.19	20.44	20.81	24	371.4	185.7	21.16	693.3	3.16E-02	0.95	0.88	-0.07	1.96E-04	6.08E-09	3.16E-04
20.39	19.38	19.89	48	742.7	371.4	20.23	1342.0	1.49E-02	0.88	0.78	-0.10	1.50E-04	2.20E-09	1.49E-04
19.22	18.48	18.85	96	1485.5	742.7	19.19	2193.8	8.22E-03	0.78	0.77	0.00	3.59E-06	2.90E-11	8.22E-05

Compression Index (Cc)
 Re-compression Index (Cr)
 Preconsolidation Pressure (Casagrande's Method) kPa



WSP
 1600 Buffalo Place
 Winnipeg, MB R3T 6B8
 Telephone: (204)-477-6650

CLIENT RM of Gimli
 PROJECT NUMBER 181-03988-00
 DATE STARTED 10/29/20 COMPLETED 10/29/20
 EXCAVATION CONTRACTOR K&L Contracting
 EXCAVATION METHOD Excavated with trenching bucket
 LOGGED BY Dana Bredin CHECKED BY _____
 NOTES _____

PROJECT NAME Gimli Evaporation Pond Facility
 PROJECT LOCATION Arnes, MB
 GROUND ELEVATION 243 m TEST PIT SIZE 3 m x 4 m
 GROUND WATER LEVELS:
 AT TIME OF EXCAVATION ---
 AT END OF EXCAVATION ---
 AFTER EXCAVATION ---

DEPTH (m)	GRAPHIC LOG	ELEV. (m)	WATER LEVEL	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	POCKET PEN. (kPa)	TORVANE (kPa)	MOISTURE CONTENT (%)	▲ SPT N VALUE ▲	
										PL	MC
		242.80		TOPSOIL - Black, loamy							
1				SAND - Brown, silty, trace gravel and cobbles, dry, loose							
		241.50		TILL - Beige, silty, sandy, some clay, trace gravel and cobbles - Dense to very dense below 1.8 m							
2											
3		240.00									

- Test pit ended in till layer
 - No seepage or water was observed

GENERAL BH PLOTS - WSP GIMLI EVAP POND TEST PITS.GPJ GINT STD CANADA GDT 11/13/20



WSP
 1600 Buffalo Place
 Winnipeg, MB R3T 6B8
 Telephone: (204)-477-6650

CLIENT RM of Gimli
 PROJECT NUMBER 181-03988-00
 DATE STARTED 10/29/20 COMPLETED 10/29/20
 EXCAVATION CONTRACTOR K&L Contracting
 EXCAVATION METHOD Excavated with trenching bucket
 LOGGED BY Dana Bredin CHECKED BY _____
 NOTES _____

PROJECT NAME Gimli Evaporation Pond Facility
 PROJECT LOCATION Arnes, MB
 GROUND ELEVATION 243 m TEST PIT SIZE 3 m x 4 m
 GROUND WATER LEVELS:
 AT TIME OF EXCAVATION ---
 AT END OF EXCAVATION ---
 AFTER EXCAVATION ---

DEPTH (m)	GRAPHIC LOG	ELEV. (m)	WATER LEVEL	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	POCKET PEN. (kPa)	TORVANE (kPa)	MOISTURE CONTENT (%)	▲ SPT N VALUE ▲	
										PL	MC
0		242.80		TOPSOIL - Black, loamy							
1		241.80		SAND - Brown, silty, trace gravel and cobbles, dry, loose - Trace boulders							
2				TILL - Beige, silty, sandy, some clay, trace gravel and cobbles - Dense to very dense below 1.5 m							
3		240.00									

- Test pit ended in till layer
 - No seepage or water was observed

GENERAL BH PLOTS - WSP GIMLI EVAP POND TEST PITS.GPJ GINT STD CANADA GDT 11/13/20



Quality Engineering | Valued Relationships

August 12, 2020

Our File No. 1000-043-11

Dana Bredin
WSP Canada Inc.
1600 Buffalo Place
Winnipeg, MB
R3T 6B8

RE 1D Consolidation Test Report – Arnes Waste Disposal

Attached is the 1D Consolidation Test Report for the above noted project. The report provides results for Sample TP02-S5 only. Obtaining relatively undisturbed oedometer specimens from Samples TP02-S7 and TP02-S8 were not successful due to the nature of the material (dense till with some sand and gravel).

It is important to note that the hydraulic conductivity and coefficient of consolidation (c_v) data presented shows a relatively high degree of variability owing to the nature of the material (heterogeneity) and care should be exercised in interpretation and application of test results to design.

If you have any questions or require additional information or clarifications, please contact Nelson Ferreira at 204.792.8458.

Kind Regards,

TREK Geotechnical

Review Control:

<i>Prepared By: RSA</i>	<i>Reviewed By: NJF</i>
-------------------------	-------------------------

Consolidation Test



TREK GEOTECHNICAL

Client: WSP Canada Inc.
 Project: Arnes Waste Disposal
 Job No: 1000-043-11
 Date : July 15, 2020 to August 7, 2020

Hole No. TP02
 Sample No. S5
 Depth: N/A
 Sample Description: Till

Ring Size 63.3 mm ϕ

Height 22.6 mm

Moisture Content	Intial	Final	Density	Intial	Final
Tare Number	w107	R111	Wt. Ring & Soil (g)	273.672	271.658
Wt. Wet Soil & Tare (g)	189.442	169.068	Wt. Ring(g)	106.247	106.247
Wt. Dry Soil & Tare (g)	175	157.756	Wt. Soil Specimen (g)	167.425	165.411
Wt. Water (g)	14.442	11.312	Height of Spec. (mm)	22.6	20.8
Wt. Tare (g)	8.608	4.246	Volume (mm ³)	71120	65443
% Moisture	8.68	7.37	Bulk Density (kN/m ³)	23.54	25.28
Hs (mm)	18.1	18.1	Dry Density (kN/m ³)	21.66	23.54
			Saturation	95.04	135.37

Cap Load (kg) 0.3586
 Cap Pressure (kPa) 1.12
 e (void Ratio) 0.25 0.15

Change of Height(mm) 1.804
 Arm Factor 11
 Specific Gravity 2.7

Conductivity



TREK GEOTECHNICAL

Client: WSP Canada Inc.
 Project: Arnes Waste Disposal
 Job No: 1000-043-11
 Date: July 15, 2020 to August 7, 2020

Hole No. TP02
 Sample No. S5
 Depth: N/A
 Sample Description: Till

Sample Height : 22.6 mm
 Ring Size: 63.3 mm Φ
 Initial Dial Reading: 19.71

D ₀	D ₁₀₀	D ₅₀	Load (lb)	P (kPa)	ΔP (kPa)	H ₅₀ (mm)	T ₅₀ (s)	c _v (mm ² /s)	e _{start}	e _{finish}	Δe	m _v (kPa ⁻¹)	k (mm/s)
19.58	19.50	19.54	1	16.7	-	22.43	441.2	5.59E-02	0.242	0.234	-0.008	-	-
19.46	19.38	19.42	2	32.3	15.6	22.31	1321.9	1.84E-02	0.234	0.228	-0.006	3.16E-04	5.71E-08
19.36	19.29	19.33	3	47.9	15.6	22.22	5862.4	4.13E-03	0.228	0.223	-0.005	2.39E-04	9.68E-09
19.25	19.14	19.19	6	94.6	46.7	22.08	259.5	9.21E-02	0.223	0.213	-0.010	1.75E-04	1.58E-07
19.04	18.94	18.99	12	188.1	93.5	21.88	181.4	1.29E-01	0.213	0.202	-0.011	9.72E-05	1.23E-07
18.85	18.73	18.79	25	390.6	202.5	21.68	60.4	3.82E-01	0.202	0.190	-0.012	5.10E-05	1.91E-07
18.61	18.47	18.54	50	780.1	389.5	21.43	169.6	1.33E-01	0.190	0.177	-0.013	2.89E-05	3.76E-08
18.37	18.23	18.30	100	1559.2	779.0	21.19	412.2	5.34E-02	0.177	0.163	-0.013	1.44E-05	7.56E-09
18.11	17.91	18.01	200	3117.2	1558.0	20.90	4301.5	4.98E-03	0.163	0.147	-0.016	8.95E-06	4.36E-10

TREK Interpretation of:

Compression Index (Cc) 0.46

Average between Unload and Re-load Re-compression Index (Cr): 0.016 (Estimated based on data points obtained prior to the preconsolidation pressure point).

Preconsolidation Pressure (Casagrande's Method) 80 kPa

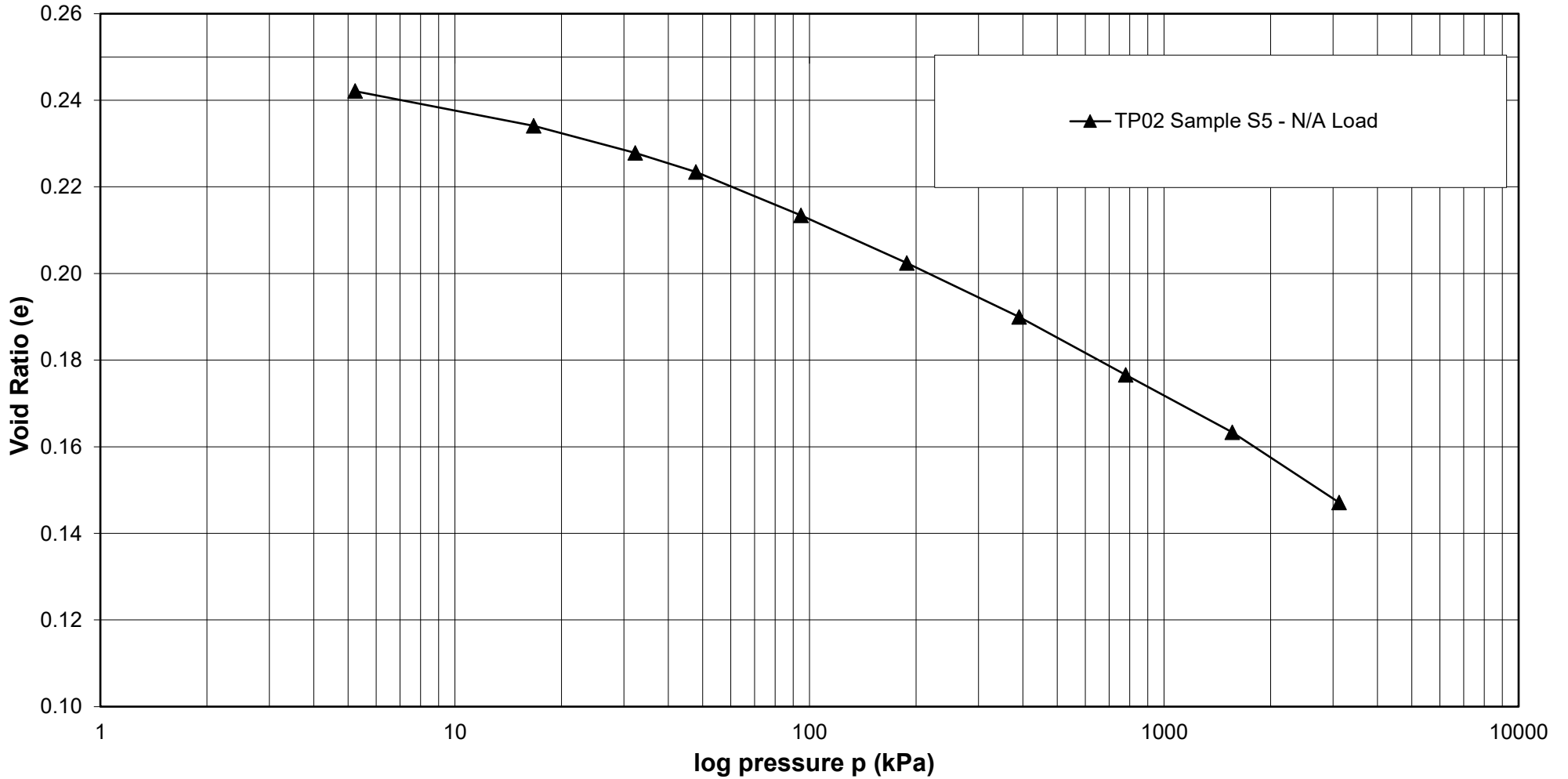
Consolidation Results - Void Ratio (e) versus log pressure p

Client: WSP Canada Inc.

Project #: 1000-043-11

Project: Arnes Waste Disposal

Date : July 15, 2020 to August 7, 2020



TREK GEOTECHNICAL

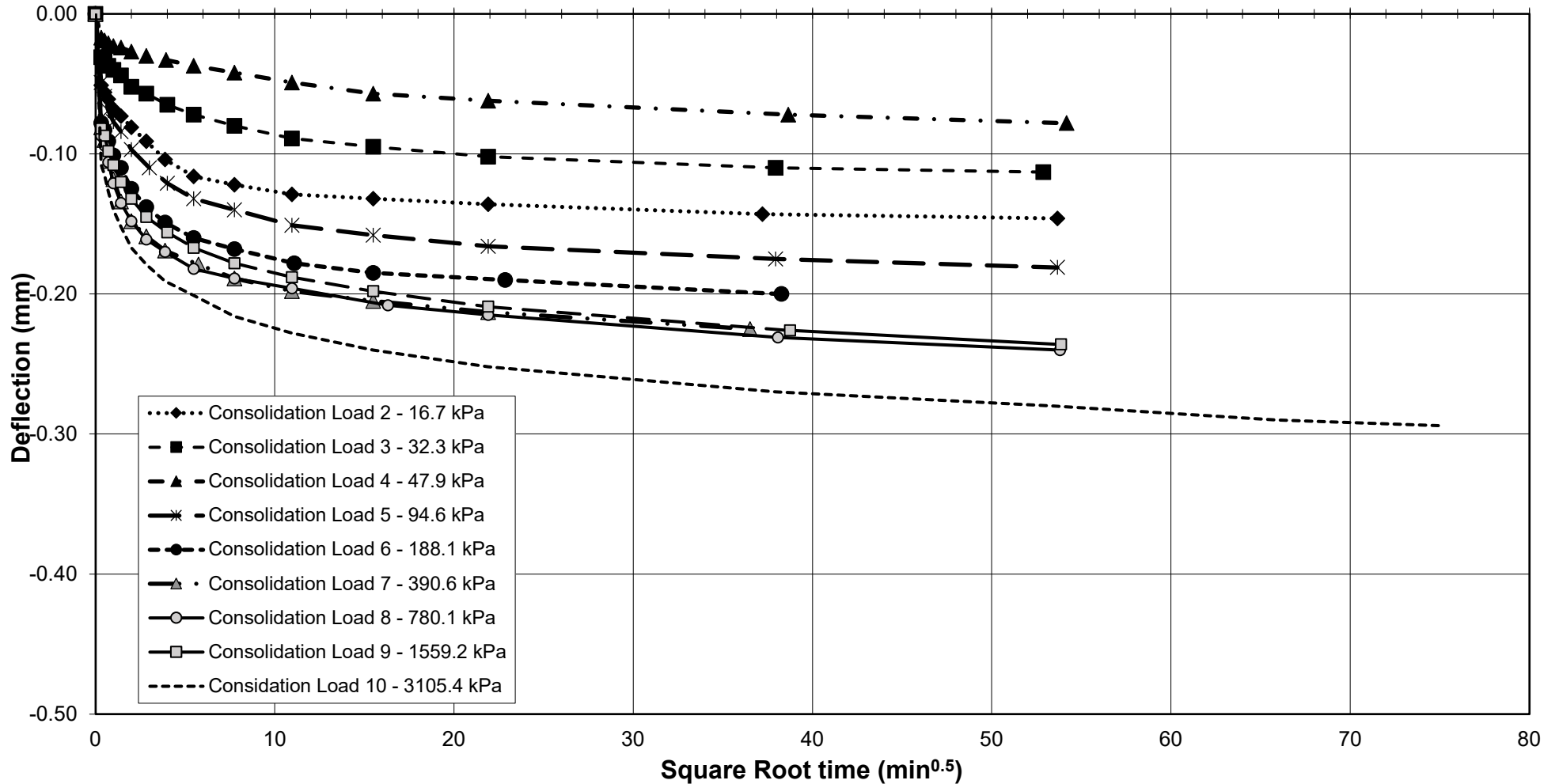
Consolidation Result - Deflection versus Square Root Time

Client: WSP Canada Inc.

Project #: 1000-043-11

Project: Arnes Waste Disposal

Date: July 15, 2020 to August 7, 2020



TREK GEOTECHNICAL



September 11, 2020

Our File No. 1000-043-11

**Dana Bredin
WSP Canada Inc.
1600 Buffalo Place
Winnipeg, MB
R3T 6B8**

RE Permeability and Associated Test Report – Arnes Waste Disposal

Attached are the Hydraulic Conductivity, bulk density measurements (5) and specific gravity of coarse aggregate test results for the above noted project on silt till samples delivered to TREK Geotechnical on August 13, 2020.

Bulk densities of the samples were measured and samples S1 and S2 were selected by WSP to combine for Hydraulic Conductivity testing using a Rigid-Wall Permeameter. ASTM D5856 does not allow gravel sizes greater than 1/6 the diameter of the permeameter mold so the oversize (>16 mm) was removed from the sample. The oversize material (14% by mass) was measured for specific gravity (OD) and was used to calculate a corrected, lower average dry density of S1 and S2 (2106 kg/m³).

The reconstituted sample was compacted in the mold to a dry density of 2110 kg/m³.

If you have any questions or require additional information or clarifications, please contact Angela Fidler-Kliewer at 204.792.8458

Kind Regards,

TREK Geotechnical

Review Control:

<i>Prepared By: BMH</i>	<i>Reviewed By: AFK</i>
-------------------------	-------------------------



Project No. 1000-043-11
Client WSP Canada
Project Arnes Waste Disposal

Test Hole TP-01
Trek Sample # S1 and S2
Depth (m) N/A
Sample Date 13-Jul-20
Test Date 24-Aug-20
Technician BMH

Specimen Details

Visual Classification SILT (TILL) - some sand to sandy, some gravel (>16 mm removed), low to no plasticity, hard

Comments The specific gravity of the soil was assumed to be 2.60

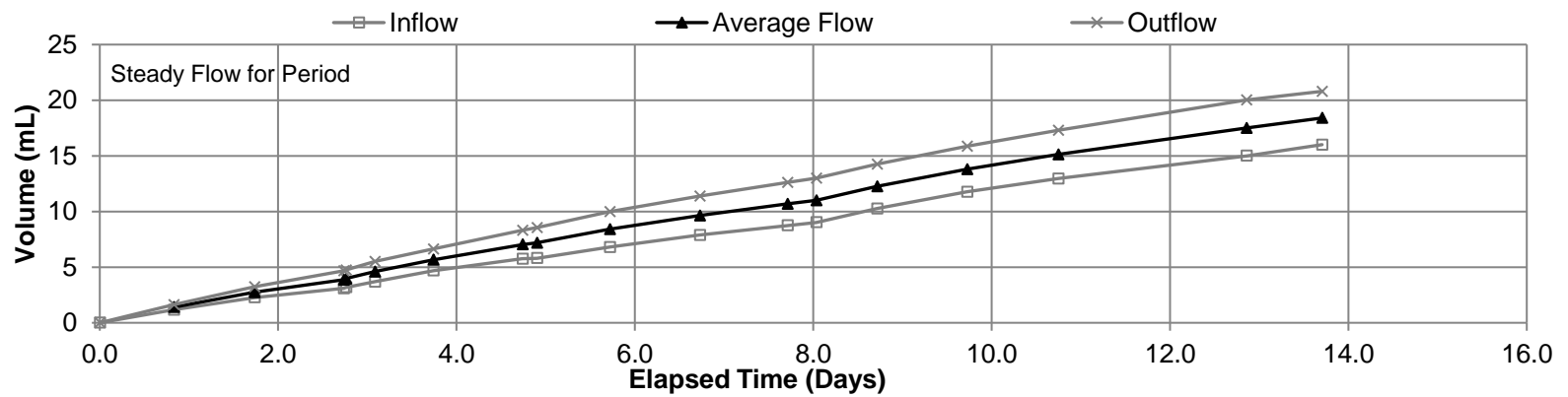
Index Testing

Liquid Limit Not Requested
Plastic Limit Not Requested
Plasticity Index Not Requested
Clay Content (%) Not Requested

Test Details

Permeant Distilled, de-aired water
Method Constant Head (Method A)
Influent Pressure 96.7 kPa
Effluent Pressure 83.7 kPa
Gradient 11.62
Head Loss 1.53 m

Permeation Graph



Steady Flow Permeation Data

Time Increment (Days)	Elapsed Time (Days)	Flow (Q)		Inflow / Outflow Ratio	Average Flow (mL)	Temperature Correction	Corrected Hydraulic Conductivity, k_{20} (m/s)
		Influent (mL)	Effluent (mL)				
0.68	8.72	10.27	14.26	0.98	1.25	0.97	2.17E-10
1.01	9.72	11.77	15.86	0.94	1.55	0.99	1.85E-10
1.02	10.75	12.95	17.30	0.82	1.31	0.99	1.53E-10
2.11	12.86	15.01	20.02	0.76	2.39	1.00	1.30E-10

Average Temperature Corrected Hydraulic Conductivity, k_{20} (m/s) 1.71E-10 (1.71x10⁻⁸ cm/s)

Consolidation Data

	Average Height (m)	Average Diameter (m)	Moisture Content (%)	Dry Density (kN/m ³)	Degree of Saturation (%)
Initial	0.1164	0.1014	9.0	20.7	99.5
Final	0.1164	0.1014	8.5	20.7	94.3



www.trekgeotechnical.ca
1712 St. James Street
Winnipeg, MB R3H 0L3
Tel: 204.975.9433 Fax: 204.975.9435

Bulk Relative Density (Specific Gravity)

Project No. 1000-043-11
Client WSP Canada
Project Arnes Waste Disposal

Sample # L20-245
Source Test Pits
Material Till
Sample Date 2020-07-13
Test Date 2020-08-21
Technician NK

Sample #	S1	S2	S3	S4	S6
Mass of sample (g)	3158.1	2827.2	1404.3	2356.4	1221.9
Mass of sample with wrap (g)	3173.9	2837.3	1424.2	2369.7	1224.8
Mass of submerged sample (g)	1840.0	1635.0	810.2	1347.0	686.3

Bulk Density (kg/m³)	2368	2351	2287	2304	2269
Average Bulk Density (kg/m³)	2360				
Combined Moisture Content (%)	8.8				
Average Dry Density (kg/m³)	2169				
Percent Oversize (%)	14				
Corrected Dry Density (kg/m³)	2106				

Comments: Samples S1 and S2 combined for hydraulic conductivity testing



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

Relative Density (Specific Gravity) and Absorption of Coarse Aggregate

ASTM C127

Project No. 1000-043-11
Client WSP Canada
Project Arnes Waste Disposal



Sample # L20-245
Source TP-01
Material Gravel
Sample Date 2020-07-13
Test Date 2020-08-22
Technician BMH

Fraction # 1
Oven Dry Mass (g) 754.0
Saturated Surface Dry Mass (g) 761.0
Apparent SSD Mass (g) 476.0

Specific Gravity (OD) 2.65
Specific Gravity (SSD) 2.67
Absorption % 0.93

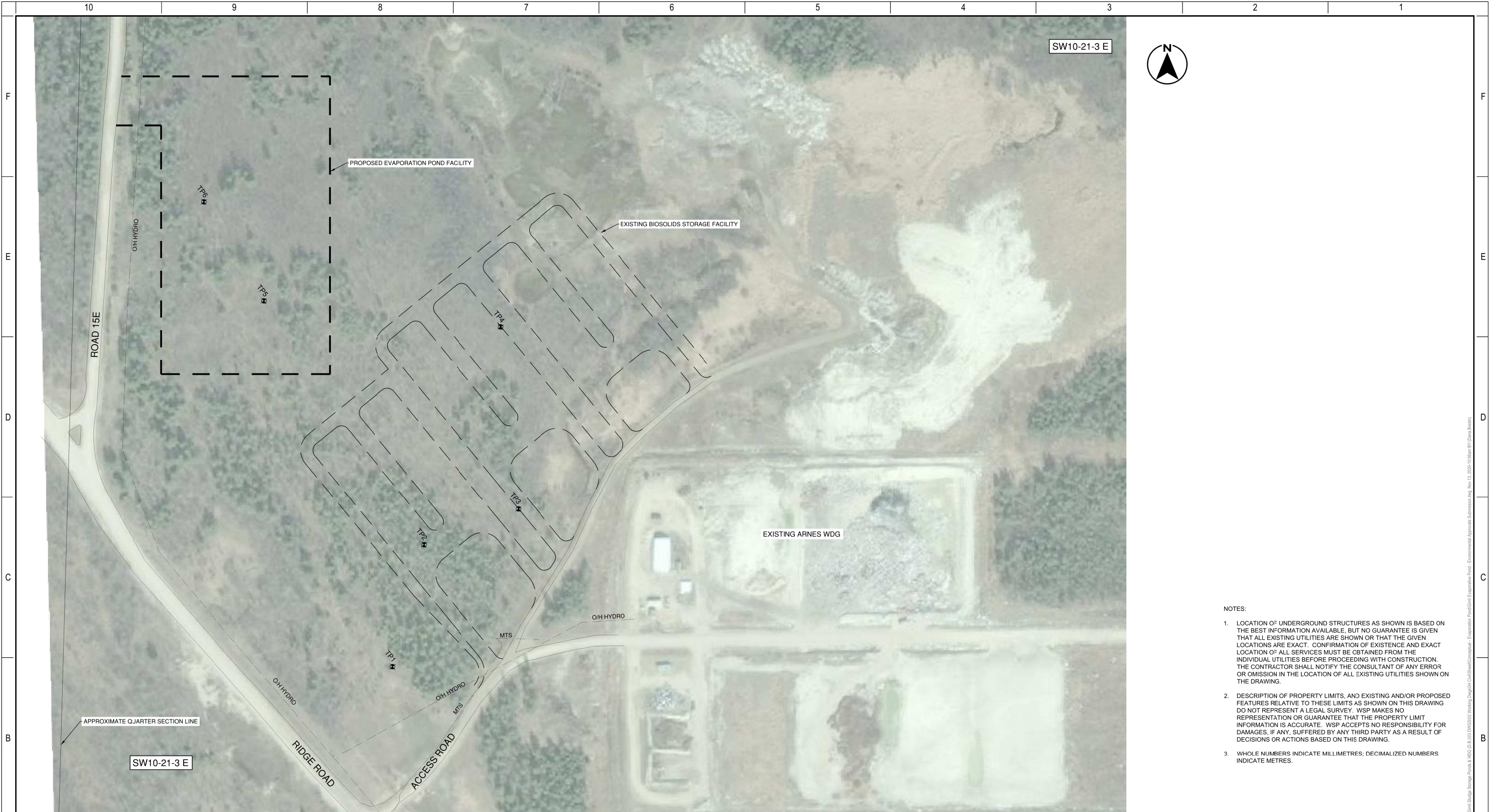
Comments: Oversize material (> 16 mm) from samples S1 and S2

APPENDIX

C

PLANS AND DETAILS





SW10-21-3 E



- NOTES:
1. LOCATION OF UNDERGROUND STRUCTURES AS SHOWN IS BASED ON THE BEST INFORMATION AVAILABLE, BUT NO GUARANTEE IS GIVEN THAT ALL EXISTING UTILITIES ARE SHOWN OR THAT THE GIVEN LOCATIONS ARE EXACT. CONFIRMATION OF EXISTENCE AND EXACT LOCATION OF ALL SERVICES MUST BE OBTAINED FROM THE INDIVIDUAL UTILITIES BEFORE PROCEEDING WITH CONSTRUCTION. THE CONTRACTOR SHALL NOTIFY THE CONSULTANT OF ANY ERROR OR OMISSION IN THE LOCATION OF ALL EXISTING UTILITIES SHOWN ON THE DRAWING.
 2. DESCRIPTION OF PROPERTY LIMITS, AND EXISTING AND/OR PROPOSED FEATURES RELATIVE TO THESE LIMITS AS SHOWN ON THIS DRAWING DO NOT REPRESENT A LEGAL SURVEY. WSP MAKES NO REPRESENTATION OR GUARANTEE THAT THE PROPERTY LIMIT INFORMATION IS ACCURATE. WSP ACCEPTS NO RESPONSIBILITY FOR DAMAGES, IF ANY, SUFFERED BY ANY THIRD PARTY AS A RESULT OF DECISIONS OR ACTIONS BASED ON THIS DRAWING.
 3. WHOLE NUMBERS INDICATE MILLIMETRES; DECIMALIZED NUMBERS INDICATE METRES.

EXISTING	LEGEND-PLAN	PROPOSED	EXISTING	LEGEND-PLAN	PROPOSED
150 WM	WATER MAIN	150 WM	59.367	GROUND ELEVATION	259.367
300 LDS	LAND DRAINAGE SEWER	300 LDS	00.00	ROAD ELEVATION	00.00
250 WWS	WASTE WATER SEWER	250 WWS	00.00	DYKE ELEVATION	00.00
250 FM	FORCEMAIN	250 FM	00.00	DITCH ELEVATION	00.00
G	GAS		TH	TEST HOLE/TEST PIT	
CS	BEL MTS / FIBRE			GUY WIRE / HYDRO POLE	
PO	OVERHEAD POWER			CURB STOP / PLUG	
PV	UNDERGROUND POWER			VALVE / HYDRANT	
	EDGE OF ROAD / DYKE			MANHOLE / CLEANOUT	
	DYKE TOE			RIP RAP	
	PROPERTY LINE			GRANULAR MATERIAL	
	FENCE			CONCRETE	
	TREE OR SHRUB LINE			CLAY CORE	
	CULVERT			IN SITU TILL	
	FLOW DIRECTION				
	DITCH/SWALE				

IS	RE	DATE	DESCRIPTION
1	0	2020-11-13	ENVIRONMENTAL APPROVALS

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SEAL: **ENGINEERS GEOSCIENTISTS MANITOBA**
D.T.G. BREIDIN
 Member
 33864
 REGISTERED PROFESSIONAL ENGINEER
 2020-11-13

CLIENT: **GIMLI**
 THE HEART OF NEW IRELAND

CLIENT REF. #:

PROJECT: **R.M. OF GIMLI EVAPORATION POND FACILITY**

PROJECT NO: 181-03988-00

DATE: 2020-11-13

wsp

1810 BUFFALO PLACE
 WINNIPEG, MANITOBA
 CANADA R3T 0B8
 PHONE: 204-477-8655 FAX: 204-474-2864
 WWW.WSP.COM

ORIGINAL SCALE: 1:1000

TITLE: **EXISTING SITE PLAN**

SHEET NUMBER: **C-101**

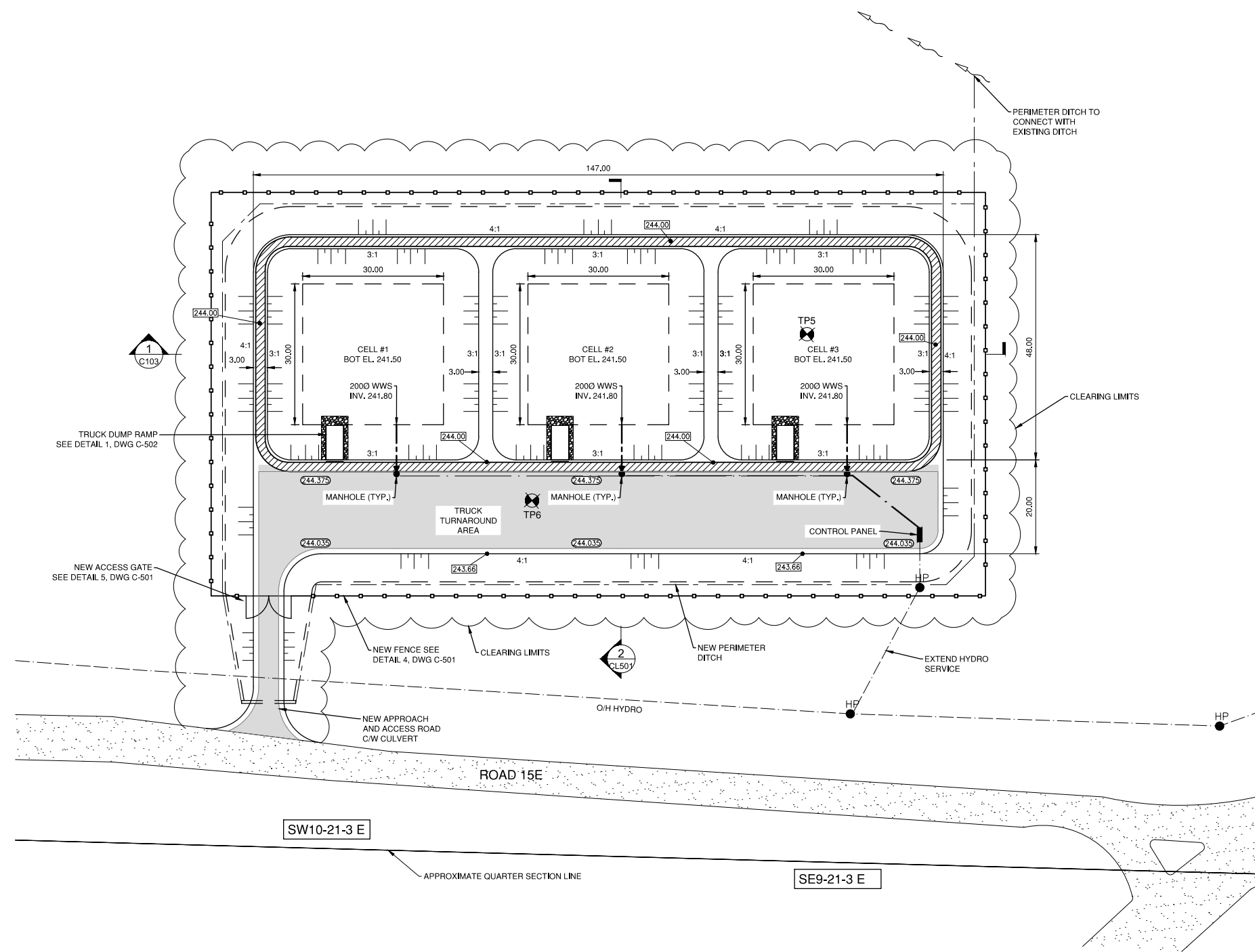
DESIGNED BY: DTGB
 DRAWN BY: IM
 CHECKED BY: DTGB
 DISCIPLINE: CIVIL

ISSUE: ENVIRONMENTAL APPROVALS
 DATE OF: 2020-11-13

REV # 0

L:\Projects\2018\181-03988-00 R.M. of Gimli Sludge Storage Ponds & WDG (D. B. 03) (DWG) Working Drawings\DWG\Civil\Sheet\CrossSectional - Evaporation Pond\Gimli_CrossSectional.dwg, Nov 13, 2020 10:56am BY (Dana, Bredin)

- GENERAL NOTES:**
- LOCATION OF UNDERGROUND STRUCTURES AS SHOWN IS BASED ON THE BEST INFORMATION AVAILABLE, BUT NO GUARANTEE IS GIVEN THAT ALL EXISTING UTILITIES ARE SHOWN OR THAT THE GIVEN LOCATIONS ARE EXACT. CONFIRMATION OF EXISTENCE AND EXACT LOCATION OF ALL SERVICES MUST BE OBTAINED FROM THE INDIVIDUAL UTILITIES BEFORE PROCEEDING WITH CONSTRUCTION. THE CONTRACTOR SHALL NOTIFY THE CONSULTANT OF ANY ERROR OR OMISSION IN THE LOCATION OF ALL EXISTING UTILITIES SHOWN ON THE DRAWING.
 - DESCRIPTION OF PROPERTY LIMITS, AND EXISTING AND/OR PROPOSED FEATURES RELATIVE TO THESE LIMITS AS SHOWN ON THIS DRAWING DO NOT REPRESENT A LEGAL SURVEY. WSP MAKES NO REPRESENTATION OR GUARANTEE THAT THE PROPERTY LIMIT INFORMATION IS ACCURATE. WSP ACCEPTS NO RESPONSIBILITY FOR DAMAGES, IF ANY, SUFFERED BY ANY THIRD PARTY AS A RESULT OF DECISIONS OR ACTIONS BASED ON THIS DRAWING.
 - DRAWINGS ARE IN METRIC. WHOLE NUMBERS INDICATE MILLIMETRES, AND DECIMALIZED NUMBERS INDICATE METRES.



EXISTING	LEGEND-PLAN	PROPOSED	EXISTING	LEGEND-PLAN	PROPOSED
59.367			GROUND ELEVATION		259.367
150 WM	WATER MAIN	150 WM	00.00		ROAD ELEVATION
300 LDS	LAND DRAINAGE SEWER	300 LDS	00.00		DYKE ELEVATION
250 WWS	WASTE WATER SEWER	250 WWS	00.00		DITCH ELEVATION
250 FM	FORCEMAIN	250 FM			SIGN / SURVEY BAR
G	GAS		TH		TEST HOLE/TEST PIT
CO	BELM'S FIBRE				
PO	OVERHEAD POWER		EO		GUY WIRE / HYDRO POLE
PU	UNDERGROUND POWER				
	EDGE OF ROAD / DYKE				CURB STOP / PLUG
	DYKE TOE				VALVE / HYDRANT
	PROPERTY LINE				MANHOLE / CLEANOUT
	FENCE				RIP RAP
	TREE OR SHRUB LINE				GRANULAR MATERIAL
	CULVERT				CONCRETE
	FLOW DIRECTION				CLAY CORE
	DITCH/SWALE				IN SITU TILL

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SEAL:

ENGINEERS
GEOSCIENTISTS
MANITOBA
Certificate of Authorization
WSP Canada Inc.
No. 5750 Date NOVEMBER 13, 2020

CLIENT:

R.M. OF GIMLI
EVAPORATION POND FACILITY

CLIENT REF. #:

PROJECT:

PROJECT NO:
181-03988-00

DATE:
2020-11-13

180 BUFFALO PLACE
WINNEPEG, MANITOBA
CANADA R3T 8B8
PHONE: 204-477-4655 FAX: 204-474-2884
WWW.WSP.COM

ORIGINAL SCALE:
1:500

TITLE:
PROPOSED SITE PLAN

SHEET NUMBER:
C-102

DESIGNED BY:
DTGB

DRAWN BY:
IM

CHECKED BY:
DTGB

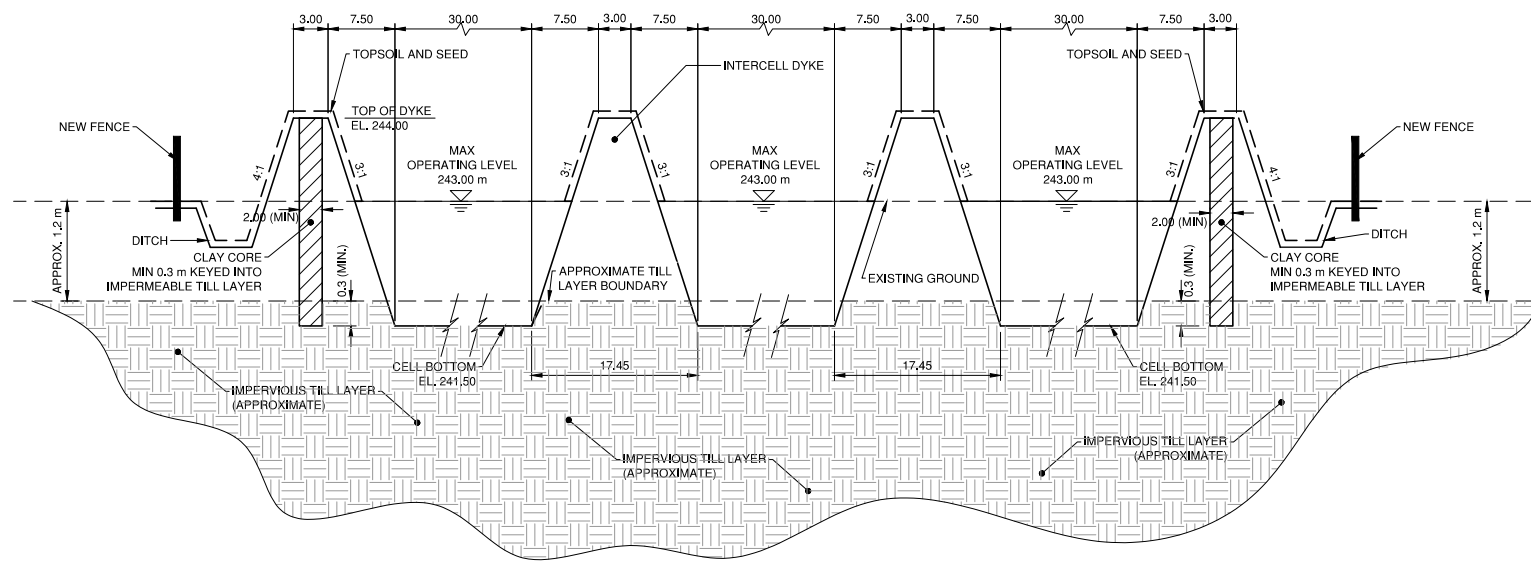
DISCIPLINE:
CIVIL

ISSUE:
ENVIRONMENTAL APPROVALS

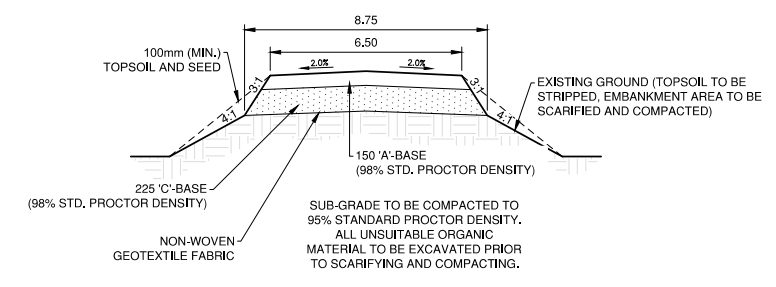
DATE OF: 2020-11-13

REV #:
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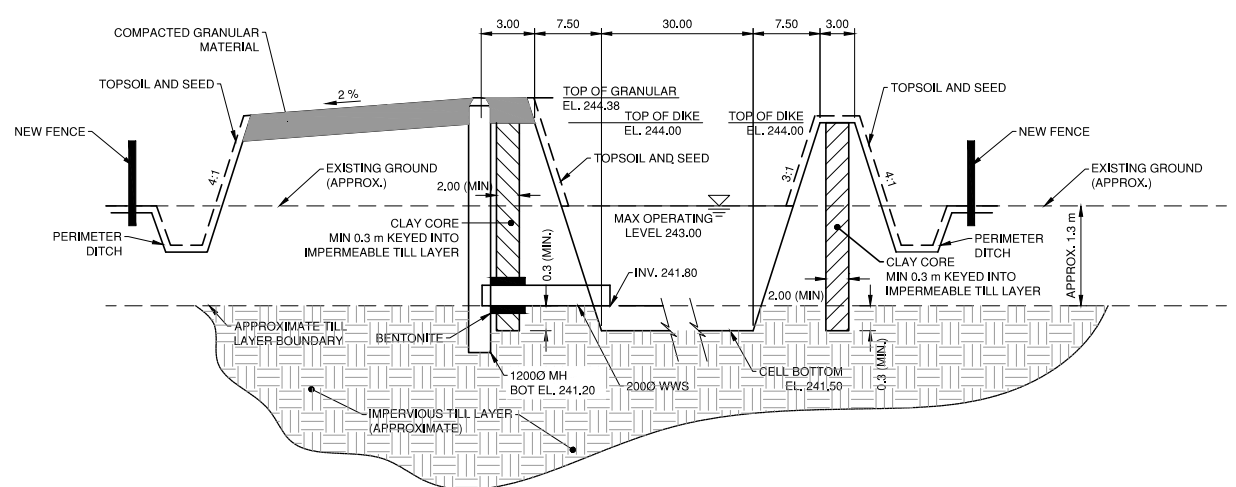
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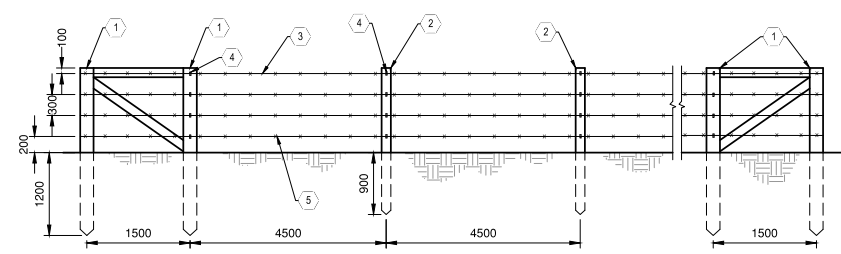
1 NORTH-SOUTH SCHEMATIC CROSS SECTION
N.T.S.



3 ACCESS ROAD GRANULAR DETAIL
N.T.S.

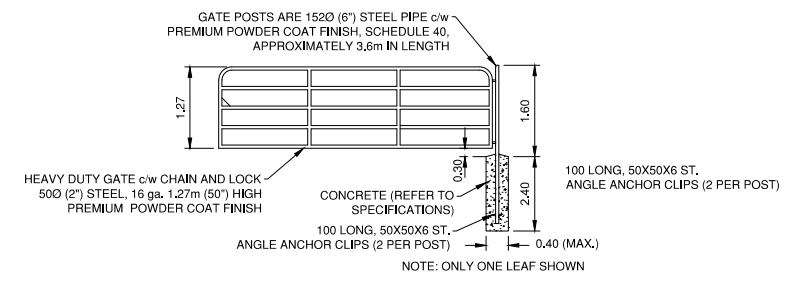


2 EAST-WEST SCHEMATIC CROSS SECTION
N.T.S.



4 BARBED WIRE PERIMETER FENCE DETAIL
N.T.S.

- NOTES:
- CORNER POSTS: 1750 TREATED WOOD POST, 2400 LONG
 - REGULAR POSTS: 1250 TREATED WOOD POST, 2100 LONG
 - 2 STRAND 20 GALVANIZED WIRE (TYP.)
 - WIRE FENCE STAPLES (TYP.)
 - 4 POINT BARBS (TYP.)



5 ACCESS GATE DETAIL
N.T.S.

EXISTING	LEGEND-PLAN	PROPOSED	EXISTING	LEGEND-PLAN	PROPOSED
150 WM	WATER MAIN	150 WM	59.367	GROUND ELEVATION	259.367
300 LDS	LAND DRAINAGE SEWER	300 LDS	00.00	ROAD ELEVATION	00.00
250 WWS	WASTE WATER SEWER	250 WWS	00.00	DYKE ELEVATION	00.00
250 FM	FORCE MAIN	250 FM	00.00	DITCH ELEVATION	00.00
G	GAS	TH	TH	SIGN / SURVEY BAR	
CB	BELT/MS/FIBRE	TH	TH	TEST HOLE/TEST PIT	
PO	OVERHEAD POWER	EO	EO	GUY WIRE / HYDRO POLE	
PU	UNDERGROUND POWER	EO	EO	CURB STOP / PLUG	
	EDGE OF ROAD / DYKE			VALVE / HYDRANT	
	DYKE TOE			MANHOLE / CLEANOUT	
	PROPERTY LINE			RIP RAP	
	FENCE			GRANULAR MATERIAL	
	TREE OR SHRUB LINE			CONCRETE	
	CULVERT			CLAY CORE	
	FLOW DIRECTION			IN SITU TILL	
	DITCH/SWALE				

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THIS DRAWING IS NOT TO BE SCALED.

SEAL:

**ENGINEERS
GEOSCIENTISTS
MANITOBA**

Certificate of Authorization
WSP Canada Inc.
No. 5750 Date: NOVEMBER 13, 2020

PROVINCE OF MANITOBA
D.T.G. BREIDIN
Member
33884
REGISTERED PROFESSIONAL ENGINEER
2020-11-13

CLIENT:

GIMLI
THE HEART OF NEW IRELAND

CLIENT REF. #:

PROJECT:

**R.M. OF GIMLI
EVAPORATION POND FACILITY**

PROJECT NO:
181-03988-00

DATE:
2020-11-13

wsp

180 BUFFALO PLACE
WINNEPEG, MANITOBA
CANADA R3T 0B8
PHONE: 204-474-9650 FAX: 204-474-2884
WWW.WSP.COM

ORIGINAL SCALE:
NTS

TITLE:

SECTION AND DETAILS

SHEET NUMBER:
C-501

DESIGNED BY:
DTGB

DRAWN BY:
IM

CHECKED BY:
DTGB

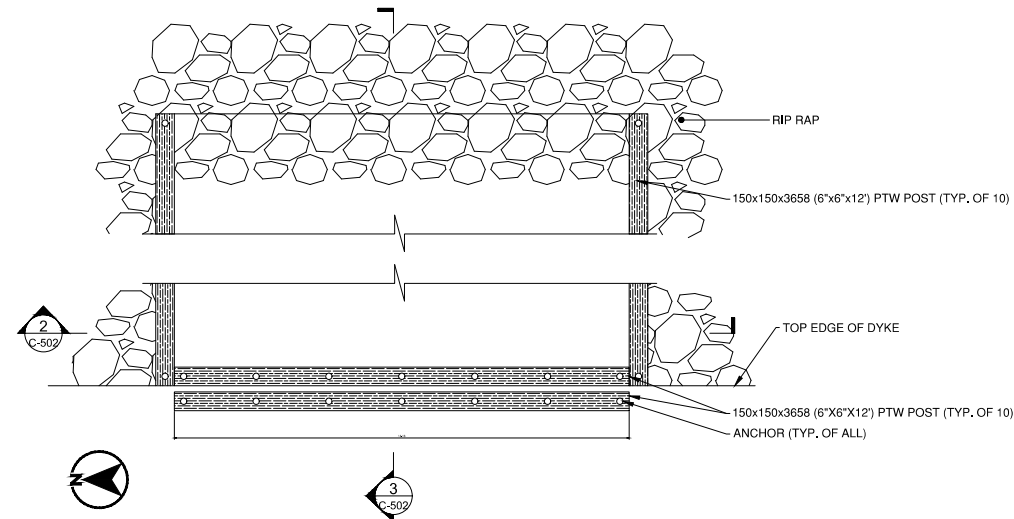
DISCIPLINE:
CIVIL

ISSUE:
ENVIRONMENTAL APPROVALS

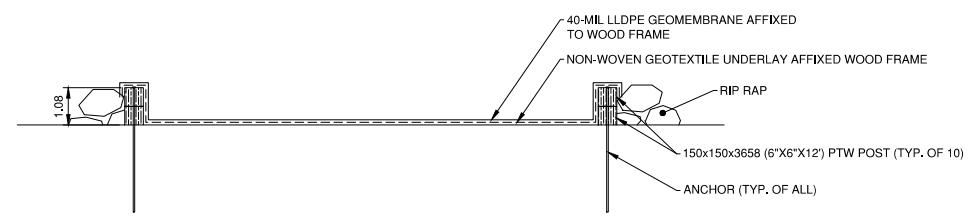
DATE OF: 2020-11-13

REV #:
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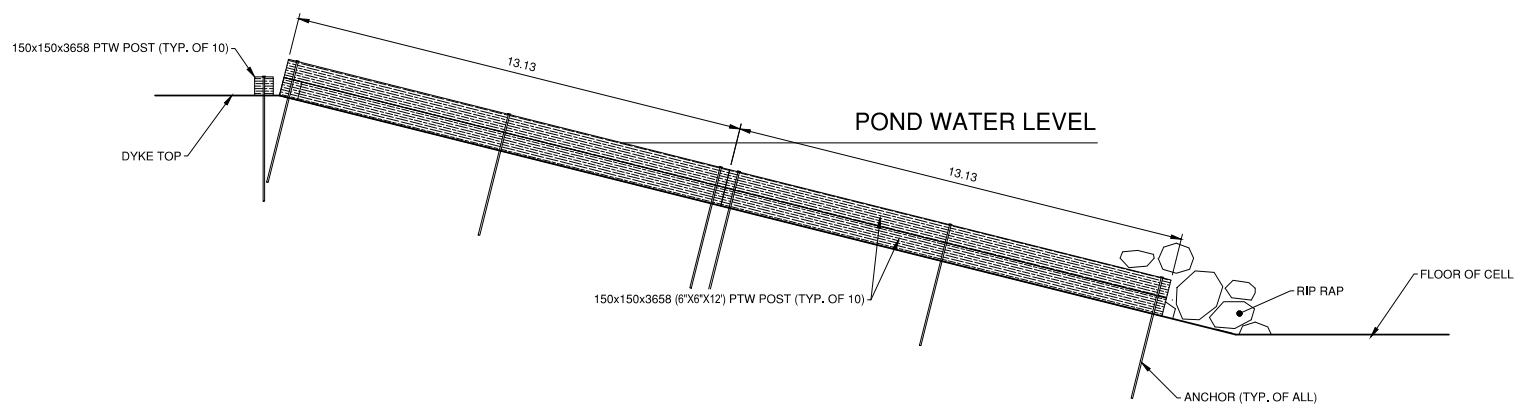
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1 TRUCK DUMP RAMP PLAN VIEW
N.T.S.



2 TRUCK DUMP RAMP SECTION VIEW
N.T.S.



3 TRUCK DUMP RAMP ELEVATION VIEW
N.T.S.

EXISTING	LEGEND-PLAN	PROPOSED	EXISTING	LEGEND-PLAN	PROPOSED
59.367			GROUND ELEVATION		259.367
150 WM	WATER MAIN	150 WM	00.00		ROAD ELEVATION
300 LDS	LAND DRAINAGE SEWER	300 LDS	00.00		DYKE ELEVATION
250 WWS	WASTE WATER SEWER	250 WWS	00.00		DITCH ELEVATION
250 FM	FORCE MAIN	250 FM	#		SIGN / SURVEY BAR
G	GAS		TH		TEST HOLE/TEST PIT
BE	BELM'S / FIBRE				
PO	OVERHEAD POWER				
PU	UNDERGROUND POWER				
	EDGE OF ROAD / DYKE				
	DYKE TOE				
	PROPERTY LINE				
	FENCE				
	TREE OR SHRUB LINE				
	CULVERT				
	FLOW DIRECTION				
	DITCH/SWALE				

IS	RE	DATE	DESCRIPTION
1	0	2020-11-13	ENVIRONMENTAL APPROVALS

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SEAL: ENGINEERS GEOSCIENTISTS MANITOBA
Certificate of Authorization WSP Canada Inc. No. 5750 Date NOVEMBER 13, 2020

PROVINCE OF MANITOBA
D.T.G. BREIDIN
Member
33884
REGISTERED PROFESSIONAL ENGINEER
2020-11-13

CLIENT: R.M. OF GIMLI
EVAPORATION POND FACILITY

PROJECT: R.M. OF GIMLI
EVAPORATION POND FACILITY

CLIENT REF. #: 181-03988-00

PROJECT NO: 181-03988-00

DATE: 2020-11-13

ORIGINAL SCALE: NTS

TITLE: TRUCK RAMP DETAILS

DESIGNED BY: DTGB
DRAWN BY: IM
CHECKED BY: DTGB
DISCIPLINE: CIVIL

SHEET NUMBER: C-502

ISSUE: ENVIRONMENTAL APPROVALS
DATE OF: 2020-11-13

REV # 0

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APPENDIX

E

WASTEWATER
ANALYSIS RESULTS



WSP Canada Inc.
ATTN: JUSTIN RAK-BANVILLE
1600 Buffalo Place
Winnipeg MB R3T 6B8

Date Received: 01-JUN-18
Report Date: 11-JUN-18 07:49 (MT)
Version: FINAL

Client Phone: 204-477-6650

Certificate of Analysis

Lab Work Order #: L2104642
Project P.O. #: NOT SUBMITTED
Job Reference: RM OF GIMLI WW SAMPLING
C of C Numbers:
Legal Site Desc:

Hua Wo
Chemistry Laboratory Manager

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

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2104642-1 DRY HOUSE CLEANING WASTE WATER							
Sampled By: MC on 31-MAY-18 @ 13:00							
Matrix: WASTE							
Miscellaneous Parameters							
Ammonia, Total (as N)	1.64		0.010	mg/L		05-JUN-18	R4070649
Biochemical Oxygen Demand	2570		600	mg/L		02-JUN-18	R4075862
Chemical Oxygen Demand	4810		100	mg/L		06-JUN-18	R4074551
Microtox	See attached.					01-JUN-18	R4066410
Phosphorus (P)-Total	4.62		0.010	mg/L		08-JUN-18	R4076908
Sulfate (SO4)	647		3.0	mg/L		04-JUN-18	R4072120
Total Kjeldahl Nitrogen	83		10	mg/L	04-JUN-18	05-JUN-18	R4070007
Total Suspended Solids	886		6.0	mg/L		06-JUN-18	R4075014
pH	6.04		0.10	pH units		05-JUN-18	R4071527
Total Metals in Water by CRC ICPMS							
Aluminum (Al)-Total	0.113		0.0030	mg/L	05-JUN-18	05-JUN-18	R4071471
Antimony (Sb)-Total	0.00113		0.00010	mg/L	05-JUN-18	05-JUN-18	R4071471
Arsenic (As)-Total	0.0137		0.00010	mg/L	05-JUN-18	05-JUN-18	R4071471
Barium (Ba)-Total	0.140		0.00010	mg/L	05-JUN-18	05-JUN-18	R4071471
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	05-JUN-18	05-JUN-18	R4071471
Bismuth (Bi)-Total	0.000054		0.000050	mg/L	05-JUN-18	05-JUN-18	R4071471
Boron (B)-Total	0.280		0.010	mg/L	05-JUN-18	05-JUN-18	R4071471
Cadmium (Cd)-Total	0.000472		0.0000050	mg/L	05-JUN-18	05-JUN-18	R4071471
Calcium (Ca)-Total	84.9		0.050	mg/L	05-JUN-18	05-JUN-18	R4071471
Cesium (Cs)-Total	0.000071		0.000010	mg/L	05-JUN-18	05-JUN-18	R4071471
Chromium (Cr)-Total	0.00971		0.00010	mg/L	05-JUN-18	05-JUN-18	R4071471
Cobalt (Co)-Total	0.00157		0.00010	mg/L	05-JUN-18	05-JUN-18	R4071471
Copper (Cu)-Total	1.21		0.050	mg/L	05-JUN-18	05-JUN-18	R4071471
Iron (Fe)-Total	4.15		0.010	mg/L	05-JUN-18	05-JUN-18	R4071471
Lead (Pb)-Total	0.00766		0.000050	mg/L	05-JUN-18	05-JUN-18	R4071471
Lithium (Li)-Total	0.0651		0.0010	mg/L	05-JUN-18	05-JUN-18	R4071471
Magnesium (Mg)-Total	164		0.0050	mg/L	05-JUN-18	05-JUN-18	R4071471
Manganese (Mn)-Total	0.281		0.00010	mg/L	05-JUN-18	05-JUN-18	R4071471
Molybdenum (Mo)-Total	0.0136		0.000050	mg/L	05-JUN-18	05-JUN-18	R4071471
Nickel (Ni)-Total	0.0152		0.00050	mg/L	05-JUN-18	05-JUN-18	R4071471
Potassium (K)-Total	90.4		0.050	mg/L	05-JUN-18	05-JUN-18	R4071471
Phosphorus (P)-Total	60.8		0.050	mg/L	05-JUN-18	05-JUN-18	R4071471
Rubidium (Rb)-Total	0.0672		0.00020	mg/L	05-JUN-18	05-JUN-18	R4071471
Selenium (Se)-Total	0.00132		0.000050	mg/L	05-JUN-18	05-JUN-18	R4071471
Silicon (Si)-Total	11.5		0.10	mg/L	05-JUN-18	05-JUN-18	R4071471
Silver (Ag)-Total	0.00107		0.000010	mg/L	05-JUN-18	05-JUN-18	R4071471
Sodium (Na)-Total	644		5.0	mg/L	05-JUN-18	05-JUN-18	R4071471
Strontium (Sr)-Total	0.711		0.00020	mg/L	05-JUN-18	05-JUN-18	R4071471
Sulfur (S)-Total	247		0.50	mg/L	05-JUN-18	05-JUN-18	R4071471
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	05-JUN-18	05-JUN-18	R4071471
Thallium (Tl)-Total	0.000013		0.000010	mg/L	05-JUN-18	05-JUN-18	R4071471
Thorium (Th)-Total	<0.00010		0.00010	mg/L	05-JUN-18	05-JUN-18	R4071471
Tin (Sn)-Total	0.00232		0.00010	mg/L	05-JUN-18	05-JUN-18	R4071471
Titanium (Ti)-Total	0.00318		0.00030	mg/L	05-JUN-18	05-JUN-18	R4071471
Tungsten (W)-Total	0.0228		0.00010	mg/L	05-JUN-18	05-JUN-18	R4071471
Uranium (U)-Total	0.000885		0.000010	mg/L	05-JUN-18	05-JUN-18	R4071471
Vanadium (V)-Total	0.00107		0.00050	mg/L	05-JUN-18	05-JUN-18	R4071471
Zinc (Zn)-Total	0.643		0.0030	mg/L	05-JUN-18	05-JUN-18	R4071471
Zirconium (Zr)-Total	0.000381		0.000060	mg/L	05-JUN-18	05-JUN-18	R4071471
Alcohols and Glycols in Water							
Ethanol	236		10	mg/L		05-JUN-18	R4074907

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2104642-1 DRY HOUSE CLEANING WASTE WATER							
Sampled By: MC on 31-MAY-18 @ 13:00							
Matrix: WASTE							
Alcohols and Glycols in Water							
Isobutanol	<10		10	mg/L		05-JUN-18	R4074907
Isopropanol	<10		10	mg/L		05-JUN-18	R4074907
Methanol	<10		10	mg/L		05-JUN-18	R4074907
n-Butanol	<10		10	mg/L		05-JUN-18	R4074907
Pentanol	<10		10	mg/L		05-JUN-18	R4074907
sec-Butanol	<10		10	mg/L		05-JUN-18	R4074907
Diethylene Glycol	<10		10	mg/L		05-JUN-18	R4074907
Ethylene Glycol	<10		10	mg/L		05-JUN-18	R4074907
Propylene Glycol	<10		10	mg/L		05-JUN-18	R4074907
Triethylene Glycol	<10		10	mg/L		05-JUN-18	R4074907
Tetraethylene Glycol	<25		25	mg/L		05-JUN-18	R4074907
Speciated Oil and Grease Gravimetric							
Mineral Oil & Grease - Gravimetric							
Mineral Oil & Grease	<5.0		5.0	mg/L		08-JUN-18	R4076402
Oil & Grease - Gravimetric							
Oil and Grease	208		5.0	mg/L		08-JUN-18	R4076385
Speciated Oil and Grease A/V Calculation							
Animal/Veg Oil & Grease	208		5.0	mg/L		09-JUN-18	

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BOD-WP	Water	Biochemical Oxygen Demand (BOD)	APHA 5210 B
Samples are diluted and seeded and then incubated in airtight bottles at 20°C for 5 days. Dissolved oxygen is measured initially and after incubation, and results are computed from the difference between initial and final DO.			
COD-WP	Water	Chemical Oxygen Demand	APHA 5220 D
This analysis is carried out using procedures adapted from APHA Method 5220 "Chemical Oxygen Demand (COD)". Chemical oxygen demand is determined using the closed reflux colorimetric method.			
EC-SCREEN-WP	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other test eg. IC, TDS, TSS, etc			
GLY+ALC-FID-WP	Water	Alcohols and Glycols in Water	ASTM D2908-91
Alcohols and glycols in water are determined by gas chromatography with flame ionization detection (GC-FID).			
MET-T-CCMS-WP	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod.)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
MICROTOX-WP	Water	Microtox	EPS/1/RM/24
This test measures the light output of luminescent marine bacteria before and after exposure to a sample of unknown toxicity. The degree of light loss is an indication of metabolic inhibition in the test organism, and therefore the degree of toxicity of the sample. Inhibition is usually expressed as the IC50, or the concentration which caused 50% inhibition of light.			
Studies have shown the major contributor to measurement uncertainty (MU) for this test is the biological response. The best estimation of MU is therefore provided in the test report as the 95% Confidence Interval of the reference toxicant.			
MOG-GRAV-WP	Water	Mineral Oil & Grease - Gravimetric	EPA 1664 (modified)
Water samples are acidified and extracted with hexane; the hexane extract is treated with silica gel to remove animal fat and vegetable oils; then collected in a pre-weighed vial. The solvent is evaporated and Mineral Oil & Grease is determined from the weight of the residue in the vial.			
N-TOTKJ-WP	Water	Total Kjeldahl Nitrogen	APHA 4500 NorgD (modified)
Aqueous samples are digested in a block digester with sulfuric acid and copper sulfate as a catalyst. Total Kjeldahl Nitrogen is then analyzed using a discrete analyzer with colorimetric detection.			
NH3-COL-WP	Water	Ammonia by colour	APHA 4500 NH3 F
Ammonia in water samples forms indophenol when reacted with hypochlorite and phenol. The intensity is amplified by the addition of sodium nitroprusside and measured colourmetrically.			
OG-GRAV-WP	Water	Oil & Grease - Gravimetric	EPA 1664 (modified)
Water samples are acidified and extracted with hexane; the hexane extract is collected in a pre-weighed vial. The solvent is evaporated and Total Oil & Grease is determined from the weight of the residue in the vial.			
OG-SPEC-CALC-WP	Water	Speciated Oil and Grease A/V Calculation	CALCULATION
Sample is extracted with hexane, sample speciation into mineral and animal/vegetable fractions is achieved via silica gel separation and is then determined gravimetrically.			
P-T-L-COL-WP	Water	Phosphorus, Total	APHA 4500 P PHOSPHORUS-L
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorous is determined colourmetrically after persulphate digestion of the sample.			
PH-WP	Water	pH	APHA 4500H
The pH of a sample is the determination of the activity of the hydrogen ions by potentiometric measurement using a standard hydrogen electrode and a reference electrode.			
SO4-IC-N-WP	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
SOLIDS-TOTSUS-WP	Water	Total Suspended Solids	APHA 2540 D (modified)
Total suspended solids in aqueous matrices is determined gravimetrically after drying the residue at 103 105°C.			

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

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
---------------	--------	------------------	--------------------

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

Laboratory Definition Code	Laboratory Location
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

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

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

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

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

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

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

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



Quality Control Report

Workorder: L2104642

Report Date: 11-JUN-18

Page 1 of 7

Client: WSP Canada Inc.
 1600 Buffalo Place
 Winnipeg MB R3T 6B8
 Contact: JUSTIN RAK-BANVILLE

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BOD-WP		Water						
Batch	R4075862							
WG2787092-2	LCS							
Biochemical Oxygen Demand			106.8		%		85-115	02-JUN-18
WG2787092-1	MB							
Biochemical Oxygen Demand			<2.0		mg/L		2	02-JUN-18
COD-WP		Water						
Batch	R4074551							
WG2790753-2	LCS							
Chemical Oxygen Demand			96.9		%		85-115	06-JUN-18
WG2790753-1	MB							
Chemical Oxygen Demand			<20		mg/L		20	06-JUN-18
GLY+ALC-FID-WP		Water						
Batch	R4074907							
WG2789890-2	LCS							
Ethanol			96.6		%		70-130	05-JUN-18
Isobutanol			96.6		%		70-130	05-JUN-18
Isopropanol			92.0		%		70-130	05-JUN-18
Methanol			91.3		%		70-130	05-JUN-18
n-Butanol			97.2		%		70-130	05-JUN-18
Pentanol			101.3		%		70-130	05-JUN-18
sec-Butanol			96.2		%		70-130	05-JUN-18
Diethylene Glycol			98.1		%		70-130	05-JUN-18
Ethylene Glycol			97.4		%		70-130	05-JUN-18
Propylene Glycol			99.4		%		70-130	05-JUN-18
Triethylene Glycol			99.0		%		70-130	05-JUN-18
Tetraethylene Glycol			93.8		%		70-130	05-JUN-18
WG2789890-1	MB							
Ethanol			<10		mg/L		10	05-JUN-18
Isobutanol			<10		mg/L		10	05-JUN-18
Isopropanol			<10		mg/L		10	05-JUN-18
Methanol			<10		mg/L		10	05-JUN-18
n-Butanol			<10		mg/L		10	05-JUN-18
Pentanol			<10		mg/L		10	05-JUN-18
sec-Butanol			<10		mg/L		10	05-JUN-18
Diethylene Glycol			<10		mg/L		10	05-JUN-18
Ethylene Glycol			<10		mg/L		10	05-JUN-18
Propylene Glycol			<10		mg/L		10	05-JUN-18



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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
GLY+ALC-FID-WP		Water						
Batch	R4074907							
WG2789890-1	MB							
Triethylene Glycol			<10		mg/L		10	05-JUN-18
Tetraethylene Glycol			<25		mg/L		25	05-JUN-18
MET-T-CCMS-WP		Water						
Batch	R4071471							
WG2788647-2	LCS							
Aluminum (Al)-Total			100.8		%		80-120	05-JUN-18
Antimony (Sb)-Total			102.5		%		80-120	05-JUN-18
Arsenic (As)-Total			102.8		%		80-120	05-JUN-18
Barium (Ba)-Total			103.0		%		80-120	05-JUN-18
Beryllium (Be)-Total			101.8		%		80-120	05-JUN-18
Bismuth (Bi)-Total			101.7		%		80-120	05-JUN-18
Boron (B)-Total			102.8		%		80-120	05-JUN-18
Cadmium (Cd)-Total			102.6		%		80-120	05-JUN-18
Calcium (Ca)-Total			101.6		%		80-120	05-JUN-18
Cesium (Cs)-Total			99.9		%		80-120	05-JUN-18
Chromium (Cr)-Total			99.0		%		80-120	05-JUN-18
Cobalt (Co)-Total			99.96		%		80-120	05-JUN-18
Copper (Cu)-Total			101.4		%		80-120	05-JUN-18
Iron (Fe)-Total			99.5		%		80-120	05-JUN-18
Lead (Pb)-Total			100.8		%		80-120	05-JUN-18
Lithium (Li)-Total			102.0		%		80-120	05-JUN-18
Magnesium (Mg)-Total			106.4		%		80-120	05-JUN-18
Manganese (Mn)-Total			99.9		%		80-120	05-JUN-18
Molybdenum (Mo)-Total			102.2		%		80-120	05-JUN-18
Nickel (Ni)-Total			99.8		%		80-120	05-JUN-18
Potassium (K)-Total			100.2		%		80-120	05-JUN-18
Phosphorus (P)-Total			104.7		%		80-120	05-JUN-18
Rubidium (Rb)-Total			103.2		%		80-120	05-JUN-18
Selenium (Se)-Total			102.9		%		80-120	05-JUN-18
Silicon (Si)-Total			103.8		%		80-120	05-JUN-18
Silver (Ag)-Total			102.2		%		80-120	05-JUN-18
Sodium (Na)-Total			104.1		%		80-120	05-JUN-18
Strontium (Sr)-Total			100.0		%		80-120	05-JUN-18
Sulfur (S)-Total			105.5		%		80-120	05-JUN-18



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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WP		Water						
Batch	R4071471							
WG2788647-2 LCS								
Tellurium (Te)-Total			96.5		%		80-120	05-JUN-18
Thallium (Tl)-Total			99.3		%		80-120	05-JUN-18
Thorium (Th)-Total			97.8		%		80-120	05-JUN-18
Tin (Sn)-Total			101.1		%		80-120	05-JUN-18
Titanium (Ti)-Total			97.1		%		80-120	05-JUN-18
Tungsten (W)-Total			101.4		%		80-120	05-JUN-18
Uranium (U)-Total			103.5		%		80-120	05-JUN-18
Vanadium (V)-Total			102.2		%		80-120	05-JUN-18
Zinc (Zn)-Total			99.7		%		80-120	05-JUN-18
Zirconium (Zr)-Total			101.8		%		80-120	05-JUN-18
WG2788647-1 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	05-JUN-18
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	05-JUN-18
Arsenic (As)-Total			<0.00010		mg/L		0.0001	05-JUN-18
Barium (Ba)-Total			<0.00010		mg/L		0.0001	05-JUN-18
Beryllium (Be)-Total			<0.00010		mg/L		0.0001	05-JUN-18
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	05-JUN-18
Boron (B)-Total			<0.010		mg/L		0.01	05-JUN-18
Cadmium (Cd)-Total			<0.0000050		mg/L		0.000005	05-JUN-18
Calcium (Ca)-Total			<0.050		mg/L		0.05	05-JUN-18
Cesium (Cs)-Total			<0.000010		mg/L		0.00001	05-JUN-18
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	05-JUN-18
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	05-JUN-18
Copper (Cu)-Total			<0.00050		mg/L		0.0005	05-JUN-18
Iron (Fe)-Total			<0.010		mg/L		0.01	05-JUN-18
Lead (Pb)-Total			<0.000050		mg/L		0.00005	05-JUN-18
Lithium (Li)-Total			<0.0010		mg/L		0.001	05-JUN-18
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	05-JUN-18
Manganese (Mn)-Total			<0.00010		mg/L		0.0001	05-JUN-18
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	05-JUN-18
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	05-JUN-18
Potassium (K)-Total			<0.050		mg/L		0.05	05-JUN-18
Phosphorus (P)-Total			<0.050		mg/L		0.05	05-JUN-18
Rubidium (Rb)-Total			<0.00020		mg/L		0.0002	05-JUN-18

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WP		Water						
Batch R4071471								
WG2788647-1 MB								
Selenium (Se)-Total			<0.000050		mg/L		0.00005	05-JUN-18
Silicon (Si)-Total			<0.10		mg/L		0.1	05-JUN-18
Silver (Ag)-Total			<0.000010		mg/L		0.00001	05-JUN-18
Sodium (Na)-Total			<0.050		mg/L		0.05	05-JUN-18
Strontium (Sr)-Total			<0.00020		mg/L		0.0002	05-JUN-18
Sulfur (S)-Total			<0.50		mg/L		0.5	05-JUN-18
Tellurium (Te)-Total			<0.00020		mg/L		0.0002	05-JUN-18
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	05-JUN-18
Thorium (Th)-Total			<0.00010		mg/L		0.0001	05-JUN-18
Tin (Sn)-Total			<0.00010		mg/L		0.0001	05-JUN-18
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	05-JUN-18
Tungsten (W)-Total			<0.00010		mg/L		0.0001	05-JUN-18
Uranium (U)-Total			<0.000010		mg/L		0.00001	05-JUN-18
Vanadium (V)-Total			<0.00050		mg/L		0.0005	05-JUN-18
Zinc (Zn)-Total			<0.0030		mg/L		0.003	05-JUN-18
Zirconium (Zr)-Total			<0.000060		mg/L		0.00006	05-JUN-18
MOG-GRAV-WP		Water						
Batch R4076402								
WG2791332-2 LCS								
Mineral Oil & Grease			86.9		%		70-130	08-JUN-18
WG2791332-1 MB								
Mineral Oil & Grease			<5.0		mg/L		5	08-JUN-18
N-TOTKJ-WP		Water						
Batch R4070007								
WG2785512-14 LCS								
Total Kjeldahl Nitrogen			94.9		%		75-125	05-JUN-18
WG2785512-13 MB								
Total Kjeldahl Nitrogen			<0.20		mg/L		0.2	05-JUN-18
NH3-COL-WP		Water						
Batch R4070649								
WG2789273-2 LCS								
Ammonia, Total (as N)			90.5		%		85-115	05-JUN-18
WG2789273-1 MB								
Ammonia, Total (as N)			<0.010		mg/L		0.01	05-JUN-18
OG-GRAV-WP		Water						



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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
OG-GRAV-WP		Water						
Batch	R4076385							
WG2791326-2	LCS							
Oil and Grease			94.9		%		70-130	08-JUN-18
WG2791326-1	MB							
Oil and Grease			<5.0		mg/L		5	08-JUN-18
P-T-L-COL-WP		Water						
Batch	R4076908							
WG2792050-6	LCS							
Phosphorus (P)-Total			95.3		%		80-120	08-JUN-18
WG2792050-5	MB							
Phosphorus (P)-Total			<0.0010		mg/L		0.001	08-JUN-18
PH-WP		Water						
Batch	R4071527							
WG2789626-2	LCS							
pH			7.42		pH units		7.3-7.5	05-JUN-18
SO4-IC-N-WP		Water						
Batch	R4072120							
WG2787882-6	LCS							
Sulfate (SO4)			99.1		%		90-110	04-JUN-18
WG2787882-5	MB							
Sulfate (SO4)			<0.30		mg/L		0.3	04-JUN-18
SOLIDS-TOTSUS-WP		Water						
Batch	R4075014							
WG2789646-10	LCS							
Total Suspended Solids			95.3		%		85-115	06-JUN-18
WG2789646-9	MB							
Total Suspended Solids			<2.0		mg/L		2	06-JUN-18

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Legend:

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

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Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
pH	1	31-MAY-18 13:00	05-JUN-18 12:00	0.25	119	hours	EHTR-FM

Legend & Qualifier Definitions:

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

Notes*:

Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2104642 were received on 01-JUN-18 13:00.

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

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

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



Microtox Bioassay Test Report

Sample ID:	L2104642-1
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Summary Results

5 min IC50 (%):	2.140
95% Confidence Interval (%):	1.224 - 3.740
15 min IC50 (%):	2.871
95% Confidence Interval (%):	1.804 - 4.569
30 min IC50 (%):	3.672
95% Confidence Interval (%):	2.492 - 5.409

Sample Information

Sample Origin:	WSP Canada Inc.
Sample Description:	Dry House Cleaning Wastewater
Sampling Date and Time:	31-May-18 13:00
Sampling Method:	Grab
Sampled By:	MC
Container(s) Description:	1 x 100 mL amber glass bottle
Sample Volume:	100 mL
Date and Time Received:	01-Jun-18 13:00
Transit Irregularities:	None
Storage Temperature (°C):	n/a

Test Information

Test Organism:	Vibrio fischeri
Test Description:	Basic Test
Reference Method:	EPS 1/RM/24, Environment Canada
Performed By:	JRB
Starting Date and Time:	01-Jun-18 16:26
Microtox Analyzer:	Model #500
Microtox Reagent Lot#:	17K4276
Date Obtained:	18-Apr-18
Temperature of Storage:	-20°C
Date and Time Reagent Reconstituted:	01-Jun-18 15:35
Reconstitution Solution Lot#:	16D4031
Salinity Adjustment:	MOAS Lot#: 17D4112
Diluent Lot#:	17H4207
Deviations from Reference Method:	None



Condition of Sample Upon Arrival

Observations

Colour:	Orange		
Odour:	Strong		
Turbidity:	High		
Solids:	High		
Temperature (°C):	15	Thermometer	S/N 91154465
Dissolved Oxygen (%):	9.8	YSI Dissolved Oxygen Meter	S/N 15M102668
pH:	6.09	VWR SympHony pH Meter	S/N D01908
Total Chlorine (mg/L):	n/a		

Sample Pre-Treatment

pH Adjustment:	n/a
Centrifugation:	n/a
Charcoal Treatment:	n/a
Chlorine Treatment:	n/a
Volume Aerated (mL):	n/a
Aeration Rate (mL/min/L):	n/a
Aeration Time (min.):	n/a
Post-aeration Dissolved Oxygen (%):	n/a

Colour-Correction Test

5 min IC50 (%):	n/a
95% Confidence Interval (%):	n/a
15 min IC50 (%):	n/a
95% Confidence Interval (%):	n/a
30 min IC50 (%):	n/a
95% Confidence Interval (%):	n/a

Reference Toxicant Test Results

Reference Toxicant:	100 mg/L Phenol
Date and Time Reference Toxicant Initiated:	01-Jun-18 16:00
5 min IC50 v/v (mg/L):	20.46
95% Confidence Interval v/v (mg/L):	17.92 - 23.35
Historic Data Mean IC50 v/v (mg/L):	19.50
Acceptance Range v/v (mg/L):	13.0 - 26.0

Observations/Comments

High toxicity observed. No colour or turbidity observed at the IC50 concentration.		
5 min IC20 (%): n/a	15 min IC20 (%): n/a	30 min IC20 (%): n/a
95% CI (%): n/a	95% CI (%): n/a	95% CI (%): n/a

APPENDIX

D

WEATHER AND
EVAPORATION DATA

Month	Date	Max Temp	Average Temp	Min Temp	Average Relative Humidity	Average Wind Speed	Average Wind Speed	Average Pressure	Solar Radiation	Net Radiation
		[C]	[C]	[C]	[%]	[km/h]	[m/s]	[kPa]	[kJ/m2 per day]	[W/m2]
Oct-20	31/10/2020	5.3	-0.2	-5.7	75	33.5	9.31	100.44	6020	69.67
	30/10/2020	3.2	-0.19	-3.6	80	19	5.28	101.67	6020	69.67
	29/10/2020	-1.7	-7.69	-13.7	71.5	11.5	3.19	102.26	6020	69.67
	28/10/2020	-0.4	-5.4	-10.4	75.5	14.5	4.03	101.58	6020	69.67
	27/10/2020	0.4	-4.14	-8.7	80	18.5	5.14	100.66	6020	69.67
	26/10/2020	-1.3	-4	-6.7	65	23	6.39	102.28	6020	69.67
	25/10/2020	-1.5	-4.25	-7	68	10.5	2.92	102.87	6020	69.67
	24/10/2020	-1	-4.8	-8.6	66	13.5	3.75	102.82	6020	69.67
	23/10/2020	-0.3	-2.8	-5.3	66	13.5	3.75	102.81	6020	69.67
	22/10/2020	2	-2.5	-7	64.5	7	1.94	102.87	6020	69.67
	21/10/2020	0.5	-2.75	-6	85	7	1.94	101.94	6020	69.67
	20/10/2020	2.3	-4.09	-10.5	68	11.5	3.19	102.09	6020	69.67
	19/10/2020	3.5	-2.2	-7.9	64.5	10.5	2.92	102.25	6020	69.67
	18/10/2020	1.1	-2.29	-5.7	64	16.5	4.58	101.85	6020	69.67
	17/10/2020	1.9	-4.89	-11.7	65	12	3.33	101.34	6020	69.67
	16/10/2020	0	-5.05	-10.1	58.5	9	2.50	101.27	6020	69.67
	15/10/2020	2.4	-3.2	-8.8	60.5	15.5	4.31	101.38	6020	69.67
	14/10/2020	6.5	1.4	-3.7	52	20	5.56	100.57	6020	69.67
	13/10/2020	11.6	5.9	0.2	48	23	6.39	100.35	6020	69.67
	12/10/2020	13	8.05	3.1	52.5	23	6.39	100	6020	69.67
	11/10/2020	19	14.05	9.1	68	26	7.22	99.74	6020	69.67
	10/10/2020	10.5	5.65	0.8	71	17	4.72	101.49	6020	69.67
	09/10/2020	12.4	6.85	1.3	64.5	18.5	5.14	100.4	6020	69.67
	08/10/2020	12.9	4.9	-3.1	71.5	10.5	2.92	101.51	6020	69.67
	07/10/2020	13.4	8.19	3	69	18	5.00	101.4	6020	69.67
	06/10/2020	17.4	10.7	4	70.5	16.5	4.58	100.34	6020	69.67
	05/10/2020	18.3	12.1	5.9	63	18.5	5.14	100.25	6020	69.67
	04/10/2020	16.1	5.9	-4.3	66	19.5	5.42	101.46	6020	69.67
	03/10/2020	11.2	2.84	-5.5	74	8.5	2.36	102.4	6020	69.67
	02/10/2020	6.4	0.85	-4.7	67.5	7	1.94	102.48	6020	69.67
	01/10/2020	6.3	1.29	-3.7	72	12.5	3.47	102.72	6020	69.67
Sep-20	30/09/2020	12.7	8.6	4.5	72.5	20.5	5.69	101.14	11814	136.74
	29/09/2020	20.1	12.05	4	59	17.5	4.86	100.46	11814	136.74
	28/09/2020	13.5	10.15	6.8	77	19.5	5.42	101.43	11814	136.74
	27/09/2020	13.1	10.7	8.3	70	19.5	5.42	100.32	11814	136.74
	26/09/2020	22.9	15.39	7.9	57	10.5	2.92	99.63	11814	136.74
	25/09/2020	25.7	17.7	9.7	58	17.5	4.86	100.04	11814	136.74
	24/09/2020	18.6	8.55	-1.5	70.5	11.5	3.19	101.05	11814	136.74
	23/09/2020	13.9	7.9	1.9	75.5	15	4.17	101.83	11814	136.74
	22/09/2020	28.1	16.65	5.2	59	14	3.89	101.38	11814	136.74
	21/09/2020	19.8	14.65	9.5	72.5	21	5.83	100.62	11814	136.74
	20/09/2020	21.8	16.95	12.1	71.5	17	4.72	100.88	11814	136.74
	19/09/2020	19.3	9.95	0.6	71	6.5	1.81	101.74	11814	136.74
	18/09/2020	11.9	3.1	-5.7	74.5	13	3.61	102.44	11814	136.74
	17/09/2020	12.8	5.4	-2	53	6.5	1.81	102.78	11814	136.74
	16/09/2020	11.1	6.4	1.7	55	19	5.28	102.34	11814	136.74
	15/09/2020	17	13.65	10.3	61.5	9.5	2.64	101.49	11814	136.74
	14/09/2020	14.6	7.2	-0.2	71.5	9	2.50	102.33	11814	136.74
	13/09/2020	13.9	7.3	0.7	68.5	12	3.33	102.2	11814	136.74
	12/09/2020	20.9	14.55	8.2	61.5	13.5	3.75	101.11	11814	136.74
	11/09/2020	22.1	14.75	7.4	53	20.5	5.69	101.84	11814	136.74
	10/09/2020	22.1	14.25	6.4	59.5	13.5	3.75	102.31	11814	136.74
	09/09/2020	16.2	8.25	0.3	58	15.5	4.31	102.67	11814	136.74
	08/09/2020	12.3	6.05	-0.2	67.5	10	2.78	102.9	11814	136.74
	07/09/2020	11.4	6.6	1.8	64.5	19	5.28	101.99	11814	136.74
	06/09/2020	18.1	13.2	8.3	71	28	7.78	100.65	11814	136.74
	05/09/2020	20.5	12.3	4.1	72	7	1.94	101.75	11814	136.74
	04/09/2020	18.8	12.55	6.3	58	17	4.72	101.5	11814	136.74
	03/09/2020	16.5	11.35	6.2	63.5	23	6.39	100.59	11814	136.74
	02/09/2020	18.3	13.65	9	71	12.5	3.47	100.04	11814	136.74
	01/09/2020	17	10.6	4.2	75	18	5.00	99.82	11814	136.74
	Sep-20	31/08/2020	16.8	11.4	6	70.5	14	3.89	100.4	19025
30/08/2020		20.1	14.3	8.5	76.5	15.5	4.31	100.37	19025	220.20
29/08/2020		22.1	15	7.9	71.5	10	2.78	101.25	19025	220.20
28/08/2020		22.3	17.6	12.9	68.5	17.5	4.86	100.87	19025	220.20
27/08/2020		24	16	8	68	7.5	2.08	101.2	19025	220.20
26/08/2020		21.8	17.14	12.5	73.5	13	3.61	100.78	19025	220.20
25/08/2020		24.6	19.05	13.5	75.5	12	3.33	101.2	19025	220.20
24/08/2020		28.1	19.5	10.9	61	13.5	3.75	101.47	19025	220.20

Month	Date	Max Temp	Average Temp	Min Temp	Average Relative Humidity	Average Wind Speed	Average Wind Speed	Average Pressure	Solar Radiation	Net Radiation	
		[C]	[C]	[C]	[%]	[km/h]	[m/s]	[kPa]	[kJ/m2 per day]	[W/m2]	
Aug-20	23/08/2020	24.1	18.64	13.2	79.5	9	2.50	101.26	19025	220.20	
	22/08/2020	22	19.8	17.6	84	15	4.17	100.9	19025	220.20	
	21/08/2020	29.1	22.5	15.9	73.5	10	2.78	100.75	19025	220.20	
	20/08/2020	28.2	20.3	12.4	66	5.5	1.53	100.82	19025	220.20	
	19/08/2020	26.9	21.5	16.1	69.5	10	2.78	100.82	19025	220.20	
	18/08/2020	32.1	21.65	11.2	62	11	3.06	101.43	19025	220.20	
	17/08/2020	22.7	15.3	7.9	68.5	6.5	1.81	102.08	19025	220.20	
	16/08/2020	22.5	16.14	9.8	61.5	15.5	4.31	101.62	19025	220.20	
	15/08/2020	24.2	18.2	12.2	62	16	4.44	101.12	19025	220.20	
	14/08/2020	18.9	16.39	13.9	85.5	9.5	2.64	101.11	19025	220.20	
	13/08/2020	22.6	19.8	17	80.5	10.5	2.92	101.16	19025	220.20	
	12/08/2020	28.3	17.95	7.6	61.5	9	2.50	101.38	19025	220.20	
	11/08/2020	26	18.7	11.4	54.5	13.5	3.75	100.86	19025	220.20	
	10/08/2020	25.6	19.5	13.4	50	22	6.11	100.5	19025	220.20	
	09/08/2020	26.7	19.39	12.1	59	17.5	4.86	100.72	19025	220.20	
	08/08/2020	27.1	20.75	14.4	55.5	21.5	5.97	100.97	19025	220.20	
	07/08/2020	29.5	22.15	14.8	72.5	15	4.17	100.86	19025	220.20	
	06/08/2020	29.6	21.9	14.2	66.5	13	3.61	101.18	19025	220.20	
	05/08/2020	28.3	18.3	8.3	65	7.5	2.08	101.32	19025	220.20	
	04/08/2020	26.1	17.2	8.3	61.5	8.5	2.36	101.83	19025	220.20	
	03/08/2020	24.3	17.45	10.6	62	7	1.94	102.25	19025	220.20	
	02/08/2020	22.9	16.95	11	65.5	10	2.78	102.32	19025	220.20	
	01/08/2020	23.4	18.25	13.1	70.5	15	4.17	101.99	19025	220.20	
	Jul-20	31/07/2020	22.9	18.6	14.3	80.5	14	3.89	101.52	23260	269.21
		30/07/2020	28	19.25	10.5	68	8.5	2.36	101.75	23260	269.21
		29/07/2020	23.8	17.5	11.2	73.5	6	1.67	101.6	23260	269.21
		28/07/2020	22.9	17.54	12.2	71.5	11	3.06	101.22	23260	269.21
		27/07/2020	25.4	19.35	13.3	62.5	19	5.28	101.16	23260	269.21
26/07/2020		25	18.55	12.1	60.5	18.5	5.14	101.16	23260	269.21	
25/07/2020		32.6	26.75	20.9	64	16.5	4.58	100.6	23260	269.21	
24/07/2020		31.2	25.7	20.2	67	17	4.72	100.63	23260	269.21	
23/07/2020		26.2	19.25	12.3	66.5	16.5	4.58	101.37	23260	269.21	
22/07/2020		26	18.8	11.6	63.5	12.5	3.47	101.68	23260	269.21	
21/07/2020		25.3	17.5	9.7	63.5	6.5	1.81	101.6	23260	269.21	
20/07/2020		22.2	15.35	8.5	68	5	1.39	101.66	23260	269.21	
19/07/2020		22.7	17.7	12.7	60.5	16.5	4.58	100.94	23260	269.21	
18/07/2020		23.5	19.05	14.6	80.5	15	4.17	100.39	23260	269.21	
17/07/2020		24.6	17.7	10.8	74.5	12	3.33	100.87	23260	269.21	
16/07/2020		25.2	19.5	13.8	60.5	17	4.72	100.79	23260	269.21	
15/07/2020		24.9	18.75	12.6	62	26	7.22	100.58	23260	269.21	
14/07/2020		23.8	17.64	11.5	66	24.5	6.81	100.55	23260	269.21	
13/07/2020		25.3	20.14	15	78	16	4.44	100.5	23260	269.21	
12/07/2020		28.3	21	13.7	64.5	10.5	2.92	101.22	23260	269.21	
11/07/2020		23.9	18.04	12.2	69.5	6.5	1.81	101.56	23260	269.21	
10/07/2020		25.1	19.3	13.5	66.5	10	2.78	101.31	23260	269.21	
09/07/2020		24.4	20	15.6	65.5	20.5	5.69	100.44	23260	269.21	
08/07/2020		27.7	22	16.3	64	15	4.17	100.48	23260	269.21	
07/07/2020		28.6	21.7	14.8	62	8.5	2.36	101.2	23260	269.21	
06/07/2020		26.4	20.75	15.1	66	12.5	3.47	101.2	23260	269.21	
05/07/2020		27.8	23.05	18.3	74.5	7	1.94	101.11	23260	269.21	
04/07/2020		26.5	21.45	16.4	72	7.5	2.08	101.58	23260	269.21	
03/07/2020		30.8	25.1	19.4	56	12	3.33	101.65	23260	269.21	
02/07/2020		32.4	24.29	16.2	65	15	4.17	101.43	23260	269.21	
01/07/2020		27.4	23.1	18.8	67.5	20	5.56	100.86	23260	269.21	
	30/06/2020	28.6	23.7	18.8	69.5	7.5	2.08	100.76	22437	259.68	
	29/06/2020	30.6	24.6	18.6	69.5	13	3.61	100.49	22437	259.68	
	28/06/2020	31.1	26	20.9	58	15.5	4.31	100.13	22437	259.68	
	27/06/2020	30.3	22.5	14.7	58	21	5.83	100.41	22437	259.68	
	26/06/2020	28.2	22.45	16.7	62	11.5	3.19	100.81	22437	259.68	
	25/06/2020	28.1	20.65	13.2	67.5	17.5	4.86	100.71	22437	259.68	
	24/06/2020	24.4	17.7	11	62	8	2.22	101.17	22437	259.68	
	23/06/2020	22.9	17.29	11.7	68	16.5	4.58	101.44	22437	259.68	
	22/06/2020	20.9	16.25	11.6	70.5	12.5	3.47	101.32	22437	259.68	
	21/06/2020	16.8	13.65	10.5	80.5	16.5	4.58	100.71	22437	259.68	
	20/06/2020	20.9	14.14	7.4	76	11	3.06	100.95	22437	259.68	
	19/06/2020	19.4	12.25	5.1	67	12.5	3.47	101.48	22437	259.68	
	18/06/2020	19.6	14.75	9.9	80	10.5	2.92	100.91	22437	259.68	
	17/06/2020	33	26.15	19.3	62	24.5	6.81	100.37	22437	259.68	
16/06/2020	28	18	8	55.5	13.5	3.75	101.09	22437	259.68		

Month	Date	Max Temp	Average Temp	Min Temp	Average Relative Humidity	Average Wind Speed	Average Wind Speed	Average Pressure	Solar Radiation	Net Radiation
		[C]	[C]	[C]	[%]	[km/h]	[m/s]	[kPa]	[kJ/m2 per day]	[W/m2]
Jun-20	15/06/2020	30.6	22.65	14.7	43.5	22	6.11	101.08	22437	259.68
	14/06/2020	25.3	19.6	13.9	52	21	5.83	101.63	22437	259.68
	13/06/2020	22.9	13.6	4.3	58	13.5	3.75	102.44	22437	259.68
	12/06/2020	17.1	11.85	6.6	55	7.5	2.08	102.99	22437	259.68
	11/06/2020	12.7	9.25	5.8	70	12	3.33	101.87	22437	259.68
	10/06/2020	18.4	13.35	8.3	63	21.5	5.97	100.77	22437	259.68
	09/06/2020	19.7	16.1	12.5	79.5	15.5	4.31	100.64	22437	259.68
	08/06/2020	23.1	18.7	14.3	79	11	3.06	100.37	22437	259.68
	07/06/2020	18.3	14.6	10.9	79.5	23	6.39	100.69	22437	259.68
	06/06/2020	19.5	10.35	1.2	63	10.5	2.92	102.06	22437	259.68
	05/06/2020	14.4	8.85	3.3	75	14.5	4.03	101.47	22437	259.68
	04/06/2020	22.2	15.64	9.1	53	20.5	5.69	100.39	22437	259.68
	03/06/2020	26.2	16.1	6	60	12	3.33	100.8	22437	259.68
	02/06/2020	27.2	17.64	8.1	53.5	18.5	5.14	100.92	22437	259.68
01/06/2020	30.7	23.35	16	39	26.5	7.36	100.43	22437	259.68	
May-20	31/05/2020	24.5	14.35	4.2	49	14.5	4.03	101.85	22182	256.74
	30/05/2020	21.1	9.4	-2.3	54	15	4.17	102.56	22182	256.74
	29/05/2020	13.4	6.85	0.3	57.5	18	5.00	102.44	22182	256.74
	28/05/2020	12.9	9.19	5.5	64	20.5	5.69	101.46	22182	256.74
	27/05/2020	24	17.8	11.6	54.5	23.5	6.53	100.69	22182	256.74
	26/05/2020	19.2	15.3	11.4	76.5	5.5	1.53	100.98	22182	256.74
	25/05/2020	19.5	14.95	10.4	65.5	8	2.22	101.49	22182	256.74
	24/05/2020	19.7	15	10.3	66.5	17.5	4.86	101.13	22182	256.74
	23/05/2020	25.6	17.8	10	71	16	4.44	100.96	22182	256.74
	22/05/2020	24.4	19.6	14.8	65	20	5.56	100.98	22182	256.74
	21/05/2020	26.4	19.85	13.3	63	21	5.83	101.07	22182	256.74
	20/05/2020	27.5	19.5	11.5	56	18.5	5.14	101.39	22182	256.74
	19/05/2020	27.2	20.39	13.6	38.5	24.5	6.81	101.57	22182	256.74
	18/05/2020	24.5	18.2	11.9	33	19	5.28	101.95	22182	256.74
	17/05/2020	24.9	13.45	2	46.5	13	3.61	101.95	22182	256.74
	16/05/2020	15.8	9.45	3.1	53.5	9	2.50	102.19	22182	256.74
	15/05/2020	8.4	3	-2.4	73.5	14	3.89	101.83	22182	256.74
	14/05/2020	10.7	5.4	0.1	81.5	8.5	2.36	100.8	22182	256.74
	13/05/2020	7.5	1.6	-4.3	66	10.5	2.92	101.32	22182	256.74
	12/05/2020	10.2	1.39	-7.4	48.5	9.5	2.64	102.41	22182	256.74
	11/05/2020	6.9	-0.34	-7.6	47	17	4.72	102.96	22182	256.74
	10/05/2020	6.2	1.05	-4.1	41.5	24.5	6.81	103.13	22182	256.74
	09/05/2020	8.1	2.19	-3.7	58.5	23.5	6.53	102.55	22182	256.74
	08/05/2020	4.9	-0.84	-6.6	60	10	2.78	102.78	22182	256.74
	07/05/2020	8.2	1.09	-6	48	20	5.56	102.72	22182	256.74
	06/05/2020	10	4.34	-1.3	47.5	18.5	5.14	102.56	22182	256.74
	05/05/2020	14	5.35	-3.3	61	13	3.61	102.16	22182	256.74
	04/05/2020	10.3	2.65	-5	66.5	8.5	2.36	102.3	22182	256.74
	03/05/2020	4.6	1.14	-2.3	76	16.5	4.58	102.32	22182	256.74
	02/05/2020	8.3	3.85	-0.6	71.5	32	8.89	100.92	22182	256.74
	01/05/2020	20.1	13.95	7.8	60.5	15.5	4.31	100.36	22182	256.74
May-20	30/04/2020	23	12.7	2.4	49.5	21	5.83	101.08	16831	194.80
	29/04/2020	13.8	6.35	-1.1	58.5	8.5	2.36	102.08	16831	194.80
	28/04/2020	15.9	8.9	1.9	60	19.5	5.42	101.31	16831	194.80
	27/04/2020	14.4	8.94	3.5	67	13	3.61	100.95	16831	194.80
	26/04/2020	17	9.1	1.2	55.5	24	6.67	101.32	16831	194.80
	25/04/2020	11.3	6	0.7	50.5	10	2.78	102.09	16831	194.80
	24/04/2020	13.4	5.2	-3	62	9.5	2.64	101.56	16831	194.80
	23/04/2020	13.3	6.1	-1.1	65.5	9	2.50	100.74	16831	194.80
	22/04/2020	8.3	3.15	-2	60	9.5	2.64	100.97	16831	194.80
	21/04/2020	2.6	-2.85	-8.3	62	10	2.78	101.52	16831	194.80
	20/04/2020	2.4	-2.34	-7.1	59	23	6.39	100.73	16831	194.80
	19/04/2020	8.9	0	-8.9	62	22.5	6.25	100.7	16831	194.80
	18/04/2020	7.1	0.04	-7	65	17	4.72	100.41	16831	194.80
	17/04/2020	11.5	1.95	-7.6	56.5	19.5	5.42	100.83	16831	194.80
	16/04/2020	3	-2.15	-7.3	56	13.5	3.75	102.18	16831	194.80
	15/04/2020	2.6	-4.55	-11.7	56	11.5	3.19	102.05	16831	194.80
	14/04/2020	-3.2	-7.44	-11.7	65	10	2.78	102.02	16831	194.80
	13/04/2020	-6.1	-8.6	-11.1	58.5	18.5	5.14	102	16831	194.80
	12/04/2020	-1.1	-4.64	-8.2	61	15	4.17	101.97	16831	194.80
	11/04/2020	1.1	-1.7	-4.5	66	22.5	6.25	101.25	16831	194.80
	10/04/2020	9.2	1.34	-6.5	72	16.5	4.58	101.07	16831	194.80
	09/04/2020	-0.6	-3.3	-6	70	19.5	5.42	101.79	16831	194.80
	08/04/2020	4	0.89	-2.2	64	21.5	5.97	100.93	16831	194.80

Month	Date	Max Temp	Average Temp	Min Temp	Average Relative Humidity	Average Wind Speed	Average Wind Speed	Average Pressure	Solar Radiation	Net Radiation
		[C]	[C]	[C]	[%]	[km/h]	[m/s]	[kPa]	[kJ/m2 per day]	[W/m2]
Apr-20	07/04/2020	5.2	2.8	0.4	71.5	13.5	3.75	100.53	16831	194.80
	06/04/2020	10.6	2.65	-5.3	68.5	13.5	3.75	101.2	16831	194.80
	05/04/2020	1.1	-6.4	-13.9	69	6.5	1.81	101.95	16831	194.80
	04/04/2020	-4.3	-12.1	-19.9	64	7.5	2.08	102.47	16831	194.80
	03/04/2020	-8.3	-13.75	-19.2	69.5	20	5.56	102.25	16831	194.80
	02/04/2020	2.2	-3.2	-8.6	87.5	16.5	4.58	101.99	16831	194.80
	01/04/2020	9.4	3.85	-1.7	66.5	14.5	4.03	101.54	16831	194.80
Oct-19	31/10/2019	0.8	-4.09	-9	78	19.5	5.42	101.27	4199	48.60
	30/10/2019	-2.5	-6.4	-10.3	78.5	13	3.61	102.21	6514	75.39
	29/10/2019	-3.7	-7.25	-10.8	75.5	16	4.44	101.75	6182	71.55
	28/10/2019	-1.7	-3.1	-4.5	74	10.5	2.92	101.41	6348	73.47
	27/10/2019	1.8	-0.65	-3.1	78.5	19.5	5.42	101.34	4062	47.01
	26/10/2019	11.1	6.3	1.5	71.5	25.5	7.08	100.03	4806	55.63
	25/10/2019	9.7	4.8	-0.1	69.5	19	5.28	100.86	7069	81.82
	24/10/2019	4.5	-0.75	-6	69	9.5	2.64	102.35	10138	117.34
	23/10/2019	3.5	0.6	-2.3	77.5	20	5.56	101.49	4584	53.06
	22/10/2019	3.2	1.9	0.6	85.5	33	9.17	100.58	2335	27.03
	21/10/2019	7	4.8	2.6	74.5	22.5	6.25	101.21	3283	38.00
	20/10/2019	14.3	7.7	1.1	72	9	2.50	100.7	8556	99.03
	19/10/2019	9.5	5.85	2.2	83.5	10	2.78	99.89	5875	68.00
	18/10/2019	11.8	8.25	4.7	81.5	13	3.61	99.74	4820	55.79
	17/10/2019	10.4	6	1.6	75	14.5	4.03	101.1	9198	106.46
	16/10/2019	3.3	1.25	-0.8	89.5	7	1.94	101.96	3644	42.18
	15/10/2019	3.9	2.5	1.1	90	10	2.78	101.82	3791	43.88
	14/10/2019	5.4	2.3	-0.8	82	8	2.22	101.25	8015	92.77
	13/10/2019	3.4	1.85	0.3	86.5	14	3.89	100.86	8585	99.36
	12/10/2019	1.8	1	0.2	94.5	23.5	6.53	99.93	8257	95.57
	11/10/2019	0.3	-0.3	-0.9	96.5	43	11.94	100.35	2368	27.41
	10/10/2019	2.3	1.04	-0.2	86.5	32.5	9.03	102.05	2634	30.49
	09/10/2019	7.5	4.25	1	80.5	29.5	8.19	101.34	1415	16.38
	08/10/2019	20.3	13.8	7.3	61	18.5	5.14	100.14	11562	133.82
	07/10/2019	17.7	8.9	0.1	69	16	4.44	101.1	13509	156.35
	06/10/2019	12.9	7.55	2.2	75	18	5.00	100.44	7431	86.01
	05/10/2019	8	5.9	3.8	82.5	13.5	3.75	100.65	3492	40.42
	04/10/2019	8.6	3.3	-2	81	15.5	4.31	102.56	4287	49.62
	03/10/2019	9.6	4.55	-0.5	71	8	2.22	102.56	6380	73.84
	02/10/2019	6	3.95	1.9	80	8	2.22	102.64	4833	55.94
	01/10/2019	6.2	3.25	0.3	84	14.5	4.03	102.21	7551	87.40
19-Sep	30/09/2019	5.7	3.65	1.6	89	17	4.72	101.54	1677	19.41
	29/09/2019	7.4	6.1	4.8	72.5	19.5	5.42	102.7	2486	28.77
	28/09/2019	10.5	4.45	-1.6	61.5	11	3.06	102.54	15345	177.60
	27/09/2019	11.9	6.1	0.3	67.5	13	3.61	100.92	12928	149.63
	26/09/2019	13.8	8.1	2.4	67	15	4.17	100.32	7933	91.82
	25/09/2019	12.9	7.9	2.9	73.5	14.5	4.03	100.35	10490	121.41
	24/09/2019	20.5	13.6	6.7	62	12	3.33	100.06	6835	79.11
	23/09/2019	24.5	15.8	7.1	67	17.5	4.86	100.66	16659	192.81
	22/09/2019	19.6	13.9	8.2	68	9	2.50	100.79	11788	136.44
	21/09/2019	18.4	15.95	13.5	90	12	3.33	100.22	3262	37.75
	20/09/2019	20.6	17.45	14.3	80.5	24.5	6.81	100.99	2901	33.58
	19/09/2019	16.7	14.39	12.1	84	10	2.78	101.57	13252	153.38
	18/09/2019	21	18.3	15.6	90.5	16.5	4.58	100.17	11111	128.60
	17/09/2019	30	24.3	18.6	69.5	20.5	5.69	100.44	15553	180.01
	16/09/2019	28	19.45	10.9	71.5	7.5	2.08	100.9	16902	195.63
	15/09/2019	27.1	18.55	10	63	8	2.22	100.97	16995	196.70
	14/09/2019	20.6	11.15	1.7	70.5	13	3.61	101.26	14862	172.01
	13/09/2019	18.1	11.6	5.1	60.5	13	3.61	101.16	13761	159.27
	12/09/2019	14.8	11.95	9.1	74	14	3.89	102.15	3692	42.73
	11/09/2019	14.6	12.85	11.1	71.5	12.5	3.47	102.55	6384	73.89
	10/09/2019	15.5	13.4	11.3	77	15	4.17	101.73	6698	77.52
	09/09/2019	17.6	10.5	3.4	74.5	12.5	3.47	101.76	7910	91.55
	08/09/2019	18.9	10.45	2	65.5	9.5	2.64	102.18	20529	237.60
	07/09/2019	14.4	9.44	4.5	71	9.5	2.64	102.4	15461	178.95
	06/09/2019	21.7	14.55	7.4	65.5	17	4.72	101.93	20601	238.44
	05/09/2019	19.7	16.85	14	81.5	8	2.22	101.52	14689	170.01
	04/09/2019	24.8	15.1	5.4	64.5	15.5	4.31	101.59	19267	223.00
	03/09/2019	16	11.1	6.2	72.5	12	3.33	101.24	8972	103.84
	02/09/2019	16.7	10.7	4.7	68	14.5	4.03	101.88	12914	149.47
	01/09/2019	21.4	13.8	6.2	72.5	15.5	4.31	101.77	15750	182.29
		31/08/2019	16.7	12.35	8	80	9.5	2.64	102.1	10086

Month	Date	Max Temp	Average Temp	Min Temp	Average Relative Humidity	Average Wind Speed	Average Wind Speed	Average Pressure	Solar Radiation	Net Radiation
		[C]	[C]	[C]	[%]	[km/h]	[m/s]	[kPa]	[kJ/m2 per day]	[W/m2]
Aug-19	30/08/2019	22.2	15.1	8	58.5	11	3.06	101.97	21750	251.74
	29/08/2019	19.5	14.7	9.9	59.5	23	6.39	100.86	22714	262.89
	28/08/2019	21.8	16.25	10.7	54	20	5.56	100.5	19645	227.37
	27/08/2019	13.5	11.85	10.2	82.5	21	5.83	100.2	8335	96.47
	26/08/2019	22.1	17.75	13.4	81.5	12.5	3.47	100.31	13658	158.08
	25/08/2019	22.4	19.39	16.4	73.5	24	6.67	100.65	4233	48.99
	24/08/2019	29	23.6	18.2	56	31	8.61	101.26	18347	212.35
	23/08/2019	25.5	16	6.5	65	17	4.72	101.91	18834	217.99
	22/08/2019	20.9	16.7	12.5	61	10	2.78	102	24096	278.89
	21/08/2019	19.3	14.1	8.9	61	13.5	3.75	101.92	16848	195.00
	20/08/2019	22.1	16.2	10.3	56	17	4.72	101.59	24001	277.79
	19/08/2019	23.9	15.8	7.7	57.5	14.5	4.03	100.88	23657	273.81
	18/08/2019	23.4	14.8	6.2	55	18	5.00	100.47	23067	266.98
	17/08/2019	23.4	17.6	11.8	67	14	3.89	100.29	14443	167.16
	16/08/2019	28.1	19.2	10.3	61	9	2.50	100.48	23221	268.76
	15/08/2019	27.5	19	10.5	60.5	12.5	3.47	100.83	20940	242.36
	14/08/2019	26.1	16.2	6.3	59	11.5	3.19	101.64	16445	190.34
	13/08/2019	23.6	16.3	9	51	10.5	2.92	101.74	19863	229.90
	12/08/2019	20.8	14.05	7.3	68.5	9	2.50	101.59	11762	136.13
	11/08/2019	23.2	15.14	7.1	63	11	3.06	101.82	25608	296.39
	10/08/2019	20.8	15.15	9.5	80.5	7.5	2.08	101.34	10138	117.34
	09/08/2019	24.4	16.54	8.7	63	8.5	2.36	101.33	25296	292.78
	08/08/2019	23.3	16.3	9.3	62	15.5	4.31	101.15	24698	285.86
	07/08/2019	22.2	16.8	11.4	58.5	17.5	4.86	100.91	24776	286.76
	06/08/2019	26.7	19.1	11.5	67	17	4.72	100.69	15675	181.42
	05/08/2019	26.4	19.35	12.3	61	12	3.33	101.01	25429	294.32
	04/08/2019	29.2	21.5	13.8	56	16.5	4.58	101.08	25309	292.93
	03/08/2019	32.6	23.5	14.4	62.5	13	3.61	101.5	24575	284.43
	02/08/2019	25.6	19.25	12.9	76	5	1.39	101.87	24591	284.62
	01/08/2019	27.3	21	14.7	71.5	8	2.22	101.74	25740	297.92
	19-Jul	31/07/2019	27.4	19.14	10.9	67	14	3.89	101.64	22725
30/07/2019		23.3	13.85	4.4	63.5	9.5	2.64	101.92	27694	320.53
29/07/2019		20.2	13.7	7.2	59.5	18.5	5.14	101.46	27708	320.69
28/07/2019		26.1	20.95	15.8	58.5	19	5.28	100.58	17122	198.17
27/07/2019		29	21.15	13.3	63.5	10.5	2.92	101.18	27293	315.89
26/07/2019		22.8	18.95	15.1	74.5	15	4.17	100.66	21991	254.53
25/07/2019		28.4	22.7	17	53	17	4.72	100.62	25140	290.97
24/07/2019		28.9	21.75	14.6	62.5	15.5	4.31	101.51	26972	312.18
23/07/2019		29.5	22.35	15.2	59.5	9	2.50	102.06	26795	310.13
22/07/2019		26.8	19.75	12.7	59.5	12	3.33	102.26	27522	318.54
21/07/2019		23.9	16.35	8.8	63	10	2.78	102.17	28088	325.09
20/07/2019		22.1	17.05	12	69.5	13	3.61	101.18	22701	262.74
19/07/2019		25	18.7	12.4	65.5	16.5	4.58	100.2	27972	323.75
18/07/2019		26.3	20.39	14.5	72.5	10.5	2.92	99.92	22850	264.47
17/07/2019		23.6	19.05	14.5	77	8.5	2.36	100.69	13181	152.56
16/07/2019		25	19.1	13.2	70.5	7.5	2.08	101.13	24516	283.75
15/07/2019		28	22.55	17.1	67	17.5	4.86	100.44	25767	298.23
14/07/2019		30.7	24.95	19.2	72.5	13.5	3.75	100.97	24994	289.28
13/07/2019		27.8	19.1	10.4	64.5	10	2.78	101.41	28848	333.89
12/07/2019		22.6	18.05	13.5	69	9.5	2.64	101.15	24794	286.97
11/07/2019		28.6	20.35	12.1	72	19	5.28	101.03	27010	312.62
10/07/2019		25.6	19.64	13.7	64	14	3.89	101.31	25244	292.18
09/07/2019		22.6	19.85	17.1	83.5	7	1.94	100.88	8095	93.69
08/07/2019		29.7	23.6	17.5	71	16.5	4.58	100.75	10300	119.21
07/07/2019		28.5	20.55	12.6	53.5	12	3.33	101.62	28293	327.47
06/07/2019		21.7	13.95	6.2	65.5	7	1.94	102.42	26194	303.17
05/07/2019		22.4	14.85	7.3	62.5	13.5	3.75	102.16	24940	288.66
04/07/2019		25.9	18.5	11.1	61	13.5	3.75	101.3	27077	313.39
03/07/2019		23.3	16.25	9.2	64	16	4.44	101.11	11630	134.61
02/07/2019		22.5	16.64	10.8	55	13.5	3.75	100.87	28796	333.29
01/07/2019		26.5	19.39	12.3	56	16.5	4.58	101.2	30850	357.06
19-Jun	30/06/2019	31.6	25	18.4	56.5	27	7.50	101.2	31192	361.02
	29/06/2019	27.8	22.6	17.4	67.5	25	6.94	101.58	14208	164.44
	28/06/2019	31	21.35	11.7	51.5	11.5	3.19	101.92	26891	311.24
	27/06/2019	29.2	21	12.8	59	12.5	3.47	101.72	25678	297.20
	26/06/2019	28.1	20.25	12.4	59	15.5	4.31	101.11	27712	320.74
	25/06/2019	26.1	19.85	13.6	65	16.5	4.58	100.33	25147	291.05
	24/06/2019	27.1	18.7	10.3	66.5	10.5	2.92	100.12	19164	221.81
	23/06/2019	25	19.1	13.2	69	18	5.00	100.66	25186	291.50

Month	Date	Max Temp	Average Temp	Min Temp	Average Relative Humidity	Average Wind Speed	Average Wind Speed	Average Pressure	Solar Radiation	Net Radiation
		[C]	[C]	[C]	[%]	[km/h]	[m/s]	[kPa]	[kJ/m2 per day]	[W/m2]
19-Jun	22/06/2019	22.9	18.75	14.6	76	30.5	8.47	101.12	15998	185.16
	21/06/2019	26.4	19.35	12.3	56	23.5	6.53	101.11	14991	173.51
	20/06/2019	28.2	19.14	10.1	52.5	14	3.89	100.88	25569	295.94
	19/06/2019	27.6	17.75	7.9	57.5	8	2.22	101.01	25166	291.27
	18/06/2019	24.5	17.75	11	58.5	11	3.06	101.47	22898	265.02
	17/06/2019	21.1	16.5	11.9	72.5	12	3.33	101.56	15850	183.45
	16/06/2019	16.4	13.45	10.5	74	14	3.89	101.31	5548	64.21
	15/06/2019	20.3	15.5	10.7	51.5	18.5	5.14	101.01	15602	180.58
	14/06/2019	25.9	20.25	14.6	45	15.5	4.31	100.46	28876	334.21
	13/06/2019	26	18.1	10.2	40.5	20	5.56	100.96	24430	282.75
	12/06/2019	20.5	10.9	1.3	51	9.5	2.64	101.88	31675	366.61
	11/06/2019	20.3	12.2	4.1	45	22.5	6.25	101.73	22006	254.70
	10/06/2019	19.6	12.55	5.5	59.5	14.5	4.03	101.89	30154	349.00
	09/06/2019	20.4	15	9.6	63	17.5	4.86	101.66	25078	290.25
	08/06/2019	25.7	18.5	11.3	76.5	24.5	6.81	100.67	9398	108.77
	07/06/2019	36.1	27.5	18.9	42.5	38	10.56	100.32	19134	221.46
	06/06/2019	27.4	19.2	11	53.5	16	4.44	100.97	26134	302.48
	05/06/2019	26.1	15.65	5.2	58	13	3.61	100.94	23976	277.50
	04/06/2019	26.7	18.75	10.8	64	20.5	5.69	100.54	28627	331.33
03/06/2019	27	19	11	56	27	7.50	100.85	14532	168.19	
02/06/2019	18.1	8.85	-0.4	54.5	13.5	3.75	101.72	25132	290.88	
01/06/2019	19.1	9.75	0.4	52.5	20	5.56	101.62	27145	314.18	
19-May	31/05/2019	14.3	8.3	2.3	53	19	5.28	101.45	28415	328.88
	30/05/2019	20.7	15.7	10.7	55	18.5	5.14	100.6	25930	300.12
	29/05/2019	24	13.85	3.7	48	10	2.78	100.72	25620	296.53
	28/05/2019	24.6	15.3	6	44	15.5	4.31	100.88	27139	314.11
	27/05/2019	18.5	8.35	-1.8	54	11	3.06	101.85	30944	358.15
	26/05/2019	12.6	7.55	2.5	56	13	3.61	102.35	16702	193.31
	25/05/2019	19.1	12.5	5.9	67.5	16.5	4.58	101.08	26371	305.22
	24/05/2019	13.1	8.35	3.6	77	10.5	2.92	101.21	7774	89.98
	23/05/2019	18.4	11.35	4.3	56	10	2.78	101.77	27064	313.24
	22/05/2019	14.8	12.6	10.4	59.5	20.5	5.69	101.22	5474	63.36
	21/05/2019	21.3	10.7	0.1	54.5	11.5	3.19	101.92	27964	323.66
	20/05/2019	18.7	9.6	0.5	53.5	12.5	3.47	102.16	29656	343.24
	19/05/2019	16.3	10.55	4.8	51.5	21.5	5.97	102.12	27895	322.86
	18/05/2019	12.8	7.85	2.9	48	22.5	6.25	102.12	24525	283.85
	17/05/2019	13.7	5.19	-3.3	57.5	16.5	4.58	101.86	28137	325.66
	16/05/2019	10.3	4.1	-2.1	65.5	18.5	5.14	101.44	29572	342.27
	15/05/2019	17.5	8.05	-1.4	59	19	5.28	101.07	9463	109.53
	14/05/2019	13.4	7.05	0.7	51.5	14.5	4.03	101.49	28405	328.76
	13/05/2019	25.4	14.89	4.4	43.5	16	4.44	100.61	21147	244.76
	12/05/2019	15.6	10.65	5.7	59.5	10.5	2.92	100.93	21318	246.74
	11/05/2019	22.1	14.95	7.8	55	16	4.44	100.71	20887	241.75
	10/05/2019	15.6	5.3	-5	47.5	12.5	3.47	101.52	25146	291.04
	09/05/2019	10.9	3.9	-3.1	54.5	17.5	4.86	102.32	28332	327.92
	08/05/2019	9.9	6.15	2.4	60	19	5.28	102.31	20407	236.19
	07/05/2019	13.6	3.75	-6.1	53	13	3.61	102.54	27922	323.17
	06/05/2019	5.6	0.44	-4.7	64.5	9	2.50	102.51	17422	201.64
	05/05/2019	3.6	0.65	-2.3	70.5	15.5	4.31	101.63	11476	132.82
04/05/2019	12.6	6.3	0	56	23	6.39	100.7	23326	269.98	
03/05/2019	14	8.9	3.8	60	20.5	5.69	101.1	14629	169.32	
02/05/2019	11.3	3.75	-3.8	62.5	9	2.50	101.83	22987	266.05	
01/05/2019	7.4	2.55	-2.3	73	7.5	2.08	102.22	5592	64.72	
19-May	30/04/2019	7.4	2.2	-3	69.5	11.5	3.19	102.66	12384	143.33
	29/04/2019	7.9	3.65	-0.6	51.5	17.5	4.86	102.48	10578	122.43
	28/04/2019	6.4	1.75	-2.9	51.5	16.5	4.58	102.32	12468	144.31
	27/04/2019	6.7	0.89	-4.9	59.5	10.5	2.92	102.03	23529	272.33
	26/04/2019	9.7	2.8	-4.1	69	14.5	4.03	101.86	23209	268.62
	25/04/2019	13.8	6.25	-1.3	60	23.5	6.53	101.14	19401	224.55
	24/04/2019	19.9	10.19	0.5	51	15.5	4.31	100.35	21262	246.09
	23/04/2019	17.1	7.2	-2.7	58	18	5.00	101.29	10674	123.54
	22/04/2019	14.5	7.2	-0.1	60	10.5	2.92	102.35	23628	273.47
	21/04/2019	14.7	6.94	-0.8	61.5	10.5	2.92	101.76	20741	240.06
	20/04/2019	14.9	9	3.1	56.5	9.5	2.64	100.67	15508	179.49
	19/04/2019	18.1	9.8	1.5	61.5	25	6.94	100.75	19351	223.97
	18/04/2019	14.2	6	-2.2	56.5	7.5	2.08	101.48	24316	281.44
	17/04/2019	10.7	4.3	-2.1	66.5	8	2.22	101.45	20150	233.22
	16/04/2019	14.1	6.55	-1	66.5	14.5	4.03	101.03	23325	269.97
15/04/2019	9.2	4.75	0.3	82	18	5.00	100.46	11380	131.71	

Month	Date	Max Temp	Average Temp	Min Temp	Average Relative Humidity	Average Wind Speed	Average Wind Speed	Average Pressure	Solar Radiation	Net Radiation
		[C]	[C]	[C]	[%]	[km/h]	[m/s]	[kPa]	[kJ/m2 per day]	[W/m2]
01-Apr	14/04/2019	10.5	4.2	-2.1	55.5	19	5.28	101.18	23562	272.71
	13/04/2019	7.7	1.55	-4.6	48	13	3.61	101.56	24348	281.81
	12/04/2019	4	1.35	-1.3	59.5	28	7.78	101.11	11856	137.22
	11/04/2019	4.6	-0.65	-5.9	60.5	22	6.11	102.37	17960	207.87
	10/04/2019	4.2	0.65	-2.9	60.5	17.5	4.86	102.7	19367	224.16
	09/04/2019	-1.5	-4.8	-8.1	66.5	18	5.00	102.29	14978	173.36
	08/04/2019	3.4	-0.55	-4.5	83	16	4.44	101.11	10938	126.60
	07/04/2019	5.6	3.3	1	90.5	9.5	2.64	100.82	7558	87.48
	06/04/2019	4.1	-1.35	-6.8	72.5	11.5	3.19	101.86	16199	187.49
	05/04/2019	1.8	-1.55	-4.9	87	12	3.33	101.79	7252	83.94
	04/04/2019	3.7	-1.69	-7.1	68.5	23	6.39	101.91	6083	70.41
	03/04/2019	-1.3	-5	-8.7	63	11	3.06	102.28	20758	240.25
	02/04/2019	1.2	-2.54	-6.3	73	18	5.00	100.91	16321	188.90
01/04/2019	6.7	2.1	-2.5	60	13.5	3.75	101.46	15838	183.31	
18-Oct	31/10/2018	1.6	0.25	-1.1	78.5	13.5	3.75	101.16	3386	39.19
	30/10/2018	5.9	3.7	1.5	85.5	17	4.72	100.67	5180	59.95
	29/10/2018	5.6	3.84	2.1	82.5	10.5	2.92	101.44	2550	29.51
	28/10/2018	4.8	2.75	0.7	85.5	10	2.78	101.31	2087	24.16
	27/10/2018	6.9	4.1	1.3	89	11.5	3.19	100.58	1596	18.47
	26/10/2018	7.5	6.3	5.1	90.5	7.5	2.08	100.88	1698	19.65
	25/10/2018	9.3	5.75	2.2	75.5	12.5	3.47	101.27	3739	43.28
	24/10/2018	12.3	3.8	-4.7	63	15.5	4.31	101.96	9227	106.79
	23/10/2018	3.7	-1.75	-7.2	72	7	1.94	102.98	10829	125.34
	22/10/2018	7	2.29	-2.4	63	20	5.56	102.04	7198	83.31
	21/10/2018	14.9	5.3	-4.3	52.5	17	4.72	101.27	11193	129.55
	20/10/2018	3.9	0.55	-2.8	60.5	18	5.00	102.42	10403	120.41
	19/10/2018	11.8	5.3	-1.2	57.5	28	7.78	101.05	7672	88.80
	18/10/2018	23.3	12.25	1.2	54	22.5	6.25	100.91	11724	135.69
	17/10/2018	4.1	-3	-10.1	64.5	16.5	4.58	102.58	12240	141.67
	16/10/2018	4.1	0.89	-2.3	70.5	22	6.11	101.67	3953	45.75
	15/10/2018	4.8	-0.14	-5.1	81	20	5.56	101.21	5792	67.04
	14/10/2018	1.7	-0.9	-3.5	81.5	13	3.61	101.79	3957	45.80
	13/10/2018	3.3	1.14	-1	75.5	17.5	4.86	100.52	4897	56.68
	12/10/2018	7.6	-0.5	-8.6	63	15	4.17	100.99	11825	136.86
	11/10/2018	0.1	-2.85	-5.8	77.5	16.5	4.58	101.73	3320	38.43
	10/10/2018	2.7	0.9	-0.9	74.5	20	5.56	102.29	4195	48.55
	09/10/2018	5.1	2.75	0.4	62	18	5.00	102.73	4623	53.51
	08/10/2018	6.6	4.2	1.8	80.5	8.5	2.36	102.42	5550	64.24
	07/10/2018	5.6	1.29	-3	80	6.5	1.81	102.82	4797	55.52
	06/10/2018	5.8	1.14	-3.5	81	7.5	2.08	102.41	5863	67.86
	05/10/2018	1.5	-0.6	-2.7	89.5	10.5	2.92	102.01	2385	27.60
	04/10/2018	3.4	-0.95	-5.3	69.5	8	2.22	102.43	13130	151.97
03/10/2018	3.4	1	-1.4	93.5	22.5	6.25	100.85	2096	24.26	
02/10/2018	7.8	5.6	3.4	84	11	3.06	101.36	5218	60.39	
01/10/2018	9.3	2.9	-3.5	64.5	13	3.61	102.34	5169	59.83	
07-Sep	30/09/2018	5.7	0.95	-3.8	62	12.5	3.47	102.67	15127	175.08
	29/09/2018	9.1	3.05	-3	55.5	11.5	3.19	102.11	13349	154.50
	28/09/2018	4	0.55	-2.9	68	17.5	4.86	102.15	8019	92.81
	27/09/2018	8.3	5.1	1.9	78	12	3.33	101.13	5255	60.82
	26/09/2018	9.3	4.3	-0.7	79	10	2.78	101.07	3370	39.00
	25/09/2018	13.7	8	2.3	71.5	11	3.06	101.37	13447	155.64
	24/09/2018	8.3	6.15	4	85.5	7.5	2.08	101.22	4677	54.13
	23/09/2018	6.1	4.55	3	69	17	4.72	102.31	4063	47.03
	22/09/2018	5.8	3.35	0.9	75	15.5	4.31	102.39	3088	35.74
	21/09/2018	10.7	7.19	3.7	67	14	3.89	102.02	11213	129.78
	20/09/2018	11.8	5.15	-1.5	73.5	10	2.78	102	4668	54.03
	19/09/2018	12.1	6.45	0.8	72	7	1.94	102.19	14848	171.85
	18/09/2018	15.1	8.69	2.3	79.5	8	2.22	101.88	15755	182.35
	17/09/2018	10.2	7.3	4.4	81	12.5	3.47	101.95	11290	130.67
	16/09/2018	13.3	9.35	5.4	89	23	6.39	101.04	9786	113.26
	15/09/2018	13.3	10.9	8.5	85	18	5.00	102.42	13341	154.41
	14/09/2018	18.7	12.5	6.3	76.5	9.5	2.64	102.08	11372	131.62
	13/09/2018	16	13.55	11.1	89.5	8.5	2.36	101.03	6461	74.78
	12/09/2018	13.7	10.14	6.6	81.5	13.5	3.75	101.62	11018	127.52
	11/09/2018	23.5	16.2	8.9	74	22.5	6.25	100.6	10307	119.29
10/09/2018	20.7	14.35	8	71	12.5	3.47	100.99	19668	227.64	
09/09/2018	25.7	19.85	14	70	19	5.28	100.83	13082	151.41	
08/09/2018	18.8	16.2	13.6	73	19	5.28	101.91	3527	40.82	
07/09/2018	18.3	11.4	4.5	61	13.5	3.75	102.91	18082	209.28	

Month	Date	Max Temp	Average Temp	Min Temp	Average Relative Humidity	Average Wind Speed	Average Wind Speed	Average Pressure	Solar Radiation	Net Radiation
		[C]	[C]	[C]	[%]	[km/h]	[m/s]	[kPa]	[kJ/m2 per day]	[W/m2]
18-Sep	06/09/2018	24.3	13.5	2.7	52.5	9.5	2.64	102.73	16880	195.37
	05/09/2018	17.8	9.95	2.1	58.5	11.5	3.19	102.6	21670	250.81
	04/09/2018	21.3	12.9	4.5	67.5	22	6.11	101.49	15484	179.21
	03/09/2018	26	16.64	7.3	58	13	3.61	101.59	20517	237.47
	02/09/2018	21.5	16	10.5	55	20	5.56	101.15	20667	239.20
	01/09/2018	24.7	15.3	5.9	58.5	19.5	5.42	100.89	21216	245.56
18-Aug	31/08/2018	25.8	18.6	11.4	59	12	3.33	100.5	14417	166.86
	30/08/2018	27.8	19.3	10.8	62	23.5	6.53	100.64	20436	236.53
	29/08/2018	21.6	15.5	9.4	64.5	10.5	2.92	101.45	20778	240.49
	28/08/2018	16.5	12.35	8.2	71.5	7	1.94	101.47	15643	181.05
	27/08/2018	15.7	13.05	10.4	76	19	5.28	101.04	14674	169.84
	26/08/2018	18.2	9.85	1.5	67.5	14.5	4.03	101.23	17732	205.23
	25/08/2018	21.4	13.39	5.4	66.5	11	3.06	100.9	13455	155.73
	24/08/2018	22.1	16.64	11.2	69.5	9	2.50	100.68	15800	182.87
	23/08/2018	25.1	18.75	12.4	58.5	13	3.61	100.65	19513	225.84
	22/08/2018	29.9	20.79	11.7	51	19.5	5.42	101.29	22433	259.64
	21/08/2018	25.5	15.6	5.7	59.5	11	3.06	102.02	23155	268.00
	20/08/2018	22.1	15.75	9.4	65	9	2.50	102.19	19987	231.33
	19/08/2018	21.6	15.9	10.2	63.5	18.5	5.14	101.64	20023	231.75
	18/08/2018	27.1	21.65	16.2	63	13.5	3.75	101.04	14555	168.46
	17/08/2018	25.1	16.64	8.2	71.5	9.5	2.64	101.87	16851	195.03
	16/08/2018	22.9	16.04	9.2	64	13	3.61	101.52	6564	75.97
	15/08/2018	31	19.64	8.3	59	16.5	4.58	101.14	23532	272.36
	14/08/2018	16.9	11.89	6.9	74	10	2.78	101.66	14570	168.63
	13/08/2018	26.4	19.75	13.1	72.5	18.5	5.14	100.91	9146	105.86
	12/08/2018	32.3	24.7	17.1	69.5	14	3.89	100.98	22339	258.55
	11/08/2018	35.8	25.2	14.6	56.5	15	4.17	101.22	21553	249.46
	10/08/2018	31.2	23.55	15.9	65	10	2.78	101.31	19826	229.47
	09/08/2018	29.2	20.35	11.5	66	11	3.06	101.43	22046	255.16
	08/08/2018	28.4	21.29	14.2	65	10.5	2.92	100.84	22247	257.49
	07/08/2018	31	22.15	13.3	59	17	4.72	100.83	23719	274.53
	06/08/2018	21.3	14.85	8.4	72.5	9.5	2.64	101.72	24793	286.96
	05/08/2018	19	15.9	12.8	82	17	4.72	101.06	17334	200.63
	04/08/2018	24.6	19.75	14.9	76	22	6.11	100.38	13078	151.37
	03/08/2018	28.8	21.1	13.4	64.5	14.5	4.03	100.68	25115	290.68
	02/08/2018	23.5	14.25	5	69.5	14	3.89	101.28	20795	240.68
	01/08/2018	15.9	11.1	6.3	73.5	10.5	2.92	101.97	15671	181.38
18-Jul	31/07/2018	21.1	16.95	12.8	77	14	3.89	101.46	10910	126.27
	30/07/2018	29.9	22.1	14.3	61	11.5	3.19	101.5	21644	250.51
	29/07/2018	28.6	20	11.4	62	8	2.22	101.78	23570	272.80
	28/07/2018	26.8	19.64	12.5	63	7	1.94	101.91	22927	265.36
	27/07/2018	26.5	18.3	10.1	62	9	2.50	101.97	20777	240.47
	26/07/2018	23.3	17.6	11.9	67	15	4.17	101.84	21542	249.33
	25/07/2018	16.5	14	11.5	84.5	16.5	4.58	101.53	7860	90.97
	24/07/2018	20.8	15.55	10.3	75	14.5	4.03	101.54	16475	190.68
	23/07/2018	23.4	17.95	12.5	73	15	4.17	101.47	27165	314.41
	22/07/2018	25.3	20.1	14.9	76.5	14	3.89	101.67	16570	191.78
	21/07/2018	25.9	18.25	10.6	65	6	1.67	102.04	25406	294.05
	20/07/2018	25.4	19.95	14.5	62.5	16	4.44	101.54	19375	224.25
	19/07/2018	27.2	22.04	16.9	73.5	12.5	3.47	100.78	18947	219.29
	18/07/2018	29.7	21.1	12.5	62.5	13	3.61	101.31	27806	321.83
	17/07/2018	24.9	15.39	5.9	66	7.5	2.08	101.96	28816	333.52
	16/07/2018	19.5	14.25	9	72	14	3.89	101.68	18736	216.85
	15/07/2018	24.4	18.14	11.9	61.5	21.5	5.97	101.16	29944	346.57
	14/07/2018	33.6	25.3	17	63.5	26	7.22	101	25243	292.16
	13/07/2018	31.4	23.1	14.8	58.5	12	3.33	101.36	28435	329.11
	12/07/2018	29.4	22.9	16.4	53.5	18	5.00	100.8	26698	309.00
	11/07/2018	27.7	23.6	19.5	69	21.5	5.97	100.83	14496	167.78
	10/07/2018	28.8	20.3	11.8	65	7.5	2.08	101.87	26347	304.94
	09/07/2018	26	17.85	9.7	59.5	8.5	2.36	102.06	30126	348.68
	08/07/2018	28.4	20.14	11.9	62	12.5	3.47	101.26	18058	209.00
	07/07/2018	32.8	25.9	19	67	26.5	7.36	100.88	26951	311.93
	06/07/2018	27.3	18.14	9	69.5	16	4.44	102.46	29791	344.80
	05/07/2018	24.6	16.89	9.2	58	13	3.61	102.67	30361	351.40
	04/07/2018	25.3	19.64	14	68.5	26	7.22	101.21	16377	189.55
	03/07/2018	23.4	17.7	12	78	15.5	4.31	101.48	23260	269.21
	02/07/2018	24.7	18.55	12.4	67	17	4.72	100.67	23260	269.21
	01/07/2018	26.9	19.45	12	67.5	10.5	2.92	100.56	23260	269.21
18-Jul	30/06/2018	23.3	18.14	13	73.5	13	3.61	100.57	22437	259.68

Month	Date	Max Temp	Average Temp	Min Temp	Average Relative Humidity	Average Wind Speed	Average Wind Speed	Average Pressure	Solar Radiation	Net Radiation	
		[C]	[C]	[C]	[%]	[km/h]	[m/s]	[kPa]	[kJ/m2 per day]	[W/m2]	
18-Jun	29/06/2018	25.8	20	14.2	66	9	2.50	100.51	22437	259.68	
	28/06/2018	28.6	19.45	10.3	58.5	8	2.22	100.66	22437	259.68	
	27/06/2018	26.8	20.5	14.2	61	12.5	3.47	100.65	22437	259.68	
	26/06/2018	29.6	23.55	17.5	63.5	17.5	4.86	100.95	22437	259.68	
	25/06/2018	25.7	20.9	16.1	69	13	3.61	101.57	22437	259.68	
	24/06/2018	21.6	19.05	16.5	76.5	11.5	3.19	101.65	22437	259.68	
	23/06/2018	26.2	21.6	17	70.5	10.5	2.92	100.79	22437	259.68	
	22/06/2018	31.1	22.95	14.8	60.5	13	3.61	100.85	22437	259.68	
	21/06/2018	33	23.65	14.3	52.5	12.5	3.47	101.16	22437	259.68	
	20/06/2018	30.3	22.4	14.5	50.5	9	2.50	101.41	22437	259.68	
	19/06/2018	28.2	19.64	11.1	51.5	8	2.22	101.74	22437	259.68	
	18/06/2018	26.1	18.2	10.3	50.5	10	2.78	101.91	22437	259.68	
	17/06/2018	24.4	17.6	10.8	53	14	3.89	101.39	22437	259.68	
	16/06/2018	20.9	17.29	13.7	70	13.5	3.75	101	22437	259.68	
	15/06/2018	27.4	21.79	16.2	60	18	5.00	100.37	22437	259.68	
	14/06/2018	26.5	18.95	11.4	59.5	17.5	4.86	100.77	22437	259.68	
	13/06/2018	27.7	18.3	8.9	52	19	5.28	100.98	22437	259.68	
	12/06/2018	22.1	15.3	8.5	68.5	21	5.83	101.04	22437	259.68	
	11/06/2018	20.8	16.14	11.5	73	17.5	4.86	100.76	22437	259.68	
	10/06/2018	30.3	23.7	17.1	66.5	19.5	5.42	100.88	22437	259.68	
	09/06/2018	20.7	18.25	15.8	75.5	12.5	3.47	101.31	22437	259.68	
	08/06/2018	27	20.25	13.5	56	9.5	2.64	101.58	22437	259.68	
	07/06/2018	28.4	17.64	6.9	58.5	15.5	4.31	101.55	22437	259.68	
	06/06/2018	21.4	14.7	8	65	12	3.33	101.24	22437	259.68	
	05/06/2018	25.8	18.35	10.9	58	19.5	5.42	100.96	22437	259.68	
	04/06/2018	15.8	9.65	3.5	65.5	13	3.61	101.48	22437	259.68	
	03/06/2018	19.5	13.4	7.3	67	17	4.72	101.23	22437	259.68	
	02/06/2018	14.4	12.85	11.3	77.5	19	5.28	100.77	22437	259.68	
	01/06/2018	14.8	12.5	10.2	67.5	20	5.56	101.72	22437	259.68	
	18-May	31/05/2018	16.3	15.1	13.9	79.5	17.5	4.86	100.88	22182	256.74
		30/05/2018	18.7	17.45	16.2	89	16	4.44	100.3	22182	256.74
29/05/2018		28.4	19.79	11.2	66.5	8.5	2.36	100.71	22182	256.74	
28/05/2018		24.9	17.45	10	56.5	10.5	2.92	101.66	22182	256.74	
27/05/2018		27.2	19.1	11	67.5	11	3.06	101.01	22182	256.74	
26/05/2018		22.2	16.8	11.4	79	6.5	1.81	100.45	22182	256.74	
25/05/2018		25.5	19.64	13.8	71	17.5	4.86	100.17	22182	256.74	
24/05/2018		27.5	20.65	13.8	71.5	13	3.61	100.77	22182	256.74	
23/05/2018		29.3	20.14	11	56	10.5	2.92	101.51	22182	256.74	
22/05/2018		28.4	18.5	8.6	43	10	2.78	101.3	22182	256.74	
21/05/2018		26.9	17.5	8.1	34.5	15	4.17	101.5	22182	256.74	
20/05/2018		27	13.65	0.3	44	14.5	4.03	102.01	22182	256.74	
19/05/2018		19.3	7.95	-3.4	52	11.5	3.19	102.33	22182	256.74	
18/05/2018		11.7	6.85	2	73.5	14	3.89	102.09	22182	256.74	
17/05/2018		9.7	8.14	6.6	69	13.5	3.75	102.27	22182	256.74	
16/05/2018		14.4	9	3.6	66	20	5.56	101.72	22182	256.74	
15/05/2018		30.9	14.55	-1.8	45	25.5	7.08	101.04	22182	256.74	
14/05/2018		20.2	11.45	2.7	41	17	4.72	101.5	22182	256.74	
13/05/2018		27.3	16.95	6.6	33.5	24	6.67	100.9	22182	256.74	
12/05/2018		22.3	11.15	0	33	18.5	5.14	101.79	22182	256.74	
11/05/2018		13	2.75	-7.5	46.5	7.5	2.08	102.12	22182	256.74	
10/05/2018		6	-0.54	-7.1	46.5	12.5	3.47	102.21	22182	256.74	
09/05/2018		14.5	6.75	-1	59	27.5	7.64	101.21	22182	256.74	
08/05/2018		17.7	10.95	4.2	44	15.5	4.31	101.81	22182	256.74	
07/05/2018		30.8	19.89	9	31	24.5	6.81	101.33	22182	256.74	
06/05/2018		19.5	11.85	4.2	53.5	8.5	2.36	101.92	22182	256.74	
05/05/2018		15	9.65	4.3	42	12.5	3.47	101.7	22182	256.74	
04/05/2018		19.7	11.2	2.7	46.5	17.5	4.86	101.15	22182	256.74	
03/05/2018		20.7	9.44	-1.8	56	15	4.17	100.89	22182	256.74	
02/05/2018		17.4	9.29	1.2	48	11	3.06	101.03	22182	256.74	
01/05/2018		4.3	2.6	0.9	76	12.5	3.47	101.09	22182	256.74	
30/04/2018	17.8	9.55	1.3	65	22	6.11	100.3	16831	194.80		
29/04/2018	23.6	14.1	4.6	47	39	10.83	100.69	16831	194.80		
28/04/2018	16.1	4.85	-6.4	56.5	16.5	4.58	102.03	16831	194.80		
27/04/2018	8.6	1.75	-5.1	67	18.5	5.14	101.81	16831	194.80		
26/04/2018	12.9	5.9	-1.1	58.5	13	3.61	101.36	16831	194.80		
25/04/2018	20.8	11.35	1.9	42	32	8.89	101.27	16831	194.80		
24/04/2018	6.2	0.95	-4.3	63.5	14.5	4.03	102.89	16831	194.80		
23/04/2018	14.7	7.65	0.6	53.5	16	4.44	102.14	16831	194.80		
22/04/2018	17.4	10.45	3.5	53.5	24.5	6.81	101.75	16831	194.80		

Month	Date	Max Temp	Average Temp	Min Temp	Average Relative Humidity	Average Wind Speed	Average Wind Speed	Average Pressure	Solar Radiation	Net Radiation
		[C]	[C]	[C]	[%]	[km/h]	[m/s]	[kPa]	[kJ/m2 per day]	[W/m2]
18-Apr	21/04/2018	19.1	9.5	-0.1	61.5	19.5	5.42	102.39	16831	194.80
	20/04/2018	15.5	6.2	-3.1	56.5	10.5	2.92	102.83	16831	194.80
	19/04/2018	12.9	5.05	-2.8	48	8	2.22	102.89	16831	194.80
	18/04/2018	12.4	3.85	-4.7	45.5	8.5	2.36	102.39	16831	194.80
	17/04/2018	10.6	1.84	-6.9	42.5	9.5	2.64	102.09	16831	194.80
	16/04/2018	7.2	-0.89	-9	51	10	2.78	102.48	16831	194.80
	15/04/2018	4.8	-1.8	-8.4	49.5	7	1.94	103.11	16831	194.80
	14/04/2018	1.9	-4.7	-11.3	51.5	11	3.06	103.43	16831	194.80
	13/04/2018	-0.6	-6.85	-13.1	50	14.5	4.03	102.77	16831	194.80
	12/04/2018	-0.9	-5.05	-9.2	58.5	12.5	3.47	101.47	16831	194.80
	11/04/2018	-1.3	-4.9	-8.5	69	8.5	2.36	101.32	16831	194.80
	10/04/2018	5.1	-1.25	-7.6	66	15	4.17	101.47	16831	194.80
	09/04/2018	1.7	-6.3	-14.3	57	12.5	3.47	102.37	16831	194.80
	08/04/2018	-3.8	-11.2	-18.6	57	7.5	2.08	102.2	16831	194.80
	07/04/2018	-4.3	-10.05	-15.8	52.5	11.5	3.19	102.37	16831	194.80
	06/04/2018	-4.7	-11.1	-17.5	52	19.5	5.42	102.4	16831	194.80
	05/04/2018	-5	-9.8	-14.6	62	19	5.28	101.92	16831	194.80
	04/04/2018	-1.6	-8.8	-16	58.5	13.5	3.75	101.86	16831	194.80
03/04/2018	-3.9	-12.3	-20.7	54	10	2.78	102.36	16831	194.80	
02/04/2018	-11.5	-16.39	-21.3	50.5	12	3.33	102.19	16831	194.80	
01/04/2018	-2.9	-9.89	-16.9	58.5	23	6.39	101.6	16831	194.80	

ENERGY BALANCE METHOD

Radiation Method Evaporation mm/year	1,356.10	Apr-20			May-20			Jun-20			Jul-20			Aug-20			Sep-20			Oct-20									
		Monthly Total Evap (mm)			Monthly Total Evap (mm)			Monthly Total Evap (mm)			Monthly Total Evap (mm)			Monthly Total Evap (mm)			Monthly Total Evap (mm)			Monthly Total Evap (mm)									
		DoM	Rn	lv	Er (mm/day)	DoM	Rn	lv	Er (mm/day)	DoM	Rn	lv	Er (mm/day)	DoM	Rn	lv	Er (mm/day)	DoM	Rn	lv	Er (mm/day)	DoM	Rn	lv	Er (mm/day)				
Average Annual		30	194.80	2,471.78	6.83	31	256.74	2,467.87	9.02	30	259.68	2,445.71	9.20	31	269.21	2,457.80	9.49	30	220.20	2,474.86	7.71	30	136.74	2,481.50	4.78	31	69.67	-	0.00
Precipitation mm / year	532.5	29	194.80	2,486.83	6.79	30	256.74	2,479.60	8.97	29	259.68	2,443.58	9.21	30	269.21	2,456.26	9.50	30	220.20	2,467.99	7.73	29	136.74	2,473.32	4.79	30	69.67	-	0.00
Net Evaporation Per Year	823.60	28	194.80	2,480.79	6.80	29	256.74	2,485.65	8.95	28	259.68	2,440.26	9.22	29	269.21	2,460.41	9.48	29	220.20	2,466.33	7.74	28	136.74	2,477.82	4.78	29	69.67	-	0.00
Evaporation		27	194.80	2,480.69	6.81	28	256.74	2,480.10	8.97	27	259.68	2,448.56	9.19	28	269.21	2,460.31	9.48	28	220.20	2,460.17	7.76	27	136.74	2,476.52	4.78	28	69.67	-	0.00
		26	194.80	2,480.31	6.81	27	256.74	2,459.69	9.05	26	259.68	2,448.67	9.19	27	269.21	2,456.02	9.50	27	220.20	2,463.96	7.74	26	136.74	2,465.41	4.81	27	69.67	-	0.00
		25	194.80	2,487.66	6.79	26	256.74	2,465.62	9.02	25	259.68	2,452.94	9.17	26	269.21	2,452.92	9.49	26	220.20	2,461.26	7.75	25	136.74	2,459.93	4.82	26	69.67	-	0.00
		24	194.80	2,489.56	6.78	25	256.74	2,466.45	9.02	24	259.68	2,459.93	9.15	25	269.21	2,438.48	9.57	25	220.20	2,456.73	7.77	24	136.74	2,481.62	4.78	25	69.67	-	0.00
		23	194.80	2,487.42	6.79	24	256.74	2,466.33	9.02	23	259.68	2,460.90	9.14	24	269.21	2,440.97	9.56	24	220.20	2,455.67	7.77	23	136.74	2,483.16	4.77	24	69.67	-	0.00
		22	194.80	2,494.41	6.77	23	256.74	2,459.69	9.05	22	259.68	2,463.37	9.14	23	269.21	2,456.26	9.50	23	220.20	2,457.70	7.76	22	136.74	2,462.42	4.81	23	69.67	-	0.00
		21	194.80	-	0.00	22	256.74	2,455.43	9.06	21	259.68	2,469.53	9.11	22	269.21	2,457.32	9.49	22	220.20	2,454.95	7.77	21	136.74	2,467.16	4.80	22	69.67	-	0.00
		20	194.80	-	0.00	21	256.74	2,454.84	9.06	20	259.68	2,468.37	9.12	21	269.21	2,460.41	9.48	21	220.20	2,448.56	7.79	20	136.74	2,461.71	4.81	21	69.67	-	0.00
		19	194.80	-	0.00	20	256.74	2,455.67	9.06	19	259.68	2,472.85	9.10	20	269.21	2,465.50	9.46	20	220.20	2,453.77	7.78	19	136.74	2,478.30	4.78	20	69.67	-	0.00
		18	194.80	2,501.79	6.75	19	256.74	2,453.56	9.07	18	259.68	2,466.92	9.12	19	269.21	2,459.93	9.48	19	220.20	2,450.93	7.79	18	136.74	2,494.53	4.75	19	69.67	-	0.00
		17	194.80	2,497.26	6.76	18	256.74	2,458.75	9.05	17	259.68	2,439.90	9.22	18	269.21	2,456.73	9.50	18	220.20	2,450.57	7.79	17	136.74	2,489.08	4.76	18	69.67	-	0.00
		16	194.80	-	0.00	17	256.74	2,470.00	9.01	16	259.68	2,459.22	9.15	17	269.21	2,459.93	9.48	17	220.20	2,465.62	7.74	16	136.74	2,486.71	4.77	17	69.67	-	0.00
		15	194.80	-	0.00	16	256.74	2,479.48	8.97	15	259.68	2,448.20	9.19	16	269.21	2,455.67	9.50	16	220.20	2,463.63	7.75	15	136.74	2,469.53	4.80	16	69.67	-	0.00
		14	194.80	-	0.00	15	256.74	2,494.77	8.92	14	259.68	2,455.43	9.17	15	269.21	2,457.44	9.49	15	220.20	2,458.75	7.76	14	136.74	2,484.82	4.77	15	69.67	-	0.00
		13	194.80	-	0.00	14	256.74	2,489.08	8.94	13	259.68	2,469.65	9.11	14	269.21	2,460.07	9.48	14	220.20	2,463.04	7.75	13	136.74	2,484.58	4.77	14	69.67	2,498.56	2.42
		12	194.80	-	0.00	13	256.74	2,498.09	8.91	12	259.68	2,473.80	9.10	13	269.21	2,454.15	9.51	13	220.20	2,454.95	7.77	12	136.74	2,467.40	4.80	13	69.67	2,487.90	2.43
		11	194.80	-	0.00	12	256.74	2,498.59	8.90	11	259.68	2,479.96	9.07	12	269.21	2,452.11	9.51	12	220.20	2,459.34	7.76	11	136.74	2,466.92	4.80	12	69.67	2,482.80	2.43
		10	194.80	2,498.70	6.76	11	256.74	-	0.00	10	259.68	2,470.24	9.11	11	269.21	2,459.13	9.49	11	220.20	2,457.56	7.76	10	136.74	2,468.11	4.80	11	69.67	2,468.58	2.45
		9	194.80	-	0.00	10	256.74	2,499.39	8.90	9	259.68	2,463.72	9.13	10	269.21	2,456.14	9.50	10	220.20	2,455.67	7.77	9	136.74	2,482.33	4.77	10	69.67	2,488.49	2.43
		8	194.80	2,499.77	6.75	9	256.74	2,496.69	8.91	8	259.68	2,457.56	9.16	9	269.21	2,454.48	9.50	9	220.20	2,455.93	7.77	8	136.74	2,487.54	4.76	9	69.67	2,485.65	2.43
		7	194.80	2,495.24	6.77	8	256.74	-	0.00	7	259.68	2,467.28	9.12	8	269.21	2,449.74	9.52	8	220.20	2,452.70	7.78	7	136.74	2,486.24	4.77	8	69.67	2,490.27	2.42
		6	194.80	2,495.60	6.76	7	256.74	2,499.30	8.90	6	259.68	2,477.35	9.08	7	269.21	2,450.45	9.52	7	220.20	2,449.38	7.79	6	136.74	2,470.60	4.80	7	69.67	2,482.47	2.43
		5	194.80	-	0.00	6	256.74	2,491.59	8.93	5	259.68	2,480.91	9.07	6	269.21	2,452.70	9.51	6	220.20	2,449.98	7.79	5	136.74	2,472.73	4.79	6	69.67	2,476.52	2.44
		4	194.80	-	0.00	5	256.74	2,489.20	8.94	4	259.68	2,464.81	9.13	5	269.21	2,447.25	9.53	5	220.20	2,458.51	7.76	4	136.74	2,472.14	4.79	5	69.67	2,473.20	2.44
		3	194.80	-	0.00	4	256.74	2,495.60	8.92	3	259.68	2,463.72	9.13	4	269.21	2,451.04	9.52	4	220.20	2,461.12	7.75	3	136.74	2,474.98	4.79	4	69.67	2,487.90	2.43
		2	194.80	-	0.00	3	256.74	2,499.18	8.90	2	259.68	2,460.07	9.15	3	269.21	2,442.39	9.55	3	220.20	2,460.52	7.76	2	136.74	2,469.53	4.80	3	69.67	2,495.15	2.42
		1	194.80	2,492.76	6.77	2	256.74	2,492.76	8.93	1	259.68	2,446.54	9.20	2	269.21	2,444.31	9.54	2	220.20	2,461.71	7.75	1	136.74	2,476.76	4.78	2	69.67	2,499.87	2.42
						1	256.74	2,468.82	9.01					1	269.21	2,447.13	9.53		1	220.20	2,458.63	7.76		1	69.67	2,498.82	2.42		

Radiation Method Evaporation mm/year	1,462.90	Apr-19			May-19			Jun-19			Jul-19			Aug-19			Sep-19			Oct-19									
		Monthly Total Evap (mm)			Monthly Total Evap (mm)			Monthly Total Evap (mm)			Monthly Total Evap (mm)			Monthly Total Evap (mm)			Monthly Total Evap (mm)			Monthly Total Evap (mm)									
		DoM	Rn	lv	Er (mm/day)	DoM	Rn	lv	Er (mm/day)	DoM	Rn	lv	Er (mm/day)	DoM	Rn	lv	Er (mm/day)	DoM	Rn	lv	Er (mm/day)	DoM	Rn	lv	Er (mm/day)				
Average Annual		30	143.33	2,496.67	4.98	31	328.88	2,482.21	11.48	30	361.02	2,442.63	12.81	31	263.02	2,456.52	9.28	30	116.74	2,472.61	4.09	30	19.41	2,493.23	0.67	31	48.60	-	0.00
Precipitation mm / year	532.5	29	122.43	2,493.23	4.26	30	300.12	2,464.67	10.55	29	164.44	2,448.32	5.82	30	320.53	2,469.06	11.25	30	251.74	2,466.09	8.85	29	28.77	2,455.93	1.02	30	75.39	-	0.00
Net Evaporation Per Year	930.40	28	144.31	2,497.73	5.01	29	296.53	2,469.06	10.41	28	311.24	2,451.28	11.20	29	320.69	2,469.41	11.25	29	262.89	2,467.04	9.23	28	177.60	2,445.95	6.29	29	71.55	-	0.00
Evaporation		27	272.33	2,499.77	9.44	28	314.11	2,465.62	11.04	27	297.20	2,452.11	10.50	28	198.17	2,452.23	7.00	28	227.37	2,463.37	8.00	27	149.63	2,463.96	5.26	28	73.47	-	0.00
		26	268.62	2,495.24	9.33	27	358.15	2,482.09	12.50	26	320.74	2,453.89	11.33	27	315.89	2,451.75	11.17	27	96.47	2,473.80	3.38	26	91.82	2,462.30	3.23	27	47.01	-	0.00
		25	224.55	2,487.07	7.82																								

ENERGY BALANCE METHOD

Radiation Method Evaporation mm/year	Apr-18				May-18				Jun-18				Jul-18				Aug-18				Sep-18				Oct-18			
	Monthly Total Evap (mm)			95.064	Monthly Total Evap (mm)			270.170	Monthly Total Evap (mm)			274.677	Monthly Total Evap (mm)			286.386	Monthly Total Evap (mm)			233.188	Monthly Total Evap (mm)			146.315	Monthly Total Evap (mm)			49.902
	DoM	Rn	lv	Er (mm/day)	DoM	Rn	lv	Er (mm/day)	DoM	Rn	lv	Er (mm/day)	DoM	Rn	lv	Er (mm/day)	DoM	Rn	lv	Er (mm/day)	DoM	Rn	lv	Er (mm/day)	DoM	Rn	lv	Er (mm/day)
Average Annual	30	194.80	2,479.25	6.81	31	256.74	2,466.09	9.02	30	259.68	2,458.89	9.15	31	126.27	2,461.71	4.45	31	166.86	2,457.80	5.88	30	175.08	2,499.63	6.07	31	39.19	2,501.29	1.36
Precipitation mm / year	29	194.80	2,468.46	6.84	30	256.74	2,460.52	9.04	29	259.68	2,454.48	9.17	30	250.51	2,449.50	8.86	30	236.53	2,456.14	8.35	29	154.50	2,494.65	5.37	30	59.95	2,493.11	2.08
Net Evaporation Per Year	28	194.80	2,490.39	6.78	29	256.74	2,454.98	9.06	28	259.68	2,455.78	9.16	29	272.80	2,454.48	9.63	29	240.49	2,465.15	8.45	28	92.81	2,500.58	3.22	29	29.51	2,492.78	1.03
Evaporation	27	194.80	2,497.73	6.76	28	256.74	2,460.52	9.04	27	259.68	2,453.30	9.17	28	265.36	2,455.33	9.37	28	181.05	2,472.61	6.35	27	60.82	2,489.79	2.12	28	24.16	2,495.36	0.84
	26	194.80	2,487.90	6.79	27	256.74	2,456.61	9.06	26	259.68	2,446.07	9.20	27	240.47	2,458.51	8.48	27	169.84	2,470.95	5.96	26	39.00	2,491.69	1.36	27	18.47	2,492.16	0.64
	25	194.80	2,474.98	6.82	26	256.74	2,462.06	9.04	25	259.68	2,452.35	9.18	26	249.33	2,460.17	8.78	26	205.23	2,478.54	7.18	25	155.64	2,482.92	5.43	26	19.65	2,486.95	0.68
	24	194.80	2,499.63	6.75	25	256.74	2,455.33	9.06	24	259.68	2,456.73	9.16	25	90.97	2,468.70	3.19	25	155.73	2,470.15	5.46	24	54.13	2,487.30	1.89	25	43.28	2,488.25	1.51
	23	194.80	2,483.75	6.80	24	256.74	2,452.94	9.07	23	259.68	2,450.69	9.18	24	190.68	2,465.03	6.70	24	182.87	2,462.44	6.44	23	47.03	2,491.10	1.64	24	106.79	2,492.87	3.71
	22	194.80	2,477.11	6.81	23	256.74	2,454.15	9.07	22	259.68	2,447.49	9.19	23	314.41	2,459.34	11.08	23	225.84	2,457.44	7.96	22	35.74	2,493.94	1.24	23	125.34	-	0.00
	21	194.80	2,479.37	6.81	22	256.74	2,458.04	9.05	21	259.68	2,445.83	9.20	22	191.78	2,454.24	6.77	22	259.64	2,452.61	9.17	21	129.78	2,484.84	4.53	22	83.31	2,496.45	2.89
	20	194.80	2,487.19	6.79	21	256.74	2,460.41	9.04	20	259.68	2,448.79	9.19	21	294.05	2,458.63	10.36	21	268.00	2,464.91	9.42	20	54.03	2,489.67	1.88	21	129.55	2,489.32	4.51
	19	194.80	2,489.91	6.78	20	256.74	2,469.53	9.01	19	259.68	2,455.33	9.17	20	224.25	2,454.60	7.92	20	231.33	2,464.55	8.13	19	171.85	2,486.59	5.99	20	120.41	2,500.58	4.17
	18	194.80	2,492.76	6.77	19	256.74	2,483.04	8.96	18	259.68	2,458.75	9.15	19	219.29	2,449.65	7.76	19	231.75	2,464.20	8.15	18	182.35	2,481.28	6.37	19	88.80	2,489.32	3.09
	17	194.80	2,497.52	6.76	18	256.74	2,485.65	8.95	17	259.68	2,460.17	9.15	18	321.83	2,451.87	11.37	18	168.46	2,450.57	5.96	17	130.67	2,484.58	4.56	18	135.69	2,472.85	4.76
	16	194.80	-	0.00	17	256.74	2,482.59	8.96	16	259.68	2,460.90	9.14	17	333.52	2,465.41	11.72	17	195.03	2,462.44	6.86	16	113.26	2,479.72	3.96	17	141.67	-	0.00
	15	194.80	-	0.00	16	256.74	2,480.55	8.97	15	259.68	2,450.24	9.18	16	216.85	2,468.11	7.61	16	75.97	2,463.87	2.67	15	154.41	2,476.05	5.40	16	45.75	2,499.77	1.59
	14	194.80	-	0.00	15	256.74	2,467.40	9.02	14	259.68	2,456.97	9.16	15	346.57	2,458.89	12.21	15	272.36	2,455.33	9.61	14	131.62	2,472.26	4.61	15	67.04	-	0.00
	13	194.80	-	0.00	14	256.74	2,474.74	8.99	13	259.68	2,458.51	9.15	14	292.16	2,441.92	10.37	14	168.63	2,473.70	5.91	13	74.78	2,469.77	2.62	14	45.80	-	0.00
	12	194.80	-	0.00	13	256.74	2,461.71	9.04	12	259.68	2,465.62	9.13	13	329.11	2,447.13	11.65	13	105.86	2,455.07	3.74	12	127.52	2,477.85	4.46	13	56.68	2,499.18	1.97
	11	194.80	-	0.00	12	256.74	2,475.45	8.99	11	259.68	2,463.63	9.13	12	309.00	2,447.61	10.94	12	258.55	2,443.34	9.17	11	119.29	2,463.49	4.20	12	136.86	-	0.00
	10	194.80	-	0.00	11	256.74	2,495.36	8.92	10	259.68	2,445.71	9.20	11	167.78	2,445.95	5.94	11	249.46	2,442.16	8.85	10	227.64	2,467.87	7.99	11	38.43	-	0.00
	9	194.80	-	0.00	10	256.74	-	0.00	9	259.68	2,458.63	9.15	10	304.94	2,453.77	10.77	10	229.47	2,446.07	8.13	9	151.41	2,454.84	5.35	10	48.55	2,499.75	1.68
	8	194.80	-	0.00	9	256.74	2,485.88	8.95	8	259.68	2,453.89	9.17	9	348.68	2,459.58	12.29	9	255.16	2,453.65	9.01	8	40.82	2,463.49	1.44	9	53.51	2,495.36	1.86
	7	194.80	-	0.00	8	256.74	2,475.93	8.99	7	259.68	2,460.07	9.15	8	209.00	2,454.15	7.38	8	257.49	2,451.42	9.10	7	209.28	2,474.86	7.33	8	64.24	2,491.93	2.23
	6	194.80	-	0.00	7	256.74	2,454.74	9.06	6	259.68	2,467.04	9.12	7	311.93	2,440.50	11.08	7	274.53	2,449.38	9.71	6	195.37	2,469.89	6.85	7	55.52	2,498.82	1.93
	5	194.80	-	0.00	6	256.74	2,473.80	8.99	5	259.68	2,458.39	9.15	6	344.80	2,458.89	12.15	6	286.96	2,466.69	10.08	5	250.81	2,478.30	8.77	6	67.86	2,499.18	2.35
	4	194.80	-	0.00	5	256.74	2,479.01	8.97	4	259.68	2,479.01	9.08	5	351.40	2,461.85	12.37	5	200.63	2,464.20	7.06	4	179.21	2,471.31	6.28	5	27.60	-	0.00
	3	194.80	-	0.00	4	256.74	2,475.34	8.99	3	259.68	2,470.12	9.11	4	189.55	2,455.33	6.69	4	151.37	2,455.07	5.34	3	237.47	2,462.44	8.36	4	151.97	-	0.00
	2	194.80	-	0.00	3	256.74	2,479.51	8.97	2	259.68	2,471.43	9.11	3	269.21	2,459.93	9.48	3	290.68	2,451.87	10.27	2	239.20	2,463.96	8.41	3	24.26	2,499.51	0.84
	1	194.80	-	0.00	2	256.74	2,479.86	8.97	1	259.68	2,472.26	9.10	2	269.21	2,457.92	9.49	2	240.68	2,468.11	8.45	1	245.56	2,465.62	8.63	2	60.39	2,488.61	2.10
					1	256.74	2,495.72	8.91					1	269.21	2,455.78	9.50	1	181.38	2,475.57	6.35					1	59.83	2,495.01	2.08

COMBINED METHOD

Combined Method	1,041.57	Apr-20				May-20				Jun-20				Jul-20				Aug-20				Sep-20				Oct-20			
		DoM	γ	Δ	E (mm/day)	DoM	γ	Δ	E (mm/day)	DoM	γ	Δ	E (mm/day)	DoM	γ	Δ	E (mm/day)	DoM	γ	Δ	E (mm/day)	DoM	γ	Δ	E (mm/day)	DoM	γ	Δ	E (mm/day)
Evaporation mm/year		30	66.07	91.93	6.24	31	66.68	103.41	7.15	30	66.57	169.16	7.27	31	66.74	129.23	6.95	31	65.55	86.93	5.25	30	65.85	72.65	3.55	31	-	-	0.00
Average Annual	532.5	29	66.32	64.54	3.95	30	66.83	77.23	6.13	29	66.45	178.40	7.89	30	66.93	136.85	7.09	30	65.71	103.45	5.56	29	65.63	92.41	4.33	30	-	-	0.00
Precipitation mm / year		28	65.98	72.48	5.01	29	66.59	64.28	5.70	28	66.30	198.91	8.93	29	66.72	122.33	6.53	29	66.33	109.76	5.49	28	66.14	82.12	3.54	29	-	-	0.00
Net Evaporation Per Year	- 509.07	27	65.75	72.45	4.36	28	66.10	77.36	6.25	27	66.26	160.65	9.00	28	66.47	122.29	6.92	28	66.25	122.23	6.40	27	65.45	81.75	3.83	28	-	-	0.00
Evaporation		26	66.00	77.42	5.72	27	66.14	122.04	8.53	26	66.52	160.71	7.73	27	66.55	136.75	8.25	27	66.36	116.12	5.50	26	65.29	109.43	4.07	27	-	-	0.00
		25	66.31	64.73	4.20	26	66.17	109.50	5.93	25	66.34	144.12	7.81	26	66.50	129.28	8.13	26	66.16	122.67	5.89	25	65.71	122.14	4.96	26	-	-	0.00
		24	65.91	60.77	3.85	25	66.49	102.92	6.11	24	66.45	122.14	6.68	25	66.66	197.78	9.00	25	66.56	137.07	6.00	24	65.79	72.68	3.14	25	-	-	0.00
		23	65.44	64.68	3.91	24	66.25	109.76	6.99	23	66.60	122.53	7.23	24	66.61	187.87	8.76	24	66.76	136.59	6.60	23	66.26	68.23	3.08	24	-	-	0.00
		22	65.40	53.73	3.63	23	66.32	122.04	7.01	22	66.46	115.89	6.69	23	66.68	136.85	7.83	23	66.57	129.19	5.59	22	66.52	115.52	4.44	23	-	-	0.00
		21	-	-	0.00	22	66.45	136.48	7.93	21	65.89	97.41	6.15	22	66.86	129.02	7.42	22	66.41	136.27	5.86	21	65.90	103.16	4.25	22	-	-	0.00
		20	-	-	0.00	21	66.52	136.22	8.13	20	66.08	103.58	6.16	21	66.72	122.33	6.72	21	66.48	160.65	6.26	20	66.21	115.25	4.23	21	-	-	0.00
		19	-	-	0.00	20	66.71	136.59	8.22	19	66.31	92.26	6.17	20	66.62	109.46	6.26	20	66.39	144.51	5.83	19	66.33	76.89	2.93	20	-	-	0.00
		18	64.85	44.60	3.54	19	66.89	144.41	10.24	18	66.09	103.08	6.04	19	66.30	122.14	7.77	19	66.46	152.29	6.26	18	66.35	53.75	2.62	19	-	-	0.00
		17	65.24	47.11	4.02	18	67.00	129.63	9.20	17	66.47	198.68	9.79	18	66.03	137.07	7.17	18	66.88	152.11	6.56	17	66.72	60.67	2.77	18	-	-	0.00
		16	-	-	0.00	17	66.69	97.57	6.88	16	66.42	129.83	7.58	17	66.25	122.14	6.91	17	66.89	109.50	5.28	16	66.50	64.52	3.80	17	-	-	0.00
		15	-	-	0.00	16	66.59	77.20	5.62	15	66.71	160.47	10.01	16	66.32	136.59	8.16	16	66.65	115.99	6.35	15	66.40	97.41	3.66	16	-	-	0.00
		14	-	-	0.00	15	65.95	53.79	4.57	14	66.88	136.48	8.79	15	66.13	129.08	8.80	15	66.45	129.63	6.68	14	66.54	68.62	2.88	15	-	-	0.00
		13	-	-	0.00	14	65.43	60.67	4.56	13	67.02	97.45	6.64	14	66.04	122.19	8.23	14	66.33	115.76	5.26	13	66.46	68.56	3.09	14	65.04	47.33	2.35
		12	-	-	0.00	13	65.53	47.25	4.23	12	67.27	86.61	5.81	13	66.17	144.69	7.47	13	66.58	136.27	5.76	12	66.21	103.24	4.11	13	65.17	60.42	3.15
		11	-	-	0.00	12	66.23	47.33	4.39	11	66.37	77.33	5.57	12	66.70	152.88	7.65	12	66.61	121.90	5.88	11	66.70	103.08	5.10	12	65.08	72.98	3.32
		10	65.36	47.35	3.48	11	-	-	0.00	10	65.91	97.65	7.19	11	66.73	129.79	6.77	11	66.31	129.13	6.70	10	66.98	103.49	4.15	11	65.28	103.66	3.39
		9	-	-	0.00	10	66.67	47.46	5.67	9	66.00	116.03	6.59	10	66.65	136.80	7.26	10	66.13	136.59	8.12	9	66.83	72.86	3.69	10	65.90	60.54	1.97
		8	65.24	44.28	3.76	9	66.37	50.51	5.26	8	65.99	129.13	6.65	9	66.12	144.85	8.42	9	66.26	136.70	7.11	8	66.84	64.70	2.89	9	65.26	64.28	2.34
		7	65.10	50.26	3.51	8	-	-	0.00	7	65.94	103.20	6.64	8	66.27	161.27	8.27	8	66.52	144.01	7.90	7	66.28	64.41	3.50	8	65.86	56.80	1.60
		6	65.52	50.32	3.56	7	66.41	47.45	5.14	6	66.56	81.99	5.78	7	66.73	152.05	7.51	7	66.53	161.08	6.68	6	65.82	97.76	4.65	7	66.00	72.90	2.31
		5	-	-	0.00	6	66.51	57.06	5.65	5	66.09	72.50	5.42	6	66.67	144.01	7.65	6	66.73	151.82	6.61	5	66.49	92.22	3.20	6	65.46	81.75	2.33
		4	-	-	0.00	5	66.31	60.69	5.10	4	65.81	109.21	7.96	5	66.76	170.01	7.36	5	66.59	129.53	5.79	4	66.34	92.04	4.30	5	65.49	92.37	2.89
		3	-	-	0.00	4	66.23	50.32	4.26	3	66.11	116.03	6.97	4	66.96	152.35	7.19	4	66.85	122.62	5.83	3	65.67	86.96	4.46	4	65.89	60.42	2.25
		2	-	-	0.00	3	66.15	47.43	4.26	2	66.28	122.19	8.07	3	67.25	188.73	8.63	3	67.14	122.38	5.66	2	65.45	97.41	3.67	3	66.31	50.24	1.36
		1	65.82	53.42	3.77	2	65.41	53.42	5.40	1	66.33	169.62	11.29	2	67.05	178.82	8.49	2	67.16	115.25	5.73	1	65.12	81.82	3.57	2	66.24	44.29	1.27
					1	65.68	97.18	6.73					1	66.59	169.94	8.73	1	67.03	129.58	6.24	1	66.42	47.37	1.49					

Combined Method	1,103.22	Apr-19				May-19				Jun-19				Jul-19				Aug-19				Sep-19				Oct-19			
		DoM	γ	Δ	E (mm/day)	DoM	γ	Δ	E (mm/day)	DoM	γ	Δ	E (mm/day)	DoM	γ	Δ	E (mm/day)	DoM	γ	Δ	E (mm/day)	DoM	γ	Δ	E (mm/day)	DoM	γ	Δ	E (mm/day)
Evaporation mm/year		30	66.44	50.51	2.65	31	66.04	72.83	7.67	30	66.94	188.87	13.00	31	66.85	136.97	7.44	31	66.72	92.18	2.78	30	65.80	53.50	0.59	31	-	-	0.00
Average Annual	532.5	29	66.41	53.50	3.18	30	65.95	109.16	8.53	29	67.04	160.53	6.40	30	66.70	97.26	7.44	30	66.81	109.68	6.56	29	67.57	64.68	1.41	30	-	-	0.00
Precipitation mm / year		28	66.19	47.19	3.19	29	65.91	97.26	7.35	28	67.18	152.47	9.17	29	66.39	97.37	8.34	29	66.06	103.12	7.75	28	67.74	57.01	3.55	29	-	-	0.00
Net Evaporation Per Year	- 570.72	27	65.95	44.28	4.35	28	66.11	109.50	8.91	27	67.03	152.88	8.71	28	66.27	143.78	6.92	28	65.92	115.89	7.32	27	66.18	64.68	3.33	28	-	-	0.00
Evaporation		26	65.96	50.26	4.69	27	66.30	72.80	7.48	26	66.58	144.57	9.46	27	66.68	152.70	8.83	27	65.45	86.61	2.69	26	65.83	72.95	2.62	27	-	-	0.00
		25	65.71	64.60	5.49	26	66.58	68.42	4.43	25	66.04	136.22	8.44	26	66.20	128.87	6.91	26	65.89	122.09	4.19	25	65.69	68.23	2.86	26	64.99	64.57	2.22
		24	65.44	82.09	6.30	25	66.06	92.07	7.37	24	65.83	129.13	6.08	25	66.41	160.40	9.55	25	66.22	136.70	2.83	24	65.63	97.45	2.67	25	65.43	56.84	2.24
		23	65.86	68.62	3.54	24	65.88	72.80	2.10	23	66.21	137.01	8.39	24	66.94	152.00	9.27	24	66.89	169.29	9.34	23	66.00	109.07	5.58	24	-	-	0.00
		22	66.55	68.62	5.59	23	66.44	86.96	7.12	22	66.49	129.08	6.18	23	67.34	160.84	8.76	23	66.83	116.12	6.29	22	66.02	97.22	3.49	23	65.58	44.39	1.34
		21	66.15	64.23	4.82	22	66.16	92.00	3.06	21	66.52	136.75	6.82	22	67.30	136.32	8.80	22	66.93	115.48	7.15	21	65.82	108.94	1.11	22	65.07	47.13	1.06
		20	65.57	77.48	4.19	21	66.50	81.75	7.28	20	66.35	136.97	8.77	21	67.02	115.80	8.13	21	66.71	103.61	5.35	20	66.43	122.38	1.95	21	65.66	56.84	1.52
		19	65.68	76.98	6.08	20	66.58	77.11	7.55	19	66.35	122.09	7.49	20	66.42	122													

COMBINED METHOD

Combined Method	1,046.78	Apr-18				May-18				Jun-18				Jul-18				Aug-18				Sep-18				Oct-18			
		DoM	γ	Δ	E (mm/day)	DoM	γ	Δ	E (mm/day)	DoM	γ	Δ	E (mm/day)	DoM	γ	Δ	E (mm/day)	DoM	γ	Δ	E (mm/day)	DoM	γ	Δ	E (mm/day)	DoM	γ	Δ	E (mm/day)
Evaporation mm/year		30	65.37	77.14	5.17	31	66.10	109.68	6.88	30	66.09	129.69	6.94	31	66.59	115.25	3.59	30	66.07	129.23	5.15	30	66.37	44.26	3.05	31	65.35	44.52	0.93
Average Annual	532.5	29	65.91	103.61	8.87	30	65.86	122.38	7.55	29	66.16	144.85	7.12	30	66.95	161.15	7.52	30	66.21	136.80	7.96	29	66.14	53.77	3.18	30	65.24	53.48	1.31
Precipitation mm / year		28	66.20	56.82	4.26	29	66.28	136.28	6.80	28	66.23	136.64	7.04	29	67.00	144.85	7.40	29	66.49	109.33	6.13	28	66.00	44.40	2.03	29	65.75	53.42	0.74
Net Evaporation Per Year	- 514.28	27	65.86	47.19	3.67	28	66.76	122.38	6.42	27	66.29	144.29	7.60	28	67.06	136.44	6.96	28	66.31	92.18	4.11	27	65.63	60.82	1.45	28	65.60	50.28	0.57
Evaporation		26	65.83	60.42	4.14	27	66.44	137.01	7.05	26	66.68	169.36	8.45	27	67.02	129.53	6.45	27	66.07	97.88	4.56	26	65.54	57.08	0.96	27	65.21	57.17	0.50
		25	66.11	86.96	7.69	26	65.92	115.39	6.26	25	66.92	143.84	7.35	26	66.89	122.23	6.90	26	65.99	76.95	4.77	25	65.97	73.01	3.43	26	65.54	64.57	0.46
		24	66.51	44.26	3.39	25	65.92	136.44	7.33	24	66.85	137.07	6.86	25	66.45	103.70	2.52	25	66.00	97.62	4.07	24	65.75	64.65	1.12	25	65.76	60.49	1.23
		23	66.45	68.37	4.77	24	66.38	144.12	7.40	23	66.45	152.17	7.25	24	66.56	109.29	5.01	24	66.06	115.53	4.76	23	66.36	56.96	1.58	24	66.09	53.44	2.53
		22	66.37	81.92	6.03	23	66.83	144.69	7.37	22	66.58	160.10	7.95	23	66.66	121.90	8.17	23	66.18	129.08	6.64	22	66.34	53.64	1.14	23	-	-	0.00
		21	66.73	77.17	5.09	22	66.59	129.33	6.97	21	66.83	169.23	8.31	22	66.93	144.73	5.51	22	66.73	143.96	8.84	21	66.34	68.63	3.12	22	66.04	50.47	2.32
		20	66.80	64.62	4.11	21	66.66	122.33	7.21	20	66.91	160.77	7.75	21	67.06	129.58	7.36	21	66.87	109.24	6.88	20	66.20	60.79	1.33	21	65.73	60.72	3.49
		19	66.77	60.84	3.91	20	66.74	97.41	6.33	19	66.95	136.44	7.16	20	66.84	136.11	6.88	20	67.00	109.11	5.78	19	66.40	64.49	3.29	20	66.18	44.40	2.61
		18	66.37	53.42	3.72	19	66.59	68.20	5.01	18	66.97	129.63	7.29	19	66.47	161.22	6.43	19	66.64	108.99	6.64	18	66.34	72.60	3.63	19	65.59	60.72	3.45
		17	66.05	47.15	3.57	18	66.36	64.28	5.11	17	66.59	122.23	7.55	18	66.76	152.76	9.25	18	66.62	152.11	5.52	17	66.30	68.56	2.74	18	65.93	92.26	4.98
		16	-	-	0.00	17	66.56	72.92	5.67	16	66.31	122.53	6.94	17	66.82	109.43	7.87	17	66.84	115.53	5.00	16	65.84	77.26	2.62	17	-	-	0.00
		15	-	-	0.00	16	66.26	77.48	6.65	15	66.19	151.95	8.39	16	66.57	103.49	5.52	16	66.57	116.08	2.82	15	66.83	81.62	3.51	16	65.72	44.28	1.50
		14	-	-	0.00	15	66.17	103.24	8.36	14	66.27	128.87	7.86	15	66.47	129.69	10.18	15	66.56	136.44	8.23	14	66.71	92.07	3.15	15	-	-	0.00
		13	-	-	0.00	14	66.27	86.89	6.80	13	66.37	129.53	8.38	14	66.83	188.44	10.52	14	66.40	86.59	3.88	13	66.10	97.49	1.76	14	-	-	0.00
		12	-	-	0.00	13	66.23	115.25	8.61	12	66.21	109.50	7.23	13	66.92	169.94	9.80	13	66.41	136.32	3.85	12	66.26	82.13	2.96	13	64.99	47.43	1.43
		11	-	-	0.00	12	66.44	87.10	6.88	11	66.08	115.99	6.96	12	66.54	160.16	10.10	12	66.78	178.26	7.94	11	65.98	115.93	4.08	12	-	-	0.00
		10	-	-	0.00	11	66.12	50.28	4.18	10	66.65	169.16	8.49	11	66.61	169.29	6.20	11	66.97	188.59	8.50	10	66.12	103.41	5.70	11	-	-	0.00
		9	-	-	0.00	10	-	-	0.00	9	66.58	129.58	6.83	10	67.08	144.51	8.06	10	66.92	169.36	6.84	9	66.37	136.22	5.09	10	66.12	44.27	1.35
		8	-	-	0.00	9	65.78	64.33	6.34	8	66.89	144.57	7.39	9	67.05	121.99	8.78	9	66.79	144.45	7.17	8	66.84	115.93	2.14	9	66.52	50.28	1.79
		7	-	-	0.00	8	66.44	81.59	6.43	7	66.70	122.19	7.51	8	66.67	144.69	6.33	8	66.46	152.54	7.35	7	67.19	86.93	5.21	8	66.41	57.13	1.29
		6	-	-	0.00	7	66.70	136.17	8.11	6	66.31	103.12	6.51	7	66.79	187.58	10.82	7	66.51	161.08	8.84	6	67.20	97.53	5.04	7	66.48	47.37	0.98
		5	-	-	0.00	6	66.57	86.61	5.56	5	66.36	129.48	8.14	6	67.33	129.69	9.24	6	66.63	103.00	6.71	5	66.89	76.89	5.60	6	66.21	47.43	1.18
		4	-	-	0.00	5	66.29	77.08	5.63	4	66.14	77.08	5.75	5	67.38	115.31	9.12	5	66.26	108.99	5.11	4	66.35	91.78	5.17	5	-	-	0.00
		3	-	-	0.00	4	66.02	87.07	5.99	3	66.22	97.61	6.66	4	66.60	136.44	6.64	4	66.06	136.32	4.99	3	66.66	115.53	6.61	4	-	-	0.00
		2	-	-	0.00	3	65.74	77.21	6.12	2	65.88	91.82	6.22	3	66.66	122.14	6.98	3	66.35	152.76	8.58	2	66.33	116.12	7.52	3	65.19	47.48	0.56
		1	-	-	0.00	2	65.83	77.30	5.72	1	66.48	92.07	6.67	2	66.18	129.28	7.71	2	66.30	103.49	6.12	1	66.11	109.50	7.27	2	65.81	60.57	1.30
						1	65.45	50.34	4.51					1	66.16	136.64	7.30	1	66.55	87.14	4.17	1	66.27	50.22	1.56				



ECOMISTER EVAPORATOR

October 16, 2020

Mr. Dana Bredin
Project Engineer
WSP
1600 Buffalo Place
Winnipeg, MT R3T 6B9



Dana,

Thank you for your inquiry in the Enhance evaporation System we call the “EcoMister” (formerly the Turbo-mister). In our communications you requested a quote for an evaporation solution that will dispose of **700 cubic meters a year** for the Landfill Site, near Gimli, Manitoba.

Slimline Manufacturing is the original developer of this type of mechanical, turbine based, trajectory evaporator. We have been engineering and building these systems for **more than 20 years**. With over **600 installations sites around the world** these systems have been used in all types of conditions including salt brine, acidic water, and nuclear wastewater. A sample client application list has been attached separately for reference.

Based on the information provided and as per our conversation the site will require one (1) **HD19 EcoMister Evaporator** to dispose of, on average, **1,613 cubic meters a year based on an 8 hour a day operating window, 5 days per week**. For the purposes of this proposal we are providing you a quote for one (1) **HD19 EcoMister Evaporator** configured with a trailer option and onboard pump package.

Assumptions from our Communications

Location: Gimli, Manitoba

Type of Water: Landfill leachate

Volume to Dispose: 700 m³/year

Operational Period: 6 months of the year at 8 hours a day 5 days a week

Evaporation data: Winnipeg, Manitoba

(https://ftp.maps.canada.ca/pub/nrcan_rncan/raster/atlas/eng/hydro_1978/water_quantity_temperature_winds/17_Mean_Annual_Lake_Evaporation_1978_150.pdf)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
mm	0	0	0	0	146	147	146	140	87	43	0	0

Seasonal Weather: Expectation is more evaporation in the summer months and seasonal shutdown in the winter.

Winds: W-SW in the summer, and N-NW in the winter.
Electrical: Assuming 460V 60Hz 3 phase
Pond Size: 50m x 50m x 1.5m deep

Conclusions

Using the annual pan evaporation data above for the period, the projected efficiency of the enhanced evaporation systems **averages 22.8% over the 6-month period for our HD19 EcoMister Evaporator**. Operating 8 hours a day, 5 days per week this equates to an average **annual disposal volume 1,613 cubic meters per year per evaporator or 11.86 cubic meters per day**. Based on the disposal requirements of **700 cubic meters per year**, the total number of evaporators will equate to one **(1) HD19 EcoMister Evaporators**.

In terms of deployment configuration, we are recommending a **HD19 Trailer Based EcoMister Evaporator with a pump package mounted directly to the trailer**. This system would accommodate the following specifications from our communications:

- **Mobility around the site** - useful for managing additional leachate locations, and movement for seasonal storage.
- **Automated Controls** - Automated controls options could be integrated into the unit, with opportunity for adding windspeed and direction control, time of use tracking, and other additional features if required.

More detailed specifications on the units can be found below.



Figure 1 - HD19 EcoMister Evaporator - Pincher Creek

Evaporator Model Specification

HD19 EcoMister Evaporator

All units in the HD series are designed to operate in the harshest environments 24 hours a day, 365 days a year, and are available in **land based**, trailer based and float-based configurations depending on your specific needs. Pump packages are also available to match the needs of your site along with wind speed and automated control systems.

BENEFITS AND FEATURES

Longevity in the Harshest Environments

The HD19 EcoMister is built with our patented stainless-steel axial flow turbine and our stainless-steel directional wind tunnel and both are coated with specially blended 3M™ Scotchkote™ for durability against the elements and to meet the corrosive conditions of operating sites. Motors are built to exceed IEEE-841 Severe Duty standards and are 3rd party tested to guarantee a 0.5 mil vibration rate to maximize the motor's operational lifetime.

Fits the Smallest Ponds

With the smallest turbine of the three evaporator sizes the HD19 offers the smallest plume for those sites with limited space. Still equipped with a dynamically balanced aluminum fan and our directional air delivery tube which creates laminar air flow, the spray pattern is engineered to reduce water particle collision and to reach maximum loft or "hang time". This longer "hang time" along with a specifically engineered droplet size maximizes your evaporation efficiency, even on a smaller pond.

Low Operating Costs

To maximize efficiency and minimize operational costs the turbine is spun to a specific size allowing for manufacturing tolerances of fewer than 30 thousandths of an inch. This allows the turbine to operate at lower horsepower requirements but provides air volumes comparable to a much larger and more costly unit. Systems are designed for minimal maintenance and down time through thoughtful design like simplified greased ports on the motors to a quick release camlock on the nozzle ring manifold.

Flexibility

Each evaporator is available in multiple base configurations including fixed land based, trailer based, and float based, providing the best solutions and setup for the needs of each site. A simplified pitch adjustment system allows the operator to easily adjust the direction and angle of the wind tunnel to optimize plume control and evaporation efficiency in varying site conditions.

Specifications

- Max Throw from Machine (Length) is 50 FT (15 M)
- Annual Disposal Volume at 50% Efficiency is >6,000,000 US Gallons (22,700 Cubic Meters)
- Manufactured from a combination of stainless steel and carbon steel
- All wetted components are 316L Stainless Steel
- Our 19" enhanced evaporation fan
- Our most popular coating system, Scotchkote™ 134 powder coat
- Custom manufactured electric motor that exceeds the 841 standards, with stainless steel motor shafts (HD) and specialty high corrosion resistant paint
- Motors are designed with a 1.5 safety margin to allow for excessive cabling runs and power quality
- Fan is supported by a single bearing for radial loads system but directly connected to motor
- Powder coated Aluminum fan. It is also available in Stainless steel for severe corrosion applications
- Independently inspected & quality controlled to ensure that operational vibration is below 0.5 mil
- Quick release nozzle ring with **Teflon nozzles**
- Available in a variety of configurations from land based, float based to units with sound enclosures
- Pump volume thru unit is **28.6 US GPM at 100 psi**
- Average weight of standard equipped land base unit is **1,000 pounds**
- **WARRANTY:** All units have a minimum one-year parts and labor warranty



Figure 3 - HD19 EcoMister Evaporator

HD (Heavy Duty) Pump Package

We have provided our standard Heavy Duty pump package for HD19 EcoMister Evaporator.

HD19 General Pump Specifications

- 5 Horsepower 460V or 575V 60Hz motor
- NPSHR by the pump a design approx. 11 -12 ft
- This design accounts for zero elevation change after the discharge of the pump

This is a stainless-steel vertical multistage pump and motor which consists of the following:

- 5 horsepower motor directly connected to stainless steel multi-stage centrifugal pump installed on the back of trailer frame
- Self-Cleaning Suction filter incased in a stainless basket
 - Throttling valve for flow control to self-cleaning filter and pressure gauge
 - Bronze swing check valve
- Certified wire reinforce hose which comes complete with Certificates of pressure testing
 - Option 1: Stainless steel intake pipe
 - Option 2: 50' of 2" distribution/manifold hose
- Pump control panel
 - Pressure switch for loss of prime
 - Loss of pressure shut down
 - Fault lights
 - Pressure monitor switch monitor for suction and discharge failure
 - All plumbing fixtures, camlocks all 316 stainless steel

Please note the client is responsible for all electrical connections required by local provincial/state or federal law for the installation.



Figure 4 - Pump Package Visual

Additional Information

Typical O&M Costs

Historical data on our evaporators for maintenance, assuming that the unit is operational 12 months a year 24-7, is as follows.

Yearly:

- Units should be greased yearly at the beginning of each season
- Nozzle replacement biannually per unit (every 2nd year) \$1,500.00 CAD Funds

Every 5 - 10 Years:

- Fan bearing replacement per unit \$350.00 CAD Funds (Qty. of 2)

Note: No labor calculations have been shown but weekly inspections should be done for general condition of units during operation. It is recommended you check for such things as plugged nozzles or leaking hoses. A second nozzle ring is recommended to minimize down time for maintenance.

Optional Equipment Information

Wind Control System Option #1

This system simple monitors and reacts to a set of preset high and low set points, the system will shut down the pumping system should the high-speed set point be achieved after a set period. Once the wind has dropped below the low speed set point the system will reengage the pump. The evaporator fan will continue to run during a wind shut down alarm. It can also track wind direction, if you require set points to ensure the spray plume stays within the containment area, it can auto shut off the evaporator to deter spray outside the designated area.



Wind Control System Option #2

This system tracks the wind speed and direction, and various trending figures. It can group evaporators to maximize operational run times. It controls both pump and evaporator start up sequence plus monitors for any plumbing or pump system failures.

- Wind direction control for 360-degree presets
- Wind high speed shut down
- Wind low speed start up
- Unit will sequence shut down the Evaporator then pump.
- Trend all control points
- Is available with cell or Wi-Fi download capacity and control point adjustment (not included in this quote)

Consisting of the Following:

- Contactors to control 1 evaporator and 1 pump (expandable)
- Client needs only supply power and wire
- Pump and evaporator are supplied with required wiring components
- Wire from controls to evaporators supplied
- Warning lights to inform personal of status of the control center
- System is programmed and tested as a functioning model before shipment.



APPENDIX

F

GENERAL
CORRESPONDENCE
FOR REFERENCE

Hailstone, Amber

From: +WPG574 - HRB Archaeology (SCH) <HRB.archaeology@gov.mb.ca>
Sent: Monday, June 04, 2018 7:05 PM
To: Bunn, Jason
Cc: Nesbitt, Christina (SCH)
Subject: RE: Environment Act Proposal - RM of Gimli - Heritage Resources information request [WSP# 181-03988-00]
Attachments: Precious Resource for all Manitobans - Heritage Objects (English).pdf

Dear Jason,

The Historic Resources Branch has no concerns at this time. However, please be advised that in addition to a provision concerning the possibility of accidentally encountering heritage resources/archaeological sites, the EAP should contain an outline of the appropriate measures to mitigate those impacts upon such an encounter. Specifically, if heritage resources or human remains are encountered during any phase of development by the R.M. of Gimli, their employees or contractors, work is to stop and the Manitoba Historic Resources Branch is to be contacted immediately. In the case of human remains, notification must also be made to the RCMP.

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

If you have any questions or comments, please feel free to contact the Branch as below. I am attaching for your reference our booklet about heritage objects/resource recognition.

Sincerely,

Suyoko Anne Tsukamoto
Impact Assessment Archaeologist
Historic Resources Branch
Manitoba Sport, Culture, and Heritage

Main Floor, 213 Notre Dame Avenue
Winnipeg, MB
R3B 1N3
T: (204) 945-3893
F: (204) 945-2384
e: suyoko.tsukamoto@gov.mb.ca

From: Bunn, Jason [mailto:Jason.Bunn@wsp.com]
Sent: May-30-18 3:26 PM
To: +WPG574 - HRB Archaeology (SCH) <HRB.archaeology@gov.mb.ca>
Subject: Environment Act Proposal - RM of Gimli - Heritage Resources information request [WSP# 181-03988-00]

Hello,

We are working on an Environment Act Proposal for the RM of Gimli regarding the construction of biosolids storage ponds (from the Gimli WWTP) at a site adjacent to the Arnes waste disposal grounds (10-21-3 EPM). Please indicate if there are any concerns in regard to Heritage Resources. I would greatly appreciate your information before June 7, 2018.

Kind regards,

Jason Bunn, P.Eng.
Engineer, Wastewater Infrastructure



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Winnipeg, Manitoba,
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Hailstone, Amber

From: Butterfield, Tamara (SD) <Tamara.Butterfield@gov.mb.ca>
Sent: Tuesday, June 05, 2018 11:00 AM
To: Bunn, Jason
Subject: RE: Environment Act Proposal - RM of Gimli - Licensed water users information request [WSP# 181-03988-00]

Hi Jason,
There are no licensed users within a one kilometre radius.

Please let me know if you need anything further.

Cheers,

Tamara

Ph. 204-945-7431
Cell 204-918-6273

From: Bunn, Jason [mailto:Jason.Bunn@wsp.com]
Sent: May-30-18 3:27 PM
To: Butterfield, Tamara (SD) <Tamara.Butterfield@gov.mb.ca>
Subject: Environment Act Proposal - RM of Gimli - Licensed water users information request [WSP# 181-03988-00]

Hi Tamara,

We are working on an Environment Act Proposal for the RM of Gimli regarding the construction of biosolids storage ponds (from the Gimli WWTP) at a site adjacent to the Arnes waste disposal grounds (SW 10-21-3 EPM). There will be no discharge from the facility to surface water courses. Please provide the licensed water users within a 1 kilometre radius from the site. I would greatly appreciate your information before June 7, 2018.

Kind regards,

Jason Bunn, P.Eng.
Engineer, Wastewater Infrastructure



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Hailstone, Amber

From: McCartney, Erin (CLPA) <Erin.McCartney@gov.mb.ca>
Sent: Thursday, May 31, 2018 9:30 AM
To: Bunn, Jason
Subject: RE: Environment Act Proposal - RM of Gimli - Mineral rights information request [WSP# 181-03988-00]
Attachments: 1713730-1 for ESW 10-21-03 EPM.pdf

Good Morning, please be advised that according to our records as of this date SW 10-21-03 EPM (154.00 acres) was transferred by the Dominion of Canada in 1920 along with the Sand and Gravel. The Crown retained ownership of the mines and minerals.

Title 533897 dated December 22, 1939 is for WSW 10-21-03 EPM excluding Road Plan 3339 WLTO and is subject to the reservations and provisos contained in the grant from the Crown. We can confirm that the sand and gravel continue to be owned by the surface's current landowner, The Rural Municipality of Gimli, and that the mines and minerals remain with the Crown.

Title 1713730/1, copy of which is attached, dated March 22, 2000 is for ESW 10-21-03 EPM and is subject to the reservations and provisos contained in the grant from the Crown. We can confirm that the sand and gravel continue to be owned by the surface's current landowner, The Rural Municipality of Gimli, and that the mines and minerals remain with the Crown.

If I can be of further assistance to you may I please hear from you.

Erin McCartney

Acting Supervisor Crown Lands Registry

Crown Lands and Property Agency
308 - 25 Tupper Street North
Portage la Prairie MB R1N 3K1
P 204-239-3805 F 204-239-3560
Toll Free 1-866-210-9589
www.clp.gov.mb.ca



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From: Bunn, Jason [mailto:Jason.Bunn@wsp.com]

Sent: May-31-18 8:50 AM

To: McCartney, Erin (CLPA) <Erin.McCartney@gov.mb.ca>

Subject: RE: Environment Act Proposal - RM of Gimli - Mineral rights information request [WSP# 181-03988-00]

Hi Erin,

I'm interested in confirming ownership of the mines, minerals, sand and gravel. Attached is the Certificate of Title, which is all that we have.

Thanks!

Jason Bunn, P.Eng.

Engineer, Wastewater Infrastructure



From: McCartney, Erin (CLPA) [<mailto:Erin.McCartney@gov.mb.ca>]

Sent: May-31-18 8:47 AM

To: Bunn, Jason <Jason.Bunn@wsp.com>

Subject: RE: Environment Act Proposal - RM of Gimli - Mineral rights information request [WSP# 181-03988-00]

Hi Jason, are you inquiring as to who has ownership or are you wanting to acquire the mines, minerals, sand and gravel? Please confirm your request and provide a copy of the current status of title(s) so that I can proceed with your request.

Erin McCartney

Acting Supervisor, Crown Lands Registry

Crown Lands and Property Agency

308 - 25 Tupper Street North

Portage la Prairie MB R1N 3K1

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From: Bunn, Jason [<mailto:Jason.Bunn@wsp.com>]

Sent: May-30-18 3:25 PM

To: McCartney, Erin (CLPA) <Erin.McCartney@gov.mb.ca>

Subject: Environment Act Proposal - RM of Gimli - Mineral rights information request [WSP# 181-03988-00]

Hi Erin,

We are working on an Environment Act Proposal for the RM of Gimli and require the mineral rights (Mines and Minerals & Sand and Gravel) for SW10-21-3 EPM. I would greatly appreciate your information before June 7, 2018.

Kind regards,

Jason Bunn, P.Eng.
Engineer, Wastewater Infrastructure



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Winnipeg, Manitoba,
R3T 6B8

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Hailstone, Amber

From: Friesen, Chris (SD) <Chris.Friesen@gov.mb.ca>
Sent: Tuesday, June 05, 2018 1:15 PM
To: Bunn, Jason
Subject: RE: Environment Act Proposal - RM of Gimli - Species search information request [WSP# 181-03988-00]

Jason

Thank you for your information request. I completed a search of the MB Conservation Data Centre rare species database which resulted in the following occurrence:

SE 9-21-3E

Bank Swallow (*Riparia riparia*), S5B, SARA: Threatened, COSEWIC: Threatened

Further information on this ranking system can be found on our website at <http://www.gov.mb.ca/conservation/cdc/consranks.html> and these designations can be found at <http://web2.gov.mb.ca/laws/statutes/ccsm/e111e.php>, <http://www.cosewic.gc.ca/> and http://www.sararegistry.gc.ca/default_e.cfm.

Manitoba's recommended setback distances can be found at <http://www.gov.mb.ca/conservation/cdc/pubs.html>

The information provided in this letter is based on existing data known to the Manitoba CDC of the Wildlife and Fisheries Branch at the time of the request. These data are dependent on the research and observations of our scientists and reflects our current state of knowledge. **An absence of data does not confirm the absence of any rare or endangered species.** Many areas of the province have never been thoroughly surveyed, however, and the absence of data in any particular geographic area does not necessarily mean that species or ecological communities of concern are not present. The information should, therefore, not be regarded as a final statement on the occurrence of any species of concern nor should it substitute for on-site surveys for species or environmental assessments. Also, because our Biotics database is continually updated and because information requests are evaluated by type of action, any given response is only appropriate for its respective request.

Please contact the Manitoba CDC for an update on this natural heritage information if more than six months passes before it is utilised.

Third party requests for products wholly or partially derived from the Biotics database must be approved by the Manitoba CDC before information is released. Once approved, the primary user will identify the Manitoba CDC as data contributors on any map or publication using data from our database, as the Manitoba Conservation Data Centre; Wildlife and Fisheries Branch, Manitoba Sustainable Development.

This letter is for information purposes only - it does not constitute consent or approval of the proposed project or activity, nor does it negate the need for any permits or approvals required by the Province of Manitoba.

We would be interested in receiving a copy of the results of any field surveys that you may undertake, to update our database with the most current knowledge of the area.

If you have any questions or require further information contact me directly at (204) 945-7747.

Chris Friesen
Coordinator

Manitoba Conservation Data Centre
204-945-7747
chris.friesen@gov.mb.ca
<http://www.manitoba.ca/sd/cdc/>

From: Bunn, Jason [mailto:Jason.Bunn@wsp.com]
Sent: May-30-18 3:26 PM
To: Friesen, Chris (SD) <Chris.Friesen@gov.mb.ca>
Subject: Environment Act Proposal - RM of Gimli - Species search information request [WSP# 181-03988-00]

Hi Chris,

We are working on an Environment Act Proposal for the RM of Gimli regarding the construction of biosolids storage ponds (from the Gimli WWTP) at a site adjacent to the Arnes waste disposal grounds (10-21-3 EPM). Please provide a listing of rare species for the identified area. I would greatly appreciate your information before June 7, 2018.

Kind regards,

Jason Bunn, P.Eng.
Engineer, Wastewater Infrastructure



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1600 Buffalo Place
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R3T 6B8

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Hailstone, Amber

From: +WPG574 - HRB Archaeology (SCH) <HRB.archaeology@gov.mb.ca>
Sent: Monday, June 04, 2018 7:05 PM
To: Bunn, Jason
Cc: Nesbitt, Christina (SCH)
Subject: RE: Environment Act Proposal - RM of Gimli - Heritage Resources information request [WSP# 181-03988-00]
Attachments: Precious Resource for all Manitobans - Heritage Objects (English).pdf

Dear Jason,

The Historic Resources Branch has no concerns at this time. However, please be advised that in addition to a provision concerning the possibility of accidentally encountering heritage resources/archaeological sites, the EAP should contain an outline of the appropriate measures to mitigate those impacts upon such an encounter. Specifically, if heritage resources or human remains are encountered during any phase of development by the R.M. of Gimli, their employees or contractors, work is to stop and the Manitoba Historic Resources Branch is to be contacted immediately. In the case of human remains, notification must also be made to the RCMP.

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

If you have any questions or comments, please feel free to contact the Branch as below. I am attaching for your reference our booklet about heritage objects/resource recognition.

Sincerely,

Suyoko Anne Tsukamoto
Impact Assessment Archaeologist
Historic Resources Branch
Manitoba Sport, Culture, and Heritage

Main Floor, 213 Notre Dame Avenue
Winnipeg, MB
R3B 1N3
T: (204) 945-3893
F: (204) 945-2384
e: suyoko.tsukamoto@gov.mb.ca

From: Bunn, Jason [mailto:Jason.Bunn@wsp.com]
Sent: May-30-18 3:26 PM
To: +WPG574 - HRB Archaeology (SCH) <HRB.archaeology@gov.mb.ca>
Subject: Environment Act Proposal - RM of Gimli - Heritage Resources information request [WSP# 181-03988-00]

Hello,

We are working on an Environment Act Proposal for the RM of Gimli regarding the construction of biosolids storage ponds (from the Gimli WWTP) at a site adjacent to the Arnes waste disposal grounds (10-21-3 EPM). Please indicate if there are any concerns in regard to Heritage Resources. I would greatly appreciate your information before June 7, 2018.

Kind regards,

Jason Bunn, P.Eng.
Engineer, Wastewater Infrastructure



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Hailstone, Amber

From: Butterfield, Tamara (SD) <Tamara.Butterfield@gov.mb.ca>
Sent: Tuesday, June 05, 2018 11:00 AM
To: Bunn, Jason
Subject: RE: Environment Act Proposal - RM of Gimli - Licensed water users information request [WSP# 181-03988-00]

Hi Jason,
There are no licensed users within a one kilometre radius.

Please let me know if you need anything further.

Cheers,

Tamara

Ph. 204-945-7431
Cell 204-918-6273

From: Bunn, Jason [mailto:Jason.Bunn@wsp.com]
Sent: May-30-18 3:27 PM
To: Butterfield, Tamara (SD) <Tamara.Butterfield@gov.mb.ca>
Subject: Environment Act Proposal - RM of Gimli - Licensed water users information request [WSP# 181-03988-00]

Hi Tamara,

We are working on an Environment Act Proposal for the RM of Gimli regarding the construction of biosolids storage ponds (from the Gimli WWTP) at a site adjacent to the Arnes waste disposal grounds (SW 10-21-3 EPM). There will be no discharge from the facility to surface water courses. Please provide the licensed water users within a 1 kilometre radius from the site. I would greatly appreciate your information before June 7, 2018.

Kind regards,

Jason Bunn, P.Eng.
Engineer, Wastewater Infrastructure



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Hailstone, Amber

From: McCartney, Erin (CLPA) <Erin.McCartney@gov.mb.ca>
Sent: Thursday, May 31, 2018 9:30 AM
To: Bunn, Jason
Subject: RE: Environment Act Proposal - RM of Gimli - Mineral rights information request [WSP# 181-03988-00]
Attachments: 1713730-1 for ESW 10-21-03 EPM.pdf

Good Morning, please be advised that according to our records as of this date SW 10-21-03 EPM (154.00 acres) was transferred by the Dominion of Canada in 1920 along with the Sand and Gravel. The Crown retained ownership of the mines and minerals.

Title 533897 dated December 22, 1939 is for WSW 10-21-03 EPM excluding Road Plan 3339 WLTO and is subject to the reservations and provisos contained in the grant from the Crown. We can confirm that the sand and gravel continue to be owned by the surface's current landowner, The Rural Municipality of Gimli, and that the mines and minerals remain with the Crown.

Title 1713730/1, copy of which is attached, dated March 22, 2000 is for ESW 10-21-03 EPM and is subject to the reservations and provisos contained in the grant from the Crown. We can confirm that the sand and gravel continue to be owned by the surface's current landowner, The Rural Municipality of Gimli, and that the mines and minerals remain with the Crown.

If I can be of further assistance to you may I please hear from you.

Erin McCartney

Acting Supervisor Crown Lands Registry

Crown Lands and Property Agency
308 - 25 Tupper Street North
Portage la Prairie MB R1N 3K1
P 204-239-3805 F 204-239-3560
Toll Free 1-866-210-9589
www.clp.gov.mb.ca



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From: Bunn, Jason [mailto:Jason.Bunn@wsp.com]

Sent: May-31-18 8:50 AM

To: McCartney, Erin (CLPA) <Erin.McCartney@gov.mb.ca>

Subject: RE: Environment Act Proposal - RM of Gimli - Mineral rights information request [WSP# 181-03988-00]

Hi Erin,

I'm interested in confirming ownership of the mines, minerals, sand and gravel. Attached is the Certificate of Title, which is all that we have.

Thanks!

Jason Bunn, P.Eng.

Engineer, Wastewater Infrastructure



From: McCartney, Erin (CLPA) [<mailto:Erin.McCartney@gov.mb.ca>]

Sent: May-31-18 8:47 AM

To: Bunn, Jason <Jason.Bunn@wsp.com>

Subject: RE: Environment Act Proposal - RM of Gimli - Mineral rights information request [WSP# 181-03988-00]

Hi Jason, are you inquiring as to who has ownership or are you wanting to acquire the mines, minerals, sand and gravel? Please confirm your request and provide a copy of the current status of title(s) so that I can proceed with your request.

Erin McCartney

Acting Supervisor, Crown Lands Registry

Crown Lands and Property Agency

308 - 25 Tupper Street North

Portage la Prairie MB R1N 3K1

P 204-239-3805 F 204-239-3560

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From: Bunn, Jason [<mailto:Jason.Bunn@wsp.com>]

Sent: May-30-18 3:25 PM

To: McCartney, Erin (CLPA) <Erin.McCartney@gov.mb.ca>

Subject: Environment Act Proposal - RM of Gimli - Mineral rights information request [WSP# 181-03988-00]

Hi Erin,

We are working on an Environment Act Proposal for the RM of Gimli and require the mineral rights (Mines and Minerals & Sand and Gravel) for SW10-21-3 EPM. I would greatly appreciate your information before June 7, 2018.

Kind regards,

Jason Bunn, P.Eng.
Engineer, Wastewater Infrastructure



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Hailstone, Amber

From: Friesen, Chris (SD) <Chris.Friesen@gov.mb.ca>
Sent: Tuesday, June 05, 2018 1:15 PM
To: Bunn, Jason
Subject: RE: Environment Act Proposal - RM of Gimli - Species search information request [WSP# 181-03988-00]

Jason

Thank you for your information request. I completed a search of the MB Conservation Data Centre rare species database which resulted in the following occurrence:

SE 9-21-3E

Bank Swallow (*Riparia riparia*), S5B, SARA: Threatened, COSEWIC: Threatened

Further information on this ranking system can be found on our website at <http://www.gov.mb.ca/conservation/cdc/consranks.html> and these designations can be found at <http://web2.gov.mb.ca/laws/statutes/ccsm/e111e.php>, <http://www.cosewic.gc.ca/> and http://www.sararegistry.gc.ca/default_e.cfm.

Manitoba's recommended setback distances can be found at <http://www.gov.mb.ca/conservation/cdc/pubs.html>

The information provided in this letter is based on existing data known to the Manitoba CDC of the Wildlife and Fisheries Branch at the time of the request. These data are dependent on the research and observations of our scientists and reflects our current state of knowledge. **An absence of data does not confirm the absence of any rare or endangered species.** Many areas of the province have never been thoroughly surveyed, however, and the absence of data in any particular geographic area does not necessarily mean that species or ecological communities of concern are not present. The information should, therefore, not be regarded as a final statement on the occurrence of any species of concern nor should it substitute for on-site surveys for species or environmental assessments. Also, because our Biotics database is continually updated and because information requests are evaluated by type of action, any given response is only appropriate for its respective request.

Please contact the Manitoba CDC for an update on this natural heritage information if more than six months passes before it is utilised.

Third party requests for products wholly or partially derived from the Biotics database must be approved by the Manitoba CDC before information is released. Once approved, the primary user will identify the Manitoba CDC as data contributors on any map or publication using data from our database, as the Manitoba Conservation Data Centre; Wildlife and Fisheries Branch, Manitoba Sustainable Development.

This letter is for information purposes only - it does not constitute consent or approval of the proposed project or activity, nor does it negate the need for any permits or approvals required by the Province of Manitoba.

We would be interested in receiving a copy of the results of any field surveys that you may undertake, to update our database with the most current knowledge of the area.

If you have any questions or require further information contact me directly at (204) 945-7747.

Chris Friesen
Coordinator

Manitoba Conservation Data Centre
204-945-7747
chris.friesen@gov.mb.ca
<http://www.manitoba.ca/sd/cdc/>

From: Bunn, Jason [mailto:Jason.Bunn@wsp.com]
Sent: May-30-18 3:26 PM
To: Friesen, Chris (SD) <Chris.Friesen@gov.mb.ca>
Subject: Environment Act Proposal - RM of Gimli - Species search information request [WSP# 181-03988-00]

Hi Chris,

We are working on an Environment Act Proposal for the RM of Gimli regarding the construction of biosolids storage ponds (from the Gimli WWTP) at a site adjacent to the Arnes waste disposal grounds (10-21-3 EPM). Please provide a listing of rare species for the identified area. I would greatly appreciate your information before June 7, 2018.

Kind regards,

Jason Bunn, P.Eng.
Engineer, Wastewater Infrastructure



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