

Manitoba Environment Act Proposal Town of Roblin Reject Water Disposal

November 2014



Executive Summary

The Town of Roblin is located 100 km west of Dauphin at the intersection of Provincial Highway 5 and Provincial Highway 83 with a population of approximately 1774 people. The Town of Roblin is seeking to construct a reject disposal line to send approximately 50,000 m³/year of membrane concentrate water into West Goose Lake at a maximum rate of 5.9 L/s, transfer it to East Goose Lake via a culvert to make use of the existing lake-level control station on East Goose Lake, and dispose of the concentrate to a natural stream.

The Town of Roblin WTP has a rated treatment capacity of 22 L/s with a 1250 m³ reservoir with raw water supplied by two ground water wells. The treatment process utilizes a reverse osmosis (RO) system to reduce hardness and total dissolved solids (TDS) with chlorine used to provide disinfection residual. Treatment parameters meet the Guidelines for Canadian Drinking Water Quality (GCDWQ). The treatment system generates a highly mineralized membrane concentrate which is currently discharged annually to the Town sewage lagoons via a retention pond.

The Town of Roblin requested the Manitoba Water Services Board (MWSB) to compile an Environment Act Proposal for a Class 1 Development Licence under the Manitoba Environment Act for the proposed reject water pipeline. The Environment Act Proposal is submitted for the discharge of concentrate resulting from the RO treatment equipment within the Water Treatment Plant (WTP). The proposed 200 mm diameter gravity reject pipeline will ensure that the wastewater system is not overloaded during peak flow conditions. The Town has made application for multiple emergency discharges of the facultative lagoon facility which currently discharges to the Shell River. The water from the retention pond and West Goose Lake will transfer to East Goose Lake via a culvert, and then pumped to a natural drain utilizing the existing lake level control station on East Goose Lake for final disposal. The natural drain meanders to the southwest for approximately five kilometres where it discharges to the Shell River, the same river in which the lagoon effluent is discharged to less than one kilometre downstream. The WTP will store concentrate water in the retention pond from October to May and release it periodically during the summer months to West and East Goose Lakes, as lake levels permit. The proposed pipeline design consists 423 m of 200 mm diameter pipeline, connection to the existing retention pond drain via a manhole on the North East side of the pond, and two cleanouts. The reject pipeline will utilize an existing ditch that drains to West Goose Lake to discharge the water. A preliminary pipeline route is shown in Appendix A. The Town of Roblin will be responsible for operating and maintaining the concentrate water pipeline.

The area surrounding the Town of Roblin is predominantly drained by the Shell River and other small tributaries of the Shell River. Based on four years of historical data obtained from a River Level Monitoring Station on the Shell River north of Roblin, the average flow in the river during the summer months is 7.3 m³/s. Based on the significant flows in the Shell River compared to the volume of discharge from the retention pond, minimal impacts are anticipated from the proposed development on

the receiving water body. These findings indicate no anticipated detrimental environmental impacts from the proposed development.

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List of Acronyms

AO	Aesthetic Objective
DBP	Disinfection By-Product
DWSA	Drinking Water Safety Act
EAP	Environment Act Proposal
GCDWQ	Guidelines for Canadian Drinking Water Quality
GUDI	Groundwater Under Direct Influence of Surface Water
HDPE	High Density Polyethylene
MWSB	Manitoba Water Services Board
ODW	Office of Drinking Water
RM	Rural Municipality
TDS	Total Dissolved Solids
THM	Trihalomethanes
TOC	Total Organic Carbon
Town	Town of Roblin
TSS	Total Suspended Solids
UV	Ultraviolet
WTP	Water Treatment Plant

1.0 Introduction

The Town of Roblin requested the Manitoba Water Services Board to compile an Environment Act Proposal for a Class 1 Development Licence under the Manitoba Environment Act for a proposed reject water disposal pipeline. This document provides the compiled information required on Manitoba Conservation's Environment Act Proposal Report Guidelines and Supplementary Guidelines for Municipal Water Supply Systems. This Environment Act Proposal is submitted for the discharge of membrane concentrate resulting from the WTP process to West Goose Lake.

1.1 Background Information

The Town of Roblin is located 100 km west of Dauphin at the intersection of Provincial Highway 5 and Provincial Highway 83 with a population of approximately 1774 people. The Town of Roblin is seeking to construct a reject disposal line to send approximately 50,000 m³/year of membrane concentrate water into West Goose Lake at a maximum rate of 5.9 L/s periodically throughout the summer months, transfer it to East Goose Lake via a culvert to make use of the existing lake-level control station on East Goose Lake, and dispose of the concentrate to a natural stream.

The Town of Roblin WTP has a rated treatment capacity of 22 L/s with a 1250 m³ reservoir with raw water supplied by two ground water wells. The treatment process utilizes a reverse osmosis (RO) system to reduce hardness and total dissolved solids (TDS) with chlorine used to provide disinfection residual. The treatment system generates a highly mineralized membrane concentrate which is currently discharged to the Town sewage lagoons via a retention pond. Effluent from the lagoon is eventually discharged to the Shell River.

Currently, the concentrate water generated by the RO treatment equipment is pumped via a dedicated forcemain to the retention pond for the months of October to May. During the summer months, the concentrate stream is discharged directly to the sewer via an overflow pipe located in a concrete reject chamber at the WTP and then discharged to the lagoon along with the municipal wastewater.

The intention of the retention pond was to allow discharge from the pond into the sanitary sewer during the summer months from May to October via a gravity sewer connected to the retention pond. During the past years since the WTP was constructed the Town has been dealing with capacity issues as the lift station dedicated to pumping wastewater effluent becomes overwhelmed and cannot handle the increased capacity imposed by system flows, infiltration, as well as the concentrate water from the Town's WTP, resulting in basements flooding upstream of the lift station. A designated reject disposal line will provide additional capacity for wastewater within the collection system and help to alleviate potential backups in the lift station.

1.1.1 Previous Studies

An Environment Act Proposal for the WTP was completed by the Stantec Consulting Ltd. for the Town of Roblin Water Treatment Plant Upgrade on January 27, 2010. The proposal reviews existing infrastructure, design criteria, concentrate water quality, and the planned reject schedule were reviewed in the writing of this report.

1.1.2 Population

In the 2011 Census, the Town of Roblin had a population of 1774, representing an increase of 102 people from the 2006 Census which equates to a 1.2% annualized growth rate. Figure 1-1 below shows the Town's population trends from 2006 to 2014. Statistics Canada indicates that there are approximately 2.8 persons per census family in the Town. A growth rate of 1.2% per year has been assumed for the next 20 years, equating to a population of 2252 people.

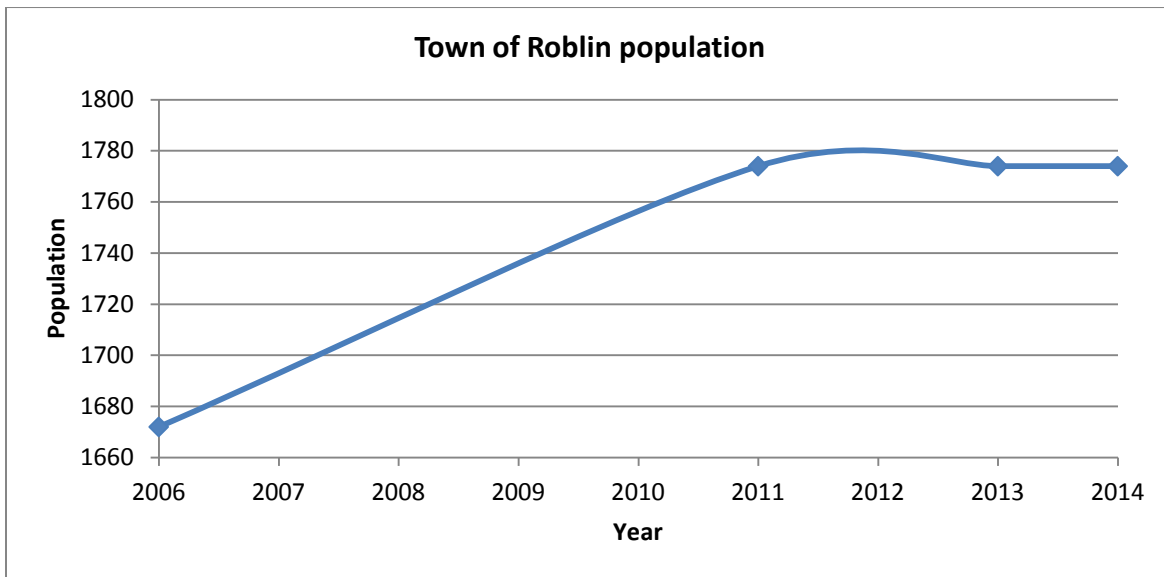


FIGURE 1-1 TOWN OF ROBLIN POPULATION TRENDS

1.1.3 Current and Projected Water Use for the Town of Roblin

Water treatment plant capacity is designed based on peak-day demand. Water consumption records for the Town for 2012-2013 indicate an average daily treated water usage of 540 m³/day. Using a peak day factor of 1.8 results in a peak day consumption of 972 m³/day.

Projected water consumption in the Town of Roblin utilizes a population of 2252 people based on a 1.2% yearly increase. Typical water consumption rates range from 250 L/person/day to 300 L/person/day and peak day usage can increase by a factor of 1.5 to

2.0. Consumptions of 300 L/person/day and a peak day factor of 1.8 were used for this assessment.

A 2034 population of 2252 people equates to an average day consumption of 675.6 m³ (9.4 L/s) and a maximum peak day use of 1,216.1 m³/day (16.9 L/s). The required treatment capacity to service the projected 20-year demand is 16.9 L/s based on the projected water and a 20 hour WTP operating day (See Table 1.2) with the remaining four hours of the day dedicated to maintenance operations.

	Units	Quantity
Current Town Population		1774
20 year future population (@1.2%/yr)		2252
Consumption/capita/day	L/c/day	300.0
Average Day Consumption	m ³ /day	675.6
	L/s	9.38
Peak Day factor		x1.8
Peak Day Consumption	m ³ /day	1,216.1
	L/s	16.9

TABLE 1.1 – 20 YEAR PROJECTED WATER CONSUMPTION

1.1.4 Raw Water Source

The Town of Roblin WTP receives raw water from two ground water wells located in NE5-26-28W. The wells divert water from a sand and gravel aquifer that is high in iron, manganese, total dissolved solids (TDS) and hardness.

1.1.5 Water Rights Act

Water Rights Licence (WRL) 2007-092 was issued to the Town of Roblin and is attached in Appendix D. In 2013, the raw water consumption was 263 cubic decameters, well within the 400 cubic decameters allowed by the WRL (See Table 1.3). The maximum instantaneous rate of withdrawal as stated in the WRL is limited to 0.022 m³/s. According to Table 1.4 below, the Town's raw water consumption is well within the limits stipulated by WRL 2007-092.

TABLE 1.3 – AVERAGE DAY RAW WATER CONSUMPTION FOR THE TOWN OF ROBLIN

Month (2013)	m ³ /day
January	722.713
February	685.744
March	695.008
April	722.108
May	763.781
June	725.193
July	755.214
August	719.596
September	730.953
October	695.222
November	698.725
December	720.019
Average	719.523
Peak	763.781

TABLE 1.4 – SUMMARY OF RAW WATER DEMANDS

Limit (WRL)	Demand (2013)	Units
400	263	Dm ³
0.022	0.010	m ³ /s

1.1.6 Water Quality

Table 1.5 summarizes the treated water quality with focus on water quality parameters of concern including hardness, manganese, pH, sodium, true colour, sulfate, Total Dissolved Solids (TDS), and turbidity. The full water chemistry data can be found in Appendix F.

TABLE 1.5 – SUMMARY OF RAW AND TREATED WATER QUALITY (2012)

Parameter	Unit	GCDWQ	Raw Water	Treated Water
Arsenic	mg/L	≤ 0.01	0.0064	0.00347
Fluoride	mg/L	≤ 1.5	0.208	0.449
Hardness	mg/L	200/500a	731	172
Iron	mg/L	≤ 0.3	3.3	0.056
Manganese	mg/L	≤ 0.05	0.515	0.0162
Nitrate	mg/L	≤ 10	< 0.0050	0.0060
pH		6.5-8.5	8.47	8.55
Total Dissolved Solids	mg/L	500	546	280
Total Organic Carbon	mg/L	-	2.4	<1.0
True Color	CU	15	26.3	< 5.0
Turbidity	NTU	≤ 0.3 / 0.1c	27.3	0.28
Sodium	mg/L	200	13.8	40.6
Sulfate	mg/L	500	280	68.0
Uranium	mg/L	≤ 0.02	< 0.0010	< 0.00010

^a Hardness levels greater than 200 are considered poor but tolerable. Hardness levels greater than 500 are generally considered unacceptable

^b THM based on average of quarterly samples

^c Turbidity limits as follows: 1.0 NTU for slow sand or diatomaceous earth filtration, 0.3 NTU for chemically assisted filtration, and 0.1 NTU for membrane filtration

The raw water is high in hardness according to the GCDWQ. While not a health concern, hardness above 200 mg/l can cause staining and scum deposits on bathroom fixtures. In Manitoba, potable water supplies with a total hardness in the range of 100 mg/l to 150 mg/l as CaCO₃ are generally considered acceptable.

Total dissolved solids (TDS) in the raw water exceed GCDWQ levels. TDS is not considered a health concern but is an aesthetic element that can make water undesirable.

The treated water quality meets all health and aesthetic standards identified in the Guidelines for Canadian Drinking Water Quality.

1.1.7 Compliance to Drinking Water Regulations

The Drinking Water Safety Regulation and Drinking Water Quality Standards Regulation under the *Drinking Water Safety Act* were proclaimed in February 2007 to ensure public water systems provide safe drinking water. These regulations outline water quality standards, bacteriological and microbial standards, operating licence requirements, disinfection testing and monitoring, and reporting requirements.

Reporting requirements under the *Drinking Water Safety Act* include the submission of: scheduled test results, events of non-compliance or emergencies, compliance plans, public water system reports, and public water system engineering assessments. In

comparison of groundwater and surface water supply systems, surface water has greater health concerns and hence greater regulatory and operational requirements. Surface water supplies must be treated and disinfected to control viruses and parasites (*Giardia lamblia* cysts & *Cryptosporidium* oocysts). Generally this is achieved by having adequate surface water treatment technology, reservoir storage for chlorine contact time and UV disinfection for the destruction or inactivation of *Giardia* & *Cryptosporidium*.

Groundwater supplies under direct influence of surface water (GUDI) have treatment requirements similar to surface water supplies. The Town of Roblin raw water source consists of secure groundwater, non-GUDI wells. The Roblin WTP is in general compliance with the DWSA, GCDWQ and the Ten State Standards and the terms and conditions of its operating licence PWS-08-116-01.

2.0 Description of Proposed Development

2.1 Project Description

The membrane treatment process at the Town of Roblin WTP produces a highly mineralized reject concentrate that is discharged to a retention pond with seasonal releases to the sewer collection system that flows to a facultative lagoon. This EAP pertains to the diversion of the membrane concentrate from the retention pond via a 200 mm gravity pipeline designed and operated to deliver concentrate water to West Goose Lake. Following discharge to West Goose Lake, the combine lake water would transfer to East Goose Lake via a culvert and pumped to a natural drain using the existing lake level control station. The natural drain meanders approximately 5 km to the southeast and ultimately flows to the Shell River, approximately 1 km upstream of where the lagoon effluent enters the river. The Shell River eventually feeds into the Shellmouth Reservoir, a section of the Assiniboine River. The WTP will hold concentrate water in the retention pond from October to May and release during the summer months depending on the seasonal water levels in West and East Goose Lake. The pipeline will connect to the existing reject retention pond via a manhole on the North East side of the retention pond. The reject pipeline will be installed by directionally drilling from the manhole to an existing ditch that drains to West Goose Lake. There will be two cleanouts approximately 400 m apart along the gravity reject pipeline. To prevent erosion at the outfall a riprap splash pad will be installed. Construction of the pipeline and outfall will be conducted during the dry season to not impact other watercourses. The proposed conceptual layout of the pipeline network is included in Appendix A. Upon installation of the 200 mm gravity drain line, the existing reject gravity sewermain will be disconnected and capped at the manhole.

The proposed pipeline is to be installed in municipally owned land and road allowances with private easements to facilitate construction if necessary. The pipeline will be constructed of High Density Polyethylene (HDPE) with Polyvinyl Chloride (PVC) cleanouts both of which have a service life of more than 40 years. Figure 2.1 below shows the project site.

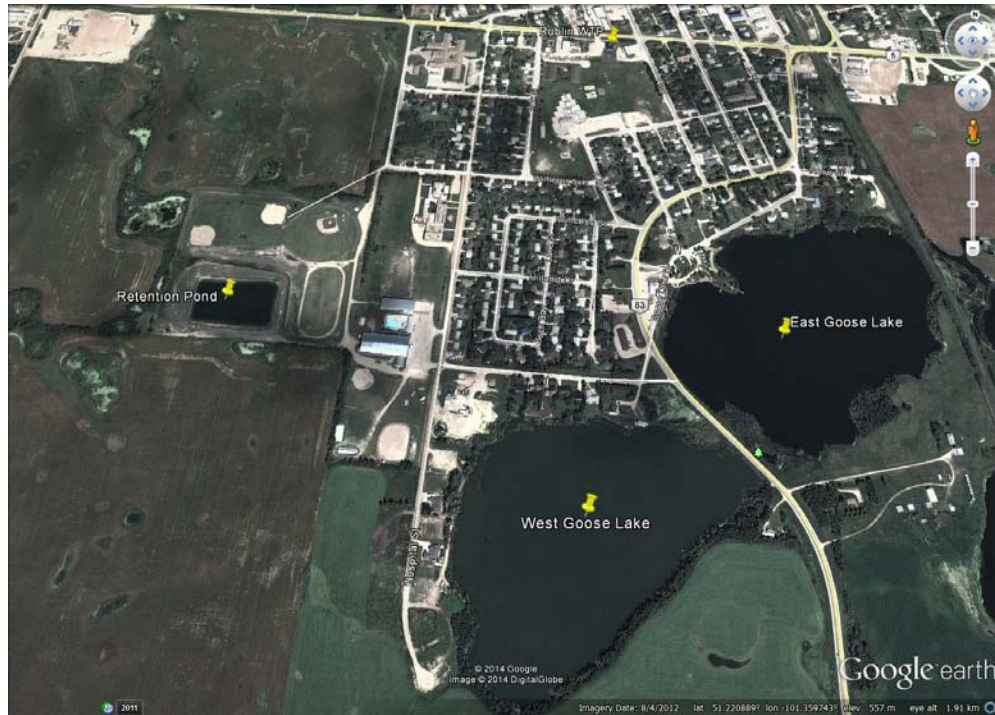


FIGURE 2.1 – PROJECT SITE LOCATION

2.1.1 The Town of Roblin Treated Water Supply

The Town of Roblin WTP treats raw water using a Reverse Osmosis treatment process that allows the Town to meet all the GCDWQ. The treatment system also contains a bypass manganese green sand filter to reduce iron and manganese in the blended water. The bypass provides additional treatment capacity while reducing the amount of concentrate. Figure 2.2 below shows the treatment system. Currently the plant only runs one membrane treatment unit at a time to meet its treated water demands. However, the second membrane treatment unit is available if the treated water demands increase.

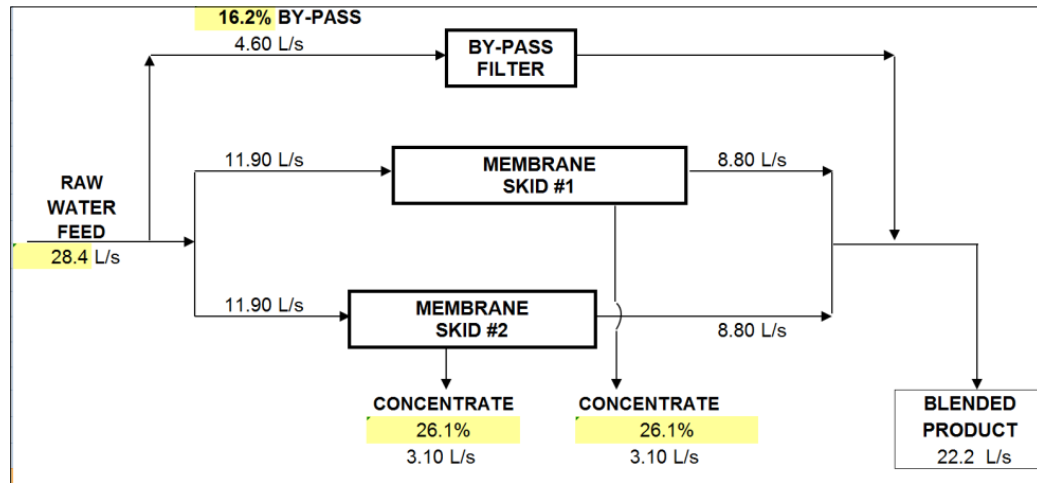


FIGURE 2.2 TREATMENT SYSTEM

2.1.2 Concentrate Water

Membrane treatment systems typically generate a mineralized concentrate stream. Concentrate streams vary between 10%-30% of the total flow from membrane systems depending on the arrangement and type of membranes selected. The current membrane system was modeled for an 80% recovery with 20% of the flow through the membrane unit being rejected as concentrate.

It is proposed that the membrane concentrate be discharged from the retention pond to the Goose Lakes continuously, ensuring that it is drained prior to the winter freeze up. Table 2.1 below shows the water quality of the concentrate from the treatment system described in Section 2.1.1 above with detailed water quality data available in Appendix F.

TABLE 2.1 – CONCENTRATE STREAM WATER QUALITY

Parameter	Units	Concentrate (2012)
Bicarbonate	mg/L	578
Calcium	mg/L	250
Carbonate	mg/L	< 12
Chloride	mg/L	48.8
Magnesium	mg/L	192
Total Kjeldahl Nitrogen	mg/L	0.76
pH	pH units	8.13
Potassium	mg/L	23.7
Sodium	mg/L	39.6
Sulphate	mg/L	1,080
Total Dissolved Solids	mg/L	2,130
Total Phosphorus	mg/L	< 0.20
Unionized Ammonia as N ¹	mg/L	0.012

2.1.3 Operation and Maintenance

The Town of Roblin will be responsible for the operation and maintenance of the WTP, distribution lines and the proposed reject water pipeline. The WTP is classified as a Class 2 facility. The Town ensures that all WTP operators are certified with the appropriate classification level. An operator is required to periodically inspect flushouts, air releases, water meters, etc., to ensure system performance is maintained. In addition, the operator is required to submit bi-weekly water samples for bacteriological testing in accordance with the Manitoba *Drinking Water Quality Standards Regulation*.

2.2 Certificate of Title

The Town of Roblin WTP is located along Highway 5 in Roblin, Manitoba. It is proposed to locate the reject pipeline within land that is predominantly owned by the Town. A land ownership map is shown in Appendix A.

2.3 Existing and Adjacent Land Use

The proposed land for the development will be on Town-owned land and road right-of-ways with minimal disturbance from directionally drilling. Adjacent land is used for mainly recreational purposes. The existing and adjacent land uses will not change as a result of the proposed development.

2.4 Land Use Designation and Zoning

The proposed development will be predominantly on Town-owned land, and land adjacent to the development is predominately agricultural land. Zoning designation for this development is not applicable.

2.5 Project Schedule

The project is scheduled to commence as soon as possible depending on the availability of funding and the receipt of all approvals.

2.6 Project Funding

This project is eligible for cost sharing between the MWSB and the Town of Roblin subject to the receipt of approvals and the availability of funding.

2.7 Regulatory Approvals

The following branches and departments will be provided with copies of plans and specifications for information purposes and for the purposes of approvals and agreements:

Manitoba Conservation and Water Stewardship
Office of Drinking Water

The contractor will be required to contact MTS, Hydro, and gas utilities for utility locations and approvals.

2.8 Public Consultation

A public consultation will not be held to discuss the proposed reject line. The reject line is not expected to warrant major concerns from the residents.

2.9 Storage of Petroleum Products and Other Chemicals

Fuel will not be stored on-site at any time or location along the proposed construction route or near any well. Fuel will be supplied by fuelling trucks which are regulated under The Storage and Handling of Petroleum Products and Allied Products Regulation. Records of fuel volumes and an emergency response plan which includes spill prevention, notification and response will be implemented. No fuelling activities will be permitted within 100 m of watercourses during construction. During construction, the contractors will be required to ensure that all equipment is properly maintained to prevent leaks of fuel and motor fluids. General household cleaning products will possibly be stored on site during construction.

3.0 Physical Environment

3.1 Physiographic Setting and Climate

The Town of Roblin has a population of approximately 1774 people and is located 100 km west of Dauphin at the intersection of Provincial Highway 5 and Provincial Highway 83. The Town of Roblin is seeking to construct a reject line to dispose of its membrane concentrate water into West Goose Lake and transfer it to East Goose Lake via a culvert to make use of the existing lake level control station that disposes to a natural drain.

The Town is situated in the Boreal plain with Shell River, the Goose Lakes, Assiniboine River and Shellmouth Reservoir as the main water ways in the area. The Town lies at an elevation of approximately 1825 ft.

Based on Environment Canada climatic data, the mean annual temperature in Roblin is -0.4 degrees Celsius with below zero average daily temperature from November through March. The mean annual precipitation is approximately 470.3mm. See Table 3.1.

TABLE 3.1 – ROBLIN MONTHLY DATA REPORT (2007)

Monthly Data Report for 2007

Month	Mean Max Temp °C	Mean Min Temp °C	Mean Temp °C	Extr Max Temp °C	Extr Min Temp °C	Total Rain mm	Total Snow cm	Total Precip mm	Snow Grnd Last Day cm	Dir of Max Gust 10's deg	Spd of Max Gust km/h
Jan	-9.8	-20.5	-15.2	3.9	-38.6	0.0	10.6	10.6			
Feb	-13.3E	-23.6E	-18.5E	-2.3	-37.2	I	10.4	10.4			
Mar	0.0	-10.2	-5.1	9.4	-25.7	9.6	13.0	22.6			
Apr	9.8	-3.2	3.3	23.9	-15.1S	6.9	0.0	6.9			
May	14.9*	3.7*	9.3*	29.1*	-3.3*	75.4	0.0	75.4	0		
Jun	20.5	8.8	14.7	28.6	0.7	125.6	0.0	125.6	0		
Jul	26.0	13.0	19.5	34.1	4.6	55.4	0.0	55.4	0		
Aug	21.0	9.1	15.1	27.5	1.1	58.2	0.0	58.2	0		
Sept	17.2	4.5	10.9	30.1	-4.8	43.6	0.0	43.6	0		
Oct	10.6	0.2E	5.4E	20.0	-8.6	26.0	0.0	26.0	0		
Nov	-2.3	-10.3	-6.3	10.8	-29.5	0.8	9.2E	10.0E			
Dec											
Sum						M	M	M			
Avg	M	M	M								
Xtrm				M	M						

Summary, average and extreme values are based on the data above.

3.2 Hydrogeology

The Town of Roblin is located in the Western Plains hydrogeological region and the Mid-Boreal Lowland eco-region. The Mid-Boreal Lowland eco-region is underlain by ridged glacial till, lacustrine silts and clays, with some extensive peat deposits. The region is associated with clayey-textured lacustrine deposits and loamy glacial till.

Drill records for wells installed in and around the Town of Roblin between 1985 and 1987 show that the hydrogeology of the area mainly consists of shallow sand and gravel deposits (M & M Drilling Rivers Ltd., 1986) lined by clay till.

3.3 Hydrology

The main water ways near the Town of Roblin are the Shell River, Goose Lakes, as well as the Assiniboine River and Shellmouth Reservoir. Within the project area, the Shell River and Goose Lakes are the main waterways. Appendix B shows a detailed map of the hydrology of the area.

It is proposed that the reject water be disposed to East Goose Lake. East Goose Lake is a landlocked lake with a gross drainage area of approximately 140,473 m² and water depths fluctuate between 1 m and 7+ m. Figure 3.1 below shows the East Goose Lake profile.

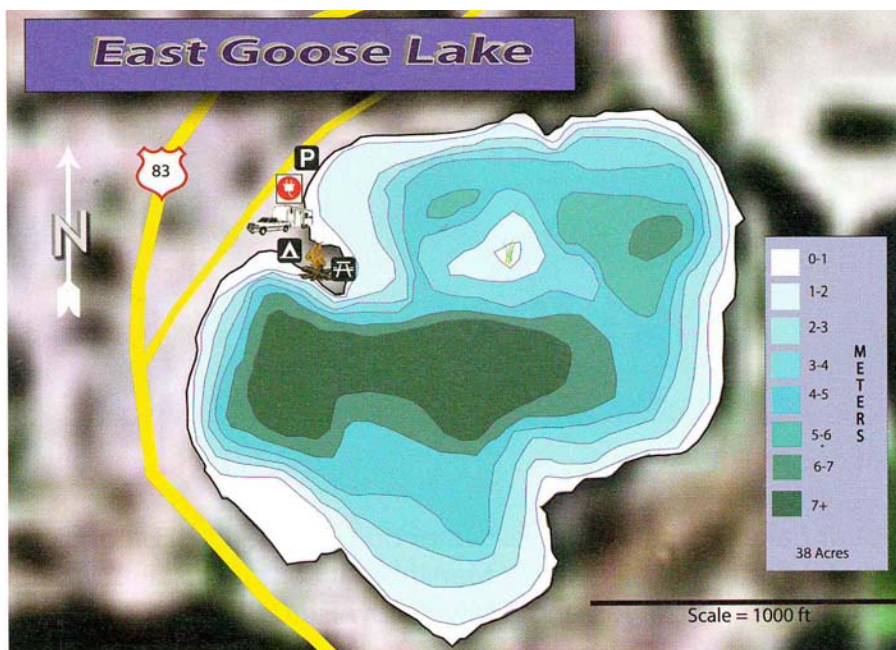


FIGURE 3.1 – EAST GOOSE LAKE PROFILE

3.4 Fish and Fish Habitat

East and West Goose Lakes are the potential fish habitat within the project area. A list of fish species found in East and West Goose Lakes have been included in Appendix C.

3.5 Wildlife Habitat and Vegetation

The project area is located within the Boreal Plains Eco-zone of the Mid-Boreal Lowland eco-region (Agriculture and Agri-Food Canada). The mean annual temperature in this eco-region is -1° C with a mean summer temperature of 13.5° C and a mean winter temperature of -17° C. The Mid-Boreal Lowland eco-region is mainly associated with trembling aspen, balsam poplar, white and black spruce, and balsam fir. This eco-region is underlain by ridged glacial till, lacustrine silts and clays, and extensive peat deposits. The region has Gray Luvisols on its loamy to clayey-textured lacustrine deposits and Eutric Brunisols developed on its loamy glacial till and Mesisols.

Throughout this eco-region pulpwood and localize lumber forestry, water oriented recreation, wildlife trapping, and hunting are the most predominant activities. In other areas, as the soils and drainage allow, oil seeds, cereals and forage crops are produced. Characteristic mammals in the eco-region include moose, deer, elk, black bear, wolf, lynx, and snowshoe hare. The main bird species in the Mid-Boreal Lowland eco-region are water fowl including duck, goose, pelican, sandhill crane, and ruffed grouse (National Ecological Framework Report).

3.6 Socioeconomic

The project area is located within the Town of Roblin. The Town has an area of 3.79km² and a population of 1774 (2011 Census). The main economic base is agriculture.

3.7 Heritage Resources

Most project activities occur in previously disturbed municipal and provincial right-of-ways. The proponent will work with Heritage Resources Branch to mitigate any concerns as required.

4.0 Potential Environmental Effects

An environmental effect includes any change that the project may cause to the environment. Environmental effects were identified from interactions between proposed project activities and environmental components. Mitigation measures and follow-up activities were identified for environmental effects determined to be adverse.

4.1 Air Quality

During construction, dust will be raised by construction equipment and there will be gaseous and particulate emissions from the construction equipment. Water spraying is an important, common and practical procedure that would be applied as required to alleviate potential dust problems. Emissions of gases and particulates would be minimized by keeping machinery in good working order. Any effects would be localized, temporary and insignificant. During operation of the development there will be no releases of pollutants to the air.

4.2 Soils

During construction, there is a risk of fuel or lubricant spills from heavy equipment and vehicle operation. Potential spills will be very small in size and standard construction spill clean-up procedures, including the removal of any impacted soil, will be used to prevent impact.

During operation, project activities are limited to regular monitoring and maintenance activities that have a negligible effect on soil disturbance and compaction because of low vehicle traffic and the use of established routes to access the outfall and water treatment plant. Regular monitoring and maintenance activities will have a negligible effect on soil contamination since fuel trucks and other hazardous substances will not be brought on-site on a regular basis. The potential adverse effect on soil quality is assessed to be minor.

4.3 Surface Water, Fish and Fish Habitat

Minor and short term impacts on surface water may occur as a result of construction activity in road allowance ditches during runoff events. The impact on surface water would include sediment that may be eroded from excavation activities, minor engine leaks and potential fuel spills should runoff events occur during construction. Horizontal directional drilling will be conducted to install the pipeline at the drain and river outlets. This will eliminate excavation within the riparian zone and minimize potential impacts. There is potential for some loss of drilling mud to surface water which will follow standard water crossing guidelines. Impacts to fisheries and fish habitat are considered minor.

Membrane concentrate contains hardness causing minerals such as calcium and magnesium. The quality data of the membrane concentrate from the Town of Roblin WTP is shown in Table 4.1. The estimated concentrate discharged to West Goose Lake annually would be a maximum of 4.4 L/s or 75,161 m³ based on 2010 Stantec EAP which assumes an average 13 hour day. This

is approximately 12% of the volume of West Goose Lake which is estimated to be 621,977 m³ based upon its gross drainage area of 138,215 m² and mean depth of 4.5 m. The volume of East Goose Lake is estimated to be 632,129 m³ based upon its gross drainage area of 140,473 m² and mean depth of 4.5 m. It should be noted that East and West Goose Lake are both assumed to have approximately the same depth, though a profile is not available. Reject concentrate from similar systems is discharged to surface water bodies in other locations across Manitoba without significant adverse effects on water quality. The Town of Roblin will perform long-term sampling of the lake water to verify water quality impacts.

Two tables are presented to assess the impact to the receiving bodies of water given that all the water will first of all enter West Goose Lake prior to entering East Goose Lake. Using the water quality data in combination with the volume and membrane concentrate data the potential impact of the proposed reject water discharge on East and West Goose Lake was assessed to be negligible (Table 4.1) due to the large volume of water in the Lake. A full water chemistry of West and East Goose Lake is shown in Appendix F. The BOD₅, CBOD₅, fecal coliform, total coliform and TSS parameters as required by the Manitoba Water Quality Standards, Objectives and Guidelines (MWQSOG) guidelines for industrial and municipal wastewater effluents discharged to a water body, are not listed in Table 4.1 below for the concentrate water because the concentrate water does not qualify as wastewater or contain fecal matter, these parameters are well under the required limits. In addition the raw water source is a secure ground source confined with clay overburden and will not contain coli form bacteria.

TABLE 4.1 – EFFECTS OF CONCENTRATE REJECT ON WEST GOOSE LAKE WATER QUALITY

Parameter	Units	MWSOG	Concentrate	West Goose Lake	Total
Flow Rate	(L/s)		4.4		
Volume (365 days)	m ³		75,161	621,977	697,138
Water Quality					
			(mg/L)	(mg/L)	
Arsenic			0.00513	0.00181	0.00217
Bicarbonate			578	140	187.2
BOD ₅	mg/L	≤ 25			<25
Calcium			250	26.5	50.6
Carbonate			< 12	18	<18
CBOD ₅	mg/L	≤ 25			<25
Chloride			48.8	61.3	60.0
Fecal Coliform	MPN/100mL	200			<200
Iron	mg/L		0.18	<0.10	0.11
Magnesium			192	26.3	44.2
Nitrogen	mg/L	15	0.76 ^b	1.44 ^b	1.37
pH			8.13	9.00	8.91
Potassium			23.7	18.0	18.6
Sodium			39.6	43.6	43.2
Sulphate			1,080	31.2	144.3
Total Coliforms	MPN/100mL	1500			<1500
Total Dissolved Solids			2,130	324	518.7
Total Phosphorus	mg/L	1	< 0.20	< 0.10	<0.20
Total Residual Chlorine	mg/L	0.02			0.0
TSS	mg/L	≤ 25			<25
Un-ionized ammonia as N ^a	mg/L	< 1.25	0.012		<1.25

^aNitrogen at 15 °C ± 1 °C

^bTotal Kjeldahl Nitrogen

TABLE 4.2 – EFFECTS OF CONCENTRATE REJECT ON EAST AND WEST GOOSE LAKES WATER QUALITY

Parameter	Units	MWSOG	Concentrate	West Goose Lake	East Goose Lake	Total
Flow Rate	(L/s)		4.4			
Volume (365 days)	m ³		75,161	621,977	632,129	1,329,267
Water Quality						
			(mg/L)	(mg/L)	(mg/L)	
Arsenic			0.00513	0.00181	0.00166	0.00193
Bicarbonate			578	140	123	156.7
BOD ₅	mg/L	≤ 25				<25
Calcium			250	26.5	33.8	42.6
Carbonate			< 12	18	< 12	<18
CBOD ₅	mg/L	≤ 25				<25
Chloride			48.8	61.3	39.7	50.3
Fecal Coliform	MPN/100mL	200				<200
Iron	mg/L		0.18	<0.1	<0.1	0.1
Magnesium			192	26.3	30.1	37.5
Nitrogen	mg/L	15	0.76 ^b	1.44 ^b	0.98 ^b	1.18
pH			8.13	9.00	8.25	8.59
Potassium			23.7	18.0	12.9	15.9
Sodium			39.6	43.6	25.5	34.8
Sulphate			1,080	31.2	41.6	95.4
Total Coliforms	MPN/100mL	1500				<1500
Total Dissolved Solids			2,130	324	315	421.8
Total Phosphorus	mg/L	1	< 0.20	< 0.10	< 0.10	<0.20
Total Residual Chlorine	mg/L	0.02				0.0
TSS	mg/L	≤ 25				<25
Unionized ammonia as N ^a	mg/L	< 1.25	0.012			<1.25

^aNitrogen at 15 °C ± 1 °C

^bTotal Kjeldahl Nitrogen

4.4 Groundwater Quality

Groundwater quality can be impacted by surface activities and surface water quality. Mitigation measures are necessary to protect groundwater quality during construction activities. In addition, it should be noted that the area is characterized by clay till which ranges from stiff to firm and exhibits a high plasticity that provides a protective layer for ground water. The proposed activities are unlikely to result in adverse changes to groundwater quality.

4.5 Groundwater Levels

No changes from the current operation are anticipated from the proposed development. No impacts to groundwater levels are anticipated from the proposed development.

4.6 Vegetation

Construction will occur primarily within municipal right-of-ways or easements that are previously disturbed, regularly managed and comprised primarily of grasses. As the areas are already disturbed, they are unlikely to contain rare plant species. The amount of vegetation disturbance is expected to be minimal. During construction access to land will be restricted to designated and previously disturbed areas. Potential effects to vegetation are considered to be negligible.

4.7 Wildlife Habitat and Vegetation

The construction and operation activities associated with this project will be limited to areas already developed for hydro lines or urban or agricultural uses. The potential adverse effects of wildlife habitat loss were assessed to be negligible to minor.

4.8 Noise and Vibration

During the construction phase of the project, there will be several sources of sound emissions including equipment used for construction. The types of noises heard due to construction are dominated by equipment engines. However, miscellaneous short term impact noises (ie: dump truck gates, back hoe buckets) are often heard. The noise will be in addition to regular community and highway activities, and the effects are considered minor.

Scheduling of various site activities can minimize the impact of noise. This would include scheduling construction for day-time hours to avoid sleep disturbance and the disruption of evening domestic activities. All equipment used on site will be fitted with appropriate mufflers and will be maintained in good working order to minimize noise levels.

4.9 Employment/Economy

Socio-economic implications are not expected as a result of environmental impacts as impacts are considered minor and short-term. Some economic implications may exist for the Town due to the costs of developing a new route for the disposal of concentrate from the WTP and making use of the recently constructed pump house. There may be some local economic benefit during construction, and the Town will economically benefit from the increased lagoon capacity. The potential effects of the project on employment and the economy were assessed to be positive.

4.10 Human Health and Well Being

The potential adverse effects of the project on human health are assessed to be negligible to minor. Short term temporary increases in noise and dust emissions will occur during construction that is considered to be minor effects. During operation, there will be a minor increase in vehicular traffic associated with monitoring and maintenance activities. The potential effects are considered minor.

The project will result in the construction of the pipeline designed and operated to deliver concentrate water safely to West Goose Lake with transfer to West Goose Lake via a culvert which will be followed by pumping out to a natural drain using the existing lake level control station for final disposal to meet the *Water Quality Standards, Objectives and Guidelines Regulation under The Water Protection Act (2011)*.

The results of this proposal are considered positive as it will increase the available pumping capacity in the existing sewage lift station and alleviate the requests for emergency discharge of the Roblin Lagoon by reducing the hydraulic loading to the existing lagoons.

4.11 Climate Change

There are no predicted impacts to climate as a result of the project activities.

5.0 Environmental Management Measures

Environmental management practices proposed to prevent or mitigate environmental effects that were determined to be adverse are identified and described below.

5.1 Air Quality

Emissions resulting from construction and transportation equipment may be mitigated by the utilization of well maintained and operating vehicles while reducing unnecessary vehicle idling.

The impact of dust may be mitigated by the use of an approved dust suppressant, limiting construction during high wind periods, and re-establishing vegetation as soon as possible.

5.2 Soils

Mitigation to potential impacts to soil by contamination from petroleum products include preparation of an emergency response plan for potential spills, use of spill clean-up equipment and materials, using properly maintained equipment, and using appropriate fuelling equipment.

Re-establishment of vegetation as soon as possible after disturbance will limit loss of soil due to wind or water erosion. Backfilling with soil stockpiles as soon as possible and minimizing the amount of soil disturbance will be implemented.

5.3 Surface Water

Mitigation of surface water issues may be achieved by limiting open cut trenching to within 30 m ahead or behind the pipe laying, redirecting surface water runoff, pumping accumulated water to adjacent ditches and providing erosion control practices as required.

Petroleum leaks or spills will be mitigated by use of properly maintained equipment, use of spill clean-up equipment and materials, and use of appropriate fuelling equipment. A prepared emergency response plan can be implemented in the event of a significant spill. In the event of a reportable spill, Manitoba Conservation and Water Stewardship will be notified through the emergency response line and appropriate measures will be taken according to Manitoba Conservation and Water Stewardship requirements.

A 100 m setback to watercourses will be maintained for fuelling activities. Horizontal directional drilling will be implemented at watercourse crossings. Vehicles will avoid entering the riparian zones, and re-establishment of vegetation will occur as soon as possible on areas of disturbed soil.

5.4 Groundwater

Mitigation of potential groundwater impacts from petroleum products can be mitigated as described in Section 5.3. However, the ground water is protected by the natural geology being overlain by clay till overburden.

5.5 Vegetation and Wildlife

Re-establishment of vegetation will occur as soon as possible on disturbed areas. Impacts to wildlife habitat can be limited by minimizing the area of construction, soil disturbance and vegetation disturbance. Other impacts resulting from dust or smoke will be minimized as previously indicated. Noise disturbance will be limited by use of muffling vehicles and equipment, limiting idling and limiting the construction area.

5.6 Fisheries

Fisheries impacts will be minimized by implementing practices to reduce soil and contaminate runoff as previously mentioned in Section 5.3 . In addition, horizontal directional drilling will occur under all watercourses containing water. The required excavation needed to introduce the drilling equipment will be maintained outside watercourse riparian zones.

If required water quality monitoring on both East and West Goose Lake will be done to provide data for the assessment of any water quality impacts affecting fish species. The proponent will work with the provincial officials should any concerns arise.

5.7 Noise and Vibration

Limiting any noise-creating activities, including regular maintenance and monitoring activities to normal working hours, and limiting unnecessary long-term idling can mitigate any potential increased noise and vibration effects.

5.8 Socio-Economic Implications

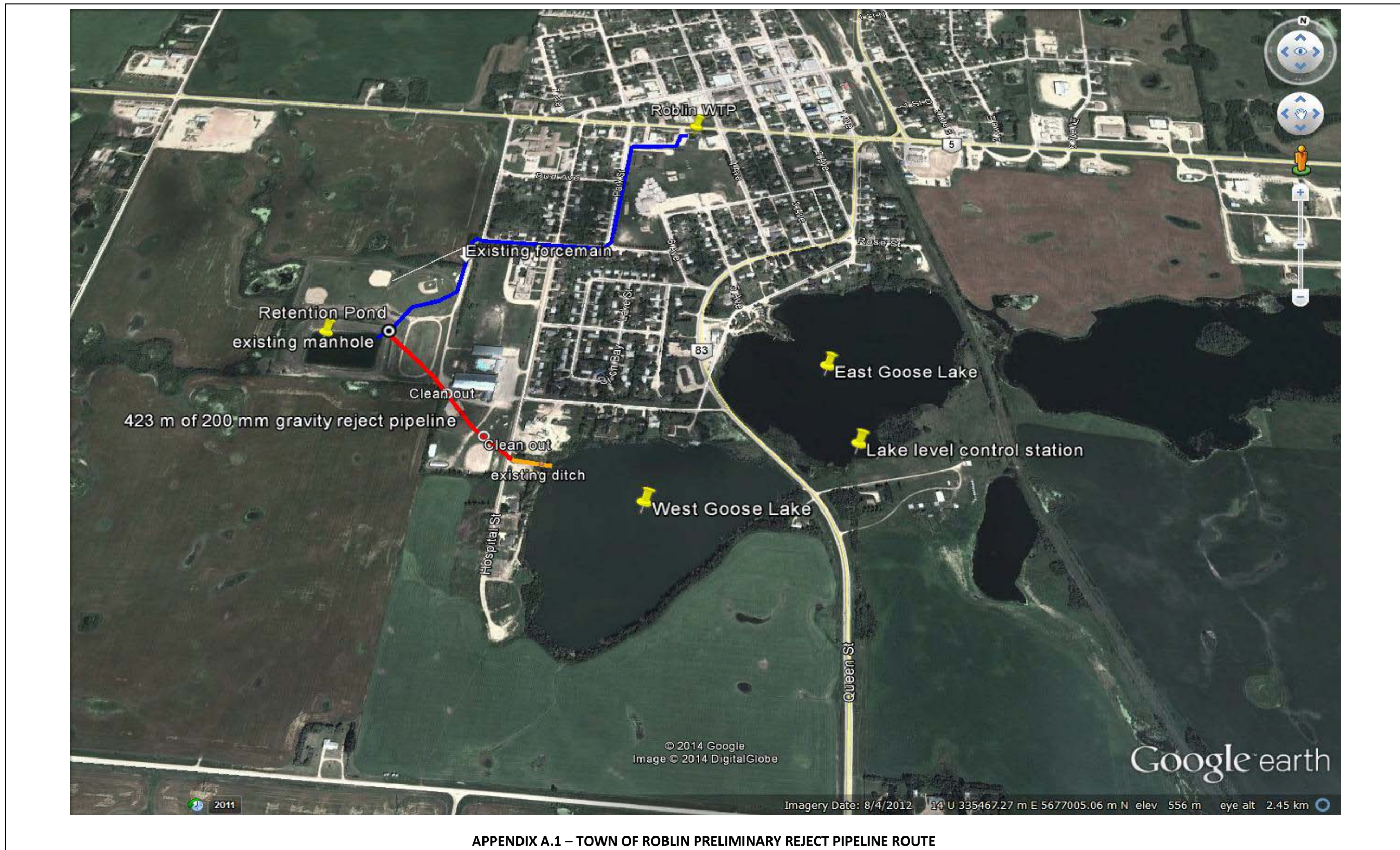
There are no known negative environmental socio-economic impacts that need mitigation. Since the proposed development would provide a reliable healthy drinking water supply, it would be expected to enhance quality of life and economic viability for the Town. The proposed project may provide some economic benefits to the area for local businesses and employment opportunities during the construction phase.

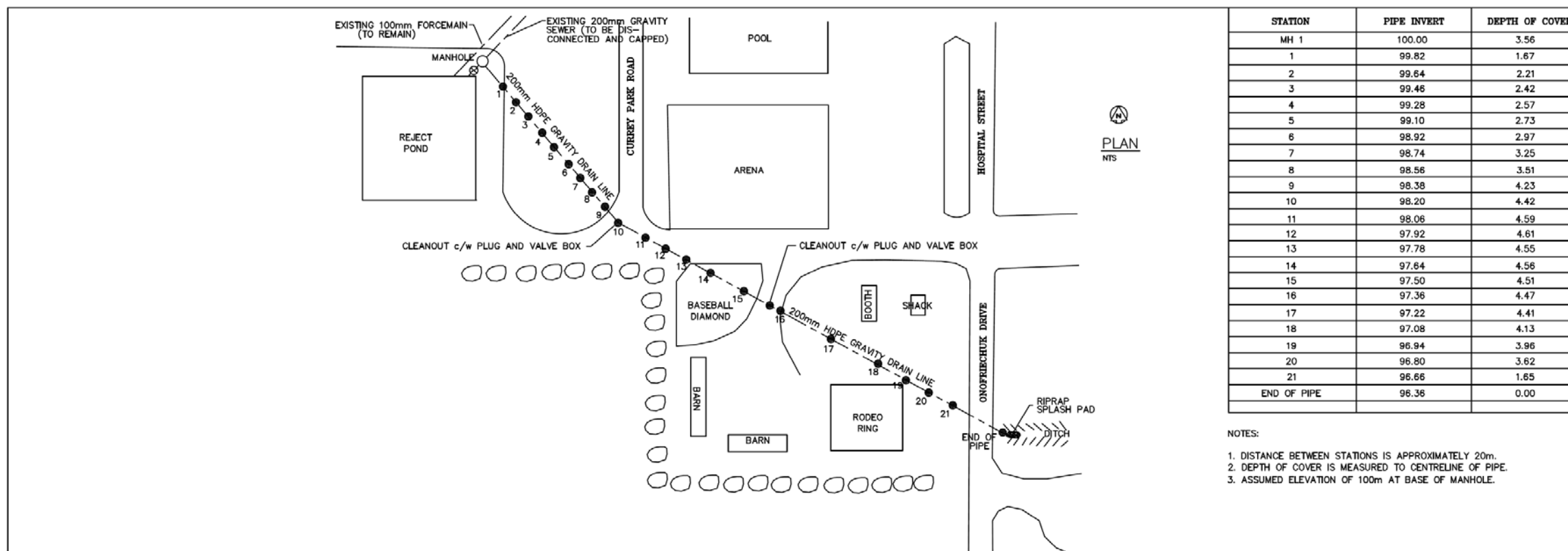
6.0 References

- a. Agriculture and Agri-Food Canada. A National Ecological Framework for Canada 29 July 2013
<http://sis.agr.gc.ca/cansis/nsdb/ecostrat/index.html>
- b. Ecological Framework For Canada. National Ecological Framework Report. 1995.
<http://sis.agr.gc.ca/cansis/publications/ecostrat/intro.html>
- c. Statistics Canada. 2012. Roblin, Manitoba (Code 4616052) and Division No. 16, Manitoba (Code 4616) (table). Census Profile. 2011 Census. Statistics Canada Catalogue no. 98-316-XWE. Ottawa. Released October 24, 2012. <http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/index.cfm?Lang=E> (accessed July 14, 2014).
- d. Environment Canada, Climate
http://climate.weather.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=MAN&StationID=27119&dlyRange=1996-03-01%7C2014-07-14&Year=2013&Month=1&cmdB1=Go
- e. Stantec Consulting Ltd., January 2010, Town of Roblin Water Treatment Plant Upgrade, File111210940.

Appendix A – Preliminary Pipeline Route

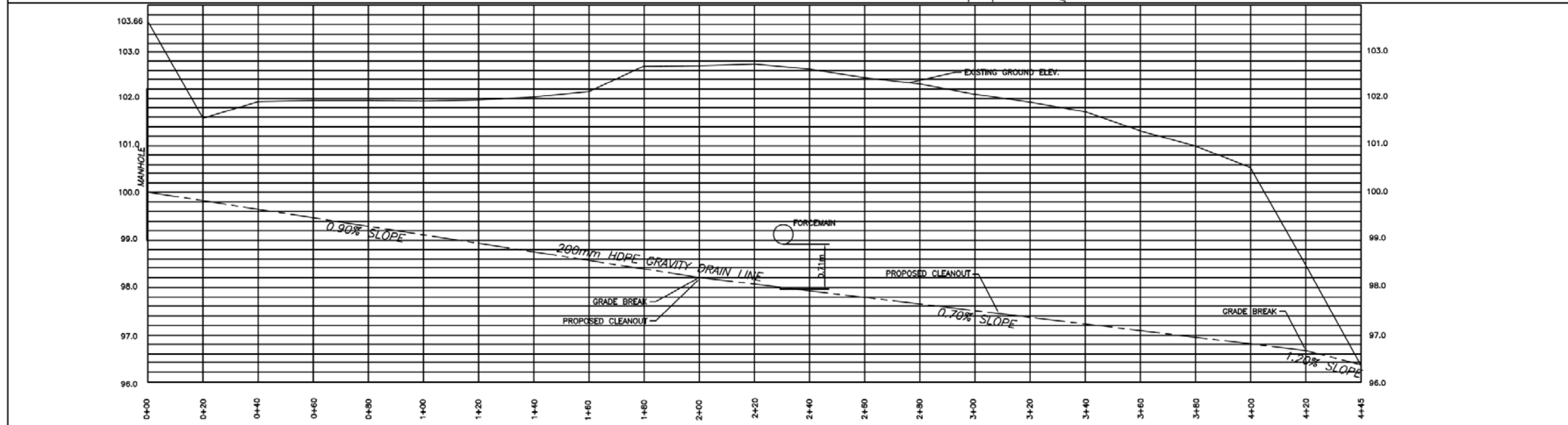
Preliminary Pipeline Route





STATION	PIPE INVERT	DEPTH OF COVER
MH 1	100.00	3.56
1	99.82	1.67
2	99.64	2.21
3	99.46	2.42
4	99.28	2.57
5	99.10	2.73
6	98.92	2.97
7	98.74	3.25
8	98.56	3.51
9	98.38	4.23
10	98.20	4.42
11	98.06	4.59
12	97.92	4.61
13	97.78	4.55
14	97.64	4.56
15	97.50	4.51
16	97.36	4.47
17	97.22	4.41
18	97.08	4.13
19	96.94	3.96
20	96.80	3.62
21	96.66	1.65
END OF PIPE	96.36	0.00

NOTES:
 1. DISTANCE BETWEEN STATIONS IS APPROXIMATELY 20m.
 2. DEPTH OF COVER IS MEASURED TO CENTRELINE OF PIPE.
 3. ASSUMED ELEVATION OF 100m AT BASE OF MANHOLE.



PROFILE
 NTS

NO.	DESCRIPTION	BY	DATE

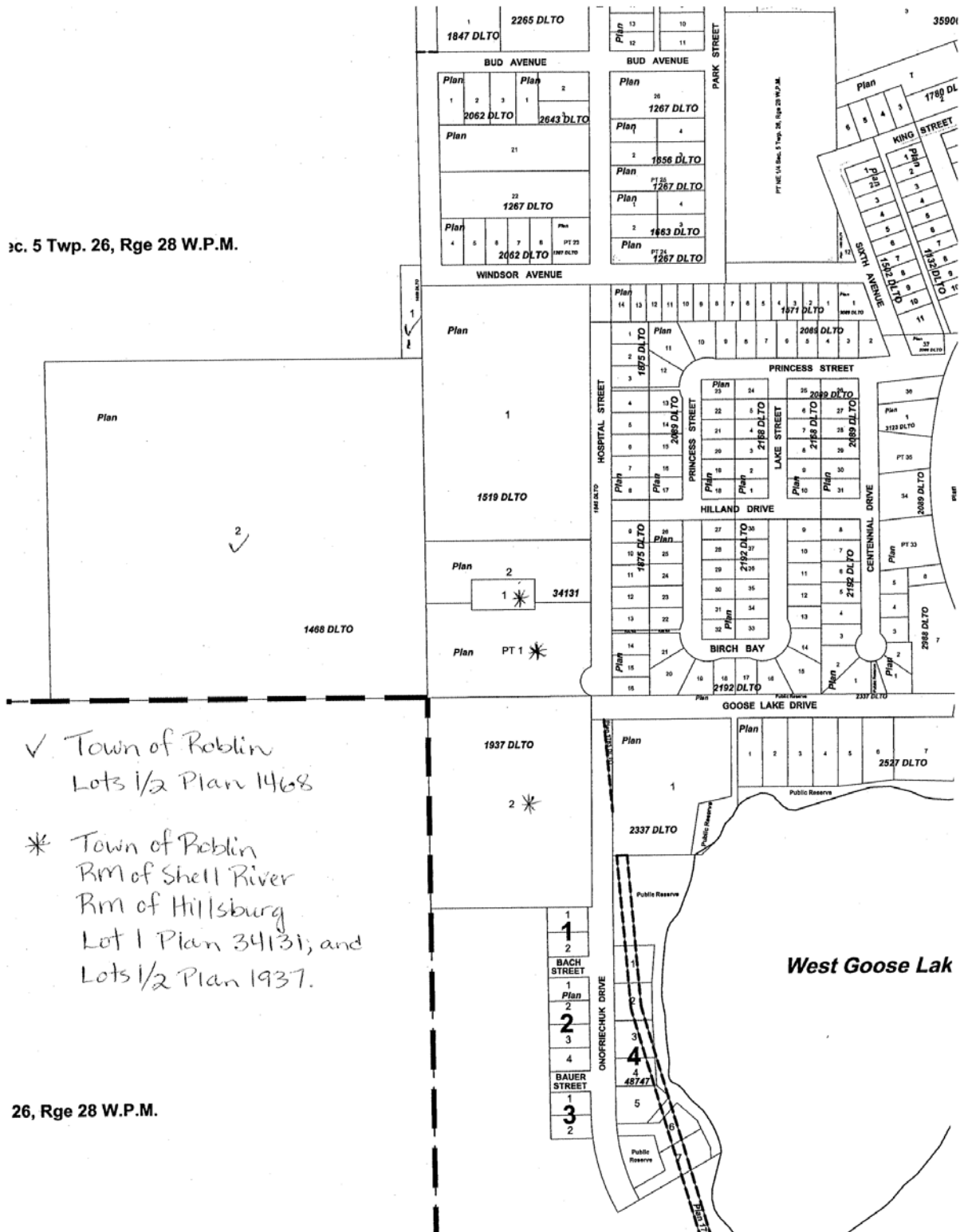
SURVEYED	BOOK NUMBER
DRAWN	ABC
DESIGNED	W. BOYCE
CHECKED	W. BOYCE
REVIEWED	

PROVINCE OF MANITOBA
 THE MANITOBA WATER SERVICES BOARD
 MANITOBA MUNICIPAL GOVERNMENT

TOWN OF ROBLIN / R.M. OF SHELL RIVER	
ROBLIN CONCENTRATE RETENTION POND GRAVITY DRAIN LINE	
SCALE	DATE
NTS	14-08-26
PROJECT NUMBER	REVISION
SHEET	1 of 1

ISSUED FOR INFORMATION

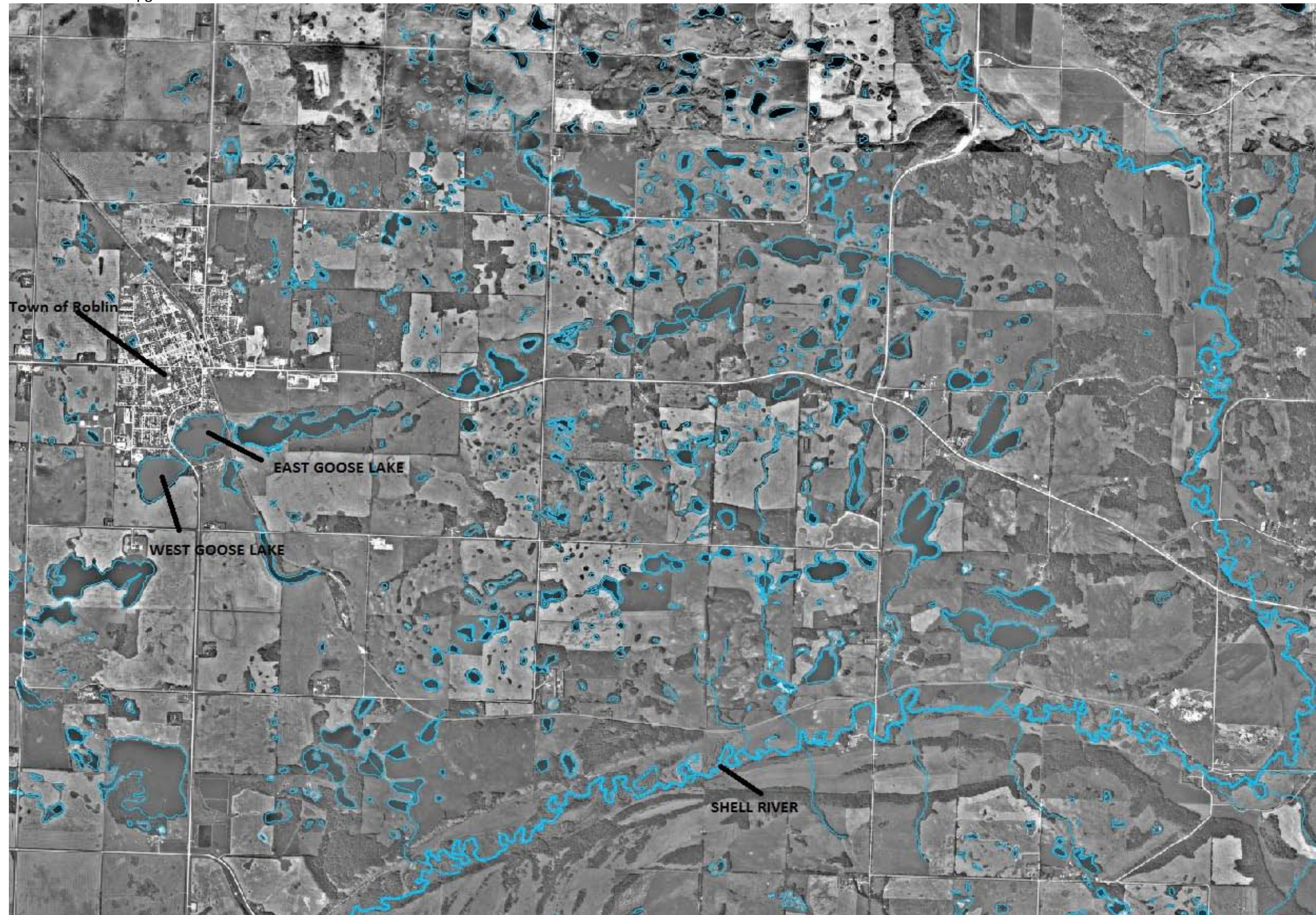
APPENDIX A.2 – TOWN OF ROBLIN PRELIMINARY REJECT PIPELINE PLAN & PROFILE



APPENDIX A.3 – LAND OWNERSHIP

Appendix B – Hydrology of the Town of Roblin

Hydrology of the Town of Roblin



APPENDIX B.1 – HYDROLOGY OF THE TOWN OF ROBLIN

Appendix C – Fish Species

Fish Species in Goose Lakes and Shell River

Waterbody: **Goose Lakes**
 Provincial Waterbody Id # 3676.00
 Watershed 5MDB
 Region Western
 District Roblin
 Map Sheet 62N03
 Latitude: 51 13 19
 Longitude: 101 20 59

Habitat Suitability

Seasonal Habitat Suitability*

All	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	None
Y													

*The month(s) the waterbody is useable for fish Habitat (without human intervention)

Habitat Classifications

Habitat Class	Class
Classification based on habitat rating	Class 1
Condition of the waterbody 5 years ago	Class 1
Intuitive classification of the waterbody	Class 1
Predicted classification in 5 years	Class 1
Predicted classification in 5 years if controlled	Class 1
Rating of the best waterbody in the same or adjacent watershed	Class 1

*Lake has been rehabilitated from Class 4 to Class 1 by controlling sewage and chemical inputs by aeration.

Resource Access

Resource	Distance (km)
Aircraft on Floats	0
Aircraft on Wheels	27
All Season Road	185
Boat	0
Electrical Power	27
FFMC Delivery Point	255
Seasonal Road	12
Walking	12

General Uses

General Use	Harvest Weight
Commercial Net	6881
Commercial Sport	
Recreational Angling	

Needed Improvements

Year	Improvements	Comments
2001	Aeration system installed in July of 1985.	

BIOLOGY

Presence

BROWN TROUT <i>Salmo trutta</i>	Common
RAINBOW TROUT <i>Salmo gairdneri</i>	Common
SMALLMOUTH BASS <i>Micropterus dolomieu</i>	Unknown
WALLEYE <i>Stizostedion vitreum</i>	Uncommon

Creel

Year	Species	Catch/Unit Effort*
------	---------	--------------------

*Catch/Unit Effort = Catch/Hour

Water Chemistry

Code	Samples	Low	High	Average	MSWQO LO	MSWQO HI	CWQG LO	CWQG HI
------	---------	-----	------	---------	----------	----------	---------	---------

Sample Dates:
2001-04-09

Physical

Alkalinity (Total)	1	218.0000	218.0000	218.0000				
Residue (Filterable)	1	888.0000	888.0000	888.0000				

MSWQO = Manitoba Surface Water Quality Objectives
 CWQG = Canadian Water Quality Guidelines

Waterbody: Shell River

Provincial Waterbody Id #
3550.00

Watershed
SMDB

Region
Western

District
Roblin

Map Sheet
62K14

Latitude: 50 58 3
 Longitude: 101 23 57

BIOLOGY

Presence

BIGMOUTH SHINER <i>Notropis dorsalis</i>	Unknown
BLACKNOSE DACE <i>Rhinichthys atratulus</i>	Unknown
BLACKNOSE SHINER <i>Notropis heterolepis</i>	Unknown
BLACKSIDED DARTER <i>Percina maculata</i>	Common
BROOK STICKLEBACK <i>Culaea inconstans</i>	Abundant
BROOK TROUT <i>Salvelinus fontinalis</i>	Unknown
BROWN TROUT <i>Salmo trutta</i>	Unknown
BURBOT <i>Lota lota</i>	Common
CARP <i>Cyprinus carpio</i>	Unknown
CHESTNUT LAMPREY <i>Ichthyomyzon castaneus</i>	Unknown
COMMON SHINER <i>Notropis cornutus</i>	Common
CREEK CHUB <i>Semotilus atromaculatus</i>	Rare
EMERALD SHINER <i>Notropis atherinoides</i>	Common
FATHEAD MINNOW <i>Pimephales promelas</i>	Unknown
FINESCALE DACE <i>Phoxinus neogaeus</i>	Unknown
FLATHEAD CHUB <i>Platygobio gracilis</i>	Unknown
IOWA DARTER <i>IOWA DARTER exile</i>	Unknown
JOHNNY DARTER <i>Etheostoma nigrum</i>	Common
LONGNOSE DACE <i>Rhinichthys cataractae</i>	Common
NORTHERN PIKE <i>Esox lucius</i>	Abundant
PEARL DACE <i>Semotilus margarita</i>	Unknown
QUILLBACK <i>Carpoides cyprinus</i>	Unknown
RAINBOW TROUT <i>Salmo gairneri</i>	Unknown
RIVER SHINER <i>Notropis blennioides</i>	Unknown
ROCK BASS <i>Ambloplites rupestris</i>	Common
SAND SHINER <i>Notropis stramineus</i>	Unknown
SHORTHEAD REDHORSE <i>Moxostoma</i>	Common

Creel

Year	Species	Catch/Unit Effort*
1967	Northern Pike	2.67
1968	Northern Pike	0.36
	Rainbow Trout	0.25

*Catch/Unit Effort = Catch/Hour

Waterbody: Shell River

Provincial Waterbody Id # 3550.00 Watershed 5MDB Region Western District Roblin Map Sheet 62K14 Latitude: 50 58 3 Longitude: 101 23 57

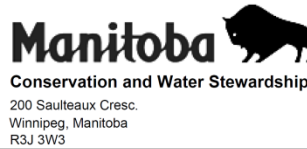
SILVER REDHORSE <i>Moxostoma anisurum</i>	Common
SPOTTAIL SHINER <i>Notropis hudsonius</i>	Unknown
TROUT PERCH <i>Percopsis omiscomaycus</i>	Unknown
WALLEYE <i>Stizostedion vitreum</i>	Abundant
WHITE SUCKER <i>Catostomus commersoni</i>	Common
YELLOW PERCH <i>Perca flavescens</i>	Common

Appendix D – Water Rights Licence

Town of Roblin Water Rights Act Licence

MG-14854 (English)

**Licence to Use Water for
Municipal-Distribution System
Purposes**



Issued in accordance with the provisions of
The Water Rights Act and regulations made thereunder.

Licence No.: **2011-015**
(Original Lic. No.: 2007-092)
U.T.M.: Zone 14 335340 E
5677767 N

Know all men by these presents that in consideration of and subject to the provisos, conditions and restrictions hereinafter contained, the Minister of Water Stewardship for the Province of Manitoba does by these presents give full right and liberty, leave and licence to **The Town of Roblin** in the Province of Manitoba (hereinafter called "the LICENSEE") to divert water from a **sand and gravel** aquifer by means of two water wells, pumps, pipeline(s) and other appurtenances (hereinafter called "the WORKS"), located on the following described lands:

parts of the Northeast Quarter of Section 5 in Township 26 in Range 28 West more particularly described in Certificate of Title No. 81797 DLTO

and more particularly shown on a plan filed in the office of the Executive Director, Regulatory and Operational Services Division, a copy of which plan is hereto attached and marked Exhibit "A" for **municipal-distribution system** purposes on the following described lands:

the Town of Roblin.

This licence is issued upon the express condition that it shall be subject to the provisions of The Water Rights Act and Regulations and all amendments thereto and, without limiting the generality of the aforesaid, to the following terms and conditions, namely:

1. The water shall be used solely for **municipal-distribution system** purposes.
2. The WORKS shall be operated in accordance with the terms herein contained.
3. a) The maximum rate at which water may be diverted pursuant hereto shall not exceed **0.0264 cubic metres per second (0.9 cubic feet per second)**.
b) The total quantity of water diverted in any one year shall not exceed **451 cubic decametres (365.63 acre feet)**.
4. Water shall not be diverted during any period when the water level in the aquifer as measured at:
 - a) Well No. 1 is more than 61.87 metres (203 feet) beneath the surface of the ground.
 - b) Well No. 2 is more than 68.58 metres (225 feet) beneath the surface of the ground.
5. The LICENSEE does hereby remise, release and forever discharge Her Majesty the Queen in Right of the Province of Manitoba, of and from all manner of action, causes of action, claims and demands whatsoever which against Her Majesty the LICENSEE ever had, now has or may hereafter have, resulting from the use of water for **municipal-distribution system** purposes.
6. In the event that the rights of others are infringed upon and/or damage to the property of others is sustained as a result of the operation or maintenance of the WORKS and the rights herein granted, the LICENSEE shall be solely responsible and shall save harmless and fully indemnify Her Majesty the Queen in Right of the Province of Manitoba, from and against any liability to which Her Majesty may become liable by virtue of the issue of this Licence and anything done pursuant hereto.
7. This Licence is not assignable or transferable by the LICENSEE and when no longer required by the LICENSEE this Licence shall be returned to the Executive Director, Regulatory and Operational Services Division, for cancellation on behalf of the Minister.
8. Upon the execution of this Licence the LICENSEE hereby grants the Minister or the Minister's agents the right of ingress and egress to and from the lands on which the WORKS are located for the purpose of inspection of the WORKS and the LICENSEE shall at all times comply with such directions and/or orders that may be given by the Minister or the Minister's agents in writing from time to time with regard to the operation and maintenance of the WORKS.
9. This Licence may be amended, suspended or cancelled by the Minister in accordance with The Water Rights Act by letter addressed to the LICENSEE at **Box 730, Roblin, MB, R0L 1P0, Canada** and thereafter this Licence shall be determined to be at an end.
10. Notwithstanding anything preceding in this Licence, the LICENSEE must have legal control, by ownership or by rental, lease, or other agreement, of the lands on which the WORKS shall be placed and the water shall be used.
11. The term of this Licence shall be January 29, 2028, and this Licence shall become effective only on the date of execution hereof by a person so authorized in the Department of Water Stewardship. The LICENSEE may apply for renewal of this Licence not more than 365 days and not less than 90 days prior to the expiry date.

12. This Licence expires automatically upon the loss of the legal control of any of the lands on which the WORKS are located or on which water is used, unless the Licence is transferred or amended by the Minister upon application for Licence transfer or amendment.
13. The LICENSEE shall keep records of daily and annual water use and shall provide a copy of such records to the Executive Director, Regulatory and Operational Services Division, not later than February 1st of the following year.
14. A flow meter must be installed, positioned to accurately measure instantaneous pumping rate and accumulative withdrawals from the water source.
15. The LICENSEE does hereby agree to correct, to the satisfaction of the Minister, any water supply problems to wells or other forms of supply, which were constructed and operating prior to the date of application for the original Licence No. 2007-092, and which are partly or wholly attributable, in the opinion of the Minister, to the diversion of water as authorized by this Licence.
16. The LICENSEE shall hold and maintain all other regulatory approvals that may be required and shall comply with all other regulatory requirements for the construction, operation, or maintenance of the WORKS or to divert or use water as provided by this Licence.

In witness whereof I the undersigned hereby agree to accept the aforesaid Licence on the terms and conditions set forth therein and hereby set my hand and seal this _____ day of _____ A.D. 20 ____ .

SIGNED, SEALED AND DELIVERED
in the presence of

_____ } _____ (Seal)
Witness Licensee

Canada, PROVINCE OF MANITOBA To Wit:

I, _____ of the _____
of _____ in the Province of Manitoba, MAKE OATH AND SAY:

1. That I was personally present and did see _____ ,
the within named party, execute the within Instrument.
2. That I know the said _____
and am satisfied that he/she is of the full age of eighteen years.
3. That the said Instrument was executed at _____
aforesaid and that I am subscribing witness thereto.

SWORN BEFORE me at the _____
in the Province of Manitoba this _____ day of _____ A.D. 20 ____ .

_____ } _____
A COMMISSIONER FOR OATHS Witness
in and for the Province of Manitoba

My Commission expires _____

Issued at the City of Winnipeg, in the Province of Manitoba, this _____ day of _____ A.D. 20 ____ .

The Honourable the Minister of Conservation and Water Stewardship (or her/his designate)

Appendix E – Watercourse Crossings

MWSB Guidelines for Watercourse Crossings

WATERCOURSE CROSSINGS

Mitigation Measure

1. All watercourse crossings will be directionally drilled.
2. A minimum undisturbed buffer zone of 15 metre will be maintained between directional drill entry/exit areas and banks of watercourse.
3. Heavy equipment (caterpillars, tractors) shall not be allowed within the buffer zone.
4. Enforce measures regarding fuelling or servicing equipment within 100 metre of watercourse.
5. Waste drill mud and cuttings will be prevented from entering surface water.
6. Should erosion control measures be implemented, post construction monitoring shall be conducted to ensure effectiveness.
7. Further erosion control measures will be implemented as necessary.

Reclamation

1. Restore all disturbed areas to original contours.
2. Install erosion control measures, if warranted, and maintain until vegetation becomes established.

Pressure Loss/Fluid Loss Response

To avoid or minimize the potential for drilling fluids and drill cuttings from entering watercourses because of a frac-out, the following monitoring and response plan will be followed:

1. A record of drilling progress will be maintained to always know the location of the drill head relative to the point of entry.
2. A record of drilling component usage (type and quantity) will be maintained throughout each drilling operation.
3. A record of drilling fluid volume used and returned will be maintained to detect any significant fluid losses. Drilling fluid pump pressure will be continuously monitored. Abnormal loss of returned fluids or loss of fluid pressure that may be indicative of a frac-out will be reported immediately to MWSB/PFRA construction field supervisor.
4. At watercourse crossings where water clarity permits, a view of the stream bottom, an observer will continuously check for signs of mud escapement to the watercourse.

Loss of Fluid and Frac-out Response Plan

1. If an abnormal loss of fluid, drop in pressure or visible plume is observed indicating a frac-out or possible frac-out, drilling is to stop immediately.
2. The contractor will notify the MWSB/PFRA construction field supervisor of the frac-out condition or potential condition and decide on the appropriate action as follows:

- a) Assign a person to visually monitor for the presence of muddy plume.
- b) Make adjustments to the mud mixture; add lost circulation material (LCM) to the drilling fluid in an attempt to prevent further loss of fluid to the ground formation and/or watercourse.
- c) Where conditions warrant and permit (i.e., shallow depth, clear water, low water velocity, potentially sensitive habitat) and where a frac-out has been visually detected, attempt to isolate the fluid release using a large diameter short piece of culvert.
- d) Under circumstances where a frac-out has occurred, and where conditions do not permit containment and the prevention of drilling fluids release to the watercourse, attempts to plug the fracture by pumping LCM are not to continue for more than 10 minutes of pumping time.
- e) If the frac-out is not contained within this time, MWSB/PFRA construction supervisor will halt any further attempts until a course of action (either abandon directional drilling or further consultation with MWSB engineers) is decided upon.

Appendix F – Water Quality Data

Town of Roblin 2012 Treated and Raw Water Quality Data

Town of Roblin 2012 Reject Water Quality Data

Goose Lakes 2014 Water Quality Data



Office of Drinking Water
ATTN: DON MICHALYK
Box 10, 27 - 2nd Avenue SW
Dauphin MB R7N 3E5

Date Received: 10-AUG-12
Report Date: 30-AUG-12 15:41 (MT)
Version: FINAL

Client Phone: 204-622-2153

Certificate of Analysis

Lab Work Order #: L1191821
Project P.O. #: 17509
Job Reference: ROBLIN PWS - 183.00
C of C Numbers:
Legal Site Desc:

Paul Nicolas

Paul Nicolas
Account Manager

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ANALYTICAL REPORT

L1191821 CONTD....
PAGE 2 of 9
30-AUG-12 15:41 (MT)

Physical Tests (WATER)

Analyte	Unit	ALS ID		L1191821-1 Sampled Date Sampled Time Sample ID	L1191821-2 Sampled Date Sampled Time Sample ID
		Guide Limit #1	Guide Limit #2		
				ROBLIN 1 - RAW	ROBLIN 2 - TREATED
Colour, True	CU	15	-	26.3	<5.0
Conductivity	umhos/cm	-	-	812	413
Hardness (as CaCO3)	mg/L	-	-	731	172
Langelier Index (4 C)	No Unit	-	-	1.5	0.76
Langelier Index (60 C)	No Unit	-	-	2.3	1.5
pH	pH units	6.5-8.5	-	8.47	8.55
Total Dissolved Solids	mg/L	500	-	546	280
Transmittance, UV (254 nm)	% T	-	-	80.8	97.4
Turbidity	NTU	-	-	27.3	0.28

Federal Guidelines for Canadian Drinking Water Quality (JAN, 2011)

#1: GCDWQ - Aesthetic Objective

#2: GCDWQ - Maximum Acceptable Concentrations (MACs)

Anions and Nutrients (WATER)

Analyte	Unit	ALS ID		L1191821-1 Sampled Date Sampled Time Sample ID	L1191821-2 Sampled Date Sampled Time Sample ID
		Guide Limit #1	Guide Limit #2		
				ROBLIN 1 - RAW	ROBLIN 2 - TREATED
Alkalinity, Total (as CaCO3)	mg/L	-	-	406	176
Ammonia, Total (as N)	mg/L	-	-	0.63 ^{DLA}	<0.010
Bicarbonate (HCO3)	mg/L	-	-	496	199
Bromide (Br)	mg/L	-	-	<0.10	<0.10
Carbonate (CO3)	mg/L	-	-	<12	<12
Chloride	mg/L	250	-	3.28	4.25
Fluoride	mg/L	-	1.5	0.208	0.449
Hydroxide (OH)	mg/L	-	-	<6.8	<6.8
Iodide (I)	mg/L	-	-	<2.0	<2.0
Nitrate and Nitrite as N	mg/L	-	10	<0.0051	0.0060
Nitrate-N	mg/L	-	10	<0.0050	0.0060
Nitrite-N	mg/L	-	1	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L	-	-	0.76	<0.20
Total Nitrogen	mg/L	-	-	0.76	<0.20
Sulfate	mg/L	500	-	280	68.0
Anion Sum	me/L	-	-	14.1	4.82
Cation Sum	me/L	-	-	14.7	4.92
Cation - Anion Balance	%	-	-	2.2	1.0

Federal Guidelines for Canadian Drinking Water Quality (JAN, 2011)

#1: GCDWQ - Aesthetic Objective

#2: GCDWQ - Maximum Acceptable Concentrations (MACs)

 Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.

 Analytical result for this parameter exceeds Guide Limit listed on this report.

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



ANALYTICAL REPORT

L1191821 CONTD....
 PAGE 3 of 9
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Organic / Inorganic Carbon (WATER)

Analyte	Unit	Guide Limit		ALS ID	L1191821-1	L1191821-2
		#1	#2	Sampled Date	Sampled Time	Sample ID
Dissolved Organic Carbon	mg/L	-	-	09-AUG-12	14:00	ROBLIN 1 - RAW
Total Inorganic Carbon	mg/L	-	-	09-AUG-12	14:00	ROBLIN 2 - TREATED
Total Organic Carbon	mg/L	-	-			

Federal Guidelines for Canadian Drinking Water Quality (JAN, 2011)

#1: GCDWQ - Aesthetic Objective

#2: GCDWQ - Maximum Acceptable Concentrations (MACs)

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.
 Analytical result for this parameter exceeds Guide Limit listed on this report.
 * Please refer to the Reference Information section for an explanation of any qualifiers noted.



ANALYTICAL REPORT

L1191821 CONTD....
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Total Metals (WATER)

Analyte	Unit	ALS ID		L1191821-1	L1191821-2
		Sampled Date	Sampled Time	09-AUG-12 14:00	09-AUG-12 14:00
		Guide Limit #1	Guide Limit #2	ROBLIN 1 - RAW	ROBLIN 2 - TREATED
Aluminum (Al)-Total	mg/L	0.1	-	<0.050 <small>DLM</small>	<0.0050
Antimony (Sb)-Total	mg/L	-	0.006	<0.0020 <small>DLM</small>	<0.00020
Arsenic (As)-Total	mg/L	-	0.01	0.0064 <small>DLM</small>	0.00347
Barium (Ba)-Total	mg/L	-	1	0.0132 <small>DLM</small>	0.00161
Beryllium (Be)-Total	mg/L	-	-	<0.0020 <small>DLM</small>	<0.00020
Bismuth (Bi)-Total	mg/L	-	-	<0.0020 <small>DLM</small>	<0.00020
Boron (B)-Total	mg/L	-	5	0.14 <small>DLM</small>	0.097
Cadmium (Cd)-Total	mg/L	-	0.005	<0.00010 <small>DLM</small>	<0.000010
Calcium (Ca)-Total	mg/L	-	-	185 <small>DLM</small>	43.8
Cesium (Cs)-Total	mg/L	-	-	<0.0010 <small>DLM</small>	<0.00010
Chromium (Cr)-Total	mg/L	-	0.05	<0.010 <small>DLM</small>	<0.0010
Cobalt (Co)-Total	mg/L	-	-	<0.0020 <small>DLM</small>	<0.00020
Copper (Cu)-Total	mg/L	1	-	0.0020 <small>DLM</small>	0.00262
Iron (Fe)-Total	mg/L	0.3	-	3.3 <small>DLM</small>	0.056 <0.10
Lead (Pb)-Total	mg/L	-	0.01	<0.00090 <small>DLM</small>	0.000096
Lithium (Li)-Total	mg/L	-	-	0.078 <small>DLM</small>	0.0285
Magnesium (Mg)-Total	mg/L	-	-	65.5 <small>DLM</small>	15.2
Manganese (Mn)-Total	mg/L	0.05	-	0.515 <small>DLM</small>	0.0162
Molybdenum (Mo)-Total	mg/L	-	-	0.0045 <small>DLM</small>	0.00087
Nickel (Ni)-Total	mg/L	-	-	<0.020 <small>DLM</small>	<0.0020
Phosphorus (P)-Total	mg/L	-	-	<1.0 <small>DLM</small>	0.91
Potassium (K)-Total	mg/L	-	-	8.50 <small>DLM</small>	3.40
Rubidium (Rb)-Total	mg/L	-	-	<0.0020 <small>DLM</small>	0.00079
Selenium (Se)-Total	mg/L	-	0.01	<0.010 <small>DLM</small>	<0.0010
Silicon (Si)-Total	mg/L	-	-	13.0 <small>DLM</small>	4.05
Silver (Ag)-Total	mg/L	-	-	<0.0010 <small>DLM</small>	<0.00010
Sodium (Na)-Total	mg/L	200	-	13.8 <small>DLM</small>	40.6
Strontium (Sr)-Total	mg/L	-	-	0.622 <small>DLM</small>	0.150
Tellurium (Te)-Total	mg/L	-	-	<0.0020 <small>DLM</small>	<0.00020
Thallium (Tl)-Total	mg/L	-	-	<0.0010 <small>DLM</small>	<0.00010
Thorium (Th)-Total	mg/L	-	-	<0.0010 <small>DLM</small>	<0.00010
Tin (Sn)-Total	mg/L	-	-	<0.0020 <small>DLM</small>	<0.00020
Titanium (Ti)-Total	mg/L	-	-	0.0054 <small>DLM</small>	0.00135

Federal Guidelines for Canadian Drinking Water Quality (JAN, 2011)

#1: GCDWQ - Aesthetic Objective

#2: GCDWQ - Maximum Acceptable Concentrations (MACs)

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.

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ANALYTICAL REPORT

L1191821 CONTD....
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Total Metals (WATER)

Analyte	Unit	ALS ID		L1191821-1	L1191821-2
		Sampled Date	Sampled Time		
		Sample ID		ROBLIN 1 - RAW	ROBLIN 2 - TREATED
		Guide Limit #1	Guide Limit #2		
Tungsten (W)-Total	mg/L	-	-	<0.0010 ^{DLM}	<0.00010
Uranium (U)-Total	mg/L	-	0.02	<0.0010 ^{DLM}	<0.00010
Vanadium (V)-Total	mg/L	-	-	<0.0020 ^{DLM}	<0.00020
Zinc (Zn)-Total	mg/L	5	-	<0.020 ^{DLM}	0.0025
Zirconium (Zr)-Total	mg/L	-	-	<0.0040 ^{DLM}	<0.00040

Federal Guidelines for Canadian Drinking Water Quality (JAN, 2011)

#1: GCDWQ - Aesthetic Objective

#2: GCDWQ - Maximum Acceptable Concentrations (MACs)

Dissolved Metals (WATER)

Analyte	Unit	ALS ID		L1191821-1	L1191821-2
		Sampled Date	Sampled Time		
		Sample ID		ROBLIN 1 - RAW	ROBLIN 2 - TREATED
		Guide Limit #1	Guide Limit #2		
Aluminum (Al)-Dissolved	mg/L	0.1	-	<0.020 ^{DLM}	<0.020 ^{DLM}

Federal Guidelines for Canadian Drinking Water Quality (JAN, 2011)

#1: GCDWQ - Aesthetic Objective

#2: GCDWQ - Maximum Acceptable Concentrations (MACs)

Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.

Analytical result for this parameter exceeds Guide Limit listed on this report.

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ANALYTICAL REPORT

L1191821 CONTD....
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Volatile Organic Compounds (WATER)

		ALS ID	L1191821-1	
		Sampled Date	09-AUG-12	
		Sampled Time	14:00	
		Sample ID	ROBLIN 1 - RAW	
Analyte	Unit	Guide Limit #1	Guide Limit #2	
Benzene	ug/L	-	5	<0.10
1,1-Dichloroethylene	ug/L	-	14	<0.10
Dichloromethane	ug/L	-	50	<0.50
Ethyl Benzene	ug/L	2.4	-	<0.10
MTBE	ug/L	15	-	<0.10
Tetrachloroethylene	ug/L	-	30	<0.10
Toluene	ug/L	24	-	<0.10
1,1,1-Trichloroethane	ug/L	-	-	<0.10
1,1,2-Trichloroethane	ug/L	-	-	<0.10
Trichloroethylene	ug/L	-	5	<0.10
o-Xylene	ug/L	-	-	<0.070
m+p-Xylenes	ug/L	-	-	0.110
Xylenes (Total)	ug/L	300	-	<0.14
Surrogate: 4-Bromofluorobenzene	%	-	-	104.0
Surrogate: 1,2-Dichloroethane d4	%	-	-	106.2
Surrogate: Toluene-d8	%	-	-	100.0

Federal Guidelines for Canadian Drinking Water Quality (JAN, 2011)

#1: GCDWQ - Aesthetic Objective

#2: GCDWQ - Maximum Acceptable Concentrations (MACs)

 Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.

 Analytical result for this parameter exceeds Guide Limit listed on this report.

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

TOWN OF ROBLIN

L1154044-2

PAGE 3 of 5
Version: FINAL

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1154044-2 RETENTION POND							
Sampled By: CLIENT on 29-MAY-12 @ 14:00							
Matrix: REJECT WATER							
Total Metals by ICP-MS							
Boron (B)-Total	0.084		0.010	mg/L	31-MAY-12	31-MAY-12	R2374863
Cadmium (Cd)-Total	0.000057		0.000010	mg/L	31-MAY-12	31-MAY-12	R2374863
Calcium (Ca)-Total	250	DLA	10	mg/L	31-MAY-12	04-JUN-12	R2376522
Cesium (Cs)-Total	<0.00010		0.00010	mg/L	31-MAY-12	31-MAY-12	R2374863
Chromium (Cr)-Total	<0.0010		0.0010	mg/L	31-MAY-12	31-MAY-12	R2374863
Cobalt (Co)-Total	0.00035		0.00020	mg/L	31-MAY-12	31-MAY-12	R2374863
Copper (Cu)-Total	0.00124		0.00020	mg/L	31-MAY-12	31-MAY-12	R2374863
Iron (Fe)-Total	0.18		0.10	mg/L	31-MAY-12	31-MAY-12	R2374863
Lead (Pb)-Total	0.000136		0.000090	mg/L	31-MAY-12	31-MAY-12	R2374863
Lithium (Li)-Total	0.223		0.0020	mg/L	31-MAY-12	31-MAY-12	R2374863
Magnesium (Mg)-Total	192	DLA	1.0	mg/L	31-MAY-12	04-JUN-12	R2376522
Manganese (Mn)-Total	0.0431		0.00030	mg/L	31-MAY-12	31-MAY-12	R2374863
Molybdenum (Mo)-Total	0.0133		0.00020	mg/L	31-MAY-12	31-MAY-12	R2374863
Nickel (Ni)-Total	0.0027		0.0020	mg/L	31-MAY-12	31-MAY-12	R2374863
Phosphorus (P)-Total	<0.20		0.20	mg/L	31-MAY-12	31-MAY-12	R2374863
Potassium (K)-Total	23.7		0.020	mg/L	31-MAY-12	31-MAY-12	R2374863
Rubidium (Rb)-Total	0.00266		0.00020	mg/L	31-MAY-12	31-MAY-12	R2374863
Selenium (Se)-Total	<0.0010		0.0010	mg/L	31-MAY-12	31-MAY-12	R2374863
Silicon (Si)-Total	20.5		0.050	mg/L	31-MAY-12	31-MAY-12	R2374863
Silver (Ag)-Total	<0.00010		0.00010	mg/L	31-MAY-12	31-MAY-12	R2374863
Sodium (Na)-Total	39.6		0.030	mg/L	31-MAY-12	31-MAY-12	R2374863
Strontium (Sr)-Total	1.32	DLA	0.010	mg/L	31-MAY-12	04-JUN-12	R2376522
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	31-MAY-12	31-MAY-12	R2374863
Thallium (Tl)-Total	<0.00010		0.00010	mg/L	31-MAY-12	31-MAY-12	R2374863
Thorium (Th)-Total	<0.00010		0.00010	mg/L	31-MAY-12	31-MAY-12	R2374863
Tin (Sn)-Total	<0.00020		0.00020	mg/L	31-MAY-12	31-MAY-12	R2374863
Titanium (Ti)-Total	0.0196		0.00020	mg/L	31-MAY-12	31-MAY-12	R2374863
Tungsten (W)-Total	<0.0010		0.0010	mg/L	31-MAY-12	31-MAY-12	R2374863
Uranium (U)-Total	0.00195		0.00010	mg/L	31-MAY-12	31-MAY-12	R2374863
Vanadium (V)-Total	0.00150		0.00020	mg/L	31-MAY-12	31-MAY-12	R2374863
Zinc (Zn)-Total	<0.0050		0.0050	mg/L	31-MAY-12	31-MAY-12	R2374863
Zirconium (Zr)-Total	0.00050		0.00040	mg/L	31-MAY-12	31-MAY-12	R2374863
Transmittance, UV (254 nm)							
Transmittance, UV (254 nm)	65.4		1.0	% T	31-MAY-12	31-MAY-12	R2374484
Turbidity							
Turbidity	8.61		0.10	NTU		30-MAY-12	R2374088
pH							
pH	8.13		0.10	pH units		30-MAY-12	R2374502

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



Town of Roblin
ATTN: JASON BOGUSKI
PO Box 730
Roblin MB R0L 1P0

Date Received: 29-JUL-14
Report Date: 21-AUG-14 13:44 (MT)
Version: FINAL

Client Phone: 204-937-2377

Certificate of Analysis

Lab Work Order #: L1493566
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

A handwritten signature in black ink, appearing to read 'G Hill', positioned above a horizontal line.

Gail Hill
Account Manager

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L1493566 CONTD....
PAGE 2 of 8
Version: FINAL

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1493566-1 EAST GOOSE LAKE							
Sampled By: CLIENT on 28-JUL-14 @ 11:00							
Matrix: Lake Water							
Carbons							
Total Carbon							
Total Carbon	47.7		1.0	mg/L		13-AUG-14	R2918010
Total Inorganic Carbon							
Total Inorganic Carbon	39.7		1.0	mg/L		13-AUG-14	R2918010
Total Organic Carbon							
Total Organic Carbon	9.0		1.0	mg/L		13-AUG-14	R2918010
Carbon,Dissolved Inorganic							
Carbon,Dissolved Inorganic	38.6		1.0	mg/L		13-AUG-14	R2918010
Dissolved Organic Carbon							
Dissolved Organic Carbon	8.9		1.0	mg/L		13-AUG-14	R2918010
Total Dissolved Carbon							
Total Dissolved Carbon	47.6		1.0	mg/L		13-AUG-14	R2918010
MB Test 54PWS							
Alkalinity							
Alkalinity, Total (as CaCO3)	101		20	mg/L		31-JUL-14	R2905362
Bicarbonate (HCO3)	123		24	mg/L		31-JUL-14	R2905362
Carbonate (CO3)	<12		12	mg/L		31-JUL-14	R2905362
Hydroxide (OH)	<6.8		6.8	mg/L		31-JUL-14	R2905362
Ammonia by colour							
Ammonia, Total (as N)	0.016		0.010	mg/L		30-JUL-14	R2903553
Bromide by Ion Chromatography							
Bromide (Br)	<0.10		0.10	mg/L		30-JUL-14	R2904236
Chloride by Ion Chromatography							
Chloride	39.7		0.20	mg/L		30-JUL-14	R2904236
Colour, True							
Colour, True	9.2		5.0	CU		29-JUL-14	R2912543
Conductivity							
Conductivity	332		20	umhos/cm		31-JUL-14	R2905362
Dissolved Aluminum by ICP-MS							
Aluminum (Al)-Dissolved	<0.0020		0.0020	mg/L	29-JUL-14	31-JUL-14	R2905359
Fluoride by Ion Chromatography							
Fluoride	0.155		0.020	mg/L		30-JUL-14	R2904236
Hardness Calculated							
Hardness (as CaCO3)	208		0.30	mg/L		12-AUG-14	
Iodide in Water - Datachem Ohio							
Iodide (I)	<2.0		2.0	mg/L		01-AUG-14	R2908268
Ion Balance Calculation							
Cation - Anion Balance	16.6			%		12-AUG-14	
Anion Sum	4.01			me/L		12-AUG-14	
Cation Sum	5.60			me/L		12-AUG-14	
Langelier Index 4C							
Langelier Index (4 C)	0.11					12-AUG-14	
Langelier Index 60C							
Langelier Index (60 C)	0.88					12-AUG-14	
Nitrate as N by Ion Chromatography							
Nitrate-N	<0.0050		0.0050	mg/L		30-JUL-14	R2904236
Nitrate+Nitrite							
Nitrate and Nitrite as N	<0.0051		0.0051	mg/L		31-JUL-14	
Nitrite as N by Ion Chromatography							
Nitrite-N	<0.0010		0.0010	mg/L		30-JUL-14	R2904236
Sulfate by Ion Chromatography							

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

L1493566 CONTD....
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 Version: FINAL

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1493566-1 EAST GOOSE LAKE							
Sampled By: CLIENT on 28-JUL-14 @ 11:00							
Matrix: Lake Water							
Sulfate by Ion Chromatography							
Sulfate	41.6		0.50	mg/L		30-JUL-14	R2904236
Total Dissolved Solids							
Total Dissolved Solids	315		5.0	mg/L		01-AUG-14	R2907802
Total Kjeldahl Nitrogen							
Total Kjeldahl Nitrogen	0.98		0.20	mg/L	02-AUG-14	05-AUG-14	R2907888
Total Metals by ICP-MS							
Aluminum (Al)-Total	0.0471		0.0050	mg/L	11-AUG-14	11-AUG-14	R2914909
Antimony (Sb)-Total	<0.00020		0.00020	mg/L	11-AUG-14	11-AUG-14	R2914909
Arsenic (As)-Total	0.00166		0.00020	mg/L	11-AUG-14	11-AUG-14	R2914909
Barium (Ba)-Total	0.0513		0.00020	mg/L	11-AUG-14	11-AUG-14	R2914909
Beryllium (Be)-Total	<0.00020		0.00020	mg/L	11-AUG-14	11-AUG-14	R2914909
Bismuth (Bi)-Total	<0.00020		0.00020	mg/L	11-AUG-14	11-AUG-14	R2914909
Boron (B)-Total	0.067		0.010	mg/L	11-AUG-14	11-AUG-14	R2914909
Cadmium (Cd)-Total	<0.000010		0.000010	mg/L	11-AUG-14	11-AUG-14	R2914909
Calcium (Ca)-Total	33.8		0.10	mg/L	11-AUG-14	11-AUG-14	R2914909
Cesium (Cs)-Total	<0.00010		0.00010	mg/L	11-AUG-14	11-AUG-14	R2914909
Chromium (Cr)-Total	<0.0010		0.0010	mg/L	11-AUG-14	11-AUG-14	R2914909
Cobalt (Co)-Total	<0.00020		0.00020	mg/L	11-AUG-14	11-AUG-14	R2914909
Copper (Cu)-Total	0.00058		0.00020	mg/L	11-AUG-14	11-AUG-14	R2914909
Iron (Fe)-Total	<0.10		0.10	mg/L	11-AUG-14	11-AUG-14	R2914909
Lead (Pb)-Total	0.000114		0.000090	mg/L	11-AUG-14	11-AUG-14	R2914909
Lithium (Li)-Total	0.0257		0.0020	mg/L	11-AUG-14	11-AUG-14	R2914909
Magnesium (Mg)-Total	30.1		0.010	mg/L	11-AUG-14	11-AUG-14	R2914909
Manganese (Mn)-Total	0.0247		0.00030	mg/L	11-AUG-14	11-AUG-14	R2914909
Molybdenum (Mo)-Total	0.00110		0.00020	mg/L	11-AUG-14	11-AUG-14	R2914909
Nickel (Ni)-Total	<0.0020		0.0020	mg/L	11-AUG-14	11-AUG-14	R2914909
Phosphorus (P)-Total	<0.10		0.10	mg/L	11-AUG-14	11-AUG-14	R2914909
Potassium (K)-Total	12.9		0.020	mg/L	11-AUG-14	11-AUG-14	R2914909
Rubidium (Rb)-Total	0.00183		0.00020	mg/L	11-AUG-14	11-AUG-14	R2914909
Selenium (Se)-Total	<0.0010		0.0010	mg/L	11-AUG-14	11-AUG-14	R2914909
Silicon (Si)-Total	1.57		0.10	mg/L	11-AUG-14	11-AUG-14	R2914909
Silver (Ag)-Total	<0.00010		0.00010	mg/L	11-AUG-14	11-AUG-14	R2914909
Sodium (Na)-Total	25.5		0.030	mg/L	11-AUG-14	11-AUG-14	R2914909
Strontium (Sr)-Total	0.125		0.00010	mg/L	11-AUG-14	11-AUG-14	R2914909
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	11-AUG-14	11-AUG-14	R2914909
Thallium (Tl)-Total	<0.00010		0.00010	mg/L	11-AUG-14	11-AUG-14	R2914909
Thorium (Th)-Total	<0.00010		0.00010	mg/L	11-AUG-14	11-AUG-14	R2914909
Tin (Sn)-Total	<0.00020		0.00020	mg/L	11-AUG-14	11-AUG-14	R2914909
Titanium (Ti)-Total	0.00350		0.00050	mg/L	11-AUG-14	11-AUG-14	R2914909
Tungsten (W)-Total	<0.00010		0.00010	mg/L	11-AUG-14	11-AUG-14	R2914909
Uranium (U)-Total	0.00073		0.00010	mg/L	11-AUG-14	11-AUG-14	R2914909
Vanadium (V)-Total	0.00047		0.00020	mg/L	11-AUG-14	11-AUG-14	R2914909
Zinc (Zn)-Total	0.0032		0.0020	mg/L	11-AUG-14	11-AUG-14	R2914909
Zirconium (Zr)-Total	<0.00040		0.00040	mg/L	11-AUG-14	11-AUG-14	R2914909
Total Nitrogen Calculated							
Total Nitrogen	0.98		0.20	mg/L		05-AUG-14	
Transmittance, UV (254 nm)							
Transmittance, UV (254 nm)	69.5		1.0	% T		31-JUL-14	R2904291
Turbidity							
Turbidity	1.71		0.10	NTU		29-JUL-14	R2910935
pH							
pH	8.25		0.10	pH units		31-JUL-14	R2905362

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

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1493566-1 EAST GOOSE LAKE Sampled By: CLIENT on 28-JUL-14 @ 11:00 Matrix: Lake Water							
L1493566-2 WEST GOOSE LAKE Sampled By: CLIENT on 28-JUL-14 @ 12:00 Matrix: Lake Water							
Carbons							
Total Carbon							
Total Carbon	45.3		1.0	mg/L		13-AUG-14	R2918010
Total Inorganic Carbon							
Total Inorganic Carbon	32.8		1.0	mg/L		13-AUG-14	R2918010
Total Organic Carbon							
Total Organic Carbon	12.6		1.0	mg/L		13-AUG-14	R2918010
Carbon,Dissolved Inorganic							
Carbon,Dissolved Inorganic	32.4		1.0	mg/L		13-AUG-14	R2918010
Dissolved Organic Carbon							
Dissolved Organic Carbon	12.4		1.0	mg/L		13-AUG-14	R2918010
Total Dissolved Carbon							
Total Dissolved Carbon	44.7		1.0	mg/L		13-AUG-14	R2918010
MB Test 54PWS							
Alkalinity							
Alkalinity, Total (as CaCO3)	145		20	mg/L		31-JUL-14	R2905362
Bicarbonate (HCO3)	140		24	mg/L		31-JUL-14	R2905362
Carbonate (CO3)	18		12	mg/L		31-JUL-14	R2905362
Hydroxide (OH)	<6.8		6.8	mg/L		31-JUL-14	R2905362
Ammonia by colour							
Ammonia, Total (as N)	0.041		0.010	mg/L		30-JUL-14	R2903553
Bromide by Ion Chromatography							
Bromide (Br)	<0.10		0.10	mg/L		30-JUL-14	R2904236
Chloride by Ion Chromatography							
Chloride	61.3		0.20	mg/L		30-JUL-14	R2904236
Colour, True							
Colour, True	12.8		5.0	CU		29-JUL-14	R2912543
Conductivity							
Conductivity	533		20	umhos/cm		31-JUL-14	R2905362
Dissolved Aluminum by ICP-MS							
Aluminum (Al)-Dissolved	0.0052		0.0020	mg/L	29-JUL-14	31-JUL-14	R2905359
Fluoride by Ion Chromatography							
Fluoride	0.142		0.020	mg/L		30-JUL-14	R2904236
Hardness Calculated							
Hardness (as CaCO3)	174		0.30	mg/L		12-AUG-14	
Iodide in Water - Datachem Ohio							
Iodide (I)	<2.0		2.0	mg/L		01-AUG-14	R2908268
Ion Balance Calculation							
Cation - Anion Balance	5.1			%		12-AUG-14	
Anion Sum	5.28			me/L		12-AUG-14	
Cation Sum	5.85			me/L		12-AUG-14	
Langelier Index 4C							
Langelier Index (4 C)	0.90					12-AUG-14	
Langelier Index 60C							
Langelier Index (60 C)	1.6					12-AUG-14	
Nitrate as N by Ion Chromatography							
Nitrate-N	<0.0050		0.0050	mg/L		30-JUL-14	R2904236
Nitrate+Nitrite							

* 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
L1493566-2 WEST GOOSE LAKE							
Sampled By: CLIENT on 28-JUL-14 @ 12:00							
Matrix: Lake Water							
Nitrate+Nitrite							
Nitrate and Nitrite as N	<0.0051		0.0051	mg/L		31-JUL-14	
Nitrite as N by Ion Chromatography							
Nitrite-N	<0.0010		0.0010	mg/L		30-JUL-14	R2904236
Sulfate by Ion Chromatography							
Sulfate	31.2		0.50	mg/L		30-JUL-14	R2904236
Total Dissolved Solids							
Total Dissolved Solids	324		5.0	mg/L		01-AUG-14	R2907802
Total Kjeldahl Nitrogen							
Total Kjeldahl Nitrogen	1.44		0.20	mg/L	02-AUG-14	05-AUG-14	R2907888
Total Metals by ICP-MS							
Aluminum (Al)-Total	0.0443		0.0050	mg/L	11-AUG-14	11-AUG-14	R2914909
Antimony (Sb)-Total	<0.00020		0.00020	mg/L	11-AUG-14	11-AUG-14	R2914909
Arsenic (As)-Total	0.00181		0.00020	mg/L	11-AUG-14	11-AUG-14	R2914909
Barium (Ba)-Total	0.0494		0.00020	mg/L	11-AUG-14	11-AUG-14	R2914909
Beryllium (Be)-Total	<0.00020		0.00020	mg/L	11-AUG-14	11-AUG-14	R2914909
Bismuth (Bi)-Total	<0.00020		0.00020	mg/L	11-AUG-14	11-AUG-14	R2914909
Boron (B)-Total	0.098		0.010	mg/L	11-AUG-14	11-AUG-14	R2914909
Cadmium (Cd)-Total	<0.000010		0.000010	mg/L	11-AUG-14	11-AUG-14	R2914909
Calcium (Ca)-Total	26.5		0.10	mg/L	11-AUG-14	11-AUG-14	R2914909
Cesium (Cs)-Total	<0.00010		0.00010	mg/L	11-AUG-14	11-AUG-14	R2914909
Chromium (Cr)-Total	<0.0010		0.0010	mg/L	11-AUG-14	11-AUG-14	R2914909
Cobalt (Co)-Total	<0.00020		0.00020	mg/L	11-AUG-14	11-AUG-14	R2914909
Copper (Cu)-Total	0.00065		0.00020	mg/L	11-AUG-14	11-AUG-14	R2914909
Iron (Fe)-Total	<0.10		0.10	mg/L	11-AUG-14	11-AUG-14	R2914909
Lead (Pb)-Total	<0.000090		0.000090	mg/L	11-AUG-14	11-AUG-14	R2914909
Lithium (Li)-Total	0.0233		0.0020	mg/L	11-AUG-14	11-AUG-14	R2914909
Magnesium (Mg)-Total	26.3		0.010	mg/L	11-AUG-14	11-AUG-14	R2914909
Manganese (Mn)-Total	0.0158		0.00030	mg/L	11-AUG-14	11-AUG-14	R2914909
Molybdenum (Mo)-Total	0.00068		0.00020	mg/L	11-AUG-14	11-AUG-14	R2914909
Nickel (Ni)-Total	<0.0020		0.0020	mg/L	11-AUG-14	11-AUG-14	R2914909
Phosphorus (P)-Total	<0.10		0.10	mg/L	11-AUG-14	11-AUG-14	R2914909
Potassium (K)-Total	18.0		0.020	mg/L	11-AUG-14	11-AUG-14	R2914909
Rubidium (Rb)-Total	0.00315		0.00020	mg/L	11-AUG-14	11-AUG-14	R2914909
Selenium (Se)-Total	<0.0010		0.0010	mg/L	11-AUG-14	11-AUG-14	R2914909
Silicon (Si)-Total	0.29		0.10	mg/L	11-AUG-14	11-AUG-14	R2914909
Silver (Ag)-Total	<0.00010		0.00010	mg/L	11-AUG-14	11-AUG-14	R2914909
Sodium (Na)-Total	43.6		0.030	mg/L	11-AUG-14	11-AUG-14	R2914909
Strontium (Sr)-Total	0.113		0.00010	mg/L	11-AUG-14	11-AUG-14	R2914909
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	11-AUG-14	11-AUG-14	R2914909
Thallium (Tl)-Total	<0.00010		0.00010	mg/L	11-AUG-14	11-AUG-14	R2914909
Thorium (Th)-Total	<0.00010		0.00010	mg/L	11-AUG-14	11-AUG-14	R2914909
Tin (Sn)-Total	<0.00020		0.00020	mg/L	11-AUG-14	11-AUG-14	R2914909
Titanium (Ti)-Total	0.00122		0.00050	mg/L	11-AUG-14	11-AUG-14	R2914909
Tungsten (W)-Total	<0.00010		0.00010	mg/L	11-AUG-14	11-AUG-14	R2914909
Uranium (U)-Total	0.00030		0.00010	mg/L	11-AUG-14	11-AUG-14	R2914909
Vanadium (V)-Total	0.00085		0.00020	mg/L	11-AUG-14	11-AUG-14	R2914909
Zinc (Zn)-Total	0.0024		0.0020	mg/L	11-AUG-14	11-AUG-14	R2914909
Zirconium (Zr)-Total	<0.00040		0.00040	mg/L	11-AUG-14	11-AUG-14	R2914909
Total Nitrogen Calculated							
Total Nitrogen	1.44		0.20	mg/L		05-AUG-14	
Transmittance, UV (254 nm)							
Transmittance, UV (254 nm)	61.1		1.0	% T		31-JUL-14	R2904291

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

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1493566-2 WEST GOOSE LAKE Sampled By: CLIENT on 28-JUL-14 @ 12:00 Matrix: Lake Water							
Turbidity Turbidity	3.60		0.10	NTU		29-JUL-14	R2910935
pH pH	9.00		0.10	pH units		31-JUL-14	R2905362

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