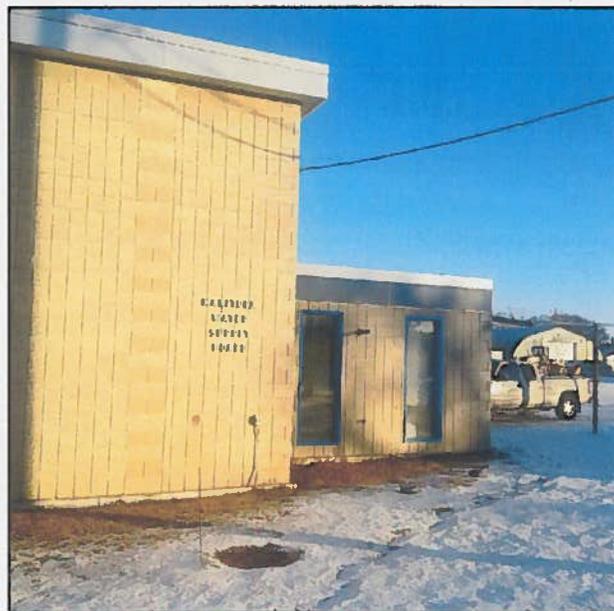


ENVIRONMENT ACT PROPOSAL MUNICIPALITY OF RUSSELL BINSARTH WATER TREATMENT PLANT UPGRADE

March 2016



Prepared by:



Unit #1A - 2010 Currie Blvd.,
Brandon, MB R7B 4E7





**THE MANITOBA WATER
SERVICES BOARD**

Unit #1A - 2010 Currie Blvd., Brandon, Manitoba, Canada R7B 4E7

T 204-726-6076 F 204-726-7196

April 25, 2016

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

Attention: Tracey Braun, M.Sc.
Director

Dear Ms. Braun:

**Re: Environment Act Proposal: Class 2 Development License
Municipality of Russell Binscarth Water Treatment Plant Upgrade**

On behalf of the Municipality of Russell Binscarth, please find enclosed an Environment Act Proposal for a Class 2 Development License. Enclosed is a cheque payable to the Minister of Finance in the amount of \$7500.00.

Please find enclosed 4 hard copies and 1 electronic copy (CD); each includes a completed application form, EAP report, and drawings.

If you have any questions, please contact the undersigned at (204) 726-6083.

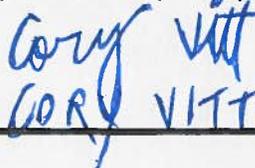
Yours truly,

Cory Vitt *APRIL 25, 2016*

Cory Vitt, M.Eng. P.Eng.
Project Engineer
enc.

Environment Act Proposal Form



Name of the development: Municipality of Russell Binscarth Water Treatment Plant Upgrade		
Type of development per Classes of Development Regulation (Manitoba Regulation 164/88): Class 2 Development		
Legal name of the applicant: Municipality of Russell Binscarth		
Mailing address of the applicant: Box 10, 178 Main Street North		
Contact Person: CAO: Wally R. Melnyk; wmelnyk@mrbgov.com		
City: Russell	Province: MB	Postal Code: R0J 1W0
Phone Number: 204-773-2253	Fax: 204-773-3370	email:
Location of the development: Municipality of Russell Binscarth		
Contact Person: CAO: Wally R. Melnyk; wmelnyk@mrbgov.com		
Street Address: various locations within Municipality		
Legal Description: various locations within Municipality		
City/Town: Russell & Binscarth	Province: MB	Postal Code: R0J 1W0
Phone Number: 204-773-2253	Fax: 204-773-3370	email:
Name of proponent contact person for purposes of the environmental assessment: Cory Vitt, M.Eng. P.Eng.		
Phone: 204-726-6083	Mailing address: MWSB	
Fax: ~~~ 204-726-7196	Unit #1A - 2010 Currie Blvd. Brandon, MB R7B 4E7	
Email address: cory.vitt@gov.mb.ca		
Webpage address:		
Date: April 25, 2016	Signature of proponent, or corporate principal of corporate proponent: 	
	Printed name: CORY VITT APRIL 25, 2016	

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

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

Per Environment Act Fees Regulation (Manitoba Regulation 168/96):	
Class 1 Developments	\$1,000
Class 2 Developments	\$7,500
Class 3 Developments:	
Transportation and Transmission Lines ..	\$10,000
Water Developments	\$60,000
Energy and Mining	\$120,000

Submit the complete EAP to:

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

For more information:

Phone: (204) 945-8321

Fax: (204) 945-5229

<http://www.gov.mb.ca/conservation/ea>

ENVIRONMENT ACT PROPOSAL MUNICIPALITY OF RUSSELL BINSARTH WATER TREATMENT PLANT UPGRADE

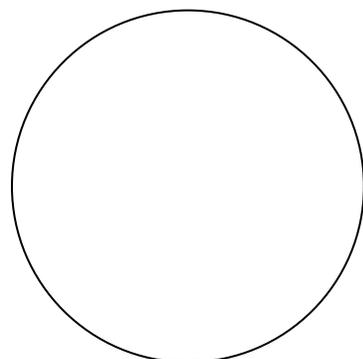
March 2016



Prepared by:



Unit #1A - 2010 Currie Blvd.,
Brandon, MB R7B 4E7



EXECUTIVE SUMMARY

The Municipality of Russell Binscarth requested the Manitoba Water Services Board (MWSB) to prepare an Environment Act Proposal (EAP) for a Class 2 Development License under the Manitoba Environment Act for an upgrade of the Water Treatment Plant (WTP) and water supply pipeline. The expansion and upgrade involves the following:

1. Installation of two new raw water supply wells in Russell and connection to the raw water pipeline feeding the Russell WTP. This upgrade was completed in 2015.
2. Construction of a new Russell WTP (adjacent to the existing WTP).
3. Construction of a Reverse Osmosis (RO) membrane concentrate pipeline from the new Russell WTP to Spear Lake north-west of Russell.
4. Construction of a treated water supply pipeline from the new Russell WTP to the existing Binscarth reservoir.

The proposed upgrades will allow the Municipality to overcome inadequate water supply with aged ineffective infrastructure, with the Binscarth WTP in violation of the operating license conditions. This EAP is submitted for this proposed infrastructure.

The Town of Russell and the Village of Binscarth amalgamated in 2015. The Municipality of Russell Binscarth supplies potable water to residents in the former Town of Russell (population of 1,611 from the 2011 census) and in the former Village of Binscarth (population of 425 from the 2011 census), from two separate aging WTPs.

The expansion includes the construction of a new 32 L/s WTP in Russell using groundwater wells as a water supply. The proposed treatment process will consist of an integrated membrane system including Reverse Osmosis (RO). Concentrate from the RO will be discharged to Spear Lake north-west of Russell. The proposed expansion to the Russell WTP will increase the operating capacity from 10 L/s to 32 L/s.

The distribution system will be expanded with the installation of approximately 19.2 kms of pressure pipeline to supply the existing Binscarth reservoir. Existing or upgraded infrastructure from the Binscarth reservoir will be utilized for re-chlorination purposes as necessary.

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0.0 List of Acronyms

AO	Aesthetic Objective
CIP	Clean-In-Place
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
MWSB	Manitoba Water Services Board
ODW	Office of Drinking Water
OS	Operational Statements
PR	Public Road
RM	Rural Municipality
RO	Reverse Osmosis
TDS	Total Dissolved Solids
THM	Trihalomethane
TOC	Total Organic Carbon
UV	Ultraviolet
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

1.0 Introduction and Background

1.1 Introduction

The Municipality of Russell Binscarth requested the Manitoba Water Services Board (MWSB) to prepare an Environment Act Proposal (EAP) for a Class 2 Development License under the Manitoba Environment Act for an upgrade of the Water Treatment Plant (WTP) in the Town of Russell. This document provides the compiled information required for Manitoba Conservation and Water Stewardship's 'Environment Act Proposal Report Guidelines' and 'Supplementary Guidelines for Municipal Water Supply Systems'. This EAP includes components of the concentrate disposal from Russell and treated water supply pipeline to Binscarth.

1.2 Background Information

The Town of Russell and the Village of Binscarth amalgamated in 2015. The Municipality of Russell Binscarth supplies potable water to residents in the former Town of Russell (population of 1,611 from the 2011 census) and in the former Village of Binscarth (population of 425 from the 2011 census), from two separate aging WTPs.

The Municipality of Russell Binscarth is located in western Manitoba, adjacent to the Saskatchewan border with a population of approximately 2500. The Russell WTP receives raw water from a sand-and-gravel aquifer located approximately 8 km east of the Town. Two 200 mm diameter wells supply water to the WTP. A 200 mm PVC and 250 mm HDPE raw water pipeline deliver water from the wells to the WTP. Raw water is treated by the Town's lime soda ash WTP renovated in 1964 with a current treatment capacity of 7.8 to 10.3 L/s. The maximum day demand from the Town was recorded at 302.8 cubic meters in 2010.

The Russell water treatment process involves mixing of lime, soda ash, and alum with the raw water to facilitate flocculation and precipitation prior to gravity filtration. The water is then re-carbonated, filtered through a dual media gravity filter, and chlorinated prior to storage in the reservoir. Treated water is stored in a 1000 cubic meter single-cell concrete reservoir with a 113 cubic meter pump well. A water tower (1956) with a capacity of 272,800 L maintains distribution pressure for a total treated water storage capacity of 1386 cubic meters, though the tower is nearing the end of its life cycle.

Bullee Consulting Ltd. in 2009 noted, "During peak flow demands, the treatment system cannot treat adequate water and the treated water storage levels decrease until demand subsides. This is not a suitable way for a water treatment plant to operate in the long term."¹ It was also noted that the distribution pumps, fire pump, and reservoir capacity are inadequate to service the system. Russell experiences average day demands of 7.1 L/s and a peak day demand near 14.2 L/s. Due to the limited capacity of the raw water wells (10.6 L/s) and the existing WTP (7.8 to 10.3 L/s), the treatment system must be expanded to provide additional capacity for Russell into the future.

The Russell WTP supplies the Town with treated water via 805 service connections with an additional 125 connections anticipated in the future.

The lime soda ash type of WTP becomes extremely difficult to maintain beyond the anticipated life expectancy. The Russell WTP is unable to treat water in conformance with the regulations of the Drinking Water Safety Act (DWSA). A major upgrade is required to bring the treated water in conformance with the DWSA and GCDWQ.

According to MWSB Municipality of Russell Binscarth Study 2015:

"The Binscarth WTP and raw water wells were originally constructed in 1965/66 with upgrades in 1980 and 1992. One main well (9.1 L/s) supplies the WTP while the backup well can provide only limited water to the system. The raw water contains high hardness, colour, and Total Organic Carbons (TOCs). Treated water in Binscarth contains trihalomethanes (THMs) that are well above the limit of 100 µg/L, and the non-GUDI (Groundwater Under Direct Influence of Surface Water) status of the Binscarth wells is currently under review. If the wells are classified as GUDI, 3-log (99.9%) removal/inactivation of *Cryptosporidium* oocysts and *Giardia* cysts is required, as well as 4-log (99.99%) removal/inactivation of viruses. Due to the presence of high organics and elevated THMs, it is suspected that the wells are GUDI and the WTP will require upgrading to achieve conformance with the drinking water regulations."⁴

"The average day demand on the Binscarth WTP is 2.3 L/s with a peak day of approximately 5.3 L/s. The Binscarth WTP requires upgrading for removal of TOCs, TDSs, THMs, and hardness, as well as upgrades to the raw water line and raw water wells, though the capacity of the water aquifer is limited."⁴

The Binscarth WTP supplies the Village with treated water via 225 service connections with an additional 40 connections anticipated in the future.

1.2.1 Previous Studies

Previous reports have been reviewed in preparation of this Environment Act Proposal.

In February 2014, the MWSB examined the Binscarth WTP and presented options for upgrading the existing infrastructure.³

According to MWSB Municipality of Russell Binscarth Study 2015:

"The existing WTP in Russell was constructed in 1955 with a major expansion in 1964, and though it continues to meet regulations, the aging infrastructure needs to be updated to avoid catastrophic failure. The Public Water System Engineering Assessment completed by Bullee Consulting Ltd. in 2009 noted that many of the main components are "obsolete, undersized, or in poor condition." Water is supplied by two 200 mm diameter artesian wells that are 18 and 24 metres deep located 4 miles east and 1 mile north of Russell. Only one well can supply the system demand and concerns over the condition of the well contribute to the urgent nature of the proposed upgrades. The raw water contains elevated levels of iron, manganese, alkalinity, arsenic, calcium, and hardness which must be addressed by the treatment process."⁴

W.L. Gibbons & Associates Inc. (WLG) report dated August 2014,⁵ provides an assessment for the Town of Russell water supply system. This report mentions that the desired future peak raw water pumping rate is 20 Lps (265 lpm) to allow for future growth. Although this only accounted for a peak demand from the Town of Russell and not the regional system.

W.L. Gibbons & Associates Inc. (WLG) report dated October 2015,⁷ provides a summary of the pumping well installations. Two new 300 mm diameter wells with a design capacity in excess of 32 Lps each were installed and tested. The well capacities were approximately 68 Lps (900 lpm) and 100 Lps (1300 lpm). No pump mechanization in the wells at this point in time.

According to WSP Technical Memorandum #1 2015:

"The existing water supply for the community of Russell, Manitoba, is in need of replacement due to deterioration of its three wells, two of which were developed in 1985 and one in 2000. Only one well is currently in operation, one is available for short-term standby and one has been abandoned and sealed. Two wells are proposed to be drilled and mechanized, and a 250 mm pipeline constructed to connect to the existing 9 km pipeline which currently conveys water from the existing well site to the community. This system is intended to provide a 32 L/s supply to Russell's Water Treatment Plant, which is currently rated at 10 L/s capacity. The plant is expected to be replaced in the medium-term with a membrane (Reverse Osmosis) facility. Future upgrading to double the proposed 32 L/s capacity (64 L/s) will be possible by upsizing the well pumps and twinning the existing 200 mm pipeline with a 300 mm line."⁸

"The general quality of the water from this part of the aquifer is not significantly different from that in the more westerly location from which the Town has been drawing for three decades. In the short term, the existing treatment plant should be adequate to meet the Town's needs. To support community growth, and to serve the needs of the region, including the Village of Binscarth which has water challenges, a new treatment plant is needed. The water should be very amenable to membrane (NF - Nano Filtration or RO - Reverse Osmosis) treatment. The presence of arsenic - even if only in relatively low concentrations, slightly above the current 0.010 mg/L limit - suggests the probability that a relatively tight RO membrane will likely be most appropriate. Pilot testing will be useful to confirm the optimum choice."⁸

The MWSB Study 2015, considered water supply and treatment alternatives for the communities of Russell and Binscarth. The report covered the new wells east of Russell and a new membrane plant at Russell, to serve both communities, as well as an alternative to develop a new facility located between the two communities. A WTP located in Russell was found to be the most cost effective solution.

1.2.2 Population

Based on the 2011 Census, the Town of Russell has a population of 1669, a 5.0% increase from 1590 in 2006. The Town has 805 service connections to the water system with 125 proposed future connections in the next 20 years. Based on the assumption that the population in the Town will increase over the next few years at an annual population growth rate of 1.0% per year, a 20-year population of approximately 2037 for the Town may be assumed.

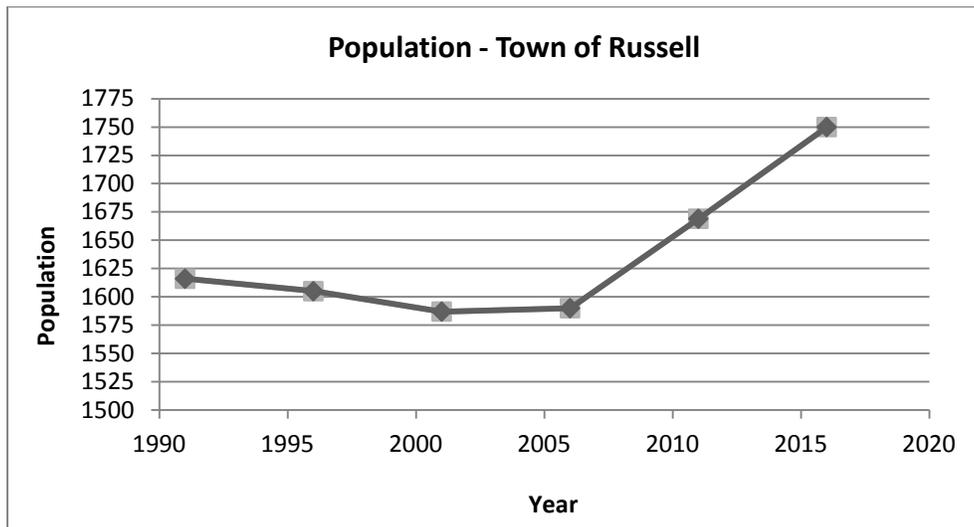


Figure 1.1 - Town of Russell Population Trends

Based on the 2011 Census, the Village of Binscarth has a population of 425, a 7.6% increase from 395 in 2006. The Village has 225 service connections to the water system with 40 proposed future connections in the next 20 years. Based on the assumption that the population in the Village will increase over the next few years at an annual population growth rate of 1.5% per year, a 20-year population of approximately 570 for the Village may be assumed.

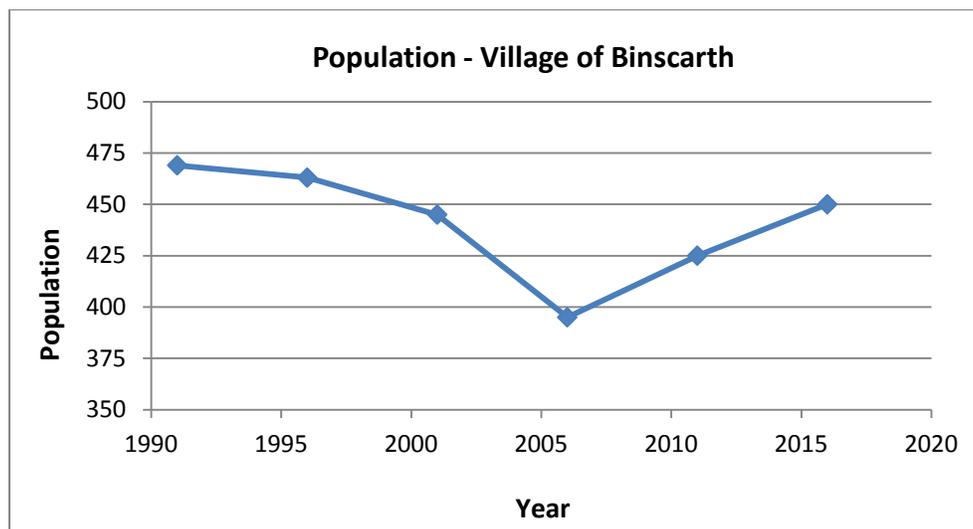


Figure 1.2 - Village of Binscarth Population Trends

1.2.3 Current and Projected Water Use

A WTP is designed based on peak day demand. When calculating water consumption, typical average daily water usage ranges from 250 L/person/day to 300 L/person/day and peak day usage (peak day factor) is typically 1.5 to 2.0 times greater. Consumptions of 300 L/person/day and a peak day factor of 2.0 were used for this study. The project treated water demands are summarized in Table 1.1.

The current peak treated water demand for Russell is 14.2 L/s and the peak day for Binscarth is 5.3 L/s, or a total of 19.5 L/s. The project 20-year peak day demand for the system is 23.3 L/s.

The 20-year average day demand for the system is 766,500 L/day. The new WTP will provide a reservoir which satisfies the required the water consumption, chlorine contact disinfection time, and emergency fire storage for a Class 5 WTP (240 L/s), Basic Fire Protection for Medium Sized Towns with 2000 to 4000 Population.

Table 1.1 - Projected Treated Water Demand for the Municipality of Russell Binscarth

Projected Treated Water Demand for the Russell Binscarth Water System		
	Quantity	Units
Russell Current Connections	805	
Binscarth Current Connections	225	
Future Connections	165	
Total Connections	1195	
Russell Current Population	1669	
Binscarth Current Population	425	
Total System Population	2094	
20 Year Future Population (@ 1.0, 1.5% per year)	2607	
Consumption/capita/day	300	L/capita/day
Average Day Consumption	782,100	L/day
Average Day Demand	9.1	L/s
Peak Day Factor	2.0	
Peak Day Consumption	1,564,200	L/day
Peak Day Demand (20 hour operating day)	18.1	L/s

1.2.4 Raw Water Source

The raw water sources for both the Town of Russell and the Village of Binscarth are wells. This EAP proposes a regional water source of non-GUDI wells several miles away from the Town of Russell.

1.2.5 Water Rights Act

The Town of Russell utilizes Water Rights License No. 2007-022 (previous License No. 85-16). The original license was implemented in 1984/85 for wells on SE-17-21-27W. The License allows the maximum instantaneous rate of withdrawal to be 11 L/s and a maximum annual usage of 250 cubic decameters.

W.L. Gibbons & Associates Inc. (WLG), applied for a groundwater exploration permit in April 2015 for the regional system. The new wells are located approximately 1.5 miles east of the old wells on SE-17-21-27W. The maximum instantaneous rate of withdrawal is 32 L/s and a maximum annual usage of 421 cubic decameters. The 0.032 cubic meters per second (32 L/s) pumping rate is the rate required for this proposed system to supply the estimated demands. The estimated 20-year raw water demand is 13.3 L/s on an average day and 29.2 L/s on a peak day.

Table 1.2 - Projected Total Water Demand for the Municipality of Russell Binscarth WTP

Demand	Unit
13.3	L/s
419,400,000	L/yr
419,400	cubic meters/yr
419.4	cubic decameters/yr

Based on Table 1.2, the proposed WTP is capable of supplying the average day demands while remaining in compliance with the proposed Water Rights License. A new Water Rights License will be applied the new raw water supply system.

1.2.6 Water Quality

The Office of Drinking Water (ODW) currently conducts annual audits of all public water systems which includes sampling and chemistry analysis every three years for secure groundwater sources and once per year for surface water and GUDI supply systems. In addition, the operator tests chlorine residuals daily on the treated water.

Raw water quality parameters exceeding the GCDWQ include arsenic, hardness, iron, manganese, and Total Dissolved Solids (TDS). Treated water quality parameters at the existing Town of Russell WTP exceeding the GCDWQ include hardness. The existing treatment system does not reduce all parameters below the maximum acceptable concentration or the aesthetic objective including hardness. A treatment system upgrade is necessary to address all the parameters that exceed the GCDWQ and the high hardness, sulfate, and TDS in the treated water.

Considering the issues with the water quality, the Town requested MWSB assistance to develop a ground water source located at SE 16-21-27W and necessary infrastructure to supply the raw water for present and future demands in the region.

Table 1.3 - Water Quality Results

Parameter	Unit	GCDWQ		Sampled: August 7, 2013	Sampled: August 7, 2013	Sampled: June 4, 2015
		AO/OG	MAC	Russell Existing Well Raw	Russell Existing WTP Treated	Russell New Well Raw
Alkalinity (Total) CaCO ₃	mg/L			481	95	439
Ammonia (Total) Nitrogen	mg/L			1.20	<0.010	0.72
Arsenic	mg/L		0.01	0.0341	0.00703	0.0383
Boron	mg/L			0.174	0.150	0.119
Calcium	mg/L			151	19.4	124
Chloride (Dissolved)	mg/L	250		4.26	12.9	1.44
Colour (True)	CU	15		<5.0	<5.0	<5.0
Conductivity	umhos/cm			1120	679	974
Fluoride (Dissolved)	mg/L		1.5	0.22	0.67	0.205
Hardness (Total) CaCO ₃	mg/L			601	159	507
Iron	mg/L	0.3		3.50	<0.10	2.97
Langelier Saturation Index (4 C)	NA			0.47	-0.35	0.70
Langelier Saturation Index (60 C)	NA			1.2	0.41	1.5
Lead	mg/L		0.01	0.000331	0.000171	<0.00090
Magnesium	mg/L			54.1	26.8	47.8
Manganese	mg/L	0.05		0.463	0.00298	0.300
Nitrate and Nitrite as N	mg/L		10	~~~	~~~	<0.070
Nitrate as N	mg/L		10	<0.0050	0.280	<0.020
Nitrite as N	mg/L		1	<0.0010	<0.0010	<0.010
pH	pH	6.5 to 8.5		7.39	8.09	7.72
Potassium	mg/L			6.72	7.49	5.85
Sodium	mg/L	200		39.1	83.0	19.7
Sulphate/ Sulfate (Dissolved)	mg/L	500		219	225	142
Total Dissolved Solids	mg/L	500		813	468	688
Total Organic Carbon	mg/L			3.1	3.0	3.8
Turbidity	NTU			38.3	0.39	42
Uranium	mg/L		0.02	0.00415	<0.00010	0.00267
Zinc	mg/L	5		0.0071	<0.0020	<0.0020

^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.

* Turbidity is a physical property that must be measured on site. It is anticipated that on site testing would demonstrate that the high turbidity recorded is a result of the high iron content oxidizing and precipitating in the raw water during transit.

^{DLA} Detected Limit Adjusted for required dilution.

1.2.7 Compliance Plan

A compliance plan has not been completed for the existing WTP.

2.0 Description of Proposed Development

2.1 Project Description

The proposed development includes:

1. Installation of two new raw water supply wells in Russell and connection to the raw water pipeline feeding the Russell WTP. This upgrade was completed in 2015.
2. Construction of a new Russell WTP (adjacent to the existing WTP).
3. Construction of a Reverse Osmosis (RO) membrane concentrate pipeline from the new Russell WTP to Spear Lake north-west of Russell.
4. Construction of a treated water supply pipeline from the new Russell WTP to the existing Binscarth reservoir.

The existing lime soda ash treatment system will be decommissioned once the proposed Reverse Osmosis (RO) membrane treatment system is operational. The two new raw water supply wells have already been installed and mechanized, utilizing an extension to the existing raw water pipeline feeding the Russell WTP. The connection from the new wells to the existing raw water pipeline has been installed in municipal road allowances.

Refer to the Drawings in the Appendix, which show the location of the wells with respect to the WTP.

The development also requires approval to discharge concentrate from the RO to Spear Lake.

2.1.1 Water Source

The groundwater will be pumped from an aquifer located beneath SE-16-21-27W approximately 10 km east of Russell. This source was selected following a groundwater study of potential options and field testing to confirm the availability of suitable groundwater resources. This aquifer has also been the source of water for Russell for the past three decades; it is a reliable and sustainable aquifer.

2.1.1.1 Well Installations

W.L. Gibbons & Associates Inc. (WLG) report dated October 2015,⁷ provides a summary of the pumping well installations.

"The two new pumping wells were installed in the summer of 2015 (June through September) by Watkins & Argue Drilling of Clearwater, MB under the direct supervision of WLG personnel."⁷

The installation of the first new supply well (designated as PW 15-01) began on July 27 and was completed on July 30, 2015."⁷

"The well was installed approximately 350 meters south of Mile Road 122N, and on the west side of PR 478. The well is located within private property to be acquired by the municipality."⁷

"A pumping test was conducted on Well PW 15-01 on September 15 to 16, 2015. Assuming the pump is set at a depth of 34.4 meters (113 feet), and a maximum safe pumping level of 18.45 meters (60 feet), the total well capacity is approximately 68 Lps (900 lpm), well in excess of the current design requirement of 32 Lps."⁷

"The installation of the second supply well (designated as PW 15-02) began on September 14 and was completed on September 17, 2015."⁷

"A well capacity test was conducted on Well PW 15-02 on September 16, 2015. Assuming the pump is set at a depth of 34.4 meters(113 feet), and a maximum safe pumping level of 18.45 meters (60 feet), the total well capacity is in excess of 100 Lps (1300 lpm)."⁷

2.1.1.2 Raw Water Quality

During the long term pump test, water samples were collected and submitted for laboratory analysis to characterize the raw water quality of the aquifer. The chemistry results indicated that the aquifer has a good water quality for membrane treatment. The chemistry results from the existing Town of Russell wells indicate that good water quality is consistent across the aquifer. The wells are considered to be installed in a confined aquifer and are not in an artesian condition as the previous production wells. The complete chemistry can be found in the Appendix.

Refer to Table 1.3 - Water Quality Results.

2.1.1.3 Raw Water Pipeline

The raw water pipeline was sized using 20-year projected water demand. The raw water pipeline has been constructed on highway and roadway Right-of-Ways (ROWs) as required. The pipeline route can be found in the Appendix.

The pipeline is 250 mm HDPE.

2.1.2 Water Treatment Plant

The Municipality of Russell Binscarth WTP is classified as a Class 3 Water Treatment Facility. The existing lime soda ash treatment system will be replaced with a 32.0 L/s Reverse Osmosis (RO) membrane unit. The proposed membrane filtration is effective in protecting against viruses and cysts such as *Cryptosporidium* oocysts and *Giardia lamblia* cysts as well as removing nitrates, TDS, iron, manganese, and softening the water to acceptable concentrations. The upgraded treatment system will supply the project 20-year population demand of the Municipality while treating water that meets the DWSA and GCDWQ.

The detailed design of the proposed WTP will be finalized when environmental approval has been received and funding has been secured.

The existing treatment system will be decommissioned once the new treatment system is fully operational and commissioned. The existing raw water line will be utilized to supply the new WTP. The old treatment equipment will be removed from the existing WTP building. Membrane concentrate accounts for 20-30% of the total raw water flow through the WTP. Using a 20% concentrate rate and a 10% by-pass rate through a pressure filter will result in an instantaneous raw water demand of 32 L/s. Figure 2.1 illustrates a schematic of the treatment process producing 26 L/s of treated water to satisfy the 20-year projected water demand.

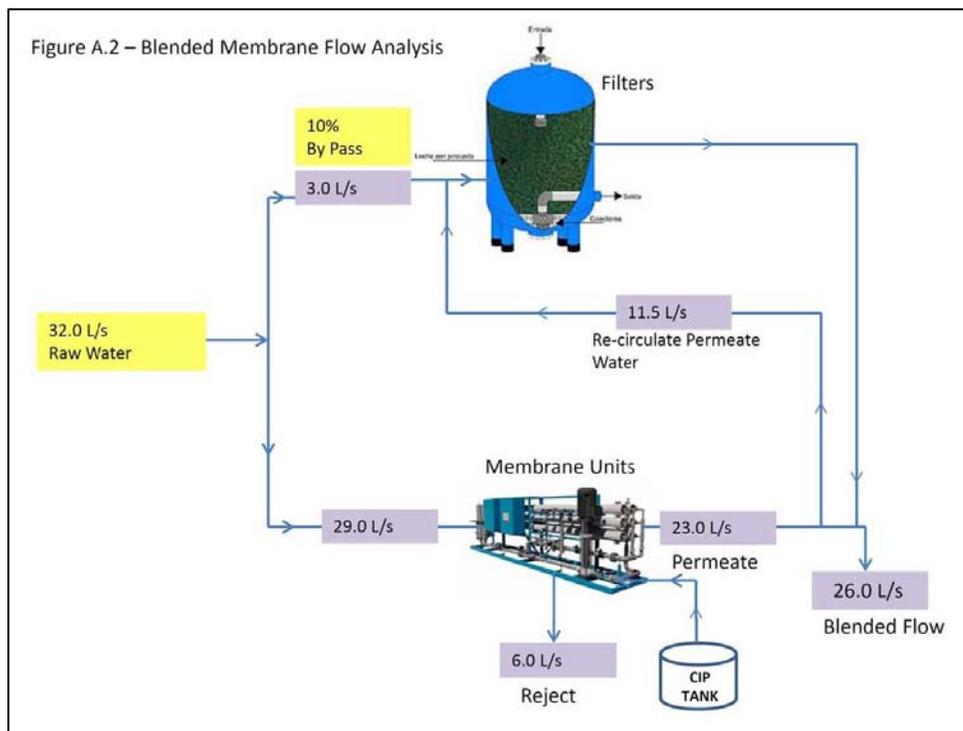


Figure 2.1 - Blended Membrane Flow Analysis

The membrane system will be designed to reduce hardness to a level acceptable to the community (generally less than 150 mg/L). Membrane systems remove a significant portion of the dissolved minerals. In order to achieve an aesthetically acceptable level of hardness, approximately 10% percent of the raw water flow will by-pass the membrane unit and receive treatment in a filter to be blended with membrane permeate. Membrane permeate is generally chemically unstable and benefits from the addition of filtered by-pass water or caustic soda to adjust the pH to a suitable level within the distribution system.

The existing Water Rights License (WRL) which is 250 cubic decameters is inadequate, thus the proposed WRL with 421 cubic decameters.

Table 2.1 - Project Total Raw Water Demand for the RO Unit

Demand	Units
32	L/s
421,000,000	L/year
421,000	cubic meters/year
421	cubic decameters/year

For design purposes, RO membrane system projections from ROSA Design software has been used to predict ion concentrations in the treated permeate, blended, and concentrate water. Raw water chemistry from the production well was used as input for the model. A detailed projected analysis is included in the Appendix.

2.1.3 Backwash and Concentrate Disposal

Membrane systems typically generate a mineralized concentrate stream. Concentrate streams vary between 10% to 30% of the total flow for membrane systems, depending on the arrangement and type of membranes selected. The proposed membrane system was modeled with an 80% recovery rate with an 20% concentrate rate of the flow through the membrane unit.

It is proposed that membrane concentrate be discharged to Spear Lake through a 200 mm diameter pipeline. Spear Lake is fed by Conjuring Creek.

According to Environment Act License No. 2738R, the wastewater treatment lagoon located in the northeast and southeast quarters of Section 4-21-28W in the RM of Russell with discharge of treated wastewater effluent south of the lagoon into a slough which drains into a tributary drain of the Silver Creek channel.

The methodology for determining the concentrate (reject water) pipeline route from the WTP RO membrane system is detailed in the following sections.

2.1.3.1 Reject Pipeline Route

Three reject pipeline route options were analyzed for the proposed new WTP for the regional system of the Municipality of Russell Binscarth. All options assume the WTP is located in the Town of Russell. Refer to the Appendix for drawings. The options are labelled on the drawings.

Option 1:

Option 1 is the preferred choice by the MWSB due to the ease of construction, the approval process, and environmental considerations.

The proposed route is as follows:

- Exit the north-west corner of the former Town of Russell.
- Follow Road 121N (which runs east-west) in highway/ road allowances or easements until reaching Road 166W (which runs north-south).
- Follow Road 166W until reaching Spear Lake at the south access for the Lake.

Option 2:

Option 2 is the preferred choice by the Municipality of Russell Binscarth due to the assumed existence of historical easements from when Russell's source of water was Spear Lake. The concept is to follow the path of the historical (and abandoned) raw water supply pipeline. However, a site visit to the municipal office in Russell on December 2, 2015 with a search through historical paper records yielded no results for historical easements. On December 7, 2015 with a careful search of Land Titles, online and phone conversations with Winnipeg and then Neepawa Land Title's staff, revealed only two documents. From the Neepawa office, Plan # 4956 (years 1964/65) and Plan # 4920 (years 1963/64), both show the limits of "Water Control Works" in Section-Township-Range 9-21-28W in the south-east quadrant. Plan # 4956 shows the area due east of Spear Lake along Conjuring Creek. Plan # 4920 shows the area due south of Spear Lake. Plan # 4920 is the relevant drawing and legal description for this proposed route.

The proposed route is as follows:

- Exit the north-west corner of the former Town of Russell.
- Follow Road 121N (which runs east-west) in highway/ road allowances or easements until reaching the finger or creek/stream feeding into Spear Lake on the south side. This is not Conjuring Creek.
- The pipeline will follow this finger or creek/stream (not along any road) until reaching a suitable exit point on Spear Lake.

Option 3:

Option 3 is the least preferred choice and is only presented if Option 1 and 2 are unavailable.

The proposed route is as follows:

- Exit the north-west corner of the former Town of Russell.
- Follow Highway 83 north in highway/ road allowances or easements until reaching a highway bridge over Conjuring Creek. This would be the discharge point for the pipeline. Conjuring Creek then runs west-bound until reaching Spear Lake.

The highway bridge has a hydrometric station from the Government of Canada, Environment Canada (EC). This information is available from the EC Wateroffice, historical hydrometric database. Station Name: "Conjuring Creek near Russell". Province: MB. Station Number: 05ME005. Latitude: 50-47'42" N. Longitude: 101-17'57" W. Gross Drainage Area (km squared): 70.4.

There are several reasons why this is not an ideal location. Conjuring Creek has a very low water level, as witnessed from a site visit that occurred on December 2, 2015. Beaver activity is also visible in this location, including under the highway bridge, and there is a history of beaver activity from discussions with Municipal officials and staff including Public Works. Furthermore, the farmer's fields in the surrounding area are quite low, and not much above the water level, especially on the north-west side of the creek. If this location was used, there is a high probability of flooding for the farmer's fields.

2.1.4 Operation and Maintenance

The Municipality is responsible for operation and maintenance of the raw water pipeline, well site, and WTP. Staff will be required to periodically inspect flushouts, air releases, etc... to ensure the system performance is maintained. In addition, an operator will be required to submit bi-weekly water samples for bacteriological testing in accordance with the Manitoba Drinking Water Quality Standards Regulation. Staff will read water meters on a quarterly basis and respond to maintenance issues related to the system.

The operators will be required to operate the facility in a safe and efficient manner in accordance with relevant operation manuals and DWSA. Operation requirements will include measurements, monitoring, sampling, testing, record-keeping, and reporting. Operators will be required to perform proper maintenance and inspection. The operators will receive training during the commissioning phase by the selected equipment supplier.

Typical operating costs include: chemicals, maintenance personnel salary, electricity costs, general repairs, water and bacteriological testing, staff certification and training, and a reserve fund for future replacement or expansion. Operating and maintenance costs are recovered through the sale of water in the distribution system.

2.1.5 Treated Water Pipeline

A 200 mm or 250 mm HDPE diameter pipeline of High Density Polyethylene (HDPE) or Poly Vinyl Chloride (PVC) will be installed to Binscarth in accordance with MWSB Standard Construction Specifications 2015. Installation will involve open cut trenches with horizontal drilling where required. The pipeline will be buried a minimum depth of 2.4 meters through roadway crossings. Excavated soil will be stock piled, adjacent to the work area, and then used as backfill. Ditches will be restored to original grades and seeded where required to prevent erosion.

Horizontal directional drilling will be in accordance with MWSB guidelines for watercourse crossings (refer to Appendix), MWSB Standard Construction Specifications 2015, and Department of Fisheries and Oceans (DFO) Operational Statements (OS). Pipeline crossings at drains will be directionally drilled, starting and ending outside of the riparian zone. Although stream crossings are usually directionally drilled, specifications permit dry intermittent drains to be crossed by open cut trenching according to MWSB Specifications and DFO OS - Isolated or Dry Open Cut Stream Crossings. All highway and roadway (PTH & PR) crossings will be directionally drilled and encased in accordance with Manitoba Infrastructure and Transportation (MIT) regulations.

Upon the completion of construction, the pipeline will be swabbed with multiple swabs until the pipeline is clean, pressure tested, and disinfected prior to commissioning the system in accordance with MWSB Specifications.

2.2 Certificate of Title

The wells will be located on municipal owned land in SE-16-21-27W. The Municipality of Russell Binscarth is in the process of acquiring title for the new well site.

The Russell WTP is on property owned by the Municipality of Russell Binscarth. The most logical location for the proposed new Russell WTP is on property adjacent to the existing WTP. However, currently this adjacent property is owned by Canadian Pacific Railway (CPR).

It is anticipated that easements will be required to facilitate the construction of the concentrate pipeline, though alternative routes are available.

It is proposed to locate the treated water pipeline to Binscarth within highway and roadway Right-of-Ways (ROWs) which are owned by the Crown. If necessary, private easements will be obtained to accommodate the pipeline installation.

2.3 Mineral Rights

All mineral rights associated with lands for the existing and proposed new facilities belong to the Crown.

2.4 Existing and Adjacent Land Use

The proposed land for the development will be on municipal and provincially owned land in highway and roadway Right-of-Ways (ROWs). Within the RM, adjacent land is agriculture. Within the Town, adjacent land is industrial, commercial, and residential. Existing and adjacent land use will not change as a result of this development.

2.5 Land Use Designation and Zoning

Refer to Section 2.4.

2.6 Agricultural and Livestock Water Use

The Public Water System (PWS) for the Municipality of Russell Binscarth was designed to include the former Town of Russell and the former Village of Binscarth. The assumption is that country residents of the RM are serviced by individual wells. Therefore, for this specific project and scope of work, the agricultural and livestock water use can be assumed to be negligible. Total water demands for "agricultural and livestock water use" can be estimated to be less than 5% of the gross water use.

2.7 Water Conservation Report

Water conservation measures include metering and pricing of water. Water conservation information in water bill mailings can be implemented. Leak detection will consist of comparing the volume of water pumped and charged to ratepayers on a quarterly basis. Since all service connections are metered, abnormalities can be identified and rectified.

2.8 Project Schedule

The development of this water project is anticipated to occur as a two-phase process. The project is tentatively scheduled to commence in 2017-2018 depending on the availability of funding and the receipt of all approvals.

2.9 Project Funding

This project is eligible for cost sharing between the Province of Manitoba and the Municipality of Russell Binscarth, subject to all approvals and the availability of funding.

2.10 Regulatory Approvals

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

- Manitoba Conservation and Water Stewardship
- Office of Drinking Water (ODW)
- Manitoba Infrastructure and Transportation (MIT)

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

2.11 Public Consultation

A public consultation will be held in the future to discuss the proposed WTP upgrade with the residents of the Municipality of Russell Binscarth as part of the Borrowing Bylaw. It is not expected that there will be major concerns forwarded to the Municipality regarding the upgrades, other than the cost of the proposed infrastructure.

3.0 Description of Existing Environment in the Project Area

3.1 Physiography

The Municipality of Russell Binscarth is located in western Manitoba, near the southwest corner of Riding Mountain National Park (RMNP).

W.L. Gibbons & Associates Inc. (WLG) report dated November 2014:

"Regional Setting:"

"Physiography:"

"The study area is located generally in T20 to 21, R27 to 28W which slopes southwest from Riding Mountain to the Assiniboine River Valley. The land surface varies from relatively flat upland areas with numerous sloughs and potholes to the steep slopes and incised gullies on the flanks of the Assiniboine River Valley and the Conjuring Creek Valley. The ground elevation in the uplands near Russell is on the order of 560 m. The base of the Assiniboine River Valley is at an elevation on the order of 410 m. Surface water drainage is towards the Assiniboine River Valley."⁶

3.2 Climate

There is a Government of Canada weather station located at Russell. Information available after October 1990. The climate ID/ station ID/ station number: 5012520. Latitude: 50-46'00.000" N. Longitude: 101-17'00.000" W. Elevation: 567.00 m.

There is a Government of Canada weather station located at Binscarth. Information available after October 2005. The climate ID/ station ID/ station number: 5010216. Latitude: 50-35'00.000" N. Longitude: 101-16'00.000" W. Elevation: 525.80 m.

In general, the western portion of Manitoba, north of Brandon and south of Riding Mountain National Park (RMNP), has weather patterns which is a mixture between Brandon and Dauphin. The western portion of Manitoba is also influenced by weather patterns blown eastbound from Saskatchewan. Historical average normal temperatures for the month of July are plus 25 degrees Celsius ranging to minus 25 degrees Celsius (without wind-chill) for the month of January. There is approximately 500 mm of precipitation (rain and snow) per year in this region.

3.3 Hydrogeology

W.L. Gibbons & Associates Inc. (WLG) report dated November 2014:

"Bedrock Geology/Hydrogeology:"⁶

"Bedrock in the study area occurs at depths ranging from 3 meters in the immediate area of the Town of Russell to in excess of 100 meters to the east and north east. The bedrock in the upland areas consists primarily of shales of the Odanah Member of the Riding Mountain Formation, underlain by the shales of the Millwood Member. Locally, the Odanah Member shales are fractured and domestic scale volumes of groundwater can be obtained from the bedrock. The Millwood Member shales are rarely fractured and are considered to be an aquitard."⁶

"To the east of the Town of Russell, the available evidence indicates that a deep buried valley has been eroded into the bedrock surface that generally follows the current orientation of Silver Creek. This buried valley has been subsequently infilled with sediments that include the sands and gravels which form the aquifer for the Towns current water supply."⁶

"Surficial Geology/Hydrogeology:"⁶

"The surficial geology of the region consists predominantly of a veneer of clay till with colluvium and alluvium in the river and creek valleys. The information from the past drilling of water wells in the study area has found that the stratigraphy at depth consists primarily of till with small layers of sands and gravels. Within the buried bedrock valley to the east of Russell, there is a thick sequence of sand and gravel deposits underlying the till and overlying the shale bedrock. This sand and gravel deposit is approximately 1 to 2 miles wide. Within the study area, the sand and gravel forms a continuous deposit from the north side of (T21-R27W) to the south side of (T20-R28W). The deposit extends to the north and south of the indicated limits. The existing Town of Russell supply wells withdraw water from this aquifer, and there have been two loading stations developed in it, one at SE21-21-27W and another at NE36-19-28W."⁶

3.4 Hydrology

There are numerous smaller "pothole" lakes surrounding Russell and Binscarth. Binscarth is approximately 20 km south of Russell. In this region, the Assiniboine River runs north-south, approximately 10 km west of Russell; the Manitoba-Saskatchewan border is 16 km west. The Shellmouth Reservoir along the Assiniboine River is approximately 20 km north-west of Russell.

The relevant waterbodies for this EAP is Conjuring Creek which runs into Spear Lake north-west of Russell.

There is a Government of Canada, Environment Canada (EC), hydrometric station located on "Conjuring Creek near Russell". Refer to Section 2.1.3.1, Reject Pipeline Route, Option 3.

Additionally, from an ArcGIS database for MWSB, Conjuring Creek is a "third order" drain.

There is a Government of Canada, Environment Canada (EC), hydrometric station located on Spear Lake. This information is available from the EC Wateroffice, historical hydrometric database. Station Name: "Spear Lake near Russell". Province: MB. Station Number: 05ME803. Latitude: 50-47'59" N. Longitude: 101-19'33" W. Gross Drainage Area (km squared): 77.4.

3.5 Fish and Fish Habitat

There is a contour map available for the depth of water on Spear Lake. Refer to the Appendix. This is from the Fish and Lake Improvement Program for the Parkland Region (FLIPPR). From this source: Maximum Depth: 4 meters (17 feet). Surface Area: 0.83 km squared or 205 Acres (90 Hectares). Thermocline: Nil. (Entire lake turns over on windy days.)

From the FLIPPR source:

"Spear Lake is a multi-species water body located just north-west of Russell, Manitoba. It contains rainbow and brown trout, walleyes and a few yellow perch."²

Lakes are classified according to their trophic status which is "productivity". Trophic state is generally indicated by three key parameters:

- Secchi disk visibility is a measure of water transparency, as indicated by the depth that light can penetrate the water.
- Total phosphorus concentration: phosphorus is the primary limiting nutrient in most North American fresh waters.
- 'Chlorophyll a' concentration: a measure of algal abundance.

Table 3.1 - EPA-NES Trophic State Delineation (1974)

Trophic State	Secchi Disk Depth (m)	'Chlorophyll a' (µg/L)	Total Phosphorus (mg/L)
Oligotrophic	>3.7	<7	<0.010
Mesotrophic	2.0-3.7	7-12	0.010-0.020
Eutrophic	<2.0	>12	>0.020

From the FLIPPR source: "Secchi: Variable according to algae content. 2.1 meter (7 feet) maximum."² Referencing Table 3.1, Spear Lake can be classified as "Mesotrophic" which translates to "intermediate productivity".

3.6 Habitat, Vegetation and Wildlife

Depending on the information source and nomenclature, the terrestrial environment (ecozone) of western Manitoba south of Riding Mountain National Park (RMNP) is called either "Prairies" or "Aspen Parkland". RMNP is part of an area of land called "Boreal Plains" or "Boreal Forest" and occasionally "Western Uplands". We will consider the Municipality of Russell Binscarth as "Aspen Parkland".

From the website for the "World Wildlife Federation" (.org), the following is available about this ecozone:

"Canadian Aspen Forests and Parklands:"⁹

"Status: Critical/ Endangered"⁹

"This ecoregion is classified primarily as having a subhumid low boreal ecoclimate, which distinguishes this ecoregion from the warmer, drier areas to the south and the cooler boreal forests to the north. It also has a transitional grassland ecoclimate. Summers are short and warm, and winters are cold and long. The Peace River Lowland area of the region generally represents the coolest temperatures for each range, while the Southwest Manitoba Uplands region represents the warmest temperatures."⁹

"Much of the region is underlain by Cretaceous shale, and covered by undulating to kettled, calcareous, glacial till with significant areas of level lacustrine, and hummocky to ridged fluvio-glacial deposits. Associated with the rougher hummocky glacial till are a large number of small lakes, ponds and sloughs occupying shallow depressions."⁹

"Description:"⁹

"Biological Distinctiveness:"⁹

"Vegetation in this ecoregion is characterized by a cover of quaking aspen (*Populus tremuloides*) with secondary quantities of balsam poplar (*P. balsamifera*), together with an understory of mixed herbs and tall shrubs. White spruce (*Picea glauca*) and balsam fir (*Abies balsamea*) are the climax species, but are not well represented because of fires. Jack pine (*Pinus banksiana*) stands may be present on drier, sandy sites. Poorly drained sites are usually covered with sedges (*Carex spp.*), willow (*Salix spp.*), some black spruce (*P. mariana*), and tamarack (*Larix laricina*). In the Turtle Mountain and Spruce Woods areas (TEC 163, 164), quaking aspen dominates with secondary quantities of balsam poplar, although white spruce and balsam fir are the climax species if fires do not occur frequently (ESWG 1995)."⁹

"Characteristic wildlife include moose (*Alces alces*), white-tailed deer (*Odocoileus virginianus*), black bear (*Ursus americanus*), wolf (*Canis lupus*), beaver (*Castor canadensis*), coyote (*Canis latrans*), marten (*Martes americana*), mink (*Mustela vison*), red fox (*Vulpes vulpes*), snowshoe hare (*Lepus americanus*), northern pocket gopher (*Thomomys talpoides*), Franklin's ground squirrel (*Citellus franklinii*), sharp-tailed grouse (*Tympahuchus phasianellus*), ruffed grouse (*Bonasa umbellus*), black-billed magpie (*Pica pica*), cormorant (*Phalacrocorax spp.*), gull (*Larus spp.*), tern (*Sterna spp.*), American white pelican (*Pelecanus erythrorhynchos*) and many neotropical migrant bird species (ESWG 1995)."⁹

"Of ecological significance, the Aspen Parkland and Forests ecoregion represents the most extensive boreal-grassland transition in the world. This ecoregion contains the northernmost breeding distribution for many warbler species (*Parulinae*) and has some of the most productive and extensive waterfowl breeding habitat on the continent. White-tailed and black-tailed deer (*Odocoileus virginianus* and *O. hemionus*) reach their northern continental limit here."⁹

The Government of Manitoba has information and detailed records on Manitoba's animals and plant communities at risk (Species-At-Risk (SAR)), together with their known location, maintained by the Manitoba Conservation Data Centre. There is an "ecoregion search" within this database. For this ecoregion, there is a long list of recognized plants and animals. However, without an in-situ (field) biological survey of the target area, there is no scientific and quantifiable method of determining what species are actually in the target area for this project.

3.7 Socioeconomic

The Municipality of Russell Binscarth is a mixture of rural living (town, village, and country), agricultural, and tourism including recreational fishing and hunting.

This Environment Act Proposal (EAP) is to expand and upgrade the Public Water System (PWS). This work will ensure the long-term supply of potable water. This is necessary to ensure the continued socio-economic sustainability and growth of these communities. There are no public safety and human health risks associated with this project. In fact, this project mitigates risks through the provision of quality water.

3.8 Parks

The nearest provincial and federal parks are located outside the environmental impact area of this project. The nearest federal park is Riding Mountain National Park (RMNP) which is north-east. The nearest provincial park is Assiniboine Provincial Park located by the Shellmouth Reservoir of the Assiniboine River, described earlier in Section 3.4. The second nearest provincial park is Duck Mountain Provincial Park which is north of RMNP. Please refer to the maps in the Appendix.

3.9 Heritage Resources

No heritage resources will be disturbed since the various components of this water expansion and upgrading project will occur on previously disturbed land such as Municipal property, highway/ roadway allowances or easements, etc...

3.10 Aboriginal Communities

Regarding First Nation (FN) communities in the area, within Manitoba the two closest communities is Gambler FN which is approximately five (5) miles west of the former Village of Binscarth, and Waywayseecappo FN closer to Rosburn and Highway 45. Gambler and Wayway are the most relevant FNs for this project. Outside the immediate territory, there is also Keeseekoowenin FN and the Birdtail Sioux FN. Gambler, Wayway, Keesee, and Birdtail all are located in Treaty # 2 land. The FNs north of Riding Mountain National Park (RMNP) do not influence this project. The FNs in the Province of Saskatchewan do not influence this project. Manitoba has a large Metis population. Metis are considered Aboriginal under Section 35 of the Constitution Act of Canada (1982) along with Indian and Inuit. There are no recognized Metis communities in western Manitoba, according to the Department of Aboriginal and Northern Affairs (ANA) for the Government of Manitoba.

4.0 Description of Environmental and Human Health Effects of the Proposed Development

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 and transportation equipment and there will be gaseous and particulate emissions from the construction equipment. Any effects would be localized, temporary and insignificant. During the development, there will be no pollutants released to the air besides the ones discussed previously.

4.2 Soils

During construction, there is a risk of fuel or lubricant spills from heavy equipment and vehicle operation. The storage of fuel or lubricants within the area of the construction site will not be allowed. Therefore, the potential spills will be very small in size and standard spill clean-up equipment and 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 volumes and the use of established routes to access the locations. 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 Habitat and Fisheries

Minor and short-term impacts on surface water may occur as a result of construction activity in highway and roadway allowances and 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. Horizontal directional drilling will be conducted to install pipelines at waterway crossings and discharge outlets. This will eliminate excavation within the riparian zone and minimize impacts. There is potential for some loss of drilling mud to the surface water. Impacts to fish habitat and fisheries are assessed to be minor.

Regarding Spear Lake, surface water will not be affected since the discharge is carefully controlled through piping and a discharge point. Fisheries will not be affected in Spear Lake since this is a human-altered and human-controlled lake as demonstrated by the year-round aeration within the lake and the stocking of fish. (From a site visit that occurred on December 2, 2015 there were discussions with Municipal officials and staff including Public Works and MWSB staff was told that Spear Lake has year-round aeration.)

Water quality samples and chemistries were taken from Spear Lake, the waterway to be used for the concentrate (RO reject water) disposal. The results were analyzed and impacts to fish habitat and fisheries were assessed to be negligible.

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. The proposed activities are unlikely to result in adverse effects to water quality. Nevertheless, the potential still exists and monitoring of the raw water quality will be required to identify any such adverse effects and allow the appropriate adjustments in the operation to the system after construction.

4.5 Groundwater Levels

A new Water Rights License (WRL) will be applied for the new production wells (raw water source) for the Municipality of Russell Binscarth. The available information indicates that the proposed withdrawal of groundwater is unlikely to result in adverse changes to groundwater levels. Nevertheless, the potential still exists and monitoring will be required.

Groundwater will be extracted through the Water Rights License for the wells supplying the regional system for the Municipality of Russell Binscarth. This groundwater has been studied in several reports most notably through W.L. Gibbons & Associates Inc. (WLG) reports from Steve Wiecek. This groundwater pumping is sustainable.

Other groundwater will not be affected.

4.6 Vegetation

Construction will occur primarily within Right-of-Ways (ROWs) 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, and the amount of vegetation disturbance is expected to be minimal.

During operation, monitoring and maintenance activities will be restricted to designated and previously disturbed areas. Potential effects to vegetation are considered to be negligible.

Forestry resources will not be impacted in short-term or long-term.

4.7 Wildlife Habitat

The construction and operation activities associated with this project will be limited to areas already developed for agriculture, industrial, commercial, or residential or hydro utilities. The potential adverse effects of wildlife habitat loss are assessed to be negligible to minor.

There will be negligible to minimal short-term impacts on wildlife and no long-term impacts.

4.8 Noise and Vibration

During construction, there will be several sources of sound emissions including construction equipment and vehicles. The types of noises heard due to construction are dominated by engines. However, miscellaneous short-term noises (i.e. dump truck gates, back hoe buckets, etc...) are often heard. The noise will be in addition to the regular community and highway activities. The effects are assessed to be minor.

4.9 Heritage Resources

No heritage resources will be disturbed since the various components of this project will occur on previously disturbed land such as Municipal property, highway/ roadway allowances or easements, etc...

4.10 Employment/Economy

Socio-economic implications are not expected as a result of the environmental impacts as the impacts are considered minor and short-term. Some economic implications may exist for the Town and RM due to the financial costs of development. However, the Town and RM will have a sustainable potable water supply to meet future demands. There will be some local economic benefit during construction. The proposed project will address limited treatment capacity at Russell and water quality at Binscarth. The potential effects of the project on employment and the economy are assessed to be positive.

There are no expected negative socio-economic implications resulting from this proposed project. In fact, there will be positive socio-economic implications since this project is necessary to ensure the continued socio-economic sustainability and growth of the communities.

4.11 Human Health and Well-being

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

The project will result in the construction of pipelines designed and operated to produce a treated water supply to meet current water quality standards. This will produce a higher standard of living. The effects on human health and well-being are considered positive.

There is no public safety and human health risks associated with this project. In fact, this project mitigates risks through the provision of quality water.

4.12 Climate Change

It is predicted there will be no impacts to the climate as a result of these project activities.

Climate change implications due to this project can be classified as negligible.

5.0 Mitigation Measures and Residual Environment Effects

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

The construction and installation of water supply pipelines and concentrate (RO reject water) pipelines will be in accordance with standard industry practices and the General and Special Conditions from the Manitoba Water Services Board (MWSB), which have been specifically designed to mitigate the risks involved with these activities. The pipelines will be constructed by open-trenching, directional drilling, or a combination of both techniques depending on the location.

The work shall be designed by a Professional Engineer registered in Manitoba and shall be in general conformance to the Ten State Standards, Canadian Standards Association (CSA), American Water Works Association (AWWA), and provincial regulatory standards and guidelines.

The protection of the environment and human health will remain a key priority throughout all phases of this project.

5.1 Air Quality

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

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

Water spraying is an important, common and practical procedure that would be applied as required to alleviate potential dust problems.

Burning of shrubs etc... will only occur on days and times where wind conditions are favorable. Burning could be limited to days permitted for burning according to the Manitoba Crop Residual Burning Program.

5.2 Soils

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

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.

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

5.3 Surface Water, Fish Habitat and Fisheries

Mitigation of surface water issues may be achieved by limiting open cut trenching to 30m from sensitive areas and providing erosion control practices as required.

The same procedures for petroleum products (fuel or lubricants) will be applied to water as with soil.

Fisheries impacts will be minimized by implementing practices to reduce soil and contaminate runoff. The proponent will work with provincial officials should any concerns arise.

Regarding Spear Lake, the proponent will conduct long-term monitoring of Spear Lake to verify impacts on water quality.

5.4 Groundwater Quality

Groundwater is primarily protected by the natural hydrogeology in the area. Mitigation of potential groundwater impacts from petroleum products was described in earlier sections. Groundwater monitoring will be performed as required to address potential issues associated with groundwater quality.

The recommended water quality sampling program consists of quarterly sampling of groundwater for the first year of operation. Following this initial year of sampling, the recommended frequency is at minimum annually. The laboratory analyses should include hardness, alkalinity, Total Dissolved Solids (TDS), electrical conductivity, major cations and anions (calcium, sodium, magnesium, hydrogen carbonate, sulfate, chloride), dissolved metals (including arsenic), and iron and manganese. The samples should be collected at a designated location on the raw water side of the water treatment system using sample bottles and methods in accordance with the laboratory instructions. This sampling is separate from any routine sampling program required as part of the operation from the WTP.

5.5 Groundwater Levels

The availability of groundwater usage for this proposal and potential future users will be assessed through the Water Rights Act Licensing process. Groundwater monitoring will be performed as required to address potential issues associated with groundwater levels.

The recommended groundwater level monitoring program would include the use of several monitoring wells at locations owned by the RM or Province. The monitoring well should be equipped with a continuous groundwater level monitoring device such as a digital pressure transducer capable of recording groundwater levels on at least a daily basis. The information would be downloaded on a regular basis (typically quarterly) and input into a suitable database capable of generating charts of water level trends over time.

5.6 Vegetation

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

5.7 Wildlife Habitat

Impacts to wildlife habitat can be limited by minimizing the area of construction, vegetation and soil disturbance.

5.8 Noise and Vibration

Noise disturbance will be limited by use of mufflers on equipment and vehicles, limiting idling, and minimizing the construction area.

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.

5.9 Heritage Resources

If by chance, heritage resources are found in an unexpected area, work will be stopped to assess the situation and the relevant authorities will be contacted.

5.10 Employment/Economy

MWSB works closely with the local community in the development of projects; as such, this should mitigate any unwanted socio-economic effects.

5.11 Human Health and Well-being

All Federal, Provincial, and Municipal acts and regulations and guidelines will be followed.

5.12 Climate Change

Mitigation for climate change is encapsulated within the other mitigation measures.

6.0 Follow-up Plans including Monitoring and Reporting

In the future, there will have to be a "Permit to Construct or Alter a Public Water System" under the Drinking Water Safety Act (DWSA), submitted to the Office of Drinking Water (ODW), which is part of Manitoba Conservation and Water Stewardship. Also, there will have to be an Operating License for the new regional system including the new Water Treatment Plant (WTP) in Russell.

7.0 Conclusions

In conclusion, this Environment Act Proposal for a Class 2 Development License under the Manitoba Environment Act for an upgrade of the Municipality of Russell Binscarth Public Water System (PWS) has demonstrated that this proposed Work meets or exceeds regulatory requirements and is environmentally responsible.

8.0 References

1. Bullee Consulting Ltd., March 2009, Town of Russell, Waterworks System Assessment, Bullee from Saskatoon, Saskatchewan.
2. FLIPPR, 20/11/2015, Fish and Lake Improvement Program for the Parkland Region (FLIPPR), Spear Lake:
<http://www.flippr.ca/l-spear.shtml>
3. MWSB, Nathan Wittmeier, February 2014, Binscarth, Water Treatment Plant Upgrading Study.
4. MWSB, Nathan Wittmeier, February 2015, Municipality of Russell-Binscarth, Treated Water Supply Study.
5. W.L. Gibbons & Associates, Steve Wiecek, August 2014, Town of Russell, Water Supply Assessment, Report on Investigation Results, File: 08-197.
6. W.L. Gibbons & Associates, Steve Wiecek, November 2014, Town of Russell, Groundwater Supply Assessment Study.
7. W.L. Gibbons & Associates, Steve Wiecek, October 2015, Municipality of Russell-Binscarth, Water Supply Upgrades, Summary Report of Pumping Well Installations, File: 08-197.
8. WSP, Bill Brant, April 2015, Technical Memorandum #1, Municipality of Russell-Binscarth, Water Supply Upgrading Project, Project #151-03520-00.
9. WWF (org), 30/11/2015, World Wildlife Fund or World Wide Fund for Nature (WWF), Ecoregion: Canadian Aspen Forests and Parklands:
<http://www.worldwildlife.org/ecoregions/na0802>

9.0 Appendix

9.1 Appendix A - Pipeline Route Drawings



MATCH LINE 'A'
SHEET 2



MATCH LINE 'B'
SHEET 2

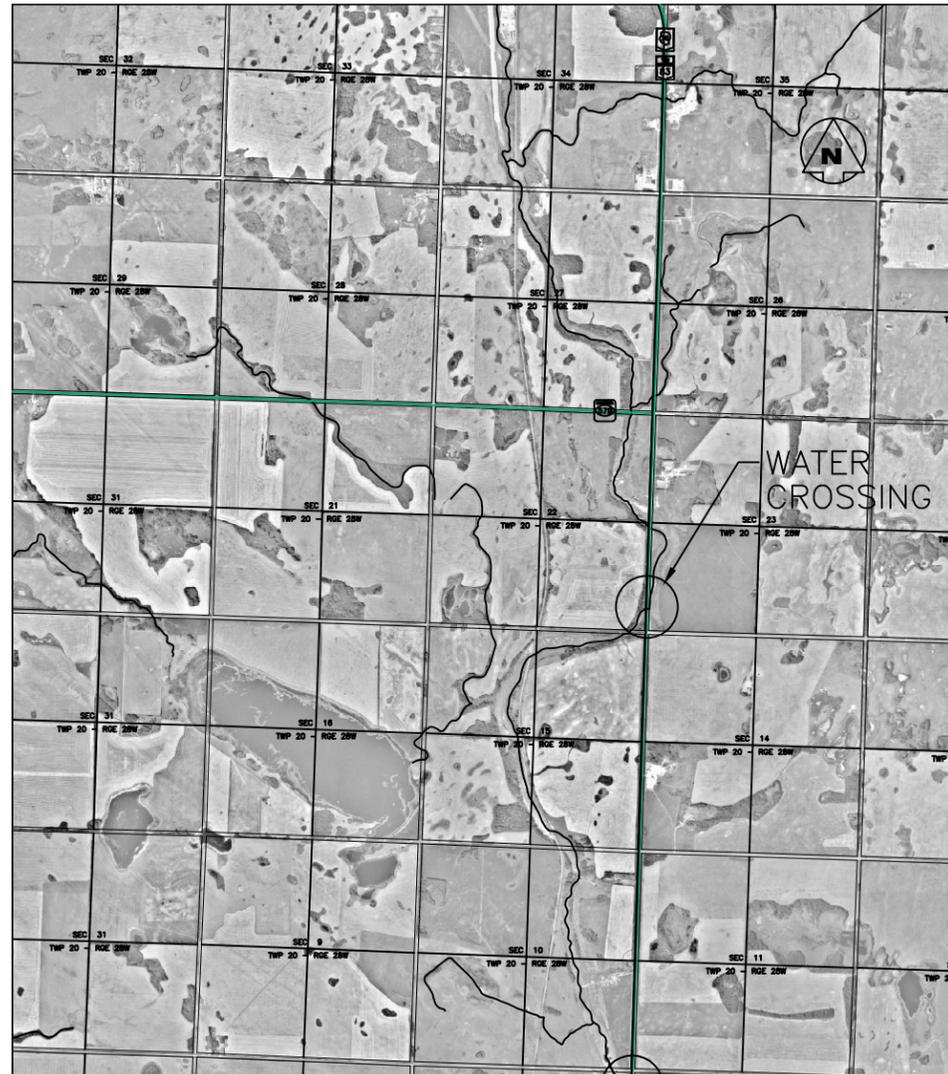
NO.	DESCRIPTION	BY	DATE

SURVEYED	BOOK NUMBER
DRAWN N. LUCIER	
DESIGNED C. VITT	
CHECKED	
REVIEWED	

PROVINCE OF MANITOBA	
THE MANITOBA WATER SERVICES BOARD	
MANITOBA LOCAL GOVERNMENT	
SUBMITTED	APPROVED
CHIEF ENGINEER	GENERAL MANAGER

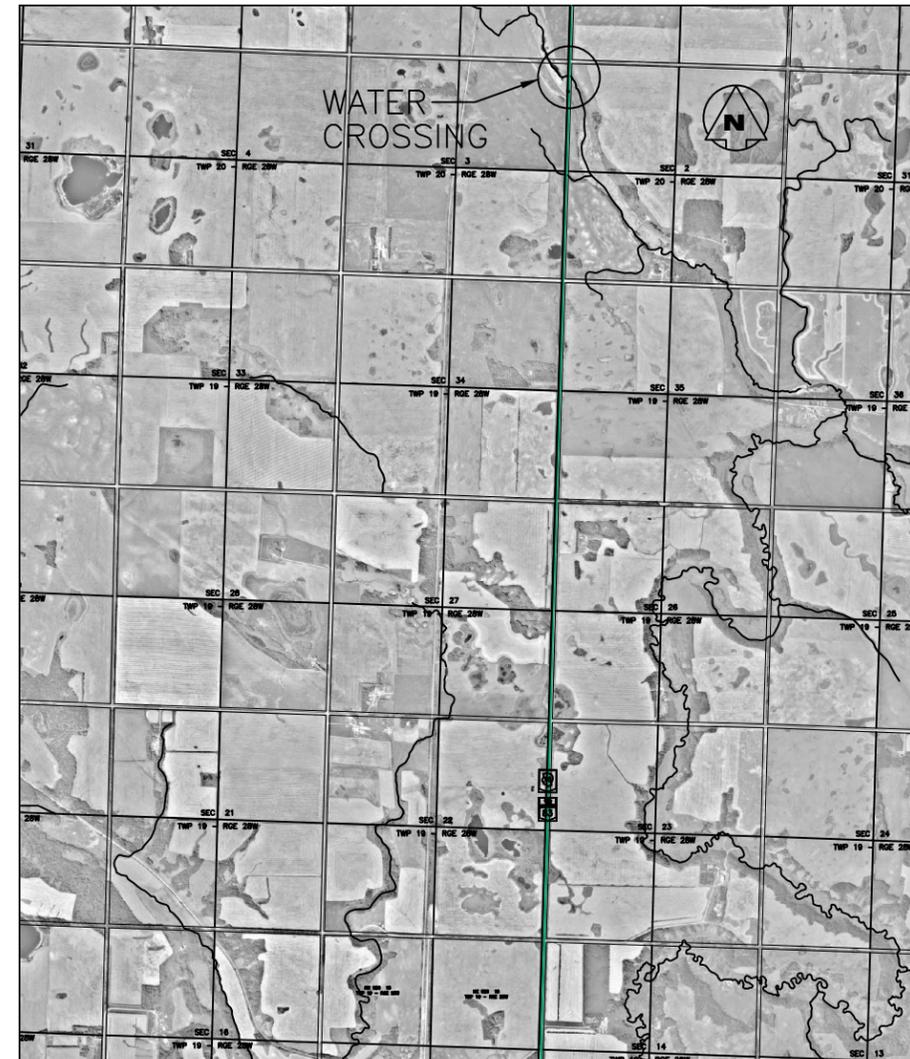
MUNICIPALITY OF RUSSELL-BINSCARTH				
WATER SUPPLY LINE				
SCALE N.T.S.	DATE 15-12-09	PROJECT NUMBER 1268	REVISION	SHEET 1 of 2

MATCH LINE 'A'
SHEET 1



MATCH LINE 'C'
SHEET 2

MATCH LINE 'C'
SHEET 2



MATCH LINE 'B'
SHEET 1

NO.	DESCRIPTION	BY	DATE

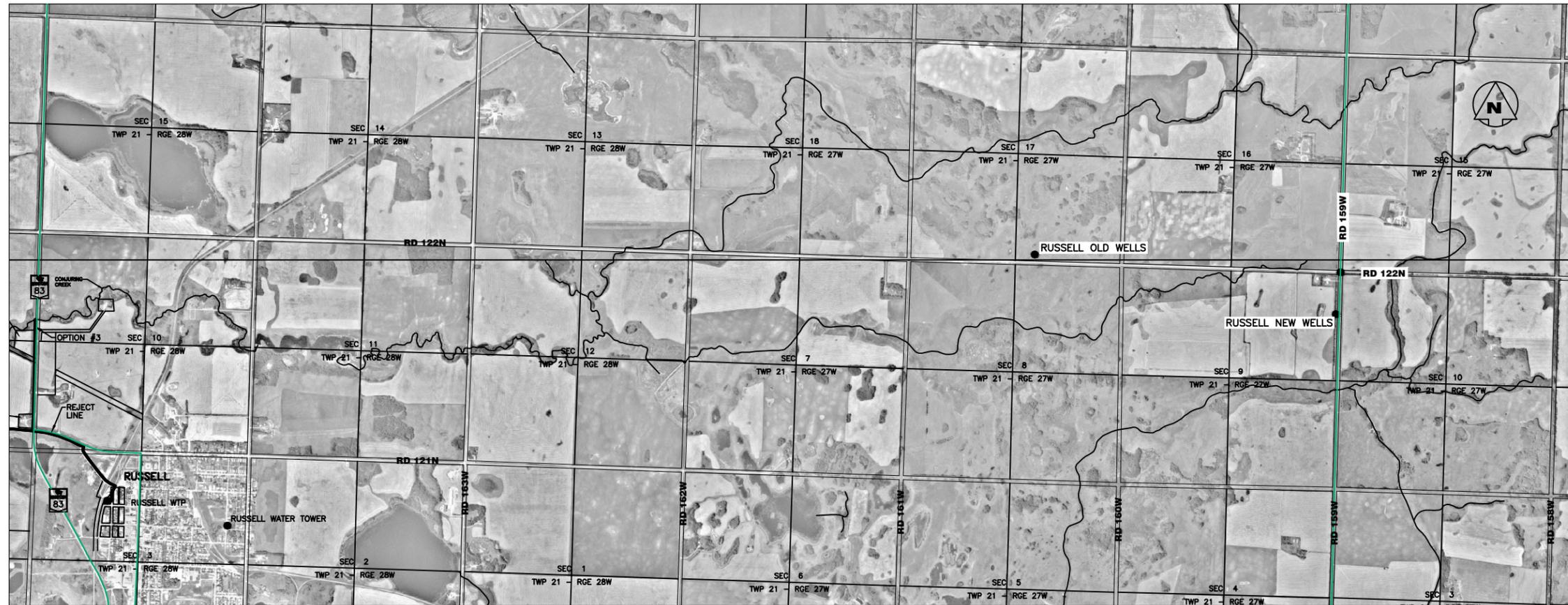
SURVEYED	BOOK NUMBER
DRAWN	N. LUCIER
DESIGNED	C. WITT
CHECKED	
REVIEWED	

PROVINCE OF MANITOBA
THE MANITOBA WATER SERVICES BOARD
MANITOBA LOCAL GOVERNMENT

SUBMITTED	APPROVED
CHIEF ENGINEER	GENERAL MANAGER

MUNICIPALITY OF RUSSELL-BINSCARTH
WATER SUPPLY LINE

SCALE	DATE	PROJECT NUMBER	REVISION	SHEET
N.T.S.	15-12-09	1268		2 of 2



NO.	DESCRIPTION	BY	DATE

SURVEYED	BOOK NUMBER
DRAWN N. LUCIER	
DESIGNED C. VITT	
CHECKED	
REVIEWED	

PROVINCE OF MANITOBA
 THE MANITOBA WATER SERVICES BOARD
 MANITOBA LOCAL GOVERNMENT

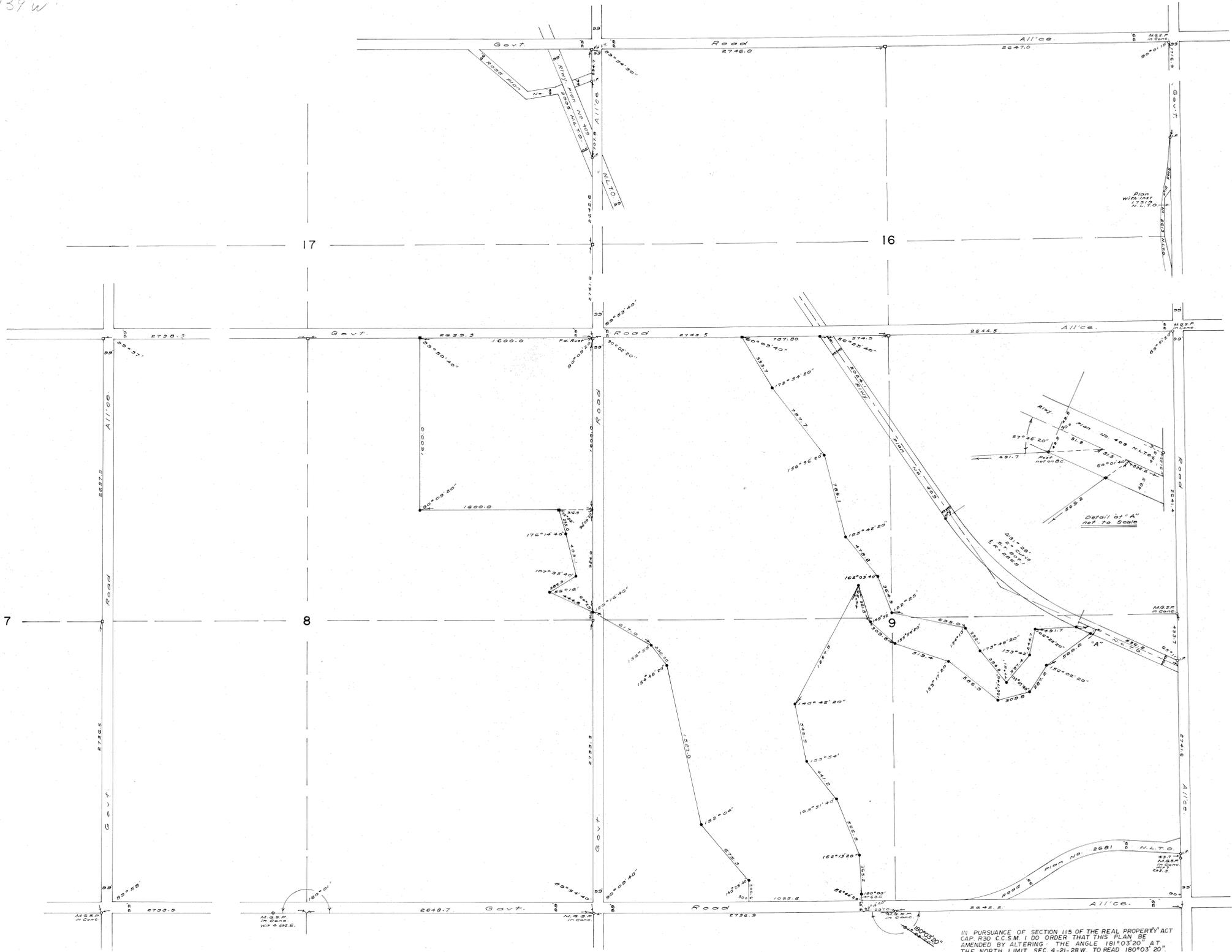
SUBMITTED	APPROVED
_____ CHEF ENGINEER	_____ GENERAL MANAGER
DATE	DATE

MUNICIPALITY OF RUSSELL-BINSCARTH

WELL LOCATIONS

SCALE N.T.S.	DATE 15-12-10	PROJECT NUMBER 1269	REVISION	SHEET 2 of 2
-----------------	------------------	------------------------	----------	-----------------

9.2 Appendix B - Old Legal Survey Drawings (#4920 & #4956)



PLAN OF SURVEY
 OF
 LAND REQUIRED FOR WATER CONTROL WORKS
 IN
 Secs 8 and 9, Twp. 21, Rge 28 W.P.M.
 — MANITOBA —
 Scale 1 inch = 400 feet

Notes
 Distances are in feet and decimals of a foot.
 Man. Govt. Survey Posts were placed at all points shown thus: ————
 Iron posts 1 1/2 x 3/4 x 1/2 were driven at all points shown thus: ————
 Iron posts 3/4 x 3/4 x 1/2 were driven at all points shown thus: ————
 Survey measurements were found at all points shown thus: ————
 Land required for Water Control Works shown bordered red.

I, Murray Quigley Foster of the City of Winnipeg, Manitoba Land Surveyor,
 make oath and say that I was present at and did personally superintend
 the survey represented by this plan, that the survey and plan are correct,
 and that the survey was made between October 28 and Nov. 8 1923.
 Sworn before me at Winnipeg
 this 10 day of Dec. 1923.
 M. Quigley Foster
 Surveyor

Approved and Confirmed
 December 18, 1923
 E. J. Gault
 Director of Surveys

H. P. Balthasar
 A Commissioner for Oaths
 My Commission expires January 9, 1925

ENTERED AND REGISTERED IN THE
 NEEDAWA LAND TITLES OFFICE
 THIS 25th DAY OF FEBRUARY A.D. 1964
 AT 9:30 A.M. AS PLAN No. 4920

D. J. Thomson
 DISTRICT REGISTRAR

IN PURSUANCE OF SECTION 115 OF THE REAL PROPERTY ACT
 CAP. 230 C.C.S.M. I DO ORDER THAT THIS PLAN BE
 AMENDED BY ALTERING THE ANGLE 181°03'20" AT
 THE NORTH LIMIT SEC. 4-21-28W. TO READ 180°03'20"
 DATED THIS 11th DAY OF DECEMBER 1985

REGISTRAR GENERAL
 EXAMINER OF SURVEYS

Approved
 18 Dec 1923
 E. J. Gault
 Director of Surveys

6457
8066 W

374

PLAN OF SURVEY
OF
WATER CONTROL WORKS
IN
S.E. 1/4, Sec. 9, Twp. 21, Rge. 28 W.P.M.
—MANITOBA—

Scale = 1 inch = 200 feet

Notes:

Distances are in feet and decimals of a foot.
Survey monuments were found at all points, shown thus:  and 
from Party 26's N.W. 1/4, 20' line shown thus: -

Approved and Confirmed
July 7, 1964


for Director of Surveys

I, Theodore Herbert Stevens of the City of Winnipeg, Manitoba Land
Surveyor, make oath and say that I was present at and did
personally supervise the survey represented by this plan,
that the survey and plan are correct, and that the survey was
made on May 21, 1964.

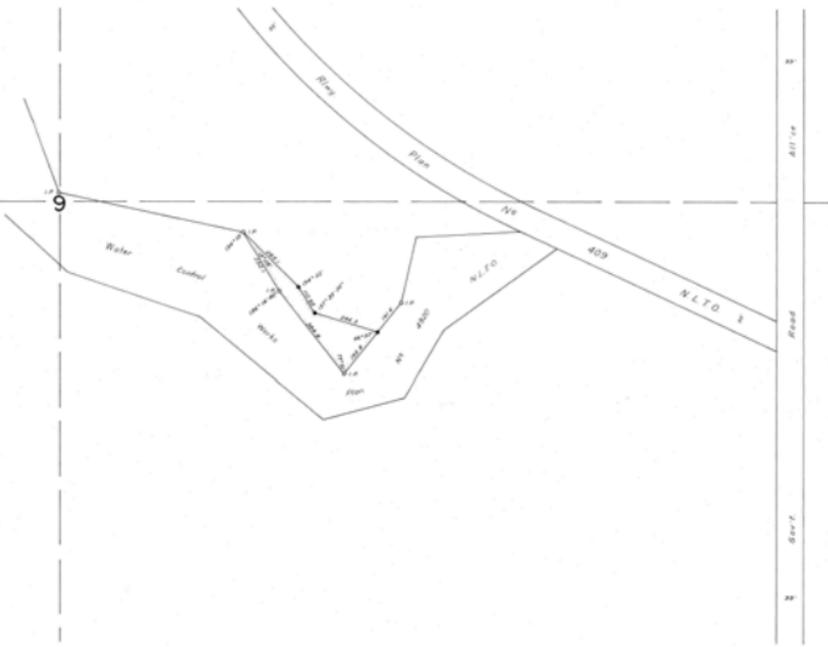
Sawn before me at Winnipeg
this 25th day of June 1964


M.L.S.


A Commissioner for Oaths
My Commission expires June 9, 1965

Entered and Filed in the
Manitoba Land Titles Office
this 22nd day of July 1964
at 9:24 am plus \$1 4-226


District Registrar



Approved
25 July 1964
R.H. Davidson
Dist. Registrar of Surveys

9.3 Appendix C - License to Construct Well

9.4 Appendix D - Existing Water Rights License (#2007-022)

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.: **2007-022**
 (Previous Lic. No.: 85-16)
 U.T.M.: Zone 14 345754 E
 5630429 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 Russell** 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:

the Southeast Quarter of Section 17, in Township 21 and Range 27, West of the Principal Meridian in Manitoba, more particularly described on Certificate of Title No. 1650415 NLTO,

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

Section 3, in Township 21 and Range 28, West of the Principal Meridian in Manitoba.

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 **0.011 cubic metres per second (0.4 cubic feet per second)**
 b) The total quantity of water diverted in any one year shall not exceed **250 cubic decametres (202.68 acre feet)**
4. 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.
5. 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.
6. 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, Infrastructure and Operations Division, for cancellation on behalf of the Minister.
7. 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.
8. This License may be amended, suspended or cancelled by the Minister in accordance with The Water Rights Act by letter addressed to the LICENSEE at **Box 10, Russell, MB, R0J 1W0, Canada** and thereafter this Licence shall be determined to be at an end.
9. 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.
10. The term of this Licence shall be **five (5) years** 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.
11. 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.
12. The LICENSEE shall keep records of daily and annual water use and shall provide a copy of such records to the Executive Director, Infrastructure and Operations Division, not later than February 1st of the following year.

13. A flow meter must be installed, positioned to accurately measure instantaneous pumping rate and accumulative withdrawals from the water source.
14. 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 issuance of the original Licence (No. 85-16), and which are partly or wholly attributable, in the opinion of the Minister, to the diversion of water as authorized by this Licence.
15. 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 _____

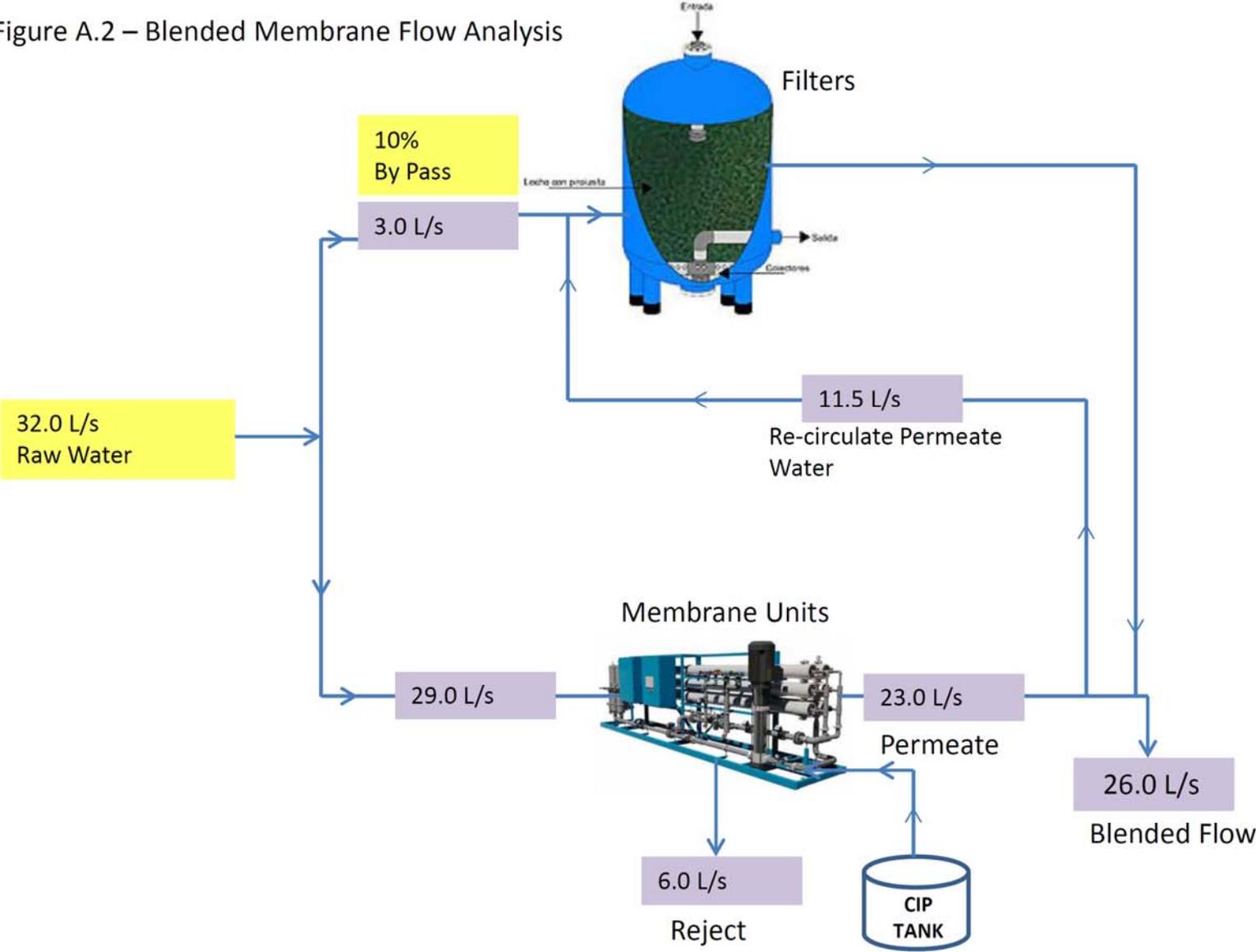
FOR OFFICE USE ONLY

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)

9.5 Appendix E - Blended Membrane Flow Analysis

Figure A.2 – Blended Membrane Flow Analysis



9.6 Appendix F - FLIPPR Spear Lake Fishing Maps



Fish and Lake Improvement Program for the Parkland Region

World Class Trout Fishery in Manitoba's Parkland

~ on the fly ~



About FLIPPER

The Lakes

Trout Festival

Fly Patterns

Tackle /
Equipment

Videos

Articles

Links

Spear Lake

Spear Lake is a multi-species water body located just north-west of Russell, Manitoba. It contains rainbow and brown trout, walleyes and a few yellow perch. Camping and campfires are permitted. Power is available for charging batteries. Electric motors are allowed and there's no need to dismount your outboard. Just tip it up.

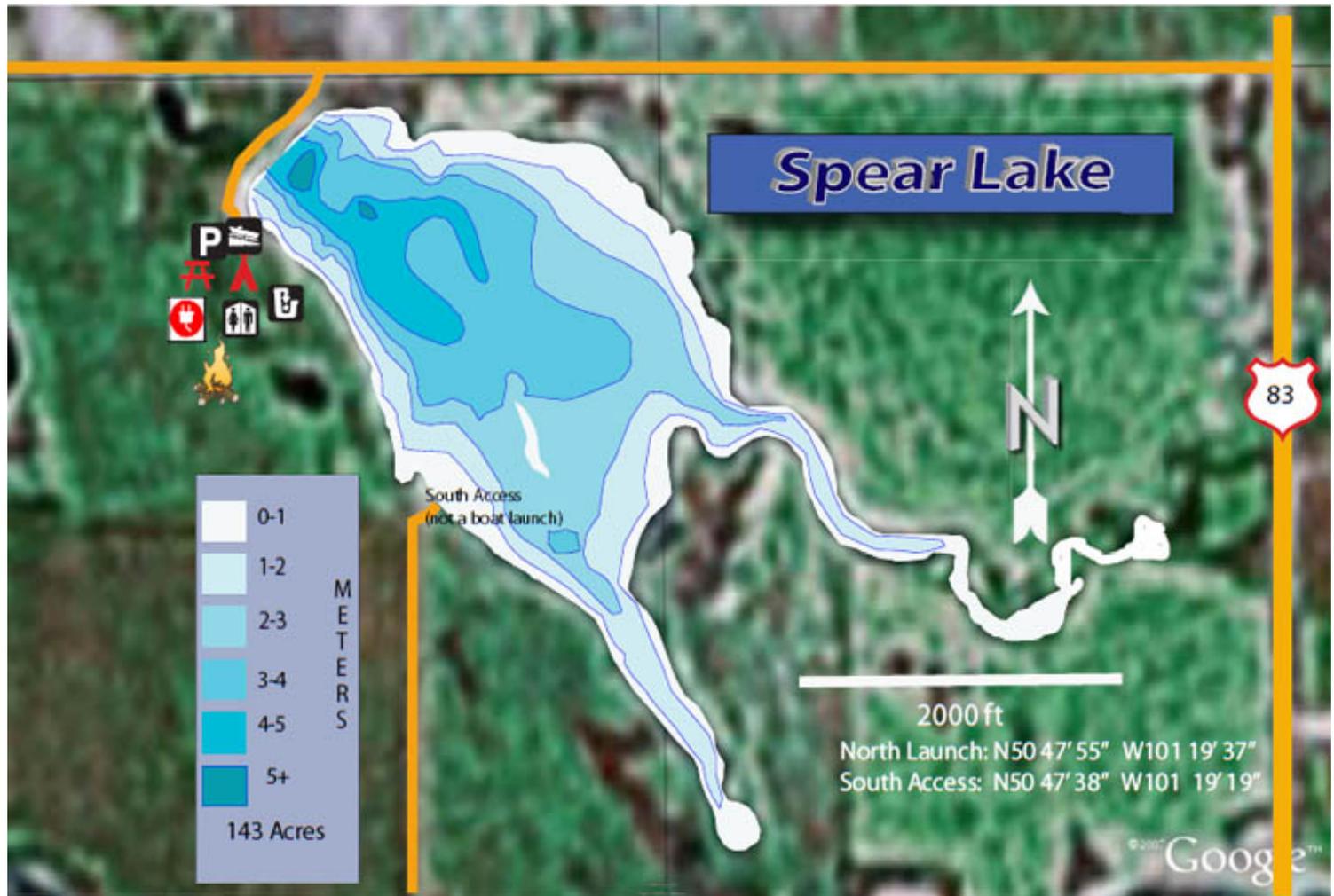
Several hotels and B&Bs are located in and nearby the town of Russell.

Directions:



Spear Lake is located at: N50 47' 58.54" W101 19' 37.34"

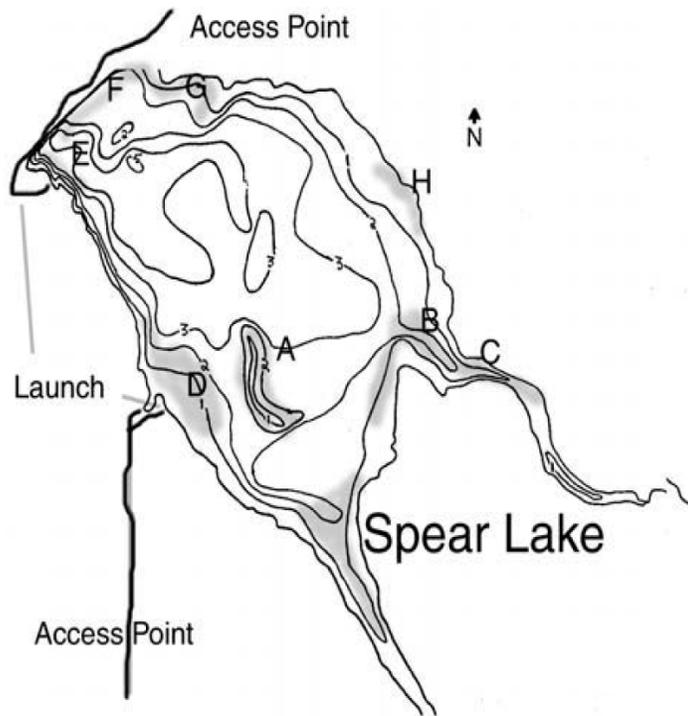
Click here to download the [Lake Contour/Information Map PDF](#) for Spear Lake



[Download the PDF](#)

Contact FLIPPR Email: FLIPPR@flippr.ca - or - Mail Box 368, Russell, MB R0J 1W0

Spear Lake



LOCATION:

1 mile North of Russell and one mile west.
Look for sign on Highway 83.

MORPHOLOGY:

Max. Depth: 4 metres - 17 feet.

Surface Area: 205 Acres - 90 Hectares

Sechi: Variable according to algae content.
2.1m - 7 ft max.

Thermocline: Nil. Entire lake turns over on windy days

Spear is no pushover. It can be cranky. On windy days it can be outrightly nasty.

Spear has recovered naturally from an encroachment of yellow perch, further helped by annual transfers

STARTING AREAS:

- A - The sunken island regularly hosts the largest fish. In summer the cupules along its weed edges are the feed table. In spring and fall, when weeds are down, the flanks become an excellent concentrator that must be covered every few hours.
- B - Mouth of the creek. A very broad flat that concentrates unbelievable numbers of feeding trout.
- C - The creek. A moderate current attracts minnows and offers the last deep water prior to entering the creek. Best in water flows but can be good any time. The largest trout are often taken here.
- D - Weed edges along a flat. Trout gather primarily to feed on snails and daphnia.
- E - The launch. What can we say? The best place in the lake is often right at one's toes. A gravelled area that hosts spawning activity in early spring, but a smorgasbord of forage year round. Fish from deep to shallow.
- F - The rip rap. Boulders attract forage. Forage attracts trout, especially when it lies adjacent to the deepest, coolest water in the lake. When minnows stack, this is the hotspot. We often hunker on the rock, break up our outlines and cast from shore.
- G - Weeds, beaches and flats. An excellent wading area. A point truncates the zone and offers some excellent fishing. Bulrushes and sedge grasses attract forage at any time, but this is a hotspot during the annual damsel hatches.
- H - Watch for cupules, (dished structures that go back into the weeds or even as far as shore). Work them. Trout pin minnows in them and then predate them. These are areas they love to pin perch fry and further reduce their population

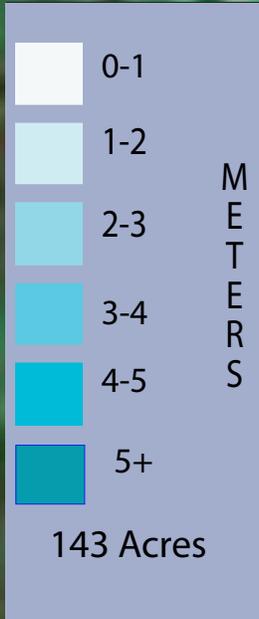
STARTING PATTERNS:

Caddis dries and emergers. Some great dry fly action can be had during the spring hatch of small black caddis.

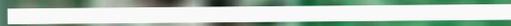
Olive and black Woolly Buggers, Bead-head Beaver and Tans, Copper Coachmen, Crystal P-Q uads, Psychedelic P-Q uads, backswimmer and scud patterns.

In the autumn when trout feed directly on daphnia we fish a rusty-pink Woolly Bugger we are ashamed to show to anyone.

Spear Lake



South Access
(not a boat launch)



2000 ft

North Launch: N50 47' 55" W101 19' 37"
South Access: N50 47' 38" W101 19' 19"

9.7 Appendix G - Nearby Parks Map



Duck Mountain Provincial Park

Dauphin

Shellmouth Reservoir/ Asessippi Provincial Park

Russell

Russell, MB R0J Binscarth

Riding Mountain National Park (RMNP)

Clear Lake at RMNP

Lake Manitoba

Brandon
Brandon

Winnipeg

Image Landsat
© 2015 Google

Google earth

Imagery Date: 4/9/2013 50°26'55.89" N 99°37'04.52" W elev 443 m eye alt 452.01 km

9.8 Appendix H - Russell Water Chemistry



Town of Russell - Water Treatment Plant
ATTN: STEVEN SMITH
Russel Water Plant
Box 10
Russell MB R0J 1W0

Date Received: 08-AUG-13
Report Date: 13-AUG-13 15:27 (MT)
Version: FINAL

Client Phone: 204-773-2253

Certificate of Analysis

Lab Work Order #: L1344556
Project P.O. #: NOT SUBMITTED
Job Reference: RUSSELL - PWS 189.00
C of C Numbers:
Legal Site Desc: 17511

Lisa Page
Account 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 A Campbell Brothers Limited Company

ANALYTICAL REPORT

Physical Tests (WATER)

		ALS ID		L1344556-1	L1344556-2
		Sampled Date		07-AUG-13	07-AUG-13
		Sampled Time		14:00	14:00
		Sample ID		RUSSELL 1-RAW	RUSSELL 2-TREATED
Analyte	Unit	Guide Limit #1	Guide Limit #2		
Colour, True	CU	15	-	<5.0	<5.0
Conductivity	umhos/cm	-	-	1120	679
Hardness (as CaCO3)	mg/L	-	-	601	159
Langelier Index (4 C)	No Unit	-	-	0.47	-0.35
Langelier Index (60 C)	No Unit	-	-	1.2	0.41
pH	pH units	6.5-8.5	-	7.39	8.09
Total Dissolved Solids	mg/L	500	-	813	468
Transmittance, UV (254 nm)	% T	-	-	88.3	94.9
Turbidity	NTU	-	-	38.3	0.39

Federal Guidelines for Canadian Drinking Water Quality (AUG, 2012)

#1: GCDWQ - Aesthetic Objective

#2: GCDWQ - Maximum Acceptable Concentrations (MACs)

Anions and Nutrients (WATER)

		ALS ID		L1344556-1	L1344556-2
		Sampled Date		07-AUG-13	07-AUG-13
		Sampled Time		14:00	14:00
		Sample ID		RUSSELL 1-RAW	RUSSELL 2-TREATED
Analyte	Unit	Guide Limit #1	Guide Limit #2		
Alkalinity, Total (as CaCO3)	mg/L	-	-	481	95
Ammonia, Total (as N)	mg/L	-	-	1.20 ^{DLA}	<0.010
Bicarbonate (HCO3)	mg/L	-	-	587	116
Bromide (Br)	mg/L	-	-	<0.10	<0.10
Carbonate (CO3)	mg/L	-	-	<12	<12
Chloride	mg/L	250	-	4.26	12.9
Fluoride	mg/L	-	1.5	0.22	0.67
Hydroxide (OH)	mg/L	-	-	<6.8	<6.8
Nitrate-N	mg/L	-	10	<0.0050	0.280
Nitrite-N	mg/L	-	1	<0.0010	<0.0010
Sulfate	mg/L	500	-	219	225

Federal Guidelines for Canadian Drinking Water Quality (AUG, 2012)

#1: GCDWQ - Aesthetic Objective

#2: GCDWQ - Maximum Acceptable Concentrations (MACs)

Organic / Inorganic Carbon (WATER)

		ALS ID		L1344556-1	L1344556-2
		Sampled Date		07-AUG-13	07-AUG-13
		Sampled Time		14:00	14:00
		Sample ID		RUSSELL 1-RAW	RUSSELL 2-TREATED
Analyte	Unit	Guide Limit #1	Guide Limit #2		
Dissolved Organic Carbon	mg/L	-	-	2.4	3.0
Total Organic Carbon	mg/L	-	-	3.1	3.0

Federal Guidelines for Canadian Drinking Water Quality (AUG, 2012)

#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

Total Metals (WATER)

		ALS ID		L1344556-1	L1344556-2
		Sampled Date		07-AUG-13	07-AUG-13
		Sampled Time		14:00	14:00
		Sample ID		RUSSELL 1-RAW	RUSSELL 2-TREATED
Analyte	Unit	Guide Limit #1	Guide Limit #2		
Aluminum (Al)-Total	mg/L	0.1	-	<0.0050	<0.0050
Antimony (Sb)-Total	mg/L	-	0.006	<0.00020	<0.00020
Arsenic (As)-Total	mg/L	-	0.01	0.0341	0.00703
Barium (Ba)-Total	mg/L	-	1	0.0131	0.00132
Beryllium (Be)-Total	mg/L	-	-	<0.00020	<0.00020
Bismuth (Bi)-Total	mg/L	-	-	<0.00020	<0.00020
Boron (B)-Total	mg/L	-	5	0.174	0.150
Cadmium (Cd)-Total	mg/L	-	0.005	0.000027	0.000026
Calcium (Ca)-Total	mg/L	-	-	151 ^{DLA}	19.4
Cesium (Cs)-Total	mg/L	-	-	<0.00010	<0.00010
Chromium (Cr)-Total	mg/L	-	0.05	<0.0010	<0.0010
Cobalt (Co)-Total	mg/L	-	-	0.00075	<0.00020
Copper (Cu)-Total	mg/L	1	-	0.00838	0.00888
Iron (Fe)-Total	mg/L	0.3	-	3.50	<0.10
Lead (Pb)-Total	mg/L	-	0.01	0.000331	0.000171
Lithium (Li)-Total	mg/L	-	-	0.115	0.109
Magnesium (Mg)-Total	mg/L	-	-	54.1	26.8
Manganese (Mn)-Total	mg/L	0.05	-	0.463	0.00298
Molybdenum (Mo)-Total	mg/L	-	-	0.00817	0.00800
Nickel (Ni)-Total	mg/L	-	-	<0.0020	<0.0020
Phosphorus (P)-Total	mg/L	-	-	0.14	<0.10
Potassium (K)-Total	mg/L	-	-	6.72	7.49
Rubidium (Rb)-Total	mg/L	-	-	0.00148	0.00248
Selenium (Se)-Total	mg/L	-	0.01	<0.0010	<0.0010
Silicon (Si)-Total	mg/L	-	-	14.3	7.23
Silver (Ag)-Total	mg/L	-	-	<0.00010	<0.00010
Sodium (Na)-Total	mg/L	200	-	39.1	83.0 ^{DLA}
Strontium (Sr)-Total	mg/L	-	-	0.607	0.108
Tellurium (Te)-Total	mg/L	-	-	<0.00020	<0.00020
Thallium (Tl)-Total	mg/L	-	-	<0.00010	<0.00010
Thorium (Th)-Total	mg/L	-	-	<0.00010	<0.00010
Tin (Sn)-Total	mg/L	-	-	<0.00020	<0.00020
Titanium (Ti)-Total	mg/L	-	-	0.00310	0.00325

Federal Guidelines for Canadian Drinking Water Quality (AUG, 2012)

#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

Total Metals (WATER)

		ALS ID		L1344556-1	L1344556-2
		Sampled Date		07-AUG-13	07-AUG-13
		Sampled Time		14:00	14:00
		Sample ID		RUSSELL 1-RAW	RUSSELL 2-TREATED
Analyte	Unit	Guide Limit #1	Guide Limit #2		
Tungsten (W)-Total	mg/L	-	-	<0.00010	<0.00010
Uranium (U)-Total	mg/L	-	0.02	0.00415	<0.00010
Vanadium (V)-Total	mg/L	-	-	<0.00020	<0.00020
Zinc (Zn)-Total	mg/L	5	-	0.0071	<0.0020
Zirconium (Zr)-Total	mg/L	-	-	<0.00040	<0.00040

Federal Guidelines for Canadian Drinking Water Quality (AUG, 2012)

#1: GCDWQ - Aesthetic Objective

#2: GCDWQ - Maximum Acceptable Concentrations (MACs)

Volatile Organic Compounds (WATER)

		ALS ID		L1344556-1
		Sampled Date		07-AUG-13
		Sampled Time		14:00
		Sample ID		RUSSELL 1-RAW
Analyte	Unit	Guide Limit #1	Guide Limit #2	
Benzene	ug/L	-	5	<0.50
1,1-Dichloroethylene	ug/L	-	14	<0.50
Dichloromethane	ug/L	-	50	1.63
Ethyl Benzene	ug/L	2.4	-	<0.50
MTBE	ug/L	15	-	<0.50
Tetrachloroethylene	ug/L	-	30	<0.50
Toluene	ug/L	24	-	<0.50
Trichloroethylene	ug/L	-	5	<0.50
Xylenes (Total)	ug/L	300	-	<1.1
Surrogate: 4-Bromofluorobenzene	%	-	-	111.6
Surrogate: 1,2-Dichloroethane d4	%	-	-	108.7
Surrogate: Toluene-d8	%	-	-	101.1

Federal Guidelines for Canadian Drinking Water Quality (AUG, 2012)

#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.

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLA	Detection Limit Adjusted For required dilution

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TOT-WP	Water	Alkalinity	APHA 2320B
Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. It is determined by titration with a standard solution of strong mineral acid to the successive HCO ₃ ⁻ and H ₂ CO ₃ endpoints indicated electrometrically.			
BR-IC-WP	Water	Bromide by Ion Chromatography	EPA 300.1 (modified)
Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.			
C-TC,TIC,TOC-WP	Water	Carbons	APHA 5310 B-INSTRUMENTAL
This method is applicable to the analysis of ground water, wastewater, and surface water samples. The form detected depends upon sample pretreatment: Unfiltered sample = TC, 0.45um filtered = TDC. Samples are injected into a combustion tube containing an oxidation catalyst. The carrier gas containing the combustion product from the combustion tube flows through an inorganic carbon reactor vessel and is then sent through a halogen scrubber into a sample cell set in a non-dispersive infrared gas analyzer (NDIR) where carbon dioxide is detected. For total inorganic carbon and dissolved inorganic carbon, the sample is injected into an IC reactor vessel where only the IC component is decomposed to become carbon dioxide.			
The peak area generated by the NDIR indicates the TC/TDC or TIC/DIC as applicable. The total organic carbon content of the sample is calculated by subtracting the TIC from the TC. TOC = TC-TIC, DOC = TDC-DIC, Particulate = Total - Dissolved.			
C-TDC,DIC,DOC-WP	Water	Carbons Dissolved	APHA 5310 B-INSTRUMENTAL
This method is applicable to the analysis of ground water, wastewater, and surface water samples. The form detected depends upon sample pretreatment: Unfiltered sample = TC, 0.45um filtered = TDC. Samples are injected into a combustion tube containing an oxidation catalyst. The carrier gas containing the combustion product from the combustion tube flows through an inorganic carbon reactor vessel and is then sent through a halogen scrubber into a sample cell set in a non-dispersive infrared gas analyzer (NDIR) where carbon dioxide is detected. For total inorganic carbon and dissolved inorganic carbon, the sample is injected into an IC reactor vessel where only the IC component is decomposed to become carbon dioxide.			
The peak area generated by the NDIR indicates the TC/TDC or TIC/DIC as applicable. The total organic carbon content of the sample is calculated by subtracting the TIC from the TC. TOC = TC-TIC, DOC = TDC-DIC, Particulate = Total - Dissolved.			
CL-L-IC-WP	Water	Chloride by Ion Chromatography	EPA 300.1 (modified)
Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.			
COLOUR-TRUE-WP	Water	Colour, True	APHA 2120C
True colour in water is analyzed by discrete analyzer using the platinum-cobalt colourimetric method. Colour is pH dependant; unless otherwise indicated, reported colour results pertain to the pH of the sample as received to within +/- 1 pH unit.			
EC-WP	Water	Conductivity	APHA 2510B
Conductivity of an aqueous solution refers to its ability to carry an electric current. Conductance of a solution is measured between two spatially fixed and chemically inert electrodes.			
ETL-HARDNESS-TOT-WP	Water	Hardness Calculated	HARDNESS CALCULATED
ETL-LANGELIER-4-WP	Water	Langelier Index 4C	Calculated
ETL-LANGELIER-60-WP	Water	Langelier Index 60C	Calculated
F-IC-WP	Water	Fluoride by Ion Chromatography	EPA 300.1 (modified)
Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.			
IONBALANCE-CALC-WP	Water	Ion Balance Calculation	APHA 1030E
MET-T-L-MS-WP	Water	Total Metals by ICP-MS	U.S. EPA 200.8-TL

Total Metals by ICP-MS: This analysis is carried out using sample preparation procedures adapted from Standard Methods for the examination of Water and Wastewater Method 3030E and analytical procedures adapted from U.S EPA Method 200.8 for analysis of metals by inductively coupled-

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
		mass spectrometry.	
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.	
NO2-L-IC-WP	Water	Nitrite as N by Ion Chromatography	EPA 300.1 (modified)
		Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.	
NO3-L-IC-WP	Water	Nitrate as N by Ion Chromatography	EPA 300.1 (modified)
		Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.	
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-WP	Water	Sulfate by Ion Chromatography	EPA 300.1 (modified)
		Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.	
SOLIDS-TDS-WP	Water	Total Dissolved Solids	APHA 2540 C (modified)
		Total dissolved solids in aqueous matrices is determined gravimetrically after evaporation of the filtrate at 180°C.	
TRANSM-UV-WT	Water	Transmittance, UV (254 nm)	APHA 5910 B-Spectrophotometer
TURBIDITY-WP	Water	Turbidity	APHA 2130B (modified)
		Turbidity in aqueous matrices is determined by the nephelometric method.	
VOC-ROU-WT	Water	Volatile Organic Compounds	SW846 8260
		The purge and trap method purges Volatile Organic Compounds (VOC) from aqueous samples by bubbling an inert gas through the sample. Once in the gaseous phase, the analytes are swept from the purging device and trapped in a short column. The compounds are that are trapped on the column are thermally desorbed and transferred to the analytical column of the GC/MS.	
XYLENES-SUM-CALC-WT	Water	Sum of Xylene Isomer Concentrations	CALCULATION
		Total xylenes represents the sum of o-xylene and m&p-xylene.	

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

Chain of Custody Numbers:

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
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

Reference Information

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.

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information.

Manitoba Conservation Water Stewardship
Office of Drinking Water
1007 Century Street, Winnipeg, Manitoba,
Canada R3H 0W4

Chain of Custody (COC)
Manitoba Drinking Water Systems
ONLY FOR: Regulatory General Chemistry &



L1344556-COFC

Report to Operator (email pdf):				Owner billing (Email):				Regular Service (is 5-7 Days):			
Contact:	Steve Smith			Contact:	Wally Melnyk			Unless otherwise requested:	<input type="checkbox"/> 1 Day, rush / priority		
Address:	Box 10 Russell MB R0J 1W0			Address:	Box 10 Russell MB R0J 1W0				<input type="checkbox"/> 2 Day, rush / priority		
Phone:	204-773-3185			Phone:	204-773-2253				<input type="checkbox"/> 3 Day, rush / priority		
Email:	russellwaterplant@hotmail.com			Email:	wally@russellmb.com						
Operator contact update (if different then above):				Owner contact update (if different then above):				Email pdf copy to:			
Contact:				Contact:				DWO:	Glen Robertson		
Address:				Address:				DWO Address:	1129 Queens Ave. Brandon MB R7A 1L9		
Phone:				Phone:				DWO Phone:	204-726-6563		
Email:				Email:				DWO Email:	glen.robertson@gov.mb.ca		
Account:	W7260	ODW Report type:	EMS (Lab-MWS)	Client / Project Information:				Analysis Request			
Agency Code:	382	Project:	DWQ-C	Operation Name:	RUSSELL - PWS				MB-CH-PWS-V2013	MB-VOC-PWS-V2013	Number of Containers
Lab:	ALS	Lab Work Order # / Job # (lab use only)		Operation Code (com code):	189.00						
				Operation Id:	17511						
				Sampled by:	Steven Smith						
Lab Sample # (lab use only)	Sample Number (YYMMII9999)	Station Number (MB99XXD999) / (MB99XXY999)	Sample Identification	Date dd-mmm-yyyy	Time hh:mm	Sample Matrix	Sample Type				
	1308GR0022	MB05MED051	Russell 1 - Raw	07-08-13	2 PM	6	1	X	X	8	
	1308GR0023	MB05MED052	Russell 2 - Treated	07-08-13	2 PM	10	1	X		5	
Failure to complete all portions of this form may delay analysis.						Sample Matrix:		Sample Type:			
Please fill in this form LEGIBLY.						6-Raw Water, 10-Treated Water		1-Grab Sample			
By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified by the Laboratory.											
For ALL other testing, please use Laboratory specific forms.											
DO NOT COPY or RE-USE this form. Sample Numbers are unique to the Office of Drinking Water and provided by DWO.											
Relinquished By:	Steven Smith	Date & Time: 2 PM Aug 7/13		Received By: (lab use only)	GH	Date & Time: (lab use only)	Aug. 8/13 12:00	Sample Condition (lab use only)			
Relinquished By:		Date & Time:		Received By: (lab use only)		Date & Time: (lab use only)		Temperature	Samples Received in Good Condition? Y / N (if no provide details)		
								13.9°C			

Operator mandatory

Operator optional

Operator to fill, if information above has changed

Opr to fill, Lab specific

pre-filled by DWO

Note: Cyanide and Mercury are not required and have been removed from the list.

Please use the Rev. July 29, 2013 Water System Chemistry List.

9.9 Appendix I - Spear Lake Water Chemistry



Municipality of Russell Binscarth - Russell
ATTN: PAUL OLARTE
PO Box 10
Russell MB R0J 1W0

Date Received: 16-DEC-15
Report Date: 07-JAN-16 07:08 (MT)
Version: FINAL REV. 2

Client Phone: 204-773-2253

Certificate of Analysis

Lab Work Order #: L1715122
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Comments:

7-JAN-2016 Revised report - Date analyzed on Ph, EC and Alkalinity corrected.

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
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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1715122-1 SPEAR LAKE WATER SAMPLE							
Sampled By: CLIENT on 14-DEC-15 @ 13:00							
Matrix:							
MB Chemistry for PWS							
% Transmittance by Spectrometry							
Transmittance, UV (254 nm)	21.3		1.0	% T		17-DEC-15	R3347340
Alkalinity, Bicarbonate							
Bicarbonate (HCO ₃)	397		1.2	mg/L		04-JAN-16	
Alkalinity, Carbonate							
Carbonate (CO ₃)	<0.60		0.60	mg/L		04-JAN-16	
Alkalinity, Hydroxide							
Hydroxide (OH)	<0.34		0.34	mg/L		04-JAN-16	
Alkalinity, Total (as CaCO₃)							
Alkalinity, Total (as CaCO ₃)	325		1.0	mg/L		31-DEC-15	R3353767
Ammonia by colour							
Ammonia, Total (as N)	0.073		0.010	mg/L		21-DEC-15	R3343635
Bromide in Water by IC							
Bromide (Br)	<0.10		0.10	mg/L		16-DEC-15	R3339238
Chloride in Water by IC (Low Level)							
Chloride (Cl)	9.13		0.10	mg/L		16-DEC-15	R3339238
Colour, True							
Colour, True	45.2		5.0	CU		17-DEC-15	R3339614
Conductivity							
Conductivity	1040		1.0	umhos/cm		02-JAN-15	R3353767
Dissolved Organic Carbon by Combustion							
Dissolved Organic Carbon	22.6		0.50	mg/L		22-DEC-15	R3350893
Fluoride in Water by IC							
Fluoride (F)	0.234		0.020	mg/L		16-DEC-15	R3339238
Hardness Calculated							
Hardness (as CaCO ₃)	567		0.30	mg/L		22-DEC-15	
Langelier Index 4C							
Langelier Index (4 C)	0.85					04-JAN-16	
Langelier Index 60C							
Langelier Index (60 C)	1.6					04-JAN-16	
Nitrate in Water by IC (Low Level)							
Nitrate (as N)	0.0796		0.0050	mg/L		16-DEC-15	R3339238
Nitrite in Water by IC (Low Level)							
Nitrite (as N)	0.0021		0.0010	mg/L		16-DEC-15	R3339238
Sulfate in Water by IC							
Sulfate (SO ₄)	264		0.30	mg/L		16-DEC-15	R3339238
Total Dissolved Solids (TDS)							
Total Dissolved Solids	743		15	mg/L		22-DEC-15	R3351519
Total Metals by ICP-MS							
Aluminum (Al)-Total	0.166		0.0050	mg/L	21-DEC-15	21-DEC-15	R3342995
Antimony (Sb)-Total	0.00029		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Arsenic (As)-Total	0.00476		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Barium (Ba)-Total	0.0670		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Beryllium (Be)-Total	<0.00020		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Bismuth (Bi)-Total	<0.00020		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Boron (B)-Total	0.113		0.010	mg/L	21-DEC-15	21-DEC-15	R3342995
Cadmium (Cd)-Total	0.000011		0.000010	mg/L	21-DEC-15	21-DEC-15	R3342995
Calcium (Ca)-Total	108		0.10	mg/L	21-DEC-15	21-DEC-15	R3342995
Cesium (Cs)-Total	<0.00010		0.00010	mg/L	21-DEC-15	21-DEC-15	R3342995
Chromium (Cr)-Total	<0.0010		0.0010	mg/L	21-DEC-15	21-DEC-15	R3342995
Cobalt (Co)-Total	0.00066		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Copper (Cu)-Total	0.00181		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995

* 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
L1715122-1 SPEAR LAKE WATER SAMPLE							
Sampled By: CLIENT on 14-DEC-15 @ 13:00							
Matrix:							
Total Metals by ICP-MS							
Iron (Fe)-Total	0.224		0.010	mg/L	21-DEC-15	21-DEC-15	R3342995
Lead (Pb)-Total	0.000255		0.000090	mg/L	21-DEC-15	21-DEC-15	R3342995
Lithium (Li)-Total	0.124		0.0020	mg/L	21-DEC-15	21-DEC-15	R3342995
Magnesium (Mg)-Total	71.9		0.010	mg/L	21-DEC-15	21-DEC-15	R3342995
Manganese (Mn)-Total	0.0458		0.00030	mg/L	21-DEC-15	21-DEC-15	R3342995
Molybdenum (Mo)-Total	0.00212		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Nickel (Ni)-Total	0.0026		0.0020	mg/L	21-DEC-15	21-DEC-15	R3342995
Phosphorus (P)-Total	0.11		0.10	mg/L	21-DEC-15	21-DEC-15	R3342995
Potassium (K)-Total	12.2		0.020	mg/L	21-DEC-15	21-DEC-15	R3342995
Rubidium (Rb)-Total	0.00326		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Selenium (Se)-Total	<0.0010		0.0010	mg/L	21-DEC-15	21-DEC-15	R3342995
Silicon (Si)-Total	3.03		0.10	mg/L	21-DEC-15	21-DEC-15	R3342995
Silver (Ag)-Total	<0.00010		0.00010	mg/L	21-DEC-15	21-DEC-15	R3342995
Sodium (Na)-Total	47.4		0.030	mg/L	21-DEC-15	21-DEC-15	R3342995
Strontium (Sr)-Total	0.459		0.00010	mg/L	21-DEC-15	21-DEC-15	R3342995
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Thallium (Tl)-Total	<0.00010		0.00010	mg/L	21-DEC-15	21-DEC-15	R3342995
Thorium (Th)-Total	<0.00010		0.00010	mg/L	21-DEC-15	21-DEC-15	R3342995
Tin (Sn)-Total	<0.00020		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Titanium (Ti)-Total	0.00468		0.00050	mg/L	21-DEC-15	21-DEC-15	R3342995
Tungsten (W)-Total	<0.00010		0.00010	mg/L	21-DEC-15	21-DEC-15	R3342995
Uranium (U)-Total	0.00582		0.00010	mg/L	21-DEC-15	21-DEC-15	R3342995
Vanadium (V)-Total	0.00459		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Zinc (Zn)-Total	0.0028		0.0020	mg/L	21-DEC-15	21-DEC-15	R3342995
Zirconium (Zr)-Total	0.00044		0.00040	mg/L	21-DEC-15	21-DEC-15	R3342995
Total Organic Carbon by Combustion							
Total Organic Carbon	22.0		0.50	mg/L		22-DEC-15	R3350875
Turbidity							
Turbidity	6.54		0.10	NTU		17-DEC-15	R3338809
pH							
pH	8.08		0.10	pH units		31-DEC-15	R3353767

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

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-CO3CO3-CALC-WP	Water	Alkalinity, Carbonate	CALCULATION
The Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. The fraction of alkalinity contributed by carbonate is calculated and reported as mg CO ₃ ²⁻ /L.			
ALK-HCO3HCO3-CALC-WP	Water	Alkalinity, Bicarbonate	CALCULATION
The Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. The fraction of alkalinity contributed by bicarbonate is calculated and reported as mg HCO ₃ ⁻ /L.			
ALK-OHOH-CALC-WP	Water	Alkalinity, Hydroxide	CALCULATION
The Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. The fraction of alkalinity contributed by hydroxide is calculated and reported as mg OH ⁻ /L.			
ALK-TITR-WP	Water	Alkalinity, Total (as CaCO ₃)	APHA 2320B
The Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. Total alkalinity is determined by titration with a strong standard mineral acid to the successive HCO ₃ ⁻ and H ₂ CO ₃ endpoints indicated electrometrically.			
BR-IC-N-WP	Water	Bromide in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
C-DOC-HTC-WP	Water	Dissolved Organic Carbon by Combustion	APHA 5310 B-WP
Filtered (0.45 um) sample is acidified and purged to remove inorganic carbon, then injected into a heated reaction chamber where organic carbon is oxidized to CO ₂ which is then transported in the carrier gas stream and measured via a non-dispersive infrared analyzer.			
C-TOC-HTC-WP	Water	Total Organic Carbon by Combustion	APHA 5310 B-WP
Sample is acidified and purged to remove inorganic carbon, then injected into a heated reaction chamber where organic carbon is oxidized to CO ₂ which is then transported in the carrier gas stream and measured via a non-dispersive infrared analyzer.			
CL-L-IC-N-WP	Water	Chloride in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
COLOUR-TRUE-WP	Water	Colour, True	APHA 2120C
True Colour is measured spectrophotometrically by comparison to platinum-cobalt standards using the single wavelength method (450 - 465 nm) after filtration of sample through a 0.45 um filter. Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.			
EC-WP	Water	Conductivity	APHA 2510B
Conductivity of an aqueous solution refers to its ability to carry an electric current. Conductance of a solution is measured between two spatially fixed and chemically inert electrodes.			
ETL-HARDNESS-TOT-WP	Water	Hardness Calculated	HARDNESS CALCULATED
ETL-LANGELIER-4-WP	Water	Langelier Index 4C	Calculated
ETL-LANGELIER-60-WP	Water	Langelier Index 60C	Calculated
F-IC-N-WP	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
IONBALANCE-CALC-WP	Water	Ion Balance Calculation	APHA 1030E
MET-T-L-MS-WP	Water	Total Metals by ICP-MS	APHA 3030E/EPA 6020A-TL
This analysis involves preliminary sample treatment by hotblock acid digestion (APHA 3030E). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).			
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.			
NO2-L-IC-N-WP	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-WP	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
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.			
TDS-WP	Water	Total Dissolved Solids (TDS)	APHA 2540 SOLIDS C,E
A well-mixed sample is filtered through a glass fiber filter paper. The filtrate is then evaporated to dryness in a pre-weighed vial and dried at 180 – 2C. The increase in vial weight represents the total dissolved solids.			
TURBIDITY-WP	Water	Turbidity	APHA 2130B (modified)
Turbidity in aqueous matrices is determined by the nephelometric method.			
UV-%TRANS-WP	Water	% Transmittance by Spectrometry	APHA 5910B
This method indicates the total concentration of UV-absorbing compounds found in water and wastewater. The analysis is carried out using procedures adapted from APHA 5910 B. The sample is filtered through a 0.45 um filter and measured for % transmittance in a quartz cell at 254 nm and reported as % Transmittance .The analysis is carried out without pH adjustment.			

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

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

Laboratory Definition Code	Laboratory Location
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.



L1715122-COFC

Report To		Report Format / D		(Rush Turnaround Time (TAT) is not available for all tests)																																						
Company: <u>Municipality of Russell/Binscarth</u>		Select Report Format: <input type="checkbox"/> PDF <input type="checkbox"/> []		R <input type="checkbox"/> Regular (Standard TAT if received by 3pm)																																						
Contact:		Quality Control (QC) Report with Report <input type="checkbox"/> Yes <input type="checkbox"/> No		P <input type="checkbox"/> Priority (2-4 business days if received by 3pm)																																						
Address: <u>Box 10 Russell, MB R0J 1W0</u>		<input type="checkbox"/> Criteria on Report - provide details below if box checked		E <input type="checkbox"/> Emergency (1-2 business days if received by 3pm)																																						
Phone: <u>204-773-2253 FAX: 204-773-3970</u>		Select Distribution: <input type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX		E2 <input type="checkbox"/> Same day or weekend emergency if received by 10am - contact ALS for surcharge.																																						
Email 1 or Fax: <u>Russellwaterplant@hotmail.com</u>		Email 2: <u>coru.vitto@gov.mb.ca</u>		Specify Date Required for E2, E or P:																																						
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Job #:		GL Account:				Routing Code:																																				
PO / AFE:		Activity Code:																																								
LSD:		Location:																																								
ALS Lab Work Order # (lab use only)		ALS Contact:		Sampler: <u>Paul Olarte</u>																																						
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)	Sample Type																																						
	<u>Spear Lake water sample</u>																																									
<u>1</u>	<u>1 L. Routine</u>																																									
<u>2</u>	<u>250 ml. Metals</u>																																									
<u>3</u>	<u>250 ml. Nutrients</u>																																									
<u>4</u>	<u>DOC</u>																																									
<u>Spear Lake water full chemistry required</u>																																										
Drinking Water (DW) Samples ¹ (client use)		Special Instructions / Specify Criteria to add on report (client use)		SAMPLE CONDITION AS RECEIVED (lab use only)																																						
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No				Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>																																						
Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No				Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>																																						
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Released by: <u>[Signature]</u>	Date: <u>Dec 14/15</u>	Time: <u>3:00 pm</u>	Received by: <u>CTS</u>	Date: <u>16-Dec-15</u>	Time: <u>8:00</u>	Received by:																																				

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-0206-v00 Form 01 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

14C

9.10 Appendix J - ROSA Hypothetical Chemistry

ROSA HYPOTHETICAL CHEMISTRY

The water quality and chemistry of reject water from a Reverse Osmosis (RO) membrane system is dependent on the chemistry of the raw water (including the source type such as groundwater or surface water), the chemistry of the water entering the RO (cases with pre-treatment prior to RO), and the type of RO system including the equipment manufacturer.

This is hypothetical chemistry of the reject water from a RO system for the Municipality of Russell Binscarth. The software program utilized is called "ROSA" from the DOW company.

Parameter	Unit	GCDWQ		Sampled: June 4, 2015	ROSA
		AO/OG	MAC	INPUT Raw Well Water	OUTPUT RO Reject
Total Dissolved Solids	mg/L	500		896.63*	1063.79
pH	pH	6.5 to 8.5		7.72	7.76
Ammonium (NH ₄ ⁺ + NH ₃)	mg/L			0.72	0.84
Potassium (K)	mg/L			5.85	6.77
Sodium (Na)	mg/L	200		19.7	41.67
Magnesium (Mg)	mg/L			47.8	55.82
Calcium (Ca)	mg/L			124	144.81
Strontium (Sr)	mg/L			0.502	0.59
Barium (Ba)	mg/L		1	0.018	0.02
Carbonate (CO ₃)	mg/L			2.693*	3.65
Bicarbonate (HCO ₃)	mg/L			536	622.93
Nitrate (NO ₃)	mg/L		10	0.019	0.02
Chloride (Cl)	mg/L	250		1.44	1.68
Fluoride (F)	mg/L		1.5	0.205	0.24
Sulfate (SO ₄)	mg/L	500		142	166.52
Silica (SiO ₂)	mg/L			15	17.54
Boron (B)	mg/L			0.119	0.12

* Refers to INPUT numbers that are generated automatically.

The Guidelines for Canadian Drinking Water Quality (GCDWQ) do not apply in this case with wastewater effluent discharge since these guidelines deal with drinking water and not effluent. There are two governing bodies and regulations that can be used to determine if the wastewater parameters meet the requirements. They are the Canadian Council of Ministers of the Environment (CCME) and the "Manitoba Water Quality Standards, Objectives, and Guidelines - November 2011" from Manitoba Water Stewardship.

		Sampled: December 14, 2015	Sampled: June 4, 2015	ROSA		
Parameter	Unit	Spear Lake	Raw Well Water	RO Reject	CCME	MB
Total Dissolved Solids	mg/L	743	688	1063.79	3000	3000
Calcium (Ca)	mg/L	108	124	144.81	1000	1000
Nitrate (NO3)	mg/L	0.0796	<0.020	0.02	13	13
Chloride (Cl)	mg/L	9.13	1.44	1.68	NA	100 to 900
Fluoride (F)	mg/L	0.234	0.205	0.24	1	1 to 2
Sulfate (SO4)	mg/L	264	142	166.52	1000	1000
Boron (B)	mg/L	0.113	0.119	0.12	1.5	1.5

In comparison of the chemistry parameters available for the Reverse Osmosis (RO) reject water from the proposed Russell Binscarth WTP to the regulatory limits (both national and provincial), all parameters are well below limits.

Thus, there will be no adverse environmental effects due to water quality.

9.11 Appendix K - MWSB Watercourse Crossing Guidelines

MWSB WATERCOURSE CROSSING GUIDELINES

Mitigation Measure:

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

Reclamation:

- Restore all disturbed areas to original contours.
- 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:
 - A record of drilling progress will be maintained to always know the location of the drill head relative to the point of entry.
 - A record of drilling component usage (type and quantity) will be maintained throughout each drilling operation.
 - 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 construction field supervisor.
 - 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:

- 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.
- The contractor will notify the MWSB construction field supervisor of the frac-out condition or potential condition and decide on the appropriate action as follows:
- Assign a person to visually monitor for the presence of muddy plume.
- 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.
- 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.
- 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.
- If the frac-out is not contained within this time, MWSB 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.

ENVIRONMENT ACT PROPOSAL MUNICIPALITY OF RUSSELL BINSARTH WATER TREATMENT PLANT UPGRADE

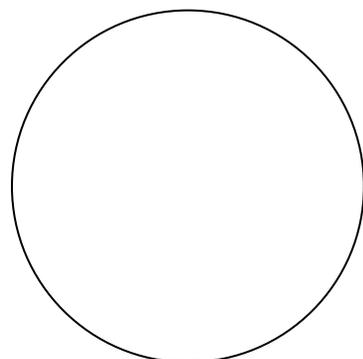
March 2016



Prepared by:



Unit #1A - 2010 Currie Blvd.,
Brandon, MB R7B 4E7



EXECUTIVE SUMMARY

The Municipality of Russell Binscarth requested the Manitoba Water Services Board (MWSB) to prepare an Environment Act Proposal (EAP) for a Class 2 Development License under the Manitoba Environment Act for an upgrade of the Water Treatment Plant (WTP) and water supply pipeline. The expansion and upgrade involves the following:

1. Installation of two new raw water supply wells in Russell and connection to the raw water pipeline feeding the Russell WTP. This upgrade was completed in 2015.
2. Construction of a new Russell WTP (adjacent to the existing WTP).
3. Construction of a Reverse Osmosis (RO) membrane concentrate pipeline from the new Russell WTP to Spear Lake north-west of Russell.
4. Construction of a treated water supply pipeline from the new Russell WTP to the existing Binscarth reservoir.

The proposed upgrades will allow the Municipality to overcome inadequate water supply with aged ineffective infrastructure, with the Binscarth WTP in violation of the operating license conditions. This EAP is submitted for this proposed infrastructure.

The Town of Russell and the Village of Binscarth amalgamated in 2015. The Municipality of Russell Binscarth supplies potable water to residents in the former Town of Russell (population of 1,611 from the 2011 census) and in the former Village of Binscarth (population of 425 from the 2011 census), from two separate aging WTPs.

The expansion includes the construction of a new 32 L/s WTP in Russell using groundwater wells as a water supply. The proposed treatment process will consist of an integrated membrane system including Reverse Osmosis (RO). Concentrate from the RO will be discharged to Spear Lake north-west of Russell. The proposed expansion to the Russell WTP will increase the operating capacity from 10 L/s to 32 L/s.

The distribution system will be expanded with the installation of approximately 19.2 kms of pressure pipeline to supply the existing Binscarth reservoir. Existing or upgraded infrastructure from the Binscarth reservoir will be utilized for re-chlorination purposes as necessary.

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0.0 List of Acronyms

AO	Aesthetic Objective
CIP	Clean-In-Place
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
MWSB	Manitoba Water Services Board
ODW	Office of Drinking Water
OS	Operational Statements
PR	Public Road
RM	Rural Municipality
RO	Reverse Osmosis
TDS	Total Dissolved Solids
THM	Trihalomethane
TOC	Total Organic Carbon
UV	Ultraviolet
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

1.0 Introduction and Background

1.1 Introduction

The Municipality of Russell Binscarth requested the Manitoba Water Services Board (MWSB) to prepare an Environment Act Proposal (EAP) for a Class 2 Development License under the Manitoba Environment Act for an upgrade of the Water Treatment Plant (WTP) in the Town of Russell. This document provides the compiled information required for Manitoba Conservation and Water Stewardship's 'Environment Act Proposal Report Guidelines' and 'Supplementary Guidelines for Municipal Water Supply Systems'. This EAP includes components of the concentrate disposal from Russell and treated water supply pipeline to Binscarth.

1.2 Background Information

The Town of Russell and the Village of Binscarth amalgamated in 2015. The Municipality of Russell Binscarth supplies potable water to residents in the former Town of Russell (population of 1,611 from the 2011 census) and in the former Village of Binscarth (population of 425 from the 2011 census), from two separate aging WTPs.

The Municipality of Russell Binscarth is located in western Manitoba, adjacent to the Saskatchewan border with a population of approximately 2500. The Russell WTP receives raw water from a sand-and-gravel aquifer located approximately 8 km east of the Town. Two 200 mm diameter wells supply water to the WTP. A 200 mm PVC and 250 mm HDPE raw water pipeline deliver water from the wells to the WTP. Raw water is treated by the Town's lime soda ash WTP renovated in 1964 with a current treatment capacity of 7.8 to 10.3 L/s. The maximum day demand from the Town was recorded at 302.8 cubic meters in 2010.

The Russell water treatment process involves mixing of lime, soda ash, and alum with the raw water to facilitate flocculation and precipitation prior to gravity filtration. The water is then re-carbonated, filtered through a dual media gravity filter, and chlorinated prior to storage in the reservoir. Treated water is stored in a 1000 cubic meter single-cell concrete reservoir with a 113 cubic meter pump well. A water tower (1956) with a capacity of 272,800 L maintains distribution pressure for a total treated water storage capacity of 1386 cubic meters, though the tower is nearing the end of its life cycle.

Bullee Consulting Ltd. in 2009 noted, "During peak flow demands, the treatment system cannot treat adequate water and the treated water storage levels decrease until demand subsides. This is not a suitable way for a water treatment plant to operate in the long term."¹ It was also noted that the distribution pumps, fire pump, and reservoir capacity are inadequate to service the system. Russell experiences average day demands of 7.1 L/s and a peak day demand near 14.2 L/s. Due to the limited capacity of the raw water wells (10.6 L/s) and the existing WTP (7.8 to 10.3 L/s), the treatment system must be expanded to provide additional capacity for Russell into the future.

The Russell WTP supplies the Town with treated water via 805 service connections with an additional 125 connections anticipated in the future.

The lime soda ash type of WTP becomes extremely difficult to maintain beyond the anticipated life expectancy. The Russell WTP is unable to treat water in conformance with the regulations of the Drinking Water Safety Act (DWSA). A major upgrade is required to bring the treated water in conformance with the DWSA and GCDWQ.

According to MWSB Municipality of Russell Binscarth Study 2015:

"The Binscarth WTP and raw water wells were originally constructed in 1965/66 with upgrades in 1980 and 1992. One main well (9.1 L/s) supplies the WTP while the backup well can provide only limited water to the system. The raw water contains high hardness, colour, and Total Organic Carbons (TOCs). Treated water in Binscarth contains trihalomethanes (THMs) that are well above the limit of 100 µg/L, and the non-GUDI (Groundwater Under Direct Influence of Surface Water) status of the Binscarth wells is currently under review. If the wells are classified as GUDI, 3-log (99.9%) removal/inactivation of *Cryptosporidium* oocysts and *Giardia* cysts is required, as well as 4-log (99.99%) removal/inactivation of viruses. Due to the presence of high organics and elevated THMs, it is suspected that the wells are GUDI and the WTP will require upgrading to achieve conformance with the drinking water regulations."⁴

"The average day demand on the Binscarth WTP is 2.3 L/s with a peak day of approximately 5.3 L/s. The Binscarth WTP requires upgrading for removal of TOCs, TDSs, THMs, and hardness, as well as upgrades to the raw water line and raw water wells, though the capacity of the water aquifer is limited."⁴

The Binscarth WTP supplies the Village with treated water via 225 service connections with an additional 40 connections anticipated in the future.

1.2.1 Previous Studies

Previous reports have been reviewed in preparation of this Environment Act Proposal.

In February 2014, the MWSB examined the Binscarth WTP and presented options for upgrading the existing infrastructure.³

According to MWSB Municipality of Russell Binscarth Study 2015:

"The existing WTP in Russell was constructed in 1955 with a major expansion in 1964, and though it continues to meet regulations, the aging infrastructure needs to be updated to avoid catastrophic failure. The Public Water System Engineering Assessment completed by Bullee Consulting Ltd. in 2009 noted that many of the main components are "obsolete, undersized, or in poor condition." Water is supplied by two 200 mm diameter artesian wells that are 18 and 24 metres deep located 4 miles east and 1 mile north of Russell. Only one well can supply the system demand and concerns over the condition of the well contribute to the urgent nature of the proposed upgrades. The raw water contains elevated levels of iron, manganese, alkalinity, arsenic, calcium, and hardness which must be addressed by the treatment process."⁴

W.L. Gibbons & Associates Inc. (WLG) report dated August 2014,⁵ provides an assessment for the Town of Russell water supply system. This report mentions that the desired future peak raw water pumping rate is 20 Lps (265 lpm) to allow for future growth. Although this only accounted for a peak demand from the Town of Russell and not the regional system.

W.L. Gibbons & Associates Inc. (WLG) report dated October 2015,⁷ provides a summary of the pumping well installations. Two new 300 mm diameter wells with a design capacity in excess of 32 Lps each were installed and tested. The well capacities were approximately 68 Lps (900 lpm) and 100 Lps (1300 lpm). No pump mechanization in the wells at this point in time.

According to WSP Technical Memorandum #1 2015:

"The existing water supply for the community of Russell, Manitoba, is in need of replacement due to deterioration of its three wells, two of which were developed in 1985 and one in 2000. Only one well is currently in operation, one is available for short-term standby and one has been abandoned and sealed. Two wells are proposed to be drilled and mechanized, and a 250 mm pipeline constructed to connect to the existing 9 km pipeline which currently conveys water from the existing well site to the community. This system is intended to provide a 32 L/s supply to Russell's Water Treatment Plant, which is currently rated at 10 L/s capacity. The plant is expected to be replaced in the medium-term with a membrane (Reverse Osmosis) facility. Future upgrading to double the proposed 32 L/s capacity (64 L/s) will be possible by upsizing the well pumps and twinning the existing 200 mm pipeline with a 300 mm line."⁸

"The general quality of the water from this part of the aquifer is not significantly different from that in the more westerly location from which the Town has been drawing for three decades. In the short term, the existing treatment plant should be adequate to meet the Town's needs. To support community growth, and to serve the needs of the region, including the Village of Binscarth which has water challenges, a new treatment plant is needed. The water should be very amenable to membrane (NF - Nano Filtration or RO - Reverse Osmosis) treatment. The presence of arsenic - even if only in relatively low concentrations, slightly above the current 0.010 mg/L limit - suggests the probability that a relatively tight RO membrane will likely be most appropriate. Pilot testing will be useful to confirm the optimum choice."⁸

The MWSB Study 2015, considered water supply and treatment alternatives for the communities of Russell and Binscarth. The report covered the new wells east of Russell and a new membrane plant at Russell, to serve both communities, as well as an alternative to develop a new facility located between the two communities. A WTP located in Russell was found to be the most cost effective solution.

1.2.2 Population

Based on the 2011 Census, the Town of Russell has a population of 1669, a 5.0% increase from 1590 in 2006. The Town has 805 service connections to the water system with 125 proposed future connections in the next 20 years. Based on the assumption that the population in the Town will increase over the next few years at an annual population growth rate of 1.0% per year, a 20-year population of approximately 2037 for the Town may be assumed.

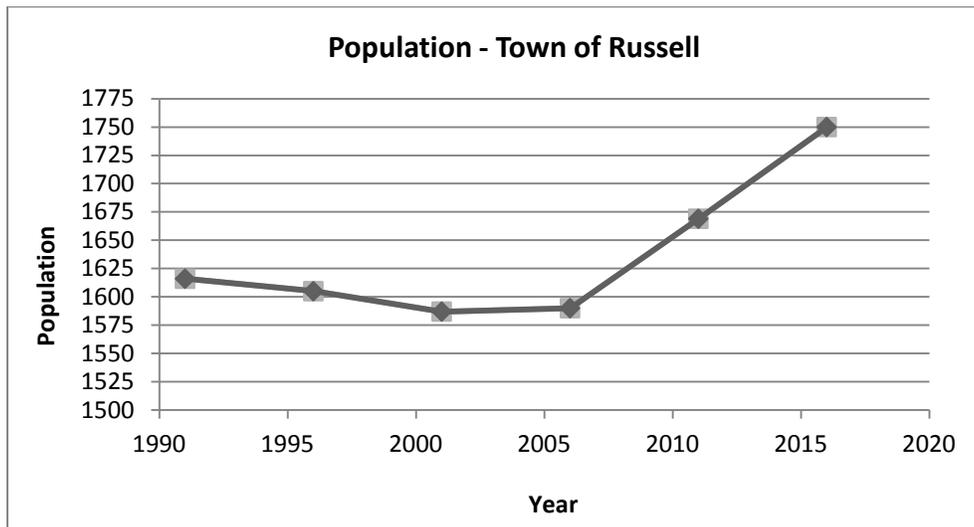


Figure 1.1 - Town of Russell Population Trends

Based on the 2011 Census, the Village of Binscarth has a population of 425, a 7.6% increase from 395 in 2006. The Village has 225 service connections to the water system with 40 proposed future connections in the next 20 years. Based on the assumption that the population in the Village will increase over the next few years at an annual population growth rate of 1.5% per year, a 20-year population of approximately 570 for the Village may be assumed.

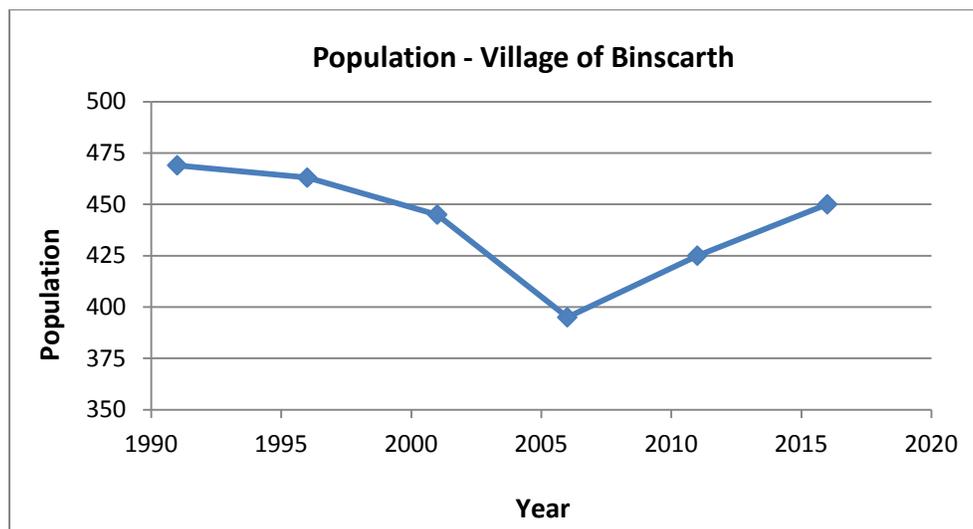


Figure 1.2 - Village of Binscarth Population Trends

1.2.3 Current and Projected Water Use

A WTP is designed based on peak day demand. When calculating water consumption, typical average daily water usage ranges from 250 L/person/day to 300 L/person/day and peak day usage (peak day factor) is typically 1.5 to 2.0 times greater. Consumptions of 300 L/person/day and a peak day factor of 2.0 were used for this study. The project treated water demands are summarized in Table 1.1.

The current peak treated water demand for Russell is 14.2 L/s and the peak day for Binscarth is 5.3 L/s, or a total of 19.5 L/s. The project 20-year peak day demand for the system is 23.3 L/s.

The 20-year average day demand for the system is 766,500 L/day. The new WTP will provide a reservoir which satisfies the required the water consumption, chlorine contact disinfection time, and emergency fire storage for a Class 5 WTP (240 L/s), Basic Fire Protection for Medium Sized Towns with 2000 to 4000 Population.

Table 1.1 - Projected Treated Water Demand for the Municipality of Russell Binscarth

Projected Treated Water Demand for the Russell Binscarth Water System		
	Quantity	Units
Russell Current Connections	805	
Binscarth Current Connections	225	
Future Connections	165	
Total Connections	1195	
Russell Current Population	1669	
Binscarth Current Population	425	
Total System Population	2094	
20 Year Future Population (@ 1.0, 1.5% per year)	2607	
Consumption/capita/day	300	L/capita/day
Average Day Consumption	782,100	L/day
Average Day Demand	9.1	L/s
Peak Day Factor	2.0	
Peak Day Consumption	1,564,200	L/day
Peak Day Demand (20 hour operating day)	18.1	L/s

1.2.4 Raw Water Source

The raw water sources for both the Town of Russell and the Village of Binscarth are wells. This EAP proposes a regional water source of non-GUDI wells several miles away from the Town of Russell.

1.2.5 Water Rights Act

The Town of Russell utilizes Water Rights License No. 2007-022 (previous License No. 85-16). The original license was implemented in 1984/85 for wells on SE-17-21-27W. The License allows the maximum instantaneous rate of withdrawal to be 11 L/s and a maximum annual usage of 250 cubic decameters.

W.L. Gibbons & Associates Inc. (WLG), applied for a groundwater exploration permit in April 2015 for the regional system. The new wells are located approximately 1.5 miles east of the old wells on SE-17-21-27W. The maximum instantaneous rate of withdrawal is 32 L/s and a maximum annual usage of 421 cubic decameters. The 0.032 cubic meters per second (32 L/s) pumping rate is the rate required for this proposed system to supply the estimated demands. The estimated 20-year raw water demand is 13.3 L/s on an average day and 29.2 L/s on a peak day.

Table 1.2 - Projected Total Water Demand for the Municipality of Russell Binscarth WTP

Demand	Unit
13.3	L/s
419,400,000	L/yr
419,400	cubic meters/yr
419.4	cubic decameters/yr

Based on Table 1.2, the proposed WTP is capable of supplying the average day demands while remaining in compliance with the proposed Water Rights License. A new Water Rights License will be applied the new raw water supply system.

1.2.6 Water Quality

The Office of Drinking Water (ODW) currently conducts annual audits of all public water systems which includes sampling and chemistry analysis every three years for secure groundwater sources and once per year for surface water and GUDI supply systems. In addition, the operator tests chlorine residuals daily on the treated water.

Raw water quality parameters exceeding the GCDWQ include arsenic, hardness, iron, manganese, and Total Dissolved Solids (TDS). Treated water quality parameters at the existing Town of Russell WTP exceeding the GCDWQ include hardness. The existing treatment system does not reduce all parameters below the maximum acceptable concentration or the aesthetic objective including hardness. A treatment system upgrade is necessary to address all the parameters that exceed the GCDWQ and the high hardness, sulfate, and TDS in the treated water.

Considering the issues with the water quality, the Town requested MWSB assistance to develop a ground water source located at SE 16-21-27W and necessary infrastructure to supply the raw water for present and future demands in the region.

Table 1.3 - Water Quality Results

Parameter	Unit	GCDWQ		Sampled: August 7, 2013	Sampled: August 7, 2013	Sampled: June 4, 2015
		AO/OG	MAC	Russell Existing Well Raw	Russell Existing WTP Treated	Russell New Well Raw
Alkalinity (Total) CaCO ₃	mg/L			481	95	439
Ammonia (Total) Nitrogen	mg/L			1.20	<0.010	0.72
Arsenic	mg/L		0.01	0.0341	0.00703	0.0383
Boron	mg/L			0.174	0.150	0.119
Calcium	mg/L			151	19.4	124
Chloride (Dissolved)	mg/L	250		4.26	12.9	1.44
Colour (True)	CU	15		<5.0	<5.0	<5.0
Conductivity	umhos/cm			1120	679	974
Fluoride (Dissolved)	mg/L		1.5	0.22	0.67	0.205
Hardness (Total) CaCO ₃	mg/L			601	159	507
Iron	mg/L	0.3		3.50	<0.10	2.97
Langelier Saturation Index (4 C)	NA			0.47	-0.35	0.70
Langelier Saturation Index (60 C)	NA			1.2	0.41	1.5
Lead	mg/L		0.01	0.000331	0.000171	<0.00090
Magnesium	mg/L			54.1	26.8	47.8
Manganese	mg/L	0.05		0.463	0.00298	0.300
Nitrate and Nitrite as N	mg/L		10	~~~	~~~	<0.070
Nitrate as N	mg/L		10	<0.0050	0.280	<0.020
Nitrite as N	mg/L		1	<0.0010	<0.0010	<0.010
pH	pH	6.5 to 8.5		7.39	8.09	7.72
Potassium	mg/L			6.72	7.49	5.85
Sodium	mg/L	200		39.1	83.0	19.7
Sulphate/ Sulfate (Dissolved)	mg/L	500		219	225	142
Total Dissolved Solids	mg/L	500		813	468	688
Total Organic Carbon	mg/L			3.1	3.0	3.8
Turbidity	NTU			38.3	0.39	42
Uranium	mg/L		0.02	0.00415	<0.00010	0.00267
Zinc	mg/L	5		0.0071	<0.0020	<0.0020

^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.

* Turbidity is a physical property that must be measured on site. It is anticipated that on site testing would demonstrate that the high turbidity recorded is a result of the high iron content oxidizing and precipitating in the raw water during transit.

^{DLA} Detected Limit Adjusted for required dilution.

1.2.7 Compliance Plan

A compliance plan has not been completed for the existing WTP.

2.0 Description of Proposed Development

2.1 Project Description

The proposed development includes:

1. Installation of two new raw water supply wells in Russell and connection to the raw water pipeline feeding the Russell WTP. This upgrade was completed in 2015.
2. Construction of a new Russell WTP (adjacent to the existing WTP).
3. Construction of a Reverse Osmosis (RO) membrane concentrate pipeline from the new Russell WTP to Spear Lake north-west of Russell.
4. Construction of a treated water supply pipeline from the new Russell WTP to the existing Binscarth reservoir.

The existing lime soda ash treatment system will be decommissioned once the proposed Reverse Osmosis (RO) membrane treatment system is operational. The two new raw water supply wells have already been installed and mechanized, utilizing an extension to the existing raw water pipeline feeding the Russell WTP. The connection from the new wells to the existing raw water pipeline has been installed in municipal road allowances.

Refer to the Drawings in the Appendix, which show the location of the wells with respect to the WTP.

The development also requires approval to discharge concentrate from the RO to Spear Lake.

2.1.1 Water Source

The groundwater will be pumped from an aquifer located beneath SE-16-21-27W approximately 10 km east of Russell. This source was selected following a groundwater study of potential options and field testing to confirm the availability of suitable groundwater resources. This aquifer has also been the source of water for Russell for the past three decades; it is a reliable and sustainable aquifer.

2.1.1.1 Well Installations

W.L. Gibbons & Associates Inc. (WLG) report dated October 2015,⁷ provides a summary of the pumping well installations.

"The two new pumping wells were installed in the summer of 2015 (June through September) by Watkins & Argue Drilling of Clearwater, MB under the direct supervision of WLG personnel."⁷

The installation of the first new supply well (designated as PW 15-01) began on July 27 and was completed on July 30, 2015."⁷

"The well was installed approximately 350 meters south of Mile Road 122N, and on the west side of PR 478. The well is located within private property to be acquired by the municipality."⁷

"A pumping test was conducted on Well PW 15-01 on September 15 to 16, 2015. Assuming the pump is set at a depth of 34.4 meters (113 feet), and a maximum safe pumping level of 18.45 meters (60 feet), the total well capacity is approximately 68 Lps (900 lpm), well in excess of the current design requirement of 32 Lps."⁷

"The installation of the second supply well (designated as PW 15-02) began on September 14 and was completed on September 17, 2015."⁷

"A well capacity test was conducted on Well PW 15-02 on September 16, 2015. Assuming the pump is set at a depth of 34.4 meters (113 feet), and a maximum safe pumping level of 18.45 meters (60 feet), the total well capacity is in excess of 100 Lps (1300 lpm)."⁷

2.1.1.2 Raw Water Quality

During the long term pump test, water samples were collected and submitted for laboratory analysis to characterize the raw water quality of the aquifer. The chemistry results indicated that the aquifer has a good water quality for membrane treatment. The chemistry results from the existing Town of Russell wells indicate that good water quality is consistent across the aquifer. The wells are considered to be installed in a confined aquifer and are not in an artesian condition as the previous production wells. The complete chemistry can be found in the Appendix.

Refer to Table 1.3 - Water Quality Results.

2.1.1.3 Raw Water Pipeline

The raw water pipeline was sized using 20-year projected water demand. The raw water pipeline has been constructed on highway and roadway Right-of-Ways (ROWs) as required. The pipeline route can be found in the Appendix.

The pipeline is 250 mm HDPE.

2.1.2 Water Treatment Plant

The Municipality of Russell Binscarth WTP is classified as a Class 3 Water Treatment Facility. The existing lime soda ash treatment system will be replaced with a 32.0 L/s Reverse Osmosis (RO) membrane unit. The proposed membrane filtration is effective in protecting against viruses and cysts such as *Cryptosporidium* oocysts and *Giardia lamblia* cysts as well as removing nitrates, TDS, iron, manganese, and softening the water to acceptable concentrations. The upgraded treatment system will supply the project 20-year population demand of the Municipality while treating water that meets the DWSA and GCDWQ.

The detailed design of the proposed WTP will be finalized when environmental approval has been received and funding has been secured.

The existing treatment system will be decommissioned once the new treatment system is fully operational and commissioned. The existing raw water line will be utilized to supply the new WTP. The old treatment equipment will be removed from the existing WTP building. Membrane concentrate accounts for 20-30% of the total raw water flow through the WTP. Using a 20% concentrate rate and a 10% by-pass rate through a pressure filter will result in an instantaneous raw water demand of 32 L/s. Figure 2.1 illustrates a schematic of the treatment process producing 26 L/s of treated water to satisfy the 20-year projected water demand.

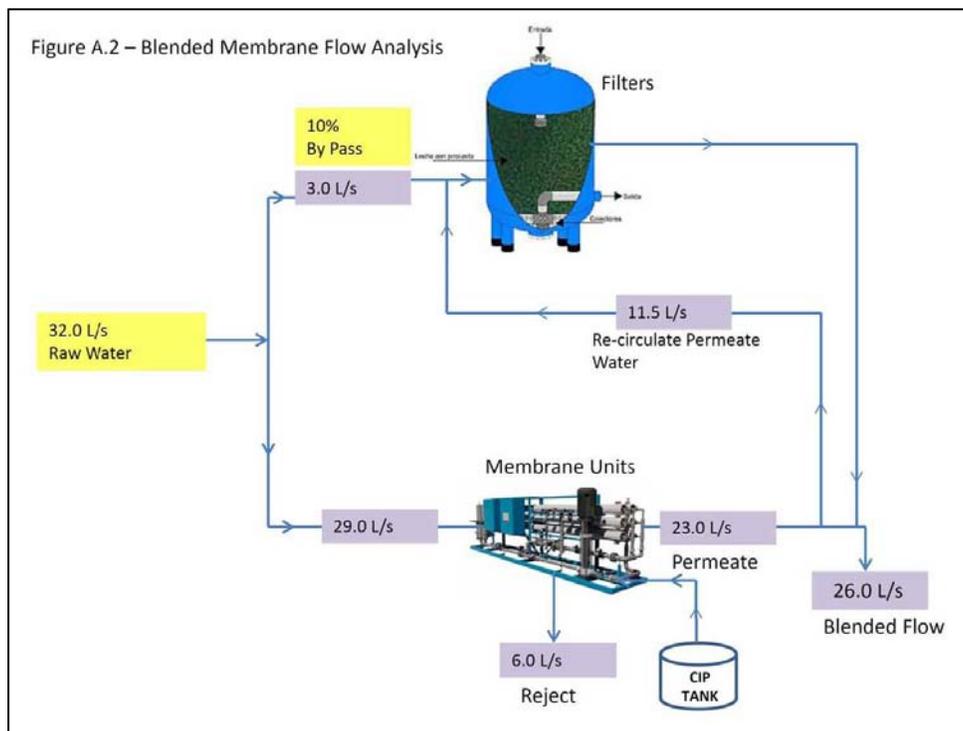


Figure 2.1 - Blended Membrane Flow Analysis

The membrane system will be designed to reduce hardness to a level acceptable to the community (generally less than 150 mg/L). Membrane systems remove a significant portion of the dissolved minerals. In order to achieve an aesthetically acceptable level of hardness, approximately 10% percent of the raw water flow will by-pass the membrane unit and receive treatment in a filter to be blended with membrane permeate. Membrane permeate is generally chemically unstable and benefits from the addition of filtered by-pass water or caustic soda to adjust the pH to a suitable level within the distribution system.

The existing Water Rights License (WRL) which is 250 cubic decameters is inadequate, thus the proposed WRL with 421 cubic decameters.

Table 2.1 - Project Total Raw Water Demand for the RO Unit

Demand	Units
32	L/s
421,000,000	L/year
421,000	cubic meters/year
421	cubic decameters/year

For design purposes, RO membrane system projections from ROSA Design software has been used to predict ion concentrations in the treated permeate, blended, and concentrate water. Raw water chemistry from the production well was used as input for the model. A detailed projected analysis is included in the Appendix.

2.1.3 Backwash and Concentrate Disposal

Membrane systems typically generate a mineralized concentrate stream. Concentrate streams vary between 10% to 30% of the total flow for membrane systems, depending on the arrangement and type of membranes selected. The proposed membrane system was modeled with an 80% recovery rate with an 20% concentrate rate of the flow through the membrane unit.

It is proposed that membrane concentrate be discharged to Spear Lake through a 200 mm diameter pipeline. Spear Lake is fed by Conjuring Creek.

According to Environment Act License No. 2738R, the wastewater treatment lagoon located in the northeast and southeast quarters of Section 4-21-28W in the RM of Russell with discharge of treated wastewater effluent south of the lagoon into a slough which drains into a tributary drain of the Silver Creek channel.

The methodology for determining the concentrate (reject water) pipeline route from the WTP RO membrane system is detailed in the following sections.

2.1.3.1 Reject Pipeline Route

Three reject pipeline route options were analyzed for the proposed new WTP for the regional system of the Municipality of Russell Binscarth. All options assume the WTP is located in the Town of Russell. Refer to the Appendix for drawings. The options are labelled on the drawings.

Option 1:

Option 1 is the preferred choice by the MWSB due to the ease of construction, the approval process, and environmental considerations.

The proposed route is as follows:

- Exit the north-west corner of the former Town of Russell.
- Follow Road 121N (which runs east-west) in highway/ road allowances or easements until reaching Road 166W (which runs north-south).
- Follow Road 166W until reaching Spear Lake at the south access for the Lake.

Option 2:

Option 2 is the preferred choice by the Municipality of Russell Binscarth due to the assumed existence of historical easements from when Russell's source of water was Spear Lake. The concept is to follow the path of the historical (and abandoned) raw water supply pipeline. However, a site visit to the municipal office in Russell on December 2, 2015 with a search through historical paper records yielded no results for historical easements. On December 7, 2015 with a careful search of Land Titles, online and phone conversations with Winnipeg and then Neepawa Land Title's staff, revealed only two documents. From the Neepawa office, Plan # 4956 (years 1964/65) and Plan # 4920 (years 1963/64), both show the limits of "Water Control Works" in Section-Township-Range 9-21-28W in the south-east quadrant. Plan # 4956 shows the area due east of Spear Lake along Conjuring Creek. Plan # 4920 shows the area due south of Spear Lake. Plan # 4920 is the relevant drawing and legal description for this proposed route.

The proposed route is as follows:

- Exit the north-west corner of the former Town of Russell.
- Follow Road 121N (which runs east-west) in highway/ road allowances or easements until reaching the finger or creek/stream feeding into Spear Lake on the south side. This is not Conjuring Creek.
- The pipeline will follow this finger or creek/stream (not along any road) until reaching a suitable exit point on Spear Lake.

Option 3:

Option 3 is the least preferred choice and is only presented if Option 1 and 2 are unavailable.

The proposed route is as follows:

- Exit the north-west corner of the former Town of Russell.
- Follow Highway 83 north in highway/ road allowances or easements until reaching a highway bridge over Conjuring Creek. This would be the discharge point for the pipeline. Conjuring Creek then runs west-bound until reaching Spear Lake.

The highway bridge has a hydrometric station from the Government of Canada, Environment Canada (EC). This information is available from the EC Wateroffice, historical hydrometric database. Station Name: "Conjuring Creek near Russell". Province: MB. Station Number: 05ME005. Latitude: 50-47'42" N. Longitude: 101-17'57" W. Gross Drainage Area (km squared): 70.4.

There are several reasons why this is not an ideal location. Conjuring Creek has a very low water level, as witnessed from a site visit that occurred on December 2, 2015. Beaver activity is also visible in this location, including under the highway bridge, and there is a history of beaver activity from discussions with Municipal officials and staff including Public Works. Furthermore, the farmer's fields in the surrounding area are quite low, and not much above the water level, especially on the north-west side of the creek. If this location was used, there is a high probability of flooding for the farmer's fields.

2.1.4 Operation and Maintenance

The Municipality is responsible for operation and maintenance of the raw water pipeline, well site, and WTP. Staff will be required to periodically inspect flushouts, air releases, etc... to ensure the system performance is maintained. In addition, an operator will be required to submit bi-weekly water samples for bacteriological testing in accordance with the Manitoba Drinking Water Quality Standards Regulation. Staff will read water meters on a quarterly basis and respond to maintenance issues related to the system.

The operators will be required to operate the facility in a safe and efficient manner in accordance with relevant operation manuals and DWSA. Operation requirements will include measurements, monitoring, sampling, testing, record-keeping, and reporting. Operators will be required to perform proper maintenance and inspection. The operators will receive training during the commissioning phase by the selected equipment supplier.

Typical operating costs include: chemicals, maintenance personnel salary, electricity costs, general repairs, water and bacteriological testing, staff certification and training, and a reserve fund for future replacement or expansion. Operating and maintenance costs are recovered through the sale of water in the distribution system.

2.1.5 Treated Water Pipeline

A 200 mm or 250 mm HDPE diameter pipeline of High Density Polyethylene (HDPE) or Poly Vinyl Chloride (PVC) will be installed to Binscarth in accordance with MWSB Standard Construction Specifications 2015. Installation will involve open cut trenches with horizontal drilling where required. The pipeline will be buried a minimum depth of 2.4 meters through roadway crossings. Excavated soil will be stock piled, adjacent to the work area, and then used as backfill. Ditches will be restored to original grades and seeded where required to prevent erosion.

Horizontal directional drilling will be in accordance with MWSB guidelines for watercourse crossings (refer to Appendix), MWSB Standard Construction Specifications 2015, and Department of Fisheries and Oceans (DFO) Operational Statements (OS). Pipeline crossings at drains will be directionally drilled, starting and ending outside of the riparian zone. Although stream crossings are usually directionally drilled, specifications permit dry intermittent drains to be crossed by open cut trenching according to MWSB Specifications and DFO OS - Isolated or Dry Open Cut Stream Crossings. All highway and roadway (PTH & PR) crossings will be directionally drilled and encased in accordance with Manitoba Infrastructure and Transportation (MIT) regulations.

Upon the completion of construction, the pipeline will be swabbed with multiple swabs until the pipeline is clean, pressure tested, and disinfected prior to commissioning the system in accordance with MWSB Specifications.

2.2 Certificate of Title

The wells will be located on municipal owned land in SE-16-21-27W. The Municipality of Russell Binscarth is in the process of acquiring title for the new well site.

The Russell WTP is on property owned by the Municipality of Russell Binscarth. The most logical location for the proposed new Russell WTP is on property adjacent to the existing WTP. However, currently this adjacent property is owned by Canadian Pacific Railway (CPR).

It is anticipated that easements will be required to facilitate the construction of the concentrate pipeline, though alternative routes are available.

It is proposed to locate the treated water pipeline to Binscarth within highway and roadway Right-of-Ways (ROWs) which are owned by the Crown. If necessary, private easements will be obtained to accommodate the pipeline installation.

2.3 Mineral Rights

All mineral rights associated with lands for the existing and proposed new facilities belong to the Crown.

2.4 Existing and Adjacent Land Use

The proposed land for the development will be on municipal and provincially owned land in highway and roadway Right-of-Ways (ROWs). Within the RM, adjacent land is agriculture. Within the Town, adjacent land is industrial, commercial, and residential. Existing and adjacent land use will not change as a result of this development.

2.5 Land Use Designation and Zoning

Refer to Section 2.4.

2.6 Agricultural and Livestock Water Use

The Public Water System (PWS) for the Municipality of Russell Binscarth was designed to include the former Town of Russell and the former Village of Binscarth. The assumption is that country residents of the RM are serviced by individual wells. Therefore, for this specific project and scope of work, the agricultural and livestock water use can be assumed to be negligible. Total water demands for "agricultural and livestock water use" can be estimated to be less than 5% of the gross water use.

2.7 Water Conservation Report

Water conservation measures include metering and pricing of water. Water conservation information in water bill mailings can be implemented. Leak detection will consist of comparing the volume of water pumped and charged to ratepayers on a quarterly basis. Since all service connections are metered, abnormalities can be identified and rectified.

2.8 Project Schedule

The development of this water project is anticipated to occur as a two-phase process. The project is tentatively scheduled to commence in 2017-2018 depending on the availability of funding and the receipt of all approvals.

2.9 Project Funding

This project is eligible for cost sharing between the Province of Manitoba and the Municipality of Russell Binscarth, subject to all approvals and the availability of funding.

2.10 Regulatory Approvals

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

- Manitoba Conservation and Water Stewardship
- Office of Drinking Water (ODW)
- Manitoba Infrastructure and Transportation (MIT)

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

2.11 Public Consultation

A public consultation will be held in the future to discuss the proposed WTP upgrade with the residents of the Municipality of Russell Binscarth as part of the Borrowing Bylaw. It is not expected that there will be major concerns forwarded to the Municipality regarding the upgrades, other than the cost of the proposed infrastructure.

3.0 Description of Existing Environment in the Project Area

3.1 Physiography

The Municipality of Russell Binscarth is located in western Manitoba, near the southwest corner of Riding Mountain National Park (RMNP).

W.L. Gibbons & Associates Inc. (WLG) report dated November 2014:

"Regional Setting:"

"Physiography:"

"The study area is located generally in T20 to 21, R27 to 28W which slopes southwest from Riding Mountain to the Assiniboine River Valley. The land surface varies from relatively flat upland areas with numerous sloughs and potholes to the steep slopes and incised gullies on the flanks of the Assiniboine River Valley and the Conjuring Creek Valley. The ground elevation in the uplands near Russell is on the order of 560 m. The base of the Assiniboine River Valley is at an elevation on the order of 410 m. Surface water drainage is towards the Assiniboine River Valley."⁶

3.2 Climate

There is a Government of Canada weather station located at Russell. Information available after October 1990. The climate ID/ station ID/ station number: 5012520. Latitude: 50-46'00.000" N. Longitude: 101-17'00.000" W. Elevation: 567.00 m.

There is a Government of Canada weather station located at Binscarth. Information available after October 2005. The climate ID/ station ID/ station number: 5010216. Latitude: 50-35'00.000" N. Longitude: 101-16'00.000" W. Elevation: 525.80 m.

In general, the western portion of Manitoba, north of Brandon and south of Riding Mountain National Park (RMNP), has weather patterns which is a mixture between Brandon and Dauphin. The western portion of Manitoba is also influenced by weather patterns blown eastbound from Saskatchewan. Historical average normal temperatures for the month of July are plus 25 degrees Celsius ranging to minus 25 degrees Celsius (without wind-chill) for the month of January. There is approximately 500 mm of precipitation (rain and snow) per year in this region.

3.3 Hydrogeology

W.L. Gibbons & Associates Inc. (WLG) report dated November 2014:

"Bedrock Geology/Hydrogeology:"⁶

"Bedrock in the study area occurs at depths ranging from 3 meters in the immediate area of the Town of Russell to in excess of 100 meters to the east and north east. The bedrock in the upland areas consists primarily of shales of the Odanah Member of the Riding Mountain Formation, underlain by the shales of the Millwood Member. Locally, the Odanah Member shales are fractured and domestic scale volumes of groundwater can be obtained from the bedrock. The Millwood Member shales are rarely fractured and are considered to be an aquitard."⁶

"To the east of the Town of Russell, the available evidence indicates that a deep buried valley has been eroded into the bedrock surface that generally follows the current orientation of Silver Creek. This buried valley has been subsequently infilled with sediments that include the sands and gravels which form the aquifer for the Towns current water supply."⁶

"Surficial Geology/Hydrogeology:"⁶

"The surficial geology of the region consists predominantly of a veneer of clay till with colluvium and alluvium in the river and creek valleys. The information from the past drilling of water wells in the study area has found that the stratigraphy at depth consists primarily of till with small layers of sands and gravels. Within the buried bedrock valley to the east of Russell, there is a thick sequence of sand and gravel deposits underlying the till and overlying the shale bedrock. This sand and gravel deposit is approximately 1 to 2 miles wide. Within the study area, the sand and gravel forms a continuous deposit from the north side of (T21-R27W) to the south side of (T20-R28W). The deposit extends to the north and south of the indicated limits. The existing Town of Russell supply wells withdraw water from this aquifer, and there have been two loading stations developed in it, one at SE21-21-27W and another at NE36-19-28W."⁶

3.4 Hydrology

There are numerous smaller "pothole" lakes surrounding Russell and Binscarth. Binscarth is approximately 20 km south of Russell. In this region, the Assiniboine River runs north-south, approximately 10 km west of Russell; the Manitoba-Saskatchewan border is 16 km west. The Shellmouth Reservoir along the Assiniboine River is approximately 20 km north-west of Russell.

The relevant waterbodies for this EAP is Conjuring Creek which runs into Spear Lake north-west of Russell.

There is a Government of Canada, Environment Canada (EC), hydrometric station located on "Conjuring Creek near Russell". Refer to Section 2.1.3.1, Reject Pipeline Route, Option 3.

Additionally, from an ArcGIS database for MWSB, Conjuring Creek is a "third order" drain.

There is a Government of Canada, Environment Canada (EC), hydrometric station located on Spear Lake. This information is available from the EC Wateroffice, historical hydrometric database. Station Name: "Spear Lake near Russell". Province: MB. Station Number: 05ME803. Latitude: 50-47'59" N. Longitude: 101-19'33" W. Gross Drainage Area (km squared): 77.4.

3.5 Fish and Fish Habitat

There is a contour map available for the depth of water on Spear Lake. Refer to the Appendix. This is from the Fish and Lake Improvement Program for the Parkland Region (FLIPPR). From this source: Maximum Depth: 4 meters (17 feet). Surface Area: 0.83 km squared or 205 Acres (90 Hectares). Thermocline: Nil. (Entire lake turns over on windy days.)

From the FLIPPR source:

"Spear Lake is a multi-species water body located just north-west of Russell, Manitoba. It contains rainbow and brown trout, walleyes and a few yellow perch."²

Lakes are classified according to their trophic status which is "productivity". Trophic state is generally indicated by three key parameters:

- Secchi disk visibility is a measure of water transparency, as indicated by the depth that light can penetrate the water.
- Total phosphorus concentration: phosphorus is the primary limiting nutrient in most North American fresh waters.
- 'Chlorophyll a' concentration: a measure of algal abundance.

Table 3.1 - EPA-NES Trophic State Delineation (1974)

Trophic State	Secchi Disk Depth (m)	'Chlorophyll a' (µg/L)	Total Phosphorus (mg/L)
Oligotrophic	>3.7	<7	<0.010
Mesotrophic	2.0-3.7	7-12	0.010-0.020
Eutrophic	<2.0	>12	>0.020

From the FLIPPR source: "Secchi: Variable according to algae content. 2.1 meter (7 feet) maximum."² Referencing Table 3.1, Spear Lake can be classified as "Mesotrophic" which translates to "intermediate productivity".

3.6 Habitat, Vegetation and Wildlife

Depending on the information source and nomenclature, the terrestrial environment (ecozone) of western Manitoba south of Riding Mountain National Park (RMNP) is called either "Prairies" or "Aspen Parkland". RMNP is part of an area of land called "Boreal Plains" or "Boreal Forest" and occasionally "Western Uplands". We will consider the Municipality of Russell Binscarth as "Aspen Parkland".

From the website for the "World Wildlife Federation" (.org), the following is available about this ecozone:

"Canadian Aspen Forests and Parklands:"⁹

"Status: Critical/ Endangered"⁹

"This ecoregion is classified primarily as having a subhumid low boreal ecoclimate, which distinguishes this ecoregion from the warmer, drier areas to the south and the cooler boreal forests to the north. It also has a transitional grassland ecoclimate. Summers are short and warm, and winters are cold and long. The Peace River Lowland area of the region generally represents the coolest temperatures for each range, while the Southwest Manitoba Uplands region represents the warmest temperatures."⁹

"Much of the region is underlain by Cretaceous shale, and covered by undulating to kettled, calcareous, glacial till with significant areas of level lacustrine, and hummocky to ridged fluvio-glacial deposits. Associated with the rougher hummocky glacial till are a large number of small lakes, ponds and sloughs occupying shallow depressions."⁹

"Description:"⁹

"Biological Distinctiveness:"⁹

"Vegetation in this ecoregion is characterized by a cover of quaking aspen (*Populus tremuloides*) with secondary quantities of balsam poplar (*P. balsamifera*), together with an understory of mixed herbs and tall shrubs. White spruce (*Picea glauca*) and balsam fir (*Abies balsamea*) are the climax species, but are not well represented because of fires. Jack pine (*Pinus banksiana*) stands may be present on drier, sandy sites. Poorly drained sites are usually covered with sedges (*Carex spp.*), willow (*Salix spp.*), some black spruce (*P. mariana*), and tamarack (*Larix laricina*). In the Turtle Mountain and Spruce Woods areas (TEC 163, 164), quaking aspen dominates with secondary quantities of balsam poplar, although white spruce and balsam fir are the climax species if fires do not occur frequently (ESWG 1995)."⁹

"Characteristic wildlife include moose (*Alces alces*), white-tailed deer (*Odocoileus virginianus*), black bear (*Ursus americanus*), wolf (*Canis lupus*), beaver (*Castor canadensis*), coyote (*Canis latrans*), marten (*Martes americana*), mink (*Mustela vison*), red fox (*Vulpes vulpes*), snowshoe hare (*Lepus americanus*), northern pocket gopher (*Thomomys talpoides*), Franklin's ground squirrel (*Citellus franklinii*), sharp-tailed grouse (*Tympahuchus phasianellus*), ruffed grouse (*Bonasa umbellus*), black-billed magpie (*Pica pica*), cormorant (*Phalacrocorax spp.*), gull (*Larus spp.*), tern (*Sterna spp.*), American white pelican (*Pelecanus erythrorhynchos*) and many neotropical migrant bird species (ESWG 1995)."⁹

"Of ecological significance, the Aspen Parkland and Forests ecoregion represents the most extensive boreal-grassland transition in the world. This ecoregion contains the northernmost breeding distribution for many warbler species (*Parulinae*) and has some of the most productive and extensive waterfowl breeding habitat on the continent. White-tailed and black-tailed deer (*Odocoileus virginianus* and *O. hemionus*) reach their northern continental limit here."⁹

The Government of Manitoba has information and detailed records on Manitoba's animals and plant communities at risk (Species-At-Risk (SAR)), together with their known location, maintained by the Manitoba Conservation Data Centre. There is an "ecoregion search" within this database. For this ecoregion, there is a long list of recognized plants and animals. However, without an in-situ (field) biological survey of the target area, there is no scientific and quantifiable method of determining what species are actually in the target area for this project.

3.7 Socioeconomic

The Municipality of Russell Binscarth is a mixture of rural living (town, village, and country), agricultural, and tourism including recreational fishing and hunting.

This Environment Act Proposal (EAP) is to expand and upgrade the Public Water System (PWS). This work will ensure the long-term supply of potable water. This is necessary to ensure the continued socio-economic sustainability and growth of these communities. There are no public safety and human health risks associated with this project. In fact, this project mitigates risks through the provision of quality water.

3.8 Parks

The nearest provincial and federal parks are located outside the environmental impact area of this project. The nearest federal park is Riding Mountain National Park (RMNP) which is north-east. The nearest provincial park is Assiniboine Provincial Park located by the Shellmouth Reservoir of the Assiniboine River, described earlier in Section 3.4. The second nearest provincial park is Duck Mountain Provincial Park which is north of RMNP. Please refer to the maps in the Appendix.

3.9 Heritage Resources

No heritage resources will be disturbed since the various components of this water expansion and upgrading project will occur on previously disturbed land such as Municipal property, highway/ roadway allowances or easements, etc...

3.10 Aboriginal Communities

Regarding First Nation (FN) communities in the area, within Manitoba the two closest communities is Gambler FN which is approximately five (5) miles west of the former Village of Binscarth, and Waywayseecappo FN closer to Rosburn and Highway 45. Gambler and Wayway are the most relevant FNs for this project. Outside the immediate territory, there is also Keeseekoowenin FN and the Birdtail Sioux FN. Gambler, Wayway, Keesee, and Birdtail all are located in Treaty # 2 land. The FNs north of Riding Mountain National Park (RMNP) do not influence this project. The FNs in the Province of Saskatchewan do not influence this project. Manitoba has a large Metis population. Metis are considered Aboriginal under Section 35 of the Constitution Act of Canada (1982) along with Indian and Inuit. There are no recognized Metis communities in western Manitoba, according to the Department of Aboriginal and Northern Affairs (ANA) for the Government of Manitoba.

4.0 Description of Environmental and Human Health Effects of the Proposed Development

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 and transportation equipment and there will be gaseous and particulate emissions from the construction equipment. Any effects would be localized, temporary and insignificant. During the development, there will be no pollutants released to the air besides the ones discussed previously.

4.2 Soils

During construction, there is a risk of fuel or lubricant spills from heavy equipment and vehicle operation. The storage of fuel or lubricants within the area of the construction site will not be allowed. Therefore, the potential spills will be very small in size and standard spill clean-up equipment and 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 volumes and the use of established routes to access the locations. 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 Habitat and Fisheries

Minor and short-term impacts on surface water may occur as a result of construction activity in highway and roadway allowances and 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. Horizontal directional drilling will be conducted to install pipelines at waterway crossings and discharge outlets. This will eliminate excavation within the riparian zone and minimize impacts. There is potential for some loss of drilling mud to the surface water. Impacts to fish habitat and fisheries are assessed to be minor.

Regarding Spear Lake, surface water will not be affected since the discharge is carefully controlled through piping and a discharge point. Fisheries will not be affected in Spear Lake since this is a human-altered and human-controlled lake as demonstrated by the year-round aeration within the lake and the stocking of fish. (From a site visit that occurred on December 2, 2015 there were discussions with Municipal officials and staff including Public Works and MWSB staff was told that Spear Lake has year-round aeration.)

Water quality samples and chemistries were taken from Spear Lake, the waterway to be used for the concentrate (RO reject water) disposal. The results were analyzed and impacts to fish habitat and fisheries were assessed to be negligible.

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. The proposed activities are unlikely to result in adverse effects to water quality. Nevertheless, the potential still exists and monitoring of the raw water quality will be required to identify any such adverse effects and allow the appropriate adjustments in the operation to the system after construction.

4.5 Groundwater Levels

A new Water Rights License (WRL) will be applied for the new production wells (raw water source) for the Municipality of Russell Binscarth. The available information indicates that the proposed withdrawal of groundwater is unlikely to result in adverse changes to groundwater levels. Nevertheless, the potential still exists and monitoring will be required.

Groundwater will be extracted through the Water Rights License for the wells supplying the regional system for the Municipality of Russell Binscarth. This groundwater has been studied in several reports most notably through W.L. Gibbons & Associates Inc. (WLG) reports from Steve Wiecek. This groundwater pumping is sustainable.

Other groundwater will not be affected.

4.6 Vegetation

Construction will occur primarily within Right-of-Ways (ROWs) 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, and the amount of vegetation disturbance is expected to be minimal.

During operation, monitoring and maintenance activities will be restricted to designated and previously disturbed areas. Potential effects to vegetation are considered to be negligible.

Forestry resources will not be impacted in short-term or long-term.

4.7 Wildlife Habitat

The construction and operation activities associated with this project will be limited to areas already developed for agriculture, industrial, commercial, or residential or hydro utilities. The potential adverse effects of wildlife habitat loss are assessed to be negligible to minor.

There will be negligible to minimal short-term impacts on wildlife and no long-term impacts.

4.8 Noise and Vibration

During construction, there will be several sources of sound emissions including construction equipment and vehicles. The types of noises heard due to construction are dominated by engines. However, miscellaneous short-term noises (i.e. dump truck gates, back hoe buckets, etc...) are often heard. The noise will be in addition to the regular community and highway activities. The effects are assessed to be minor.

4.9 Heritage Resources

No heritage resources will be disturbed since the various components of this project will occur on previously disturbed land such as Municipal property, highway/ roadway allowances or easements, etc...

4.10 Employment/Economy

Socio-economic implications are not expected as a result of the environmental impacts as the impacts are considered minor and short-term. Some economic implications may exist for the Town and RM due to the financial costs of development. However, the Town and RM will have a sustainable potable water supply to meet future demands. There will be some local economic benefit during construction. The proposed project will address limited treatment capacity at Russell and water quality at Binscarth. The potential effects of the project on employment and the economy are assessed to be positive.

There are no expected negative socio-economic implications resulting from this proposed project. In fact, there will be positive socio-economic implications since this project is necessary to ensure the continued socio-economic sustainability and growth of the communities.

4.11 Human Health and Well-being

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

The project will result in the construction of pipelines designed and operated to produce a treated water supply to meet current water quality standards. This will produce a higher standard of living. The effects on human health and well-being are considered positive.

There is no public safety and human health risks associated with this project. In fact, this project mitigates risks through the provision of quality water.

4.12 Climate Change

It is predicted there will be no impacts to the climate as a result of these project activities.

Climate change implications due to this project can be classified as negligible.

5.0 Mitigation Measures and Residual Environment Effects

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

The construction and installation of water supply pipelines and concentrate (RO reject water) pipelines will be in accordance with standard industry practices and the General and Special Conditions from the Manitoba Water Services Board (MWSB), which have been specifically designed to mitigate the risks involved with these activities. The pipelines will be constructed by open-trenching, directional drilling, or a combination of both techniques depending on the location.

The work shall be designed by a Professional Engineer registered in Manitoba and shall be in general conformance to the Ten State Standards, Canadian Standards Association (CSA), American Water Works Association (AWWA), and provincial regulatory standards and guidelines.

The protection of the environment and human health will remain a key priority throughout all phases of this project.

5.1 Air Quality

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

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

Water spraying is an important, common and practical procedure that would be applied as required to alleviate potential dust problems.

Burning of shrubs etc... will only occur on days and times where wind conditions are favorable. Burning could be limited to days permitted for burning according to the Manitoba Crop Residual Burning Program.

5.2 Soils

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

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.

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

5.3 Surface Water, Fish Habitat and Fisheries

Mitigation of surface water issues may be achieved by limiting open cut trenching to 30m from sensitive areas and providing erosion control practices as required.

The same procedures for petroleum products (fuel or lubricants) will be applied to water as with soil.

Fisheries impacts will be minimized by implementing practices to reduce soil and contaminate runoff. The proponent will work with provincial officials should any concerns arise.

Regarding Spear Lake, the proponent will conduct long-term monitoring of Spear Lake to verify impacts on water quality.

5.4 Groundwater Quality

Groundwater is primarily protected by the natural hydrogeology in the area. Mitigation of potential groundwater impacts from petroleum products was described in earlier sections. Groundwater monitoring will be performed as required to address potential issues associated with groundwater quality.

The recommended water quality sampling program consists of quarterly sampling of groundwater for the first year of operation. Following this initial year of sampling, the recommended frequency is at minimum annually. The laboratory analyses should include hardness, alkalinity, Total Dissolved Solids (TDS), electrical conductivity, major cations and anions (calcium, sodium, magnesium, hydrogen carbonate, sulfate, chloride), dissolved metals (including arsenic), and iron and manganese. The samples should be collected at a designated location on the raw water side of the water treatment system using sample bottles and methods in accordance with the laboratory instructions. This sampling is separate from any routine sampling program required as part of the operation from the WTP.

5.5 Groundwater Levels

The availability of groundwater usage for this proposal and potential future users will be assessed through the Water Rights Act Licensing process. Groundwater monitoring will be performed as required to address potential issues associated with groundwater levels.

The recommended groundwater level monitoring program would include the use of several monitoring wells at locations owned by the RM or Province. The monitoring well should be equipped with a continuous groundwater level monitoring device such as a digital pressure transducer capable of recording groundwater levels on at least a daily basis. The information would be downloaded on a regular basis (typically quarterly) and input into a suitable database capable of generating charts of water level trends over time.

5.6 Vegetation

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

5.7 Wildlife Habitat

Impacts to wildlife habitat can be limited by minimizing the area of construction, vegetation and soil disturbance.

5.8 Noise and Vibration

Noise disturbance will be limited by use of mufflers on equipment and vehicles, limiting idling, and minimizing the construction area.

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.

5.9 Heritage Resources

If by chance, heritage resources are found in an unexpected area, work will be stopped to assess the situation and the relevant authorities will be contacted.

5.10 Employment/Economy

MWSB works closely with the local community in the development of projects; as such, this should mitigate any unwanted socio-economic effects.

5.11 Human Health and Well-being

All Federal, Provincial, and Municipal acts and regulations and guidelines will be followed.

5.12 Climate Change

Mitigation for climate change is encapsulated within the other mitigation measures.

6.0 Follow-up Plans including Monitoring and Reporting

In the future, there will have to be a "Permit to Construct or Alter a Public Water System" under the Drinking Water Safety Act (DWSA), submitted to the Office of Drinking Water (ODW), which is part of Manitoba Conservation and Water Stewardship. Also, there will have to be an Operating License for the new regional system including the new Water Treatment Plant (WTP) in Russell.

7.0 Conclusions

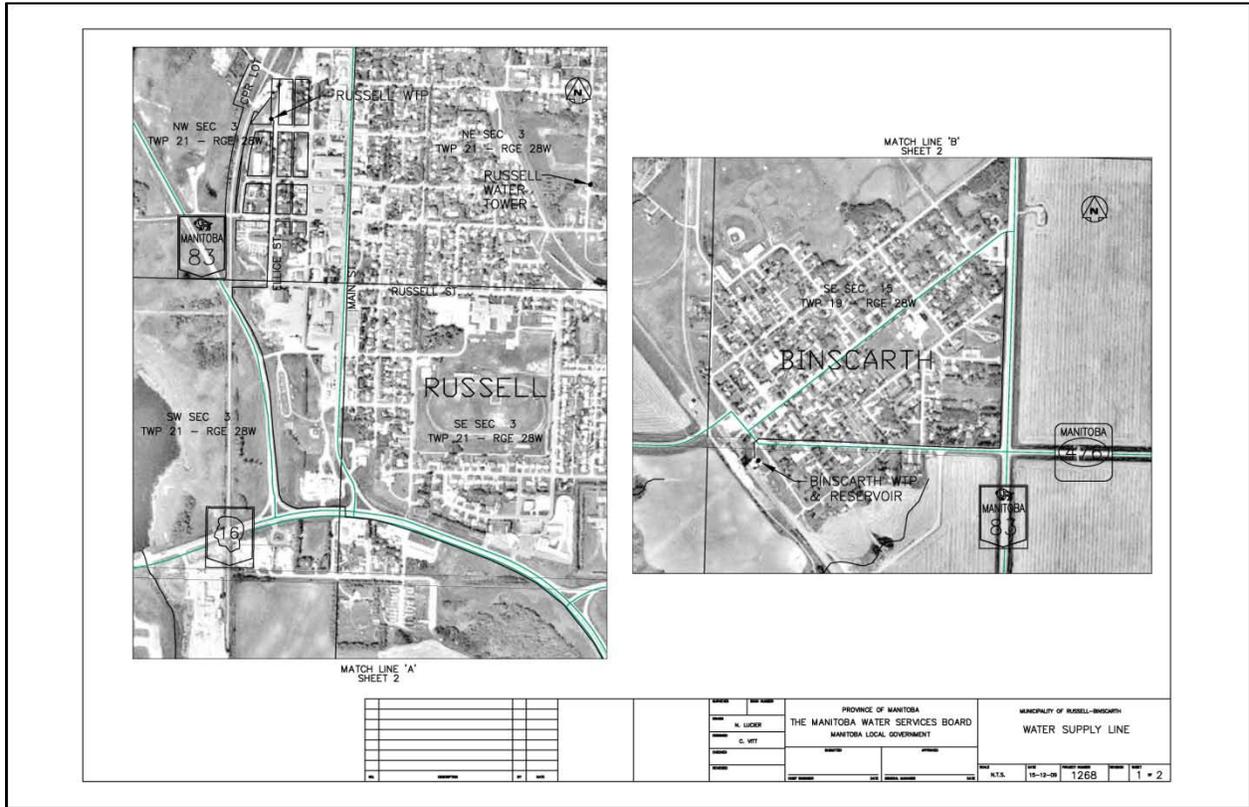
In conclusion, this Environment Act Proposal for a Class 2 Development License under the Manitoba Environment Act for an upgrade of the Municipality of Russell Binscarth Public Water System (PWS) has demonstrated that this proposed Work meets or exceeds regulatory requirements and is environmentally responsible.

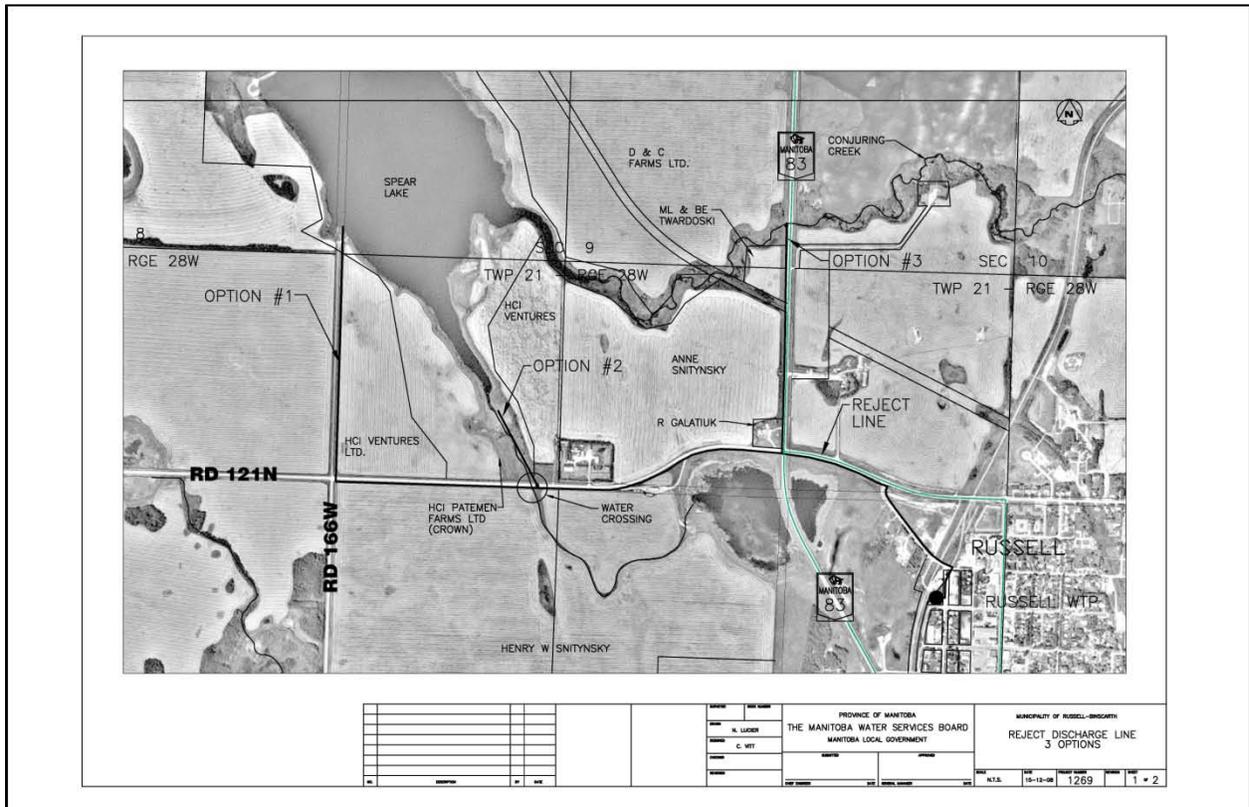
8.0 References

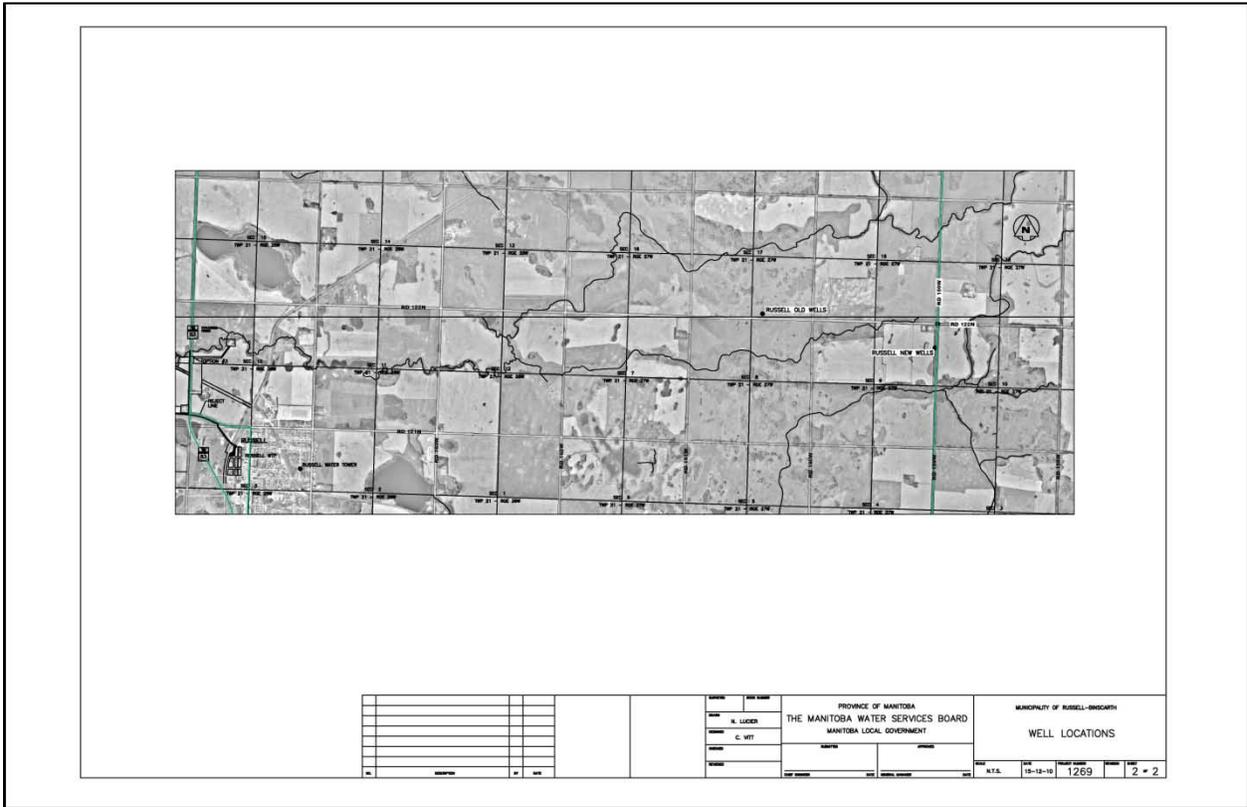
1. Bullee Consulting Ltd., March 2009, Town of Russell, Waterworks System Assessment, Bullee from Saskatoon, Saskatchewan.
2. FLIPPR, 20/11/2015, Fish and Lake Improvement Program for the Parkland Region (FLIPPR), Spear Lake:
<http://www.flippr.ca/l-spear.shtml>
3. MWSB, Nathan Wittmeier, February 2014, Binscarth, Water Treatment Plant Upgrading Study.
4. MWSB, Nathan Wittmeier, February 2015, Municipality of Russell-Binscarth, Treated Water Supply Study.
5. W.L. Gibbons & Associates, Steve Wiecek, August 2014, Town of Russell, Water Supply Assessment, Report on Investigation Results, File: 08-197.
6. W.L. Gibbons & Associates, Steve Wiecek, November 2014, Town of Russell, Groundwater Supply Assessment Study.
7. W.L. Gibbons & Associates, Steve Wiecek, October 2015, Municipality of Russell-Binscarth, Water Supply Upgrades, Summary Report of Pumping Well Installations, File: 08-197.
8. WSP, Bill Brant, April 2015, Technical Memorandum #1, Municipality of Russell-Binscarth, Water Supply Upgrading Project, Project #151-03520-00.
9. WWF (org), 30/11/2015, World Wildlife Fund or World Wide Fund for Nature (WWF), Ecoregion: Canadian Aspen Forests and Parklands:
<http://www.worldwildlife.org/ecoregions/na0802>

9.0 Appendix

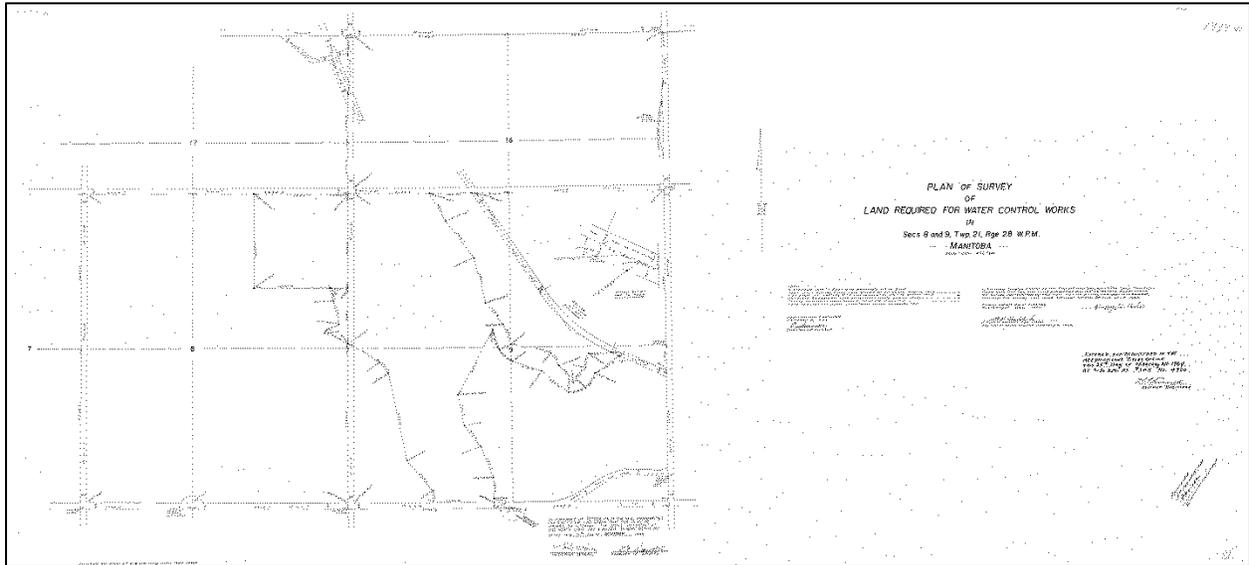
9.1 Appendix A - Pipeline Route Drawings







9.2 Appendix B - Old Legal Survey Drawings (#4920 & #4956)



9.3 Appendix C - License to Construct Well

FORM E

Application for Licence to Construct a Well and Divert Groundwater

Water Stewardship Division
 Water Use Licensing Section
 200 Saulteaux Crescent
 Winnipeg MB R3J 3W3



Pursuant to *The Water Rights Act*

APPLICANT'S NAME: Municipality of Russell - Binscarth		CONTACT NAME: Walter Melnyk, CAO		PHONE: (204) 773-2253
POST OFFICE ADDRESS: Box 10				MOBILE:
CITY or TOWN: Russell	PROV: MB	POSTAL CODE: R0J 1W0	E-MAIL ADDRESS: town@russellmb.ca	

hereby applies for authority to construct a water well(s) on the following described land(s):

SE	16	21	27	W
QUARTER	SECTION	TOWNSHIP	RANGE	E OR W

or otherwise described as _____
 and divert groundwater for Municipal
 (municipal, agricultural, industrial, irrigation, other uses)
 use purposes on the following described land:

QUARTER	SECTION	TOWNSHIP	RANGE	E OR W
---------	---------	----------	-------	--------

or otherwise described as Municipality of Russell - Binscarth Water Supply System

at the following rates:

0.032 _____ cubic metres per second (pumping rate)
 _____ cubic decametres per day (daily usage)
 421 _____ cubic decametres per year (annual usage)

Total number of acres to be irrigated: _____ (if applicable)

The above described lands are held as follows: (check applicable box)

as registered owner purchased under agreement for sale lessee to be determined

Attach copy(s) of the certificate(s) of title or title number(s).

Is this application for the renewal of an existing licence? YES NO Existing Licence No. _____
 Is this application for the transfer of an existing licence? YES NO Existing Licence No. _____
 Is this application to amend an existing licence? YES NO Existing Licence No. _____

Date: April 6 _____ 20 15 _____

(Signature of applicant) _____

**** IMPORTANT ****

FEE OF \$100.00 MUST ACCOMPANY THIS APPLICATION, CHEQUE AND APPLICATION MUST BE MAILED TO:

MANITOBA CONSERVATION
 CASHIER'S OFFICE
 BOX 42, 200 SAULTEAUX CRESCENT
 WINNIPEG MB R3J 3W3

CHEQUES TO BE MADE PAYABLE TO MINISTER OF FINANCE

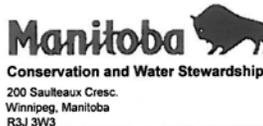
FOR OFFICE USE ONLY:

MG-14843
2013-11-30

9.4 Appendix D - Existing Water Rights License (#2007-022)

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.: **2007-022**
(Previous Lic. No.: 85-16)
U.T.M.: Zone 14 345754 E
5630429 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 Russell** 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:

the Southeast Quarter of Section 17, in Township 21 and Range 27, West of the Principal Meridian in Manitoba, more particularly described on Certificate of Title No. 1650415 NLTO,

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

Section 3, in Township 21 and Range 28, West of the Principal Meridian in Manitoba.

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 **0.011 cubic metres per second (0.4 cubic feet per second)** .
b) The total quantity of water diverted in any one year shall not exceed **250 cubic decametres (202.68 acre feet)** .
4. 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.
5. 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.
6. 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, Infrastructure and Operations Division, for cancellation on behalf of the Minister.
7. 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.
8. 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 10, Russell, MB, R0J 1W0, Canada** and thereafter this Licence shall be determined to be at an end.
9. 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.
10. The term of this Licence shall be **five (5) years** 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.
11. 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.
12. The LICENSEE shall keep records of daily and annual water use and shall provide a copy of such records to the Executive Director, Infrastructure and Operations Division, not later than February 1st of the following year.

Page 1 of 2

13. A flow meter must be installed, positioned to accurately measure instantaneous pumping rate and accumulative withdrawals from the water source.
14. 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 issuance of the original Licence (No. 85-16), and which are partly or wholly attributable, in the opinion of the Minister, to the diversion of water as authorized by this Licence.
15. 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_____.

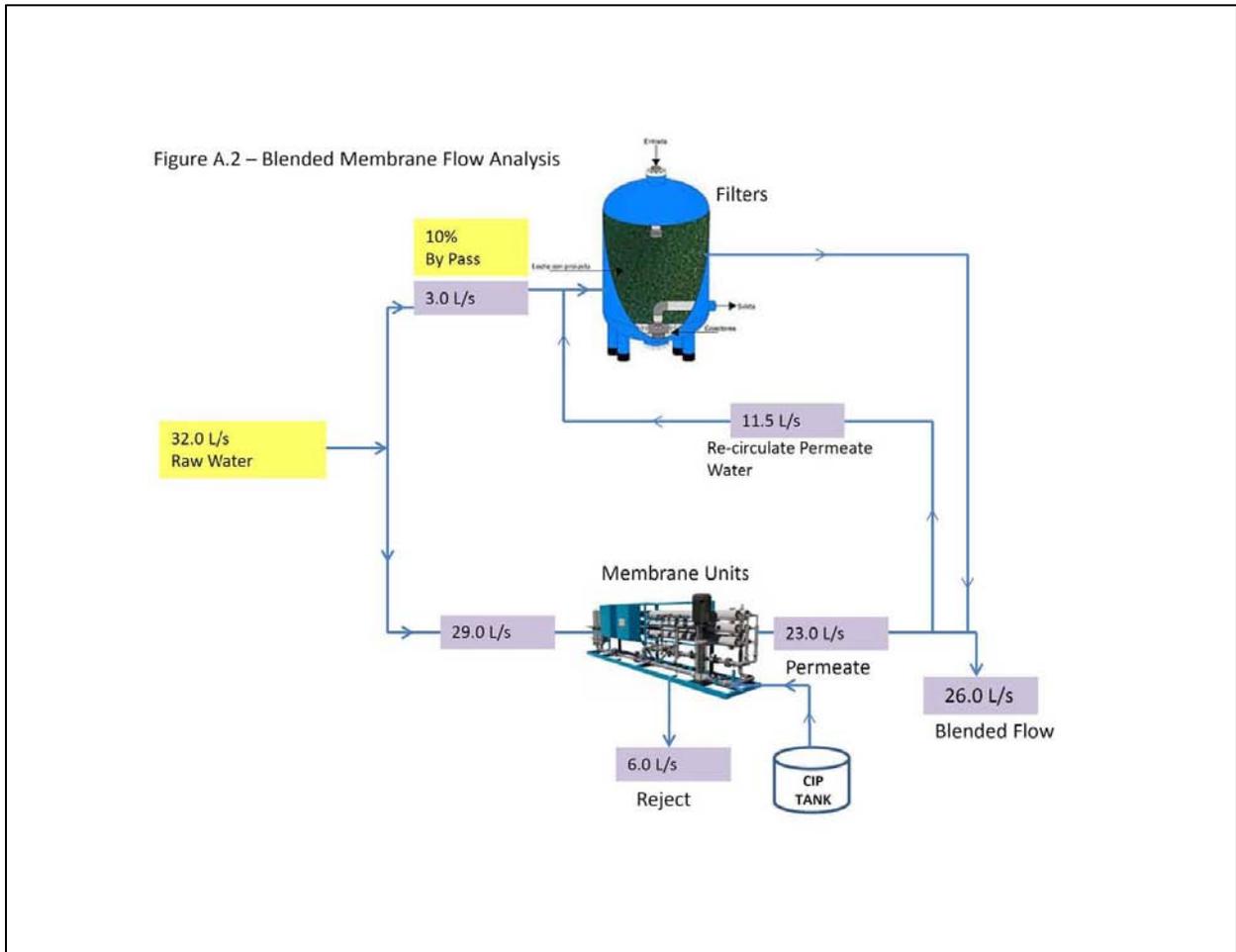
_____) _____
A COMMISSIONER FOR OATHS Witness
in and for the Province of Manitoba

My Commission expires _____

FOR OFFICE USE ONLY
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)

9.5 Appendix E - Blended Membrane Flow Analysis



9.6 Appendix F - FLIPPR Spear Lake Fishing Maps

20/11/2015

FLIPPR



Fish and Lake Improvement Program
for the Parkland Region

World Class Trout Fishery in Manitoba's Parkland

~ on the fly ~



About FLIPPER

The Lakes

Trout Festival

Fly Patterns

Tackle /
Equipment

Videos

Articles

Links

Spear Lake

Spear Lake is a multi-species water body located just north-west of Russell, Manitoba. It contains rainbow and brown trout, walleyes and a few yellow perch. Camping and campfires are permitted. Power is available for charging batteries. Electric motors are allowed and there's no need to dismount your outboard. Just tip it up.

Several hotels and B&Bs are located in and nearby the town of Russell.

Directions:



Spear Lake is located at: N50 47' 58.54" W101 19' 37.34"

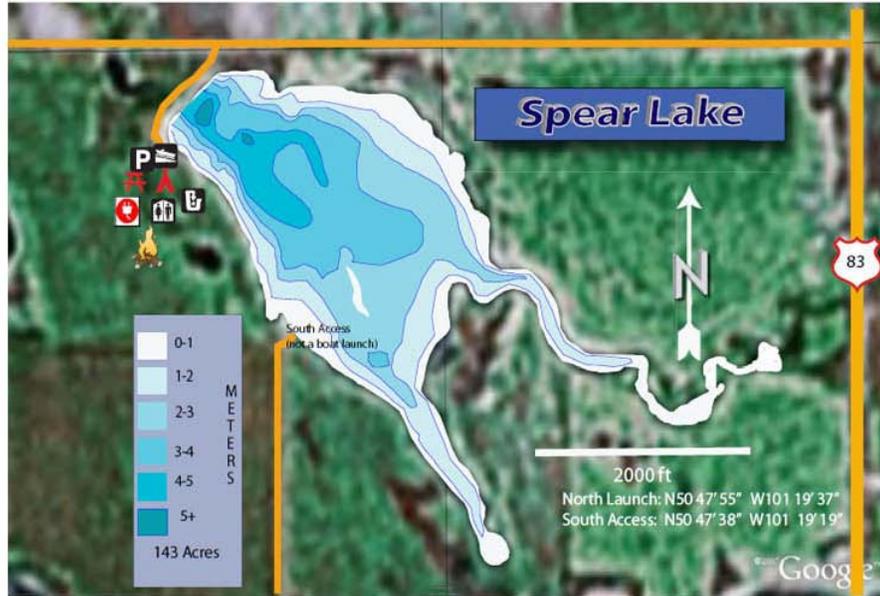
<http://www.flippr.ca/l-spear.shtml>

1/2

20/11/2015

FLIPPR

Click here to download the [Lake Contour/Information Map.PDF](#) for Spear Lake



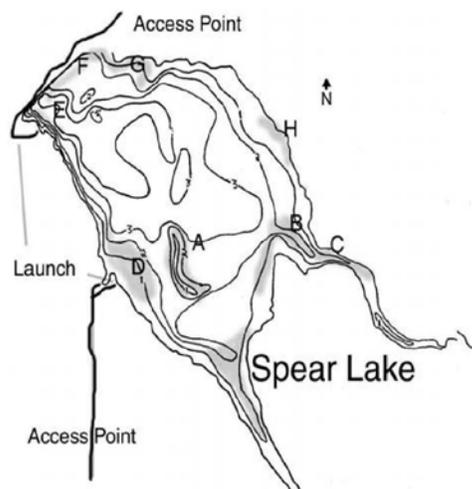
[Download the PDF](#)

Contact FLIPPR Email: FLIPPR@flippr.ca - or - Mail Box 368, Russell, MB R0J 1W0

<http://www.flippr.ca/spear.s.html>

22

Spear Lake



LOCATION:

1 mile North of Russell and one mile west.
Look for sign on Highway 83.

MORPHOLOGY:

Max. Depth: 4 metres - 17 feet.

Surface Area: 205 Acres - 90 Hectares

Secchi: Variable according to algae content.
2.1m - 7 ft max.

Thermocline: Nil. Entire lake turns over on windy days

Spear is no pushover. It can be cranky. On windy days it can be outrightly nasty.

Spear has recovered naturally from an encroachment of yellow perch, further helped by annual transfers

STARTING AREAS:

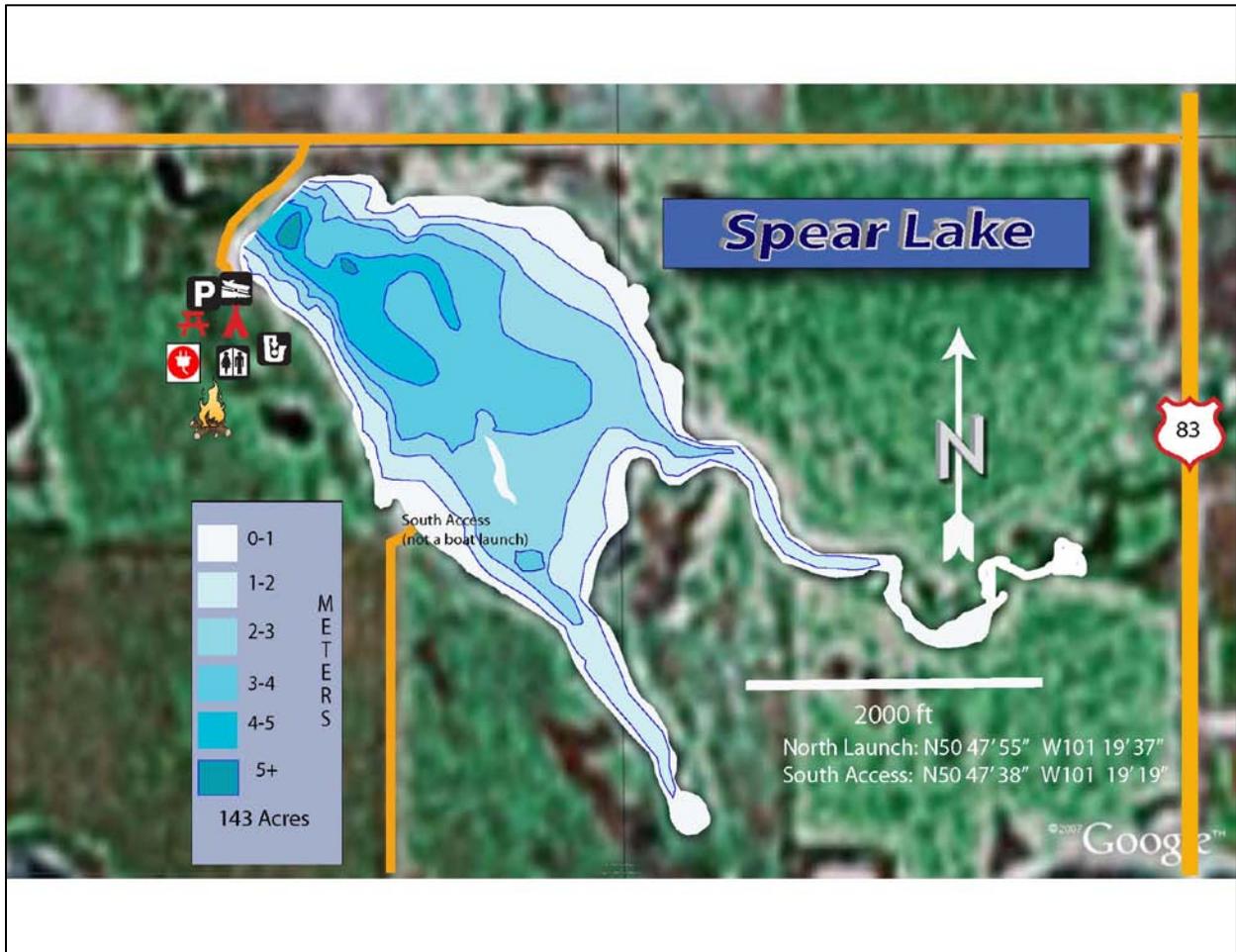
- A - The sunken island regularly hosts the largest fish. In summer the cupules along its weed edges are the feed table. In spring and fall, when weeds are down, the flanks become an excellent concentrator that must be covered every few hours.
- B - Mouth of the creek. A very broad flat that concentrates unbelievable numbers of feeding trout.
- C - The creek. A moderate current attracts minnows and offers the last deep water prior to entering the creek. Best in water flows but can be good any time. The largest trout are often taken here.
- D - Weed edges along a flat. Trout gather primarily to feed on snails and daphnia.
- E - The launch. What can we say? The best place in the lake is often right at one's toes. A gravelled area that hosts spawning activity in early spring, but a smorgasbord of forage year round. Fish from deep to shallow.
- F - The rip rap. Boulders attract forage. Forage attracts trout, especially when it lies adjacent to the deepest, coolest water in the lake. When minnows stack, this is the hotspot. We often hunker on the rock, break up our outlines and cast from shore.
- G - Weeds, beaches and flats. An excellent wading area. A point truncates the zone and offers some excellent fishing. Bulrushes and sedge grasses attract forage at any time, but this is a hotspot during the annual damsel hatches.
- H - Watch for cupules, (dished structures that go back into the weeds or even as far as shore). Work them. Trout pin minnows in them and then predate them. These are areas they love to pin perch fry and further reduce their population

STARTING PATTERNS:

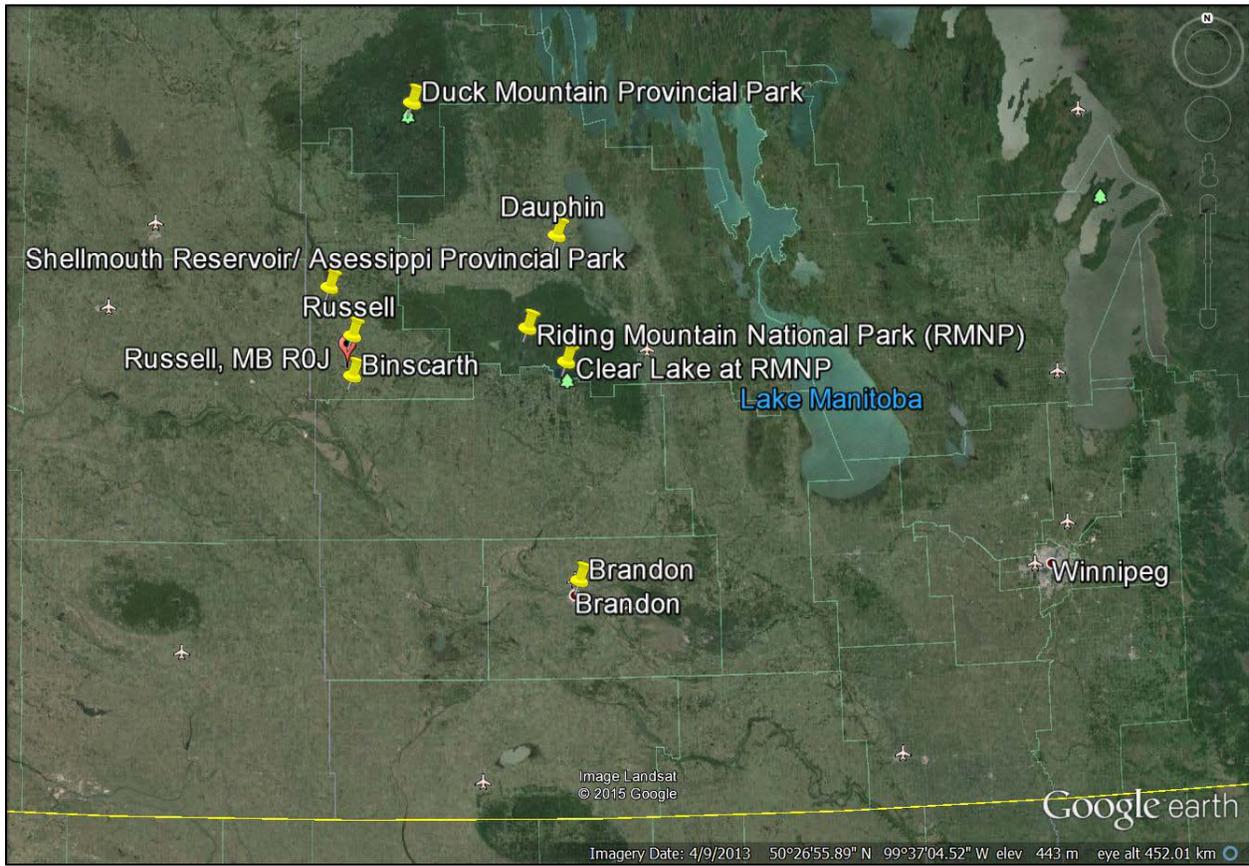
Caddis dries and emergers. Some great dry fly action can be had during the spring hatch of small black caddis.

Olive and black Woolly Buggers, Bead-head Beaver and Tans, Copper Coachmen, Crystal P-Quads, Psychedelic P-Q uads, backswimmer and scud patterns.

In the autumn when trout feed directly on daphnia we fish a rusty-pink Woolly Bugger we are ashamed to show to anyone.



9.7 Appendix G - Nearby Parks Map



9.8 Appendix H - Russell Water Chemistry



Town of Russell - Water Treatment Plant
ATTN: STEVEN SMITH
Russel Water Plant
Box 10
Russell MB R0J 1W0

Date Received: 08-AUG-13
Report Date: 13-AUG-13 15:27 (MT)
Version: FINAL

Client Phone: 204-773-2253

Certificate of Analysis

Lab Work Order #: L1344556
Project P.O. #: NOT SUBMITTED
Job Reference: RUSSELL - PWS 189.00
C of C Numbers:
Legal Site Desc: 17511

Lisa Page
Account 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
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Environmental

www.alsglobal.com

RIGHT SOLUTIONS RIGHT PARTNER

ALS ID		L1344556-1		L1344556-2	
Sampled Date		07-AUG-13		07-AUG-13	
Sampled Time		14:00		14:00	
Sample ID		RUSSELL 1-RAW		RUSSELL 2-TREATED	
Analyte	Unit	Guide Limit #1	Guide Limit #2		
Colour, True	CU	15	-	<5.0	<5.0
Conductivity	umhos/cm	-	-	1120	679
Hardness (as CaCO3)	mg/L	-	-	601	159
Langelier Index (4 C)	No Unit	-	-	0.47	-0.35
Langelier Index (60 C)	No Unit	-	-	1.2	0.41
pH	pH units	6.5-8.5	-	7.39	8.09
Total Dissolved Solids	mg/L	500	-	813	468
Transmittance, UV (254 nm)	% T	-	-	88.3	94.9
Turbidity	NTU	-	-	38.3	0.39

Federal Guidelines for Canadian Drinking Water Quality (AUG, 2012)
 #1: GCDWQ - Aesthetic Objective
 #2: GCDWQ - Maximum Acceptable Concentrations (MACs)

Anions and Nutrients (WATER)

ALS ID		L1344556-1		L1344556-2	
Sampled Date		07-AUG-13		07-AUG-13	
Sampled Time		14:00		14:00	
Sample ID		RUSSELL 1-RAW		RUSSELL 2-TREATED	
Analyte	Unit	Guide Limit #1	Guide Limit #2		
Alkalinity, Total (as CaCO3)	mg/L	-	-	481	95
Ammonia, Total (as N)	mg/L	-	-	1.20 ^{DLA}	<0.010
Bicarbonate (HCO3)	mg/L	-	-	587	116
Bromide (Br)	mg/L	-	-	<0.10	<0.10
Carbonate (CO3)	mg/L	-	-	<12	<12
Chloride	mg/L	250	-	4.26	12.9
Fluoride	mg/L	-	1.5	0.22	0.67
Hydroxide (OH)	mg/L	-	-	<6.8	<6.8
Nitrate-N	mg/L	-	10	<0.0050	0.280
Nitrite-N	mg/L	-	1	<0.0010	<0.0010
Sulfate	mg/L	500	-	219	225

Federal Guidelines for Canadian Drinking Water Quality (AUG, 2012)
 #1: GCDWQ - Aesthetic Objective
 #2: GCDWQ - Maximum Acceptable Concentrations (MACs)

Organic / Inorganic Carbon (WATER)

ALS ID		L1344556-1		L1344556-2	
Sampled Date		07-AUG-13		07-AUG-13	
Sampled Time		14:00		14:00	
Sample ID		RUSSELL 1-RAW		RUSSELL 2-TREATED	
Analyte	Unit	Guide Limit #1	Guide Limit #2		
Dissolved Organic Carbon	mg/L	-	-	2.4	3.0
Total Organic Carbon	mg/L	-	-	3.1	3.0

Federal Guidelines for Canadian Drinking Water Quality (AUG, 2012)
 #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

L1344556 CONTD....
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Total Metals (WATER)

Analyte	Unit	ALS ID		L1344556-1	L1344556-2
		Guide Limit #1	Guide Limit #2	RUSSELL 1-RAW	RUSSELL 2-TREATED
Aluminum (Al)-Total	mg/L	0.1	-	<0.0050	<0.0050
Antimony (Sb)-Total	mg/L	-	0.006	<0.00020	<0.00020
Arsenic (As)-Total	mg/L	-	0.01	0.0341	0.00703
Barium (Ba)-Total	mg/L	-	1	0.0131	0.00132
Beryllium (Be)-Total	mg/L	-	-	<0.00020	<0.00020
Bismuth (Bi)-Total	mg/L	-	-	<0.00020	<0.00020
Boron (B)-Total	mg/L	-	5	0.174	0.150
Cadmium (Cd)-Total	mg/L	-	0.005	0.000027	0.000026
Calcium (Ca)-Total	mg/L	-	-	151 ^{DLA}	19.4
Cesium (Cs)-Total	mg/L	-	-	<0.00010	<0.00010
Chromium (Cr)-Total	mg/L	-	0.05	<0.0010	<0.0010
Cobalt (Co)-Total	mg/L	-	-	0.00075	<0.00020
Copper (Cu)-Total	mg/L	1	-	0.00838	0.00888
Iron (Fe)-Total	mg/L	0.3	-	3.50	<0.10
Lead (Pb)-Total	mg/L	-	0.01	0.000331	0.000171
Lithium (Li)-Total	mg/L	-	-	0.115	0.109
Magnesium (Mg)-Total	mg/L	-	-	54.1	26.8
Manganese (Mn)-Total	mg/L	0.05	-	0.463	0.00298
Molybdenum (Mo)-Total	mg/L	-	-	0.00817	0.00800
Nickel (Ni)-Total	mg/L	-	-	<0.0020	<0.0020
Phosphorus (P)-Total	mg/L	-	-	0.14	<0.10
Potassium (K)-Total	mg/L	-	-	6.72	7.49
Rubidium (Rb)-Total	mg/L	-	-	0.00148	0.00248
Selenium (Se)-Total	mg/L	-	0.01	<0.0010	<0.0010
Silicon (Si)-Total	mg/L	-	-	14.3	7.23
Silver (Ag)-Total	mg/L	-	-	<0.00010	<0.00010
Sodium (Na)-Total	mg/L	200	-	39.1	83.0 ^{DLA}
Strontium (Sr)-Total	mg/L	-	-	0.607	0.108
Tellurium (Te)-Total	mg/L	-	-	<0.00020	<0.00020
Thallium (Tl)-Total	mg/L	-	-	<0.00010	<0.00010
Thorium (Th)-Total	mg/L	-	-	<0.00010	<0.00010
Tin (Sn)-Total	mg/L	-	-	<0.00020	<0.00020
Titanium (Ti)-Total	mg/L	-	-	0.00310	0.00325

Federal Guidelines for Canadian Drinking Water Quality (AUG, 2012)

#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.

ALS		Environmental		ANALYTICAL REPORT		L1344556 CONTD....	
						PAGE 4 of 7	
						13-AUG-13 15:27 (MT)	
Total Metals (WATER)							
		ALS ID		L1344556-1	L1344556-2		
		Sampled Date		07-AUG-13	07-AUG-13		
		Sampled Time		14:00	14:00		
		Sample ID		RUSSELL 1-RAW	RUSSELL 2-TREATED		
Analyte	Unit	Guide Limit #1	Guide Limit #2				
Tungsten (W)-Total	mg/L	-	-	<0.00010	<0.00010		
Uranium (U)-Total	mg/L	-	0.02	0.00415	<0.00010		
Vanadium (V)-Total	mg/L	-	-	<0.00020	<0.00020		
Zinc (Zn)-Total	mg/L	5	-	0.0071	<0.0020		
Zirconium (Zr)-Total	mg/L	-	-	<0.00040	<0.00040		
Federal Guidelines for Canadian Drinking Water Quality (AUG, 2012)							
#1: GCDWQ - Aesthetic Objective							
#2: GCDWQ - Maximum Acceptable Concentrations (MACs)							
Volatile Organic Compounds (WATER)							
		ALS ID		L1344556-1			
		Sampled Date		07-AUG-13			
		Sampled Time		14:00			
		Sample ID		RUSSELL 1-RAW			
Analyte	Unit	Guide Limit #1	Guide Limit #2				
Benzene	ug/L	-	5	<0.50			
1,1-Dichloroethylene	ug/L	-	14	<0.50			
Dichloromethane	ug/L	-	50	1.63			
Ethyl Benzene	ug/L	2.4	-	<0.50			
MTBE	ug/L	15	-	<0.50			
Tetrachloroethylene	ug/L	-	30	<0.50			
Toluene	ug/L	24	-	<0.50			
Trichloroethylene	ug/L	-	5	<0.50			
Xylenes (Total)	ug/L	300	-	<1.1			
Surrogate: 4-Bromofluorobenzene	%	-	-	111.6			
Surrogate: 1,2-Dichloroethane d4	%	-	-	108.7			
Surrogate: Toluene-d8	%	-	-	101.1			
Federal Guidelines for Canadian Drinking Water Quality (AUG, 2012)							
#1: GCDWQ - Aesthetic Objective							
#2: GCDWQ - Maximum Acceptable Concentrations (MACs)							
<p> Detection Limit for result exceeds Guide Limit. Assessment against Guide Limit cannot be made.</p> <p> Analytical result for this parameter exceeds Guide Limit listed on this report.</p> <p>* Please refer to the Reference Information section for an explanation of any qualifiers noted.</p>							

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLA	Detection Limit Adjusted For required dilution

Methods Listed (if applicable):

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

ALK-TOT-WP	Water	Alkalinity	APHA 2320B
------------	-------	------------	------------

Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. It is determined by titration with a standard solution of strong mineral acid to the successive HCO₃⁻ and H₂CO₃ endpoints indicated electrometrically.

BR-IC-WP	Water	Bromide by Ion Chromatography	EPA 300.1 (modified)
----------	-------	-------------------------------	----------------------

Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.

C-TC, TIC, TOC-WP	Water	Carbons	APHA 5310 B-INSTRUMENTAL
-------------------	-------	---------	--------------------------

This method is applicable to the analysis of ground water, wastewater, and surface water samples. The form detected depends upon sample pretreatment: Unfiltered sample = TC, 0.45um filtered = TDC. Samples are injected into a combustion tube containing an oxidation catalyst. The carrier gas containing the combustion product from the combustion tube flows through an inorganic carbon reactor vessel and is then sent through a halogen scrubber into a sample cell set in a non-dispersive infrared gas analyzer (NDIR) where carbon dioxide is detected. For total inorganic carbon and dissolved inorganic carbon, the sample is injected into an IC reactor vessel where only the IC component is decomposed to become carbon dioxide.

The peak area generated by the NDIR indicates the TC/TDC or TIC/DIC as applicable. The total organic carbon content of the sample is calculated by subtracting the TIC from the TC.

TOC = TC-TIC, DOC = TDC-DIC, Particulate = Total - Dissolved.

C-TDC, DIC, DOC-WP	Water	Carbons Dissolved	APHA 5310 B-INSTRUMENTAL
--------------------	-------	-------------------	--------------------------

This method is applicable to the analysis of ground water, wastewater, and surface water samples. The form detected depends upon sample pretreatment: Unfiltered sample = TC, 0.45um filtered = TDC. Samples are injected into a combustion tube containing an oxidation catalyst. The carrier gas containing the combustion product from the combustion tube flows through an inorganic carbon reactor vessel and is then sent through a halogen scrubber into a sample cell set in a non-dispersive infrared gas analyzer (NDIR) where carbon dioxide is detected. For total inorganic carbon and dissolved inorganic carbon, the sample is injected into an IC reactor vessel where only the IC component is decomposed to become carbon dioxide.

The peak area generated by the NDIR indicates the TC/TDC or TIC/DIC as applicable. The total organic carbon content of the sample is calculated by subtracting the TIC from the TC.

TOC = TC-TIC, DOC = TDC-DIC, Particulate = Total - Dissolved.

CL-L-IC-WP	Water	Chloride by Ion Chromatography	EPA 300.1 (modified)
------------	-------	--------------------------------	----------------------

Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.

COLOUR-TRUE-WP	Water	Colour, True	APHA 2120C
----------------	-------	--------------	------------

True colour in water is analyzed by discrete analyzer using the platinum-cobalt colourimetric method. Colour is pH dependant; unless otherwise indicated, reported colour results pertain to the pH of the sample as received to within +/- 1 pH unit.

EC-WP	Water	Conductivity	APHA 2510B
-------	-------	--------------	------------

Conductivity of an aqueous solution refers to its ability to carry an electric current. Conductance of a solution is measured between two spatially fixed and chemically inert electrodes.

ETL-HARDNESS-TOT-WP	Water	Hardness Calculated	HARDNESS CALCULATED
---------------------	-------	---------------------	---------------------

ETL-LANGELIER-4-WP	Water	Langelier Index 4C	Calculated
--------------------	-------	--------------------	------------

ETL-LANGELIER-60-WP	Water	Langelier Index 60C	Calculated
---------------------	-------	---------------------	------------

F-IC-WP	Water	Fluoride by Ion Chromatography	EPA 300.1 (modified)
---------	-------	--------------------------------	----------------------

Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.

IONBALANCE-CALC-WP	Water	Ion Balance Calculation	APHA 1030E
--------------------	-------	-------------------------	------------

MET-T-L-MS-WP	Water	Total Metals by ICP-MS	U.S. EPA 200.8-TL
---------------	-------	------------------------	-------------------

Total Metals by ICP-MS: This analysis is carried out using sample preparation procedures adapted from Standard Methods for the examination of Water and Wastewater Method 3030E and analytical procedures adapted from U.S EPA Method 200.8 for analysis of metals by inductively coupled-

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
mass spectrometry.			
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.			
NO2-L-IC-WP	Water	Nitrite as N by Ion Chromatography	EPA 300.1 (modified)
Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.			
NO3-L-IC-WP	Water	Nitrate as N by Ion Chromatography	EPA 300.1 (modified)
Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.			
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-WP	Water	Sulfate by Ion Chromatography	EPA 300.1 (modified)
Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.			
SOLIDS-TDS-WP	Water	Total Dissolved Solids	APHA 2540 C (modified)
Total dissolved solids in aqueous matrices is determined gravimetrically after evaporation of the filtrate at 180 °C.			
TRANSM-UV-WT	Water	Transmittance, UV (254 nm)	APHA 5910 B-Spectrophotometer
TURBIDITY-WP	Water	Turbidity	APHA 2130B (modified)
Turbidity in aqueous matrices is determined by the nephelometric method.			
VOC-ROU-WT	Water	Volatile Organic Compounds	SW846 8260
The purge and trap method purges Volatile Organic Compounds (VOC) from aqueous samples by bubbling an inert gas through the sample. Once in the gaseous phase, the analytes are swept from the purging device and trapped in a short column. The compounds are that are trapped on the column are thermally desorbed and transferred to the analytical column of the GC/MS.			
XYLENES-SUM-CALC-WT	Water	Sum of Xylene Isomer Concentrations	CALCULATION
Total xylenes represents the sum of o-xylene and m&p-xylene.			

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

Chain of Custody Numbers:

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
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

Reference Information

L1344556 CONTD....
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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.

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information.

Manitoba Conservation Water Stewardship Office of Drinking Water 1007 Century Street, Winnipeg, Manitoba, Canada R3H 0W4		Chain of Custody (COC) Manitoba Drinking Water Systems ONLY FOR: Regulatory General Chemistry 8		 L1344556-COFC	
Report to Operator (email pdf): Contact: Steve Smith Address: Box 10 Russell MB R0J 1W0 Phone: 204-773-3185 Email: russelwaterplant@hotmail.com			Owner billing (Email): Contact: Wally Melnyk Address: Box 10 Russell MB R0J 1W0 Phone: 204-773-2253 Email: wally@russellmb.com		
Operator contact update (if different then above): Contact: _____ Address: _____ Phone: _____ Email: _____			Owner contact update (if different then above): Contact: _____ Address: _____ Phone: _____ Email: _____		
Account: W7260 ODW Report type: EMS (Lab-MWS)			Client / Project Information: Operation Name: RUSSELL - PWS Operation Code (com code): 189.00 Operation Id: 17511 Sampled by: <i>Steve Smith</i>		
Agency Code: 382 Project: DWQ-C			Analysis Request MB-CH-PWS-V2013 MB-VOC-PWS-V2013 Number of Containers: 5		
Lab: ALS Lab Work Order # / Job # (lab use only)			Lab Sample # (lab use only) Station Number Sample Identification Date Time Sample Matrix Sample Type		
1308GR0022 MB05MED051 Russell 1 - Raw 07-08-13 2 PM 6 1			X X 5		
1308GR0023 MB05MED052 Russell 2 - Treated 07-08-13 2 PM 10 1			X X 5		
Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY . By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified by the Laboratory. For ALL other testing, please use Laboratory specific forms. DO NOT COPY or RE-USE this form. Sample Numbers are unique to the Office of Drinking Water and provided by DWO.					
Relinquished By: <i>Steven Smith</i> Date & Time: <i>2 PM Aug 7/13</i>		Received By: <i>GH</i> (lab use only) Date & Time: <i>Aug 8/13 12:00</i>		Sample Condition (lab use only)	
Relinquished By: _____ Date & Time: _____		Received By: _____ (lab use only) Date & Time: _____		Temperature: <i>13.9°C</i> Samples Received in Good Condition? Y/N (if no provide details)	
Operator mandatory		Operator optional		Operator to fill, if information above has changed	
				Opr to fill, Lab specific pre-filled by DWO	
Note: Cyanide and Mercury are not required and have been removed from the list. Please use the Rev. July 29, 2013 Water System Chemistry List.					

9.9 Appendix I - Spear Lake Water Chemistry



Municipality of Russell Binscarth - Russell
ATTN: PAUL OLARTE
PO Box 10
Russell MB R0J 1W0

Date Received: 16-DEC-15
Report Date: 07-JAN-16 07:08 (MT)
Version: FINAL REV. 2

Client Phone: 204-773-2253

Certificate of Analysis

Lab Work Order #: L1715122
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Comments:

7-JAN-2016 Revised report - Date analyzed on Ph, EC and Alkalinity corrected.

A handwritten signature in black ink, appearing to read 'Hua Wo', written over a horizontal line.

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
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Environmental A small icon of a globe with a leaf, representing environmental services.

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 PAGE 2 of 5
 Version: FINAL REV.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1715122-1 SPEAR LAKE WATER SAMPLE Sampled By: CLIENT on 14-DEC-15 @ 13:00 Matrix: MB Chemistry for PWS							
% Transmittance by Spectrometry Transmittance, UV (254 nm)	21.3		1.0	% T		17-DEC-15	R3347340
Alkalinity, Bicarbonate Bicarbonate (HCO3)	397		1.2	mg/L		04-JAN-16	
Alkalinity, Carbonate Carbonate (CO3)	<0.60		0.60	mg/L		04-JAN-16	
Alkalinity, Hydroxide Hydroxide (OH)	<0.34		0.34	mg/L		04-JAN-16	
Alkalinity, Total (as CaCO3) Alkalinity, Total (as CaCO3)	325		1.0	mg/L		31-DEC-15	R3353767
Ammonia by colour Ammonia, Total (as N)	0.073		0.010	mg/L		21-DEC-15	R3343635
Bromide in Water by IC Bromide (Br)	<0.10		0.10	mg/L		16-DEC-15	R3339238
Chloride in Water by IC (Low Level) Chloride (Cl)	9.13		0.10	mg/L		16-DEC-15	R3339238
Colour, True Colour, True	45.2		5.0	CU		17-DEC-15	R3339614
Conductivity Conductivity	1040		1.0	umhos/cm		02-JAN-15	R3353767
Dissolved Organic Carbon by Combustion Dissolved Organic Carbon	22.6		0.50	mg/L		22-DEC-15	R3350893
Fluoride in Water by IC Fluoride (F)	0.234		0.020	mg/L		16-DEC-15	R3339238
Hardness Calculated Hardness (as CaCO3)	567		0.30	mg/L		22-DEC-15	
Langelier Index 4C Langelier Index (4 C)	0.85					04-JAN-16	
Langelier Index 60C Langelier Index (60 C)	1.6					04-JAN-16	
Nitrate in Water by IC (Low Level) Nitrate (as N)	0.0796		0.0050	mg/L		16-DEC-15	R3339238
Nitrite in Water by IC (Low Level) Nitrite (as N)	0.0021		0.0010	mg/L		16-DEC-15	R3339238
Sulfate in Water by IC Sulfate (SO4)	264		0.30	mg/L		16-DEC-15	R3339238
Total Dissolved Solids (TDS) Total Dissolved Solids	743		15	mg/L		22-DEC-15	R3351519
Total Metals by ICP-MS							
Aluminum (Al)-Total	0.166		0.0050	mg/L	21-DEC-15	21-DEC-15	R3342995
Antimony (Sb)-Total	0.00029		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Arsenic (As)-Total	0.00476		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Barium (Ba)-Total	0.0670		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Beryllium (Be)-Total	<0.00020		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Bismuth (Bi)-Total	<0.00020		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Boron (B)-Total	0.113		0.010	mg/L	21-DEC-15	21-DEC-15	R3342995
Cadmium (Cd)-Total	0.000011		0.000010	mg/L	21-DEC-15	21-DEC-15	R3342995
Calcium (Ca)-Total	108		0.10	mg/L	21-DEC-15	21-DEC-15	R3342995
Cesium (Cs)-Total	<0.00010		0.00010	mg/L	21-DEC-15	21-DEC-15	R3342995
Chromium (Cr)-Total	<0.0010		0.0010	mg/L	21-DEC-15	21-DEC-15	R3342995
Cobalt (Co)-Total	0.00066		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Copper (Cu)-Total	0.00181		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995

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

L1715122 CONTD...
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 Version: FINAL REV.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1715122-1 SPEAR LAKE WATER SAMPLE Sampled By: CLIENT on 14-DEC-15 @ 13:00 Matrix:							
Total Metals by ICP-MS							
Iron (Fe)-Total	0.224		0.010	mg/L	21-DEC-15	21-DEC-15	R3342995
Lead (Pb)-Total	0.000255		0.000090	mg/L	21-DEC-15	21-DEC-15	R3342995
Lithium (Li)-Total	0.124		0.0020	mg/L	21-DEC-15	21-DEC-15	R3342995
Magnesium (Mg)-Total	71.9		0.010	mg/L	21-DEC-15	21-DEC-15	R3342995
Manganese (Mn)-Total	0.0458		0.00030	mg/L	21-DEC-15	21-DEC-15	R3342995
Molybdenum (Mo)-Total	0.00212		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Nickel (Ni)-Total	0.0026		0.0020	mg/L	21-DEC-15	21-DEC-15	R3342995
Phosphorus (P)-Total	0.11		0.10	mg/L	21-DEC-15	21-DEC-15	R3342995
Potassium (K)-Total	12.2		0.020	mg/L	21-DEC-15	21-DEC-15	R3342995
Rubidium (Rb)-Total	0.00326		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Selenium (Se)-Total	<0.0010		0.0010	mg/L	21-DEC-15	21-DEC-15	R3342995
Silicon (Si)-Total	3.03		0.10	mg/L	21-DEC-15	21-DEC-15	R3342995
Silver (Ag)-Total	<0.00010		0.00010	mg/L	21-DEC-15	21-DEC-15	R3342995
Sodium (Na)-Total	47.4		0.030	mg/L	21-DEC-15	21-DEC-15	R3342995
Strontium (Sr)-Total	0.459		0.00010	mg/L	21-DEC-15	21-DEC-15	R3342995
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Thallium (Tl)-Total	<0.00010		0.00010	mg/L	21-DEC-15	21-DEC-15	R3342995
Thorium (Th)-Total	<0.00010		0.00010	mg/L	21-DEC-15	21-DEC-15	R3342995
Tin (Sn)-Total	<0.00020		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Titanium (Ti)-Total	0.00468		0.00050	mg/L	21-DEC-15	21-DEC-15	R3342995
Tungsten (W)-Total	<0.00010		0.00010	mg/L	21-DEC-15	21-DEC-15	R3342995
Uranium (U)-Total	0.00582		0.00010	mg/L	21-DEC-15	21-DEC-15	R3342995
Vanadium (V)-Total	0.00459		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Zinc (Zn)-Total	0.0028		0.0020	mg/L	21-DEC-15	21-DEC-15	R3342995
Zirconium (Zr)-Total	0.00044		0.00040	mg/L	21-DEC-15	21-DEC-15	R3342995
Total Organic Carbon by Combustion							
Total Organic Carbon	22.0		0.50	mg/L		22-DEC-15	R3350875
Turbidity							
Turbidity	6.54		0.10	NTU		17-DEC-15	R3338809
pH							
pH	8.08		0.10	pH units		31-DEC-15	R3353767

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

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-CO3CO3-CALC-WP	Water	Alkalinity, Carbonate	CALCULATION
The Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. The fraction of alkalinity contributed by carbonate is calculated and reported as mg CO ₃ 2-/L.			
ALK-HCO3HCO3-CALC-WP	Water	Alkalinity, Bicarbonate	CALCULATION
The Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. The fraction of alkalinity contributed by bicarbonate is calculated and reported as mg HCO ₃ -/L.			
ALK-OHOH-CALC-WP	Water	Alkalinity, Hydroxide	CALCULATION
The Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. The fraction of alkalinity contributed by hydroxide is calculated and reported as mg OH-/L.			
ALK-TITR-WP	Water	Alkalinity, Total (as CaCO ₃)	APHA 2320B
The Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. Total alkalinity is determined by titration with a strong standard mineral acid to the successive HCO ₃ - and H ₂ CO ₃ endpoints indicated electrometrically.			
BR-IC-N-WP	Water	Bromide in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
C-DOC-HTC-WP	Water	Dissolved Organic Carbon by Combustion	APHA 5310 B-WP
Filtered (0.45 um) sample is acidified and purged to remove inorganic carbon, then injected into a heated reaction chamber where organic carbon is oxidized to CO ₂ which is then transported in the carrier gas stream and measured via a non-dispersive infrared analyzer.			
C-TOC-HTC-WP	Water	Total Organic Carbon by Combustion	APHA 5310 B-WP
Sample is acidified and purged to remove inorganic carbon, then injected into a heated reaction chamber where organic carbon is oxidized to CO ₂ which is then transported in the carrier gas stream and measured via a non-dispersive infrared analyzer.			
CL-L-IC-N-WP	Water	Chloride in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
COLOUR-TRUE-WP	Water	Colour, True	APHA 2120C
True Colour is measured spectrophotometrically by comparison to platinum-cobalt standards using the single wavelength method (450 - 465 nm) after filtration of sample through a 0.45 um filter. Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.			
EC-WP	Water	Conductivity	APHA 2510B
Conductivity of an aqueous solution refers to its ability to carry an electric current. Conductance of a solution is measured between two spatially fixed and chemically inert electrodes.			
ETL-HARDNESS-TOT-WP	Water	Hardness Calculated	HARDNESS CALCULATED
ETL-LANGELIER-4-WP	Water	Langelier Index 4C	Calculated
ETL-LANGELIER-60-WP	Water	Langelier Index 60C	Calculated
F-IC-N-WP	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
IONBALANCE-CALC-WP	Water	Ion Balance Calculation	APHA 1030E
MET-T-L-MS-WP	Water	Total Metals by ICP-MS	APHA 3030E/EPA 6020A-TL
This analysis involves preliminary sample treatment by hotblock acid digestion (APHA 3030E). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).			
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.			
NO2-L-IC-N-WP	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-WP	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
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.			
TDS-WP	Water	Total Dissolved Solids (TDS)	APHA 2540 SOLIDS C,E
A well-mixed sample is filtered through a glass fiber filter paper. The filtrate is then evaporated to dryness in a pre-weighed vial and dried at 180 – 2C. The increase in vial weight represents the total dissolved solids.			
TURBIDITY-WP	Water	Turbidity	APHA 2130B (modified)
Turbidity in aqueous matrices is determined by the nephelometric method.			
UV-%TRANS-WP	Water	% Transmittance by Spectrometry	APHA 5910B
This method indicates the total concentration of UV-absorbing compounds found in water and wastewater. The analysis is carried out using procedures adapted from APHA 5910 B. The sample is filtered through a 0.45 um filter and measured for % transmittance in a quartz cell at 254 nm and reported as % Transmittance .The analysis is carried out without pH adjustment.			

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

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

Laboratory Definition Code	Laboratory Location
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.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
 Canada Toll Free: 1 800 668 9878
 www.alsglobal.com

COC Number: 14-504767
 Page ___ of ___

L1715122-COFC

Report To Company: <u>Municipality of Russell/BinscARTH</u> Contact: <u>Box 10 Russell, MB R0J 1W0</u> Phone: <u>204-773-2253 FAX: 204-773-9370</u> Email 1 or Fax: <u>Russell water plant via hotmail, cad</u> Email 2: <u>coru.vlth@gov.mb.ca</u>		Report Format / D Select Report Format: <input type="checkbox"/> PDF <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Quality Control (QC) Report with Report <input type="checkbox"/> Yes <input type="checkbox"/> No Create on Report - provide details below if box checked Select Distribution: <input type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Specify Date Required for E2, E or P: _____		(Rush Turnaround Time (TAT) is not available for all tests) R <input type="checkbox"/> Regular (standard TAT if selected by item) P <input type="checkbox"/> Priority (2-4 business days if received by 3pm) E <input type="checkbox"/> Emergency (1-2 business days if received by 3pm) E2 <input type="checkbox"/> Same day or next business emergency if received by 10am - contact ALS for surcharge.	
Invoice To: Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Copy of Invoice with Report <input type="checkbox"/> Yes <input type="checkbox"/> No		Invoice Distribution Select Invoice Distribution: <input type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: _____ Email 2: _____		Indicate if Blank (B), Preserved (P) or Filled and Preserved (FP) below	
Company Contact: _____ Project Information: _____		Oil and Gas Required Fields (client use) Approver ID: _____ Cost Center: _____ GL Account: _____ Routing Code: _____ Activity Code: _____ Location: _____		Number of Containers	
ALS Quote #: _____ Job #: _____ PID / AFE: _____ LSD: _____ ALS Lab Work Order # (lab use only): _____		ALS Contact: <u>Paul Clarte</u>			
ALS Sample # (lab use only): _____		Sample Identification and/or Coordinates (This description will appear on the report) <u>Spear Lake water sample</u>		Date (dd-mm-yy): _____ Time (hh:mm): _____ Sample Type: _____	
1 <u>1 L. Routine</u> 2 <u>250 ml. Metals</u> 3 <u>250 ml. Nutrients</u> 4 <u>DOC</u>		Special Instructions / Specify Criteria to add on report (client use) <u>Spear Lake water full chemistry required</u>		SAMPLE CONDITION AS RECEIVED (lab use only) Frozen <input type="checkbox"/> SF Observations Yes <input type="checkbox"/> No <input type="checkbox"/> Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/> Cooling initiated <input type="checkbox"/>	
Drinking Water (DW) Samples (client use) Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No		INITIAL SHIPMENT RECEPTION (lab use only) Released by: <u>[Signature]</u> Date: <u>Dec 14/15</u> Time: <u>8:00 pm</u> Received by: <u>CJS</u> Date: <u>16-Dec-15</u> Time: <u>8:00</u>		FINAL SHIPMENT RECEPTION (lab use only) Received by: _____ Date: _____ Time: _____	

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

White - LABORATORY COPY Yellow - CLIENT COPY

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

9.10 Appendix J - ROSA Hypothetical Chemistry

ROSA HYPOTHETICAL CHEMISTRY

The water quality and chemistry of reject water from a Reverse Osmosis (RO) membrane system is dependent on the chemistry of the raw water (including the source type such as groundwater or surface water), the chemistry of the water entering the RO (cases with pre-treatment prior to RO), and the type of RO system including the equipment manufacturer.

This is hypothetical chemistry of the reject water from a RO system for the Municipality of Russell Binscarth. The software program utilized is called "ROSA" from the DOW company.

Parameter	Unit	GCDWQ		Sampled: June 4, 2015	ROSA
		AO/OG	MAC	INPUT Raw Well Water	OUTPUT RO Reject
Total Dissolved Solids	mg/L	500		896.63*	1063.79
pH	pH	6.5 to 8.5		7.72	7.76
Ammonium (NH ₄ ⁺ + NH ₃)	mg/L			0.72	0.84
Potassium (K)	mg/L			5.85	6.77
Sodium (Na)	mg/L	200		19.7	41.67
Magnesium (Mg)	mg/L			47.8	55.82
Calcium (Ca)	mg/L			124	144.81
Strontium (Sr)	mg/L			0.502	0.59
Barium (Ba)	mg/L		1	0.018	0.02
Carbonate (CO ₃)	mg/L			2.693*	3.65
Bicarbonate (HCO ₃)	mg/L			536	622.93
Nitrate (NO ₃)	mg/L		10	0.019	0.02
Chloride (Cl)	mg/L	250		1.44	1.68
Fluoride (F)	mg/L		1.5	0.205	0.24
Sulfate (SO ₄)	mg/L	500		142	166.52
Silica (SiO ₂)	mg/L			15	17.54
Boron (B)	mg/L			0.119	0.12

* Refers to INPUT numbers that are generated automatically.

The Guidelines for Canadian Drinking Water Quality (GCDWQ) do not apply in this case with wastewater effluent discharge since these guidelines deal with drinking water and not effluent. There are two governing bodies and regulations that can be used to determine if the wastewater parameters meet the requirements. They are the Canadian Council of Ministers of the Environment (CCME) and the "Manitoba Water Quality Standards, Objectives, and Guidelines - November 2011" from Manitoba Water Stewardship.

		Sampled: December 14, 2015	Sampled: June 4, 2015	ROSA		
Parameter	Unit	Spear Lake	Raw Well Water	RO Reject	CCME	MB
Total Dissolved Solids	mg/L	743	688	1063.79	3000	3000
Calcium (Ca)	mg/L	108	124	144.81	1000	1000
Nitrate (NO3)	mg/L	0.0796	<0.020	0.02	13	13
Chloride (Cl)	mg/L	9.13	1.44	1.68	NA	100 to 900
Fluoride (F)	mg/L	0.234	0.205	0.24	1	1 to 2
Sulfate (SO4)	mg/L	264	142	166.52	1000	1000
Boron (B)	mg/L	0.113	0.119	0.12	1.5	1.5

In comparison of the chemistry parameters available for the Reverse Osmosis (RO) reject water from the proposed Russell Binscarth WTP to the regulatory limits (both national and provincial), all parameters are well below limits.

Thus, there will be no adverse environmental effects due to water quality.

9.11 Appendix K - MWSB Watercourse Crossing Guidelines

MWSB WATERCOURSE CROSSING GUIDELINES

Mitigation Measure:

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

Reclamation:

- Restore all disturbed areas to original contours.
- 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:
 - A record of drilling progress will be maintained to always know the location of the drill head relative to the point of entry.
 - A record of drilling component usage (type and quantity) will be maintained throughout each drilling operation.
 - 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 construction field supervisor.
 - 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:

- 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.
- The contractor will notify the MWSB construction field supervisor of the frac-out condition or potential condition and decide on the appropriate action as follows:
- Assign a person to visually monitor for the presence of muddy plume.
- 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.
- 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.
- 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.
- If the frac-out is not contained within this time, MWSB 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.



MATCH LINE 'A'
SHEET 2



MATCH LINE 'B'
SHEET 2

NO.	DESCRIPTION	BY	DATE

SURVEYED	BOOK NUMBER	PROVINCE OF MANITOBA THE MANITOBA WATER SERVICES BOARD MANITOBA LOCAL GOVERNMENT	
DRAWN	N. LUCIER		
DESIGNED	C. VITT		
CHECKED			
REVIEWED		SUBMITTED	APPROVED
		CHIEF ENGINEER	GENERAL MANAGER

MUNICIPALITY OF RUSSELL-BINSCARTH			
WATER SUPPLY LINE			
SCALE	DATE	PROJECT NUMBER	SHEET
N.T.S.	15-12-08	1268	1 of 2



MATCH LINE 'A'
SHEET 2



MATCH LINE 'B'
SHEET 2

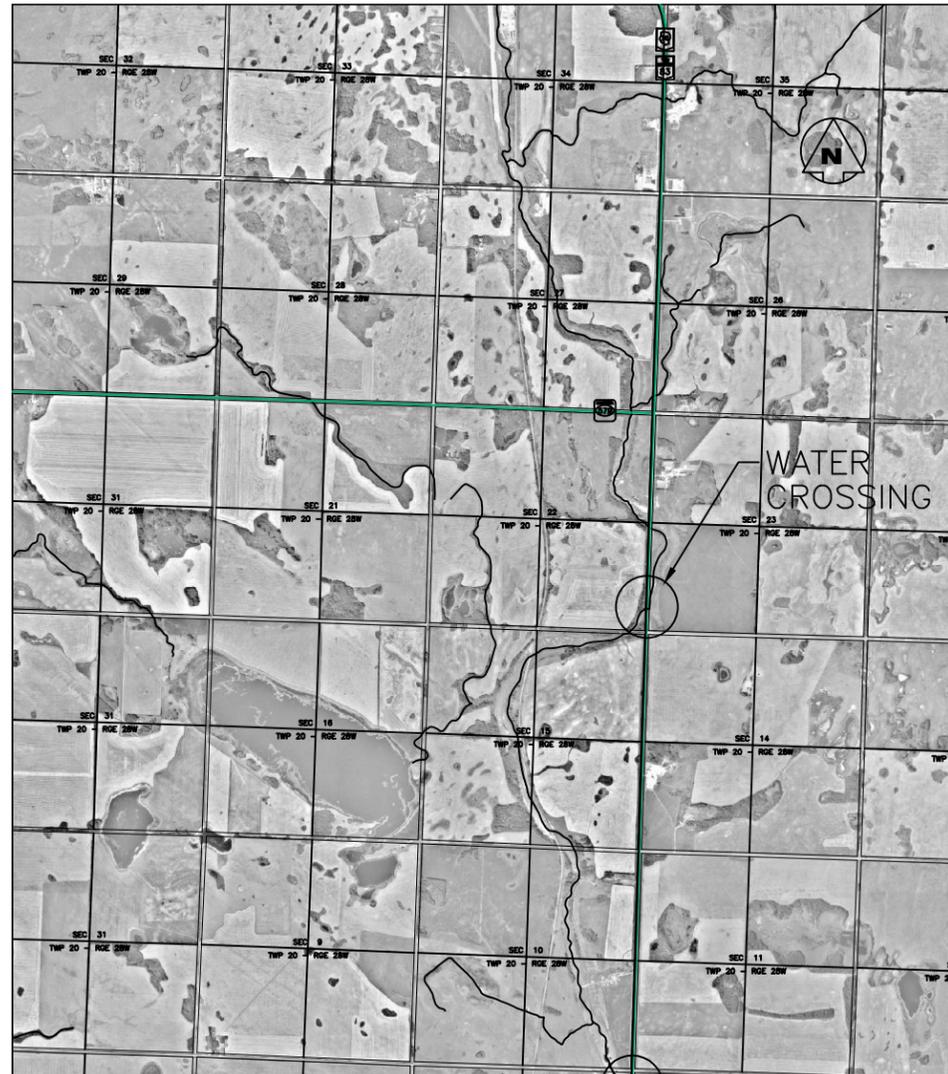
NO.	DESCRIPTION	BY	DATE

SURVEYED	BOOK NUMBER
DRAWN	N. LUCIER
DESIGNED	C. VITT
CHECKED	
REVIEWED	

PROVINCE OF MANITOBA	
THE MANITOBA WATER SERVICES BOARD	
MANITOBA LOCAL GOVERNMENT	
SUBMITTED	APPROVED
CHIEF ENGINEER	GENERAL MANAGER

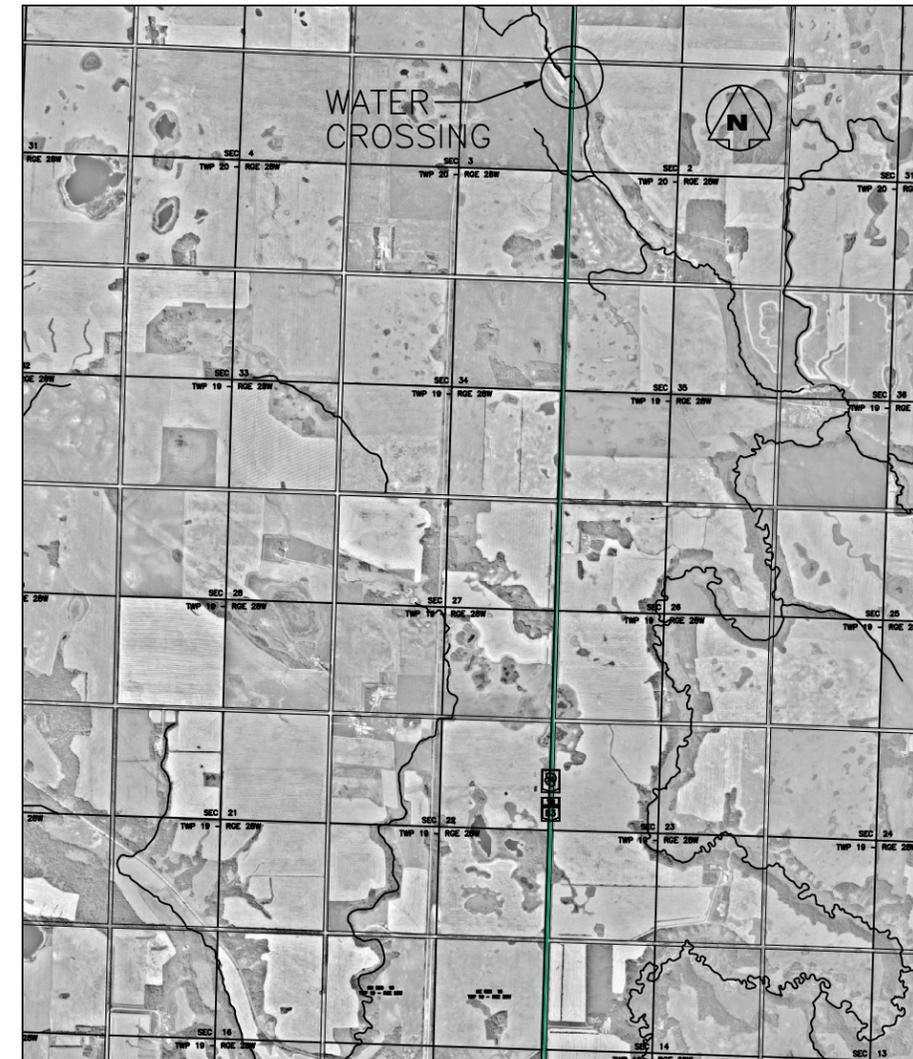
MUNICIPALITY OF RUSSELL-BINSCARTH				
WATER SUPPLY LINE				
SCALE	DATE	PROJECT NUMBER	REVISION	SHEET
N.T.S.	15-12-09	1268		1 of 2

MATCH LINE 'A'
SHEET 1



MATCH LINE 'C'
SHEET 2

MATCH LINE 'C'
SHEET 2



MATCH LINE 'B'
SHEET 1

NO.	DESCRIPTION	BY	DATE

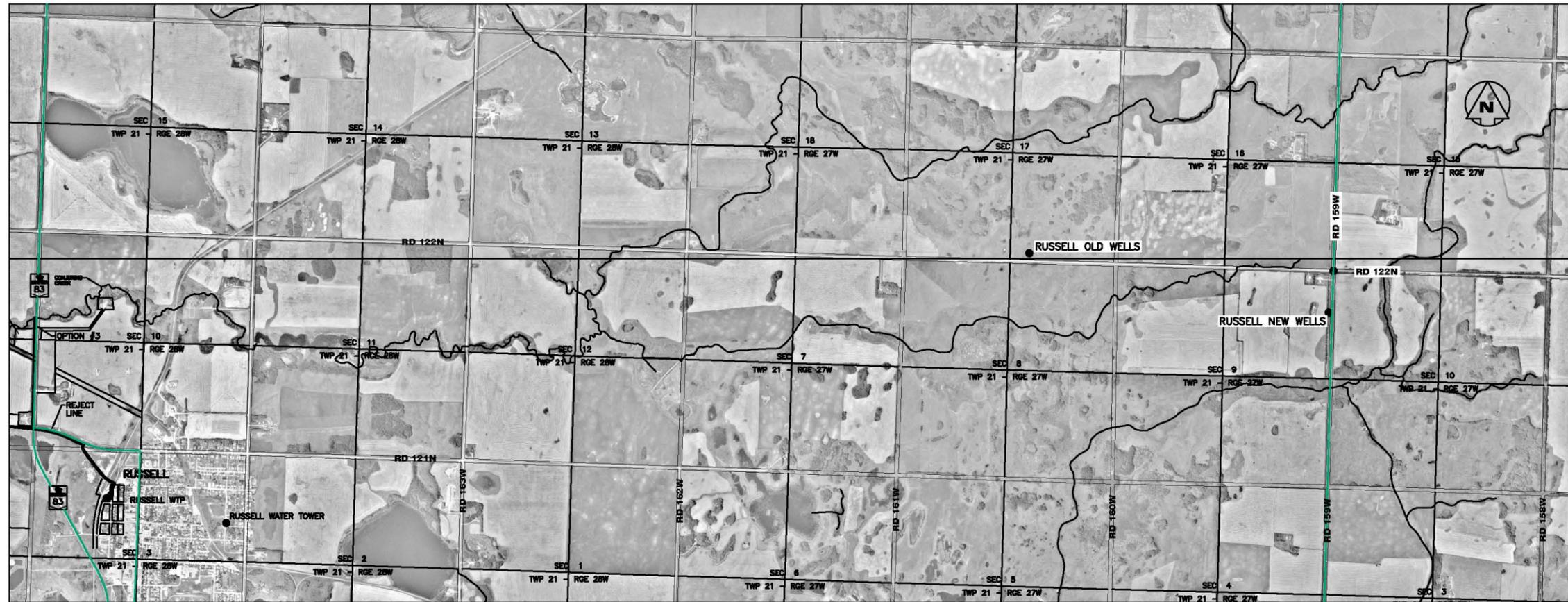
SURVEYED	BOOK NUMBER
DRAWN	N. LUCIER
DESIGNED	C. WITT
CHECKED	
REVIEWED	

PROVINCE OF MANITOBA
THE MANITOBA WATER SERVICES BOARD
MANITOBA LOCAL GOVERNMENT

SUBMITTED	APPROVED
CHIEF ENGINEER	GENERAL MANAGER

MUNICIPALITY OF RUSSELL-BINSCARTH
WATER SUPPLY LINE

SCALE	DATE	PROJECT NUMBER	REVISION	SHEET
N.T.S.	15-12-09	1268		2 of 2

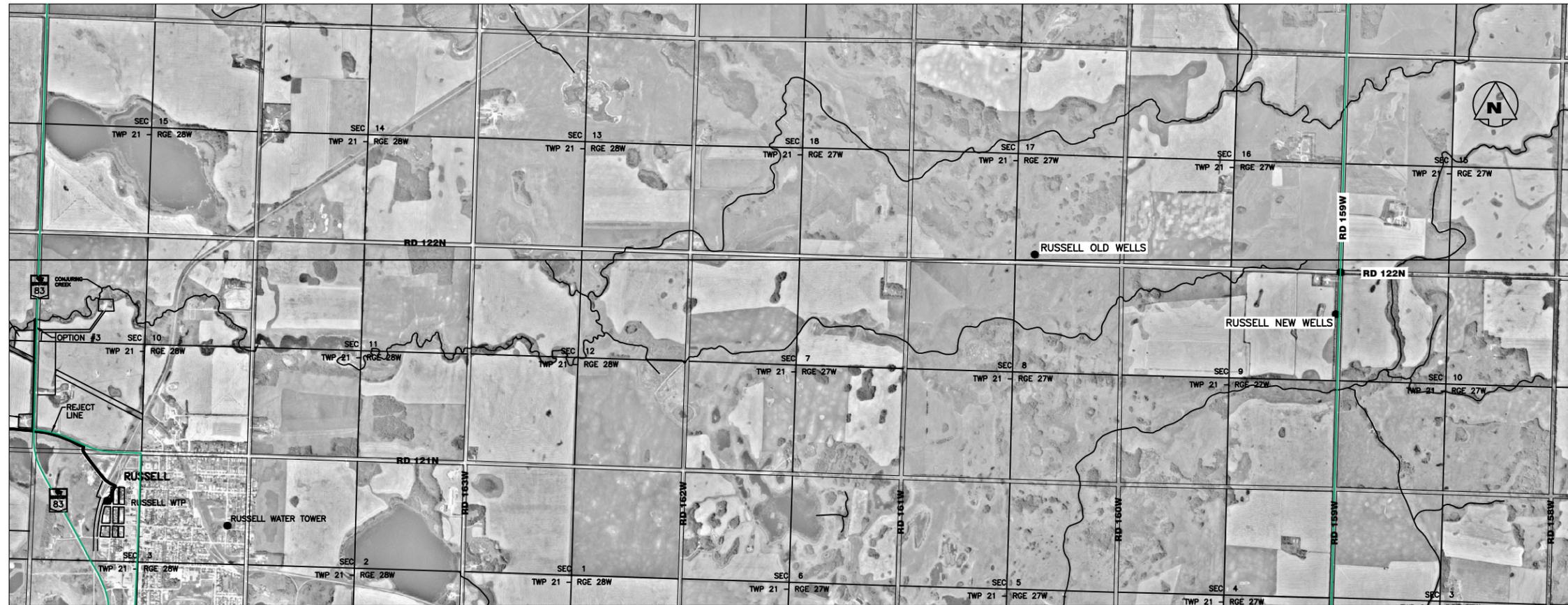


NO.	DESCRIPTION	BY	DATE

SURVEYED	BOOK NUMBER
DRAWN	N. LUCIER
DESIGNED	C. VITT
CHECKED	
REVIEWED	

PROVINCE OF MANITOBA THE MANITOBA WATER SERVICES BOARD MANITOBA LOCAL GOVERNMENT	
SUBMITTED	APPROVED
CHIEF ENGINEER	GENERAL MANAGER

MUNICIPALITY OF RUSSELL-BINSCARTH		WELL LOCATIONS	
SCALE	DATE	PROJECT NUMBER	SHEET
N.T.S.	15-12-10	1269	2 of 2



NO.	DESCRIPTION	BY	DATE

SURVEYED	BOOK NUMBER
DRAWN N. LUCIER	
DESIGNED C. VITT	
CHECKED	
REVIEWED	

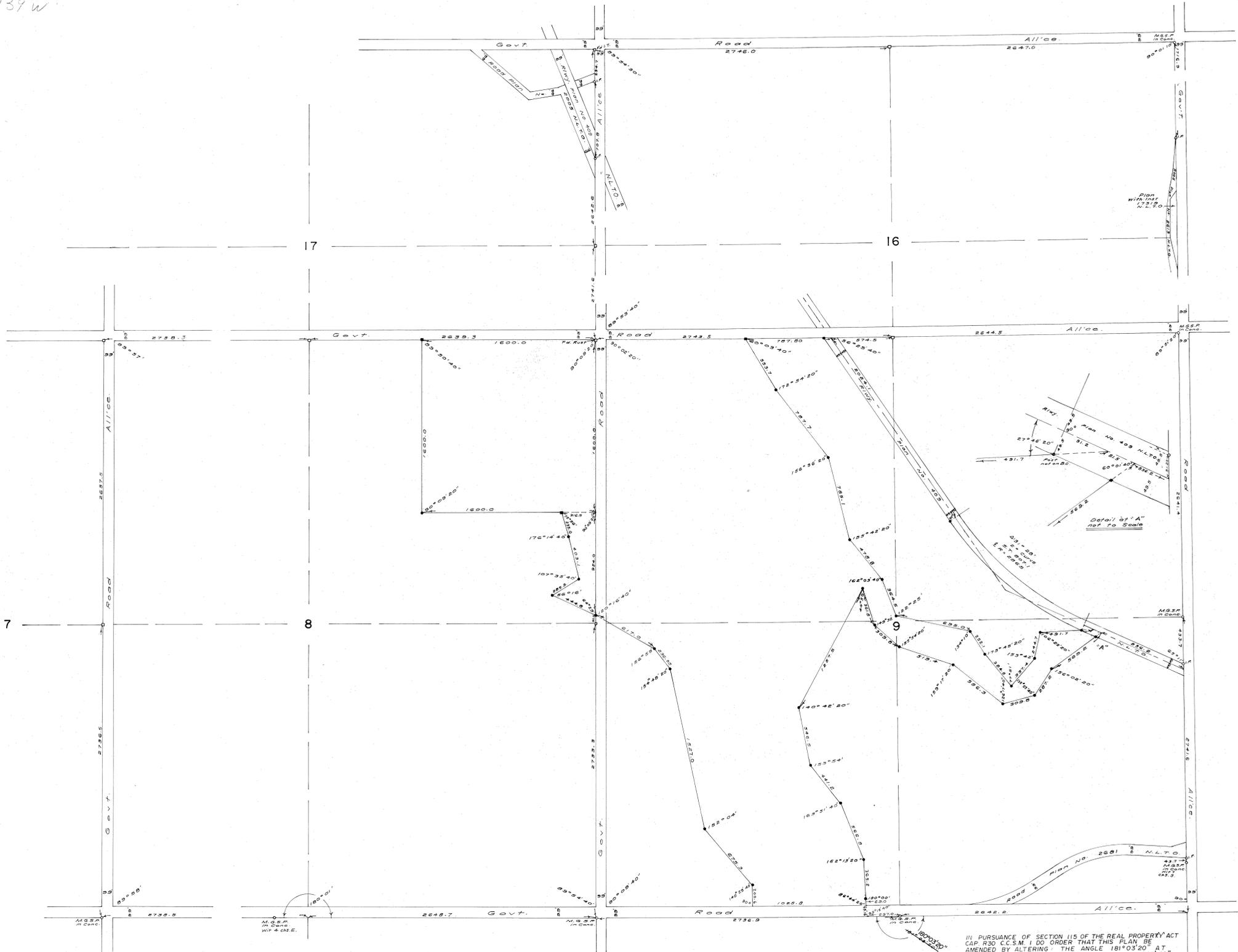
PROVINCE OF MANITOBA
 THE MANITOBA WATER SERVICES BOARD
 MANITOBA LOCAL GOVERNMENT

SUBMITTED	APPROVED
_____ CHEF ENGINEER	_____ GENERAL MANAGER
DATE	DATE

MUNICIPALITY OF RUSSELL-BINSCARTH

WELL LOCATIONS

SCALE N.T.S.	DATE 15-12-10	PROJECT NUMBER 1269	REVISION	SHEET 2 of 2
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PLAN OF SURVEY
 OF
 LAND REQUIRED FOR WATER CONTROL WORKS
 IN
 Secs 8 and 9, Twp. 21, Rge 28 W.P.M.
 — MANITOBA —
 Scale 1 inch = 400 feet

Notes
 Distances are in feet and decimals of a foot.
 Man. Govt. Survey Posts were placed at all points shown thus: — — — — —
 Iron posts 1 1/2 x 3/4 inch N.L.T. were driven at all points shown thus: — — — — —
 Iron posts 3/4 x 3/4 inch were driven at all points shown thus: — — — — —
 Survey measurements were found at all points shown thus: — — — — —
 Land required for Water Control Works shown bordered red.

I, Murray Quigley Foster of the City of Winnipeg, Manitoba Land Surveyor,
 make oath and say that I was present at and did personally superintend
 the survey represented by this plan, that the survey and plan are correct,
 and that the survey was made between October 28 and Nov. 8 1923.
 Sworn before me at Winnipeg
 this 10 day of Dec. 1923
 M. Quigley Foster
 Surveyor

Approved and Confirmed
 December 18, 1923
 E. J. Gault
 Director of Surveys

H.P. Balthus
 A Commissioner for Oaths
 My Commission expires January 9, 1925

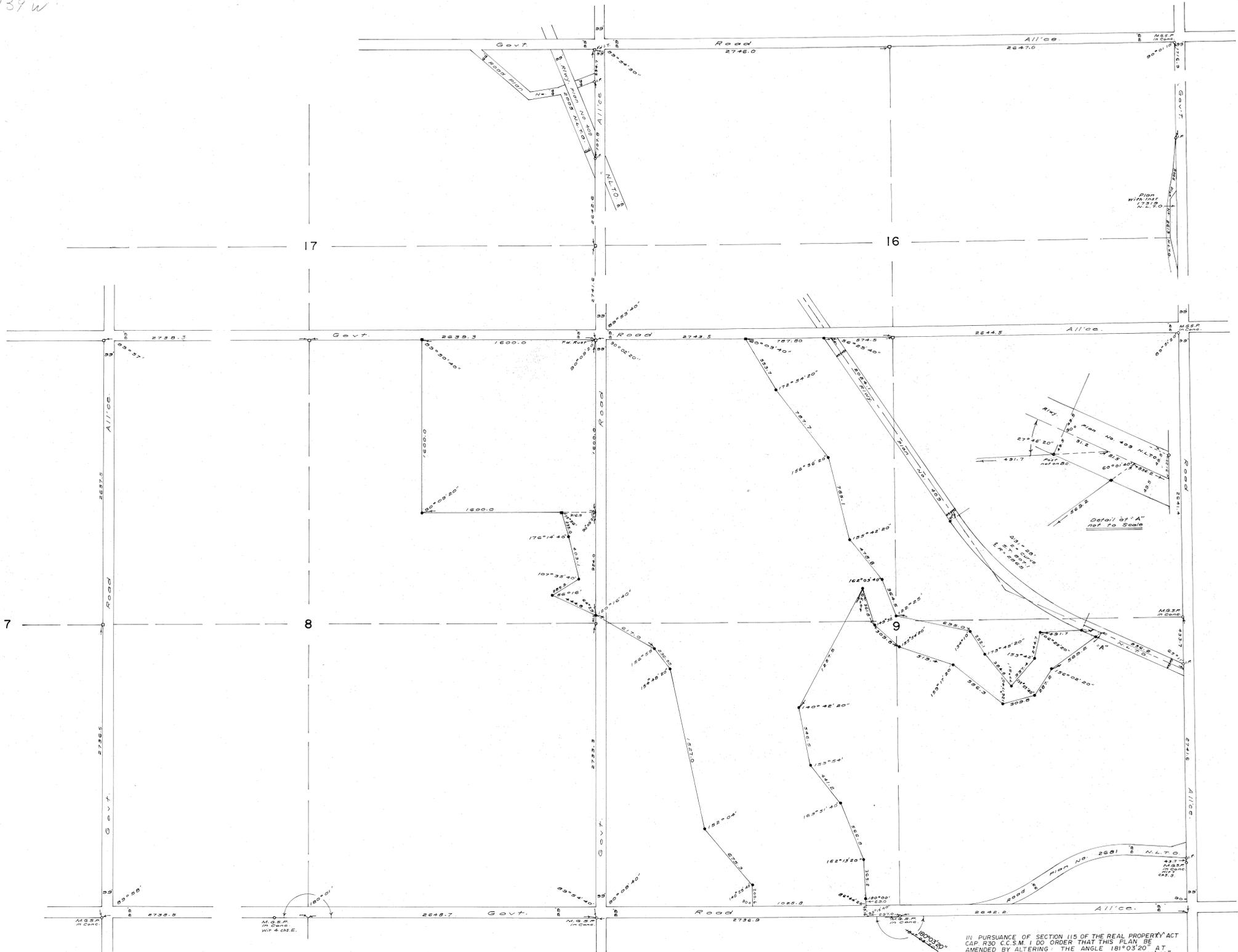
ENTERED AND REGISTERED IN THE
 NEEDAWA LAND TITLES OFFICE
 THIS 25th DAY OF FEBRUARY A.D. 1964
 AT 9:30 A.M. AS PLAN No. 4920

D. J. Thomson
 DISTRICT REGISTRAR

IN PURSUANCE OF SECTION 115 OF THE REAL PROPERTY ACT
 CAP. 230 C.C.S.M. I DO ORDER THAT THIS PLAN BE
 AMENDED BY ALTERING THE ANGLE 181°03'20" AT
 THE NORTH LIMIT SEC. 4-21-28W. TO READ 180°03'20"
 DATED THIS 11th DAY OF DECEMBER 1985

REGISTRAR GENERAL
 EXAMINER OF SURVEYS

Approved
 18 Dec 1923
 E. J. Gault



PLAN OF SURVEY
 OF
 LAND REQUIRED FOR WATER CONTROL WORKS
 IN
 Secs 8 and 9, Twp. 21, Rge 28 W.P.M.
 — MANITOBA —
 Scale 1 inch = 400 feet

Notes
 Distances are in feet and decimals of a foot.
 Man. Govt. Survey Posts were placed at all points shown thus: ————
 Iron posts 1 1/2 x 3/4 inch M.S.P. were driven at all points shown thus: ————
 Iron posts 3/4 x 3/4 inch were driven at all points shown thus: ————
 Survey measurements were found at all points shown thus: ————
 Land required for Water Control Works shown bordered red.

I, Murray Quigley Foster of the City of Winnipeg, Manitoba Land Surveyor,
 make oath and say that I was present at and did personally superintend
 the survey represented by this plan, that the survey and plan are correct,
 and that the survey was made between October 28 and Nov. 8 1923.
 Sworn before me at Winnipeg
 this 10 day of Dec. 1923.
 M. Quigley Foster
 Surveyor

Approved and Confirmed
 December 18, 1923
 E. J. Gault
 Director of Surveys

H.P. Balthasar
 A Commissioner for Oaths
 My Commission expires January 9, 1925

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REGISTRAR GENERAL
 EXAMINER OF SURVEYS

Approved
 18 Feb 1924
 E. J. Gault

6457
8066 W

374

PLAN OF SURVEY
OF
WATER CONTROL WORKS
IN
S.E. 1/4, Sec. 9, Twp. 21, Rge. 28 W.P.M.
—MANITOBA—

Scale = 1 inch = 200 feet

Notes:

Distances are in feet and decimals of a foot.
Survey monuments were found at all points, shown thus:  and 
from Party 26's N.W. 1/4, see division of all points, shown thus:  and 
Land required for Water Control Works shown bordered red.

Approved and Confirmed
July 7, 1964


for Director of Surveys

I, Theodore Herbert Stevens of the City of Winnipeg, Manitoba Land
Surveyor, make oath and say that I was present at and did
personally supervise the survey represented by this plan,
that the survey and plan are correct, and that the survey was
made on May 21, 1964.

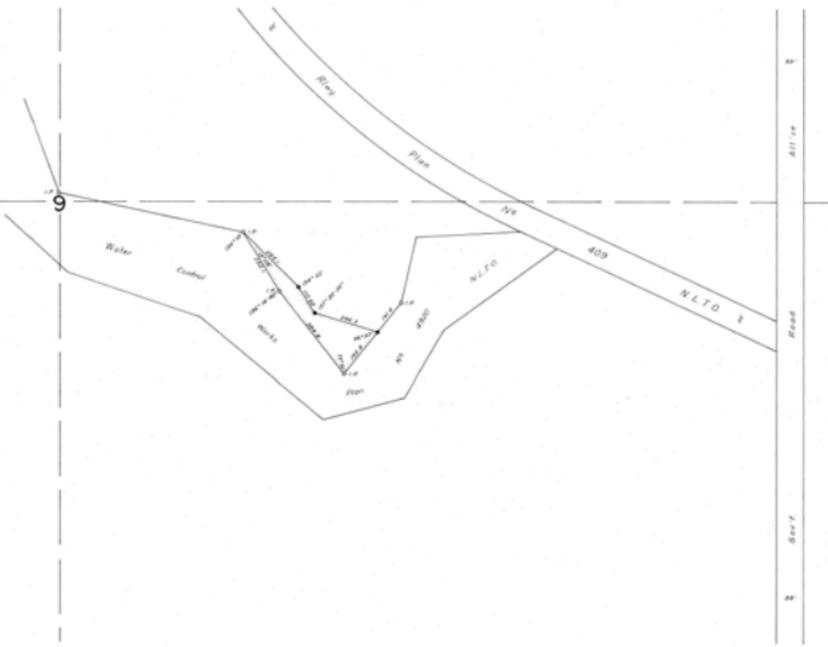
Sworn before me at Winnipeg
this 25th day of June 1964.


M.L.S.


A Commissioner for Oaths
My Commission expires Jan 9, 1965.

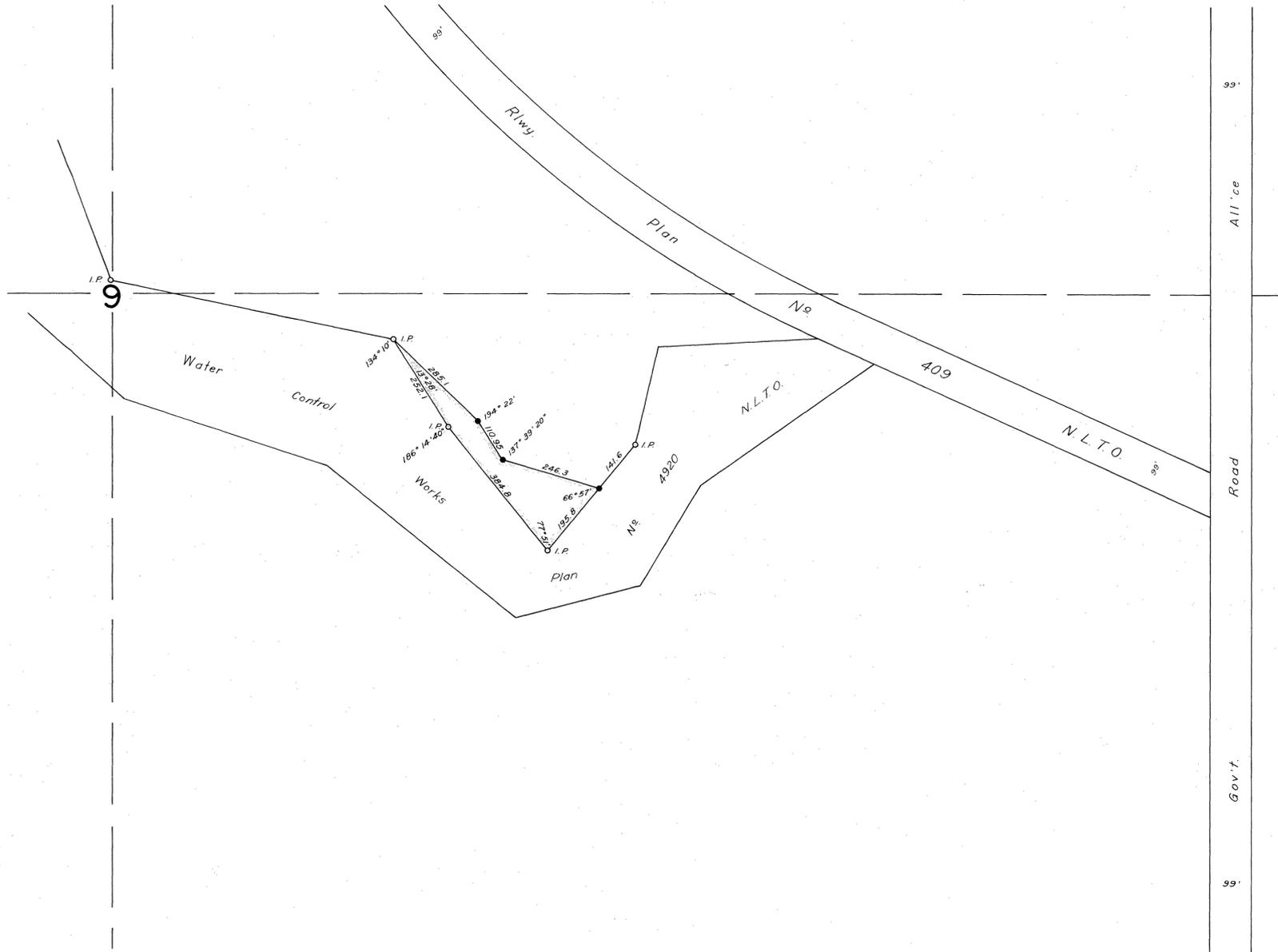
Entered and Filed in the
Manitoba Land Titles Office
this 22nd day of July 1964
at 9:25 am plus \$1 4-226


District Registrar



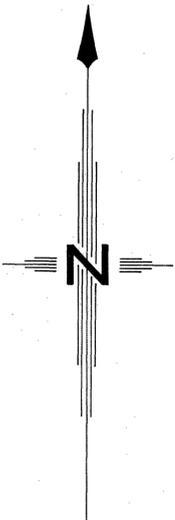
Approved
in July 1964
R.D. Davidson
Dist. Registrar of Surveys

6457
8066 W



PLAN OF SURVEY
OF
WATER CONTROL WORKS
IN
S.E. 1/4, Sec. 9, Twp. 21, Rge. 28 W.P.M.
—MANITOBA—

Scale = 1 inch = 200 feet



Notes:
Distances are in feet and decimals of a foot.
Survey monuments were found at all points shown thus—○—
Iron Posts 3/4" x 3/4" x 30" were driven at all points shown thus—●—
Land required for Water Control Works shown bordered red.

Approved and Confirmed
July 7, 1964
[Signature]
For Director of Surveys

I, Theodore Herbert Stevens of the City of Winnipeg, Manitoba Land Surveyor, make oath and say that I was present at and did personally superintend the survey represented by this plan, that the survey and plan are correct, and that the survey was made on May 21, 1964.

Sworn before me at Winnipeg
this 26 day of June 1964.

[Signature]
M.L.S.

[Signature]
A Commissioner for Oaths
My Commission expires Jan. 9, 1965.

Entered and Filed in the
Neepawa Land Titles Office
this 20 day of July A.D. 1964
at 9:24 as plan No. 4956

[Signature]
Deputy District Registrar

Approved
15th July 1964
[Signature]
Deputy Examiner of Surveys

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.: **2007-022**
 (Previous Lic. No.: 85-16)
 U.T.M.: Zone 14 345754 E
 5630429 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 Russell** 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:

the Southeast Quarter of Section 17, in Township 21 and Range 27, West of the Principal Meridian in Manitoba, more particularly described on Certificate of Title No. 1650415 NLTO,

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

Section 3, in Township 21 and Range 28, West of the Principal Meridian in Manitoba.

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 **0.011 cubic metres per second (0.4 cubic feet per second)**.
 b) The total quantity of water diverted in any one year shall not exceed **250 cubic decametres (202.68 acre feet)**.
4. 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.
5. 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.
6. 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, Infrastructure and Operations Division, for cancellation on behalf of the Minister.
7. 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.
8. This License may be amended, suspended or cancelled by the Minister in accordance with The Water Rights Act by letter addressed to the LICENSEE at **Box 10, Russell, MB, R0J 1W0, Canada** and thereafter this Licence shall be determined to be at an end.
9. 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.
10. The term of this Licence shall be **five (5) years** 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.
11. 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.
12. The LICENSEE shall keep records of daily and annual water use and shall provide a copy of such records to the Executive Director, Infrastructure and Operations Division, not later than February 1st of the following year.

13. A flow meter must be installed, positioned to accurately measure instantaneous pumping rate and accumulative withdrawals from the water source.
14. 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 issuance of the original Licence (No. 85-16), and which are partly or wholly attributable, in the opinion of the Minister, to the diversion of water as authorized by this Licence.
15. 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 _____

FOR OFFICE USE ONLY

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)

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.: **2007-022**
 (Previous Lic. No.: 85-16)
 U.T.M.: Zone 14 345754 E
 5630429 N

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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 **0.011 cubic metres per second (0.4 cubic feet per second)**.
 b) The total quantity of water diverted in any one year shall not exceed **250 cubic decametres (202.68 acre feet)**.
4. 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.
5. 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.
6. 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, Infrastructure and Operations Division, for cancellation on behalf of the Minister.
7. 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.
8. 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 10, Russell, MB, R0J 1W0, Canada** and thereafter this Licence shall be determined to be at an end.
9. 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.
10. The term of this Licence shall be **five (5) years** 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.
11. 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.
12. The LICENSEE shall keep records of daily and annual water use and shall provide a copy of such records to the Executive Director, Infrastructure and Operations Division, not later than February 1st of the following year.

13. A flow meter must be installed, positioned to accurately measure instantaneous pumping rate and accumulative withdrawals from the water source.
14. 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 issuance of the original Licence (No. 85-16), and which are partly or wholly attributable, in the opinion of the Minister, to the diversion of water as authorized by this Licence.
15. 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 _____

FOR OFFICE USE ONLY

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)

Figure A.2 – Blended Membrane Flow Analysis

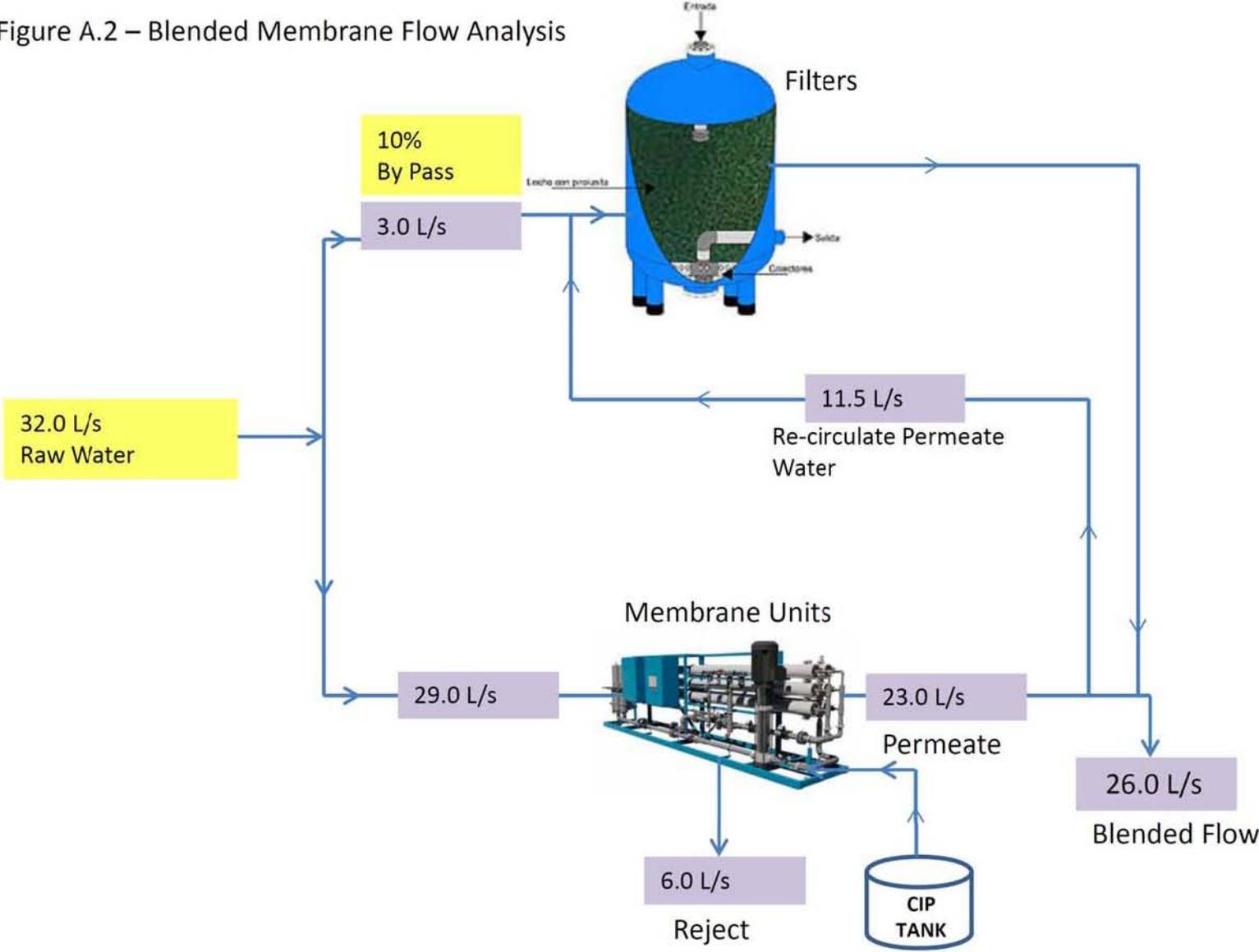
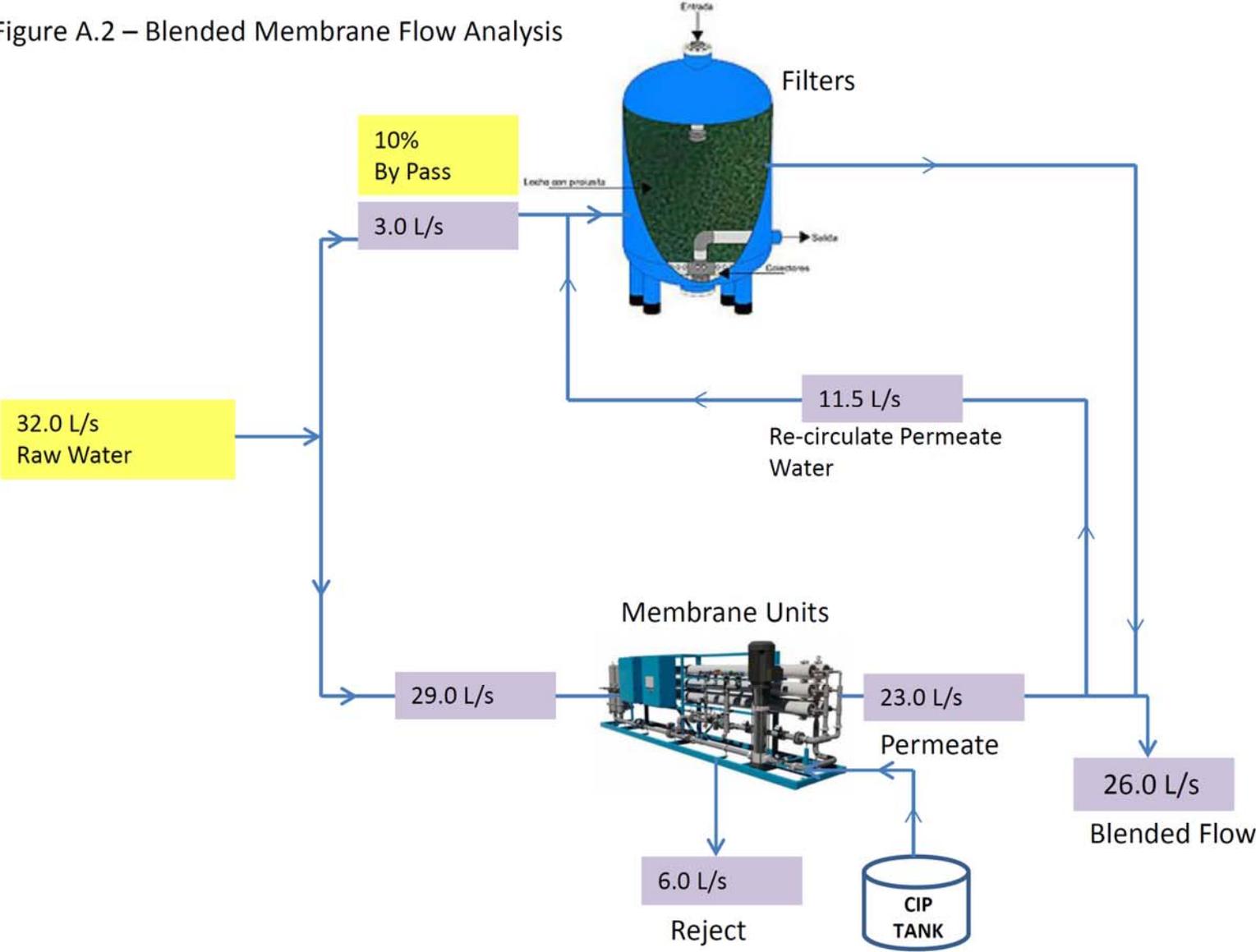


Figure A.2 – Blended Membrane Flow Analysis





Fish and Lake Improvement Program for the Parkland Region

World Class Trout Fishery in Manitoba's Parkland

~ on the fly ~



About FLIPPER

The Lakes

Trout Festival

Fly Patterns

Tackle /
Equipment

Videos

Articles

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Spear Lake

Spear Lake is a multi-species water body located just north-west of Russell, Manitoba. It contains rainbow and brown trout, walleyes and a few yellow perch. Camping and campfires are permitted. Power is available for charging batteries. Electric motors are allowed and there's no need to dismount your outboard. Just tip it up.

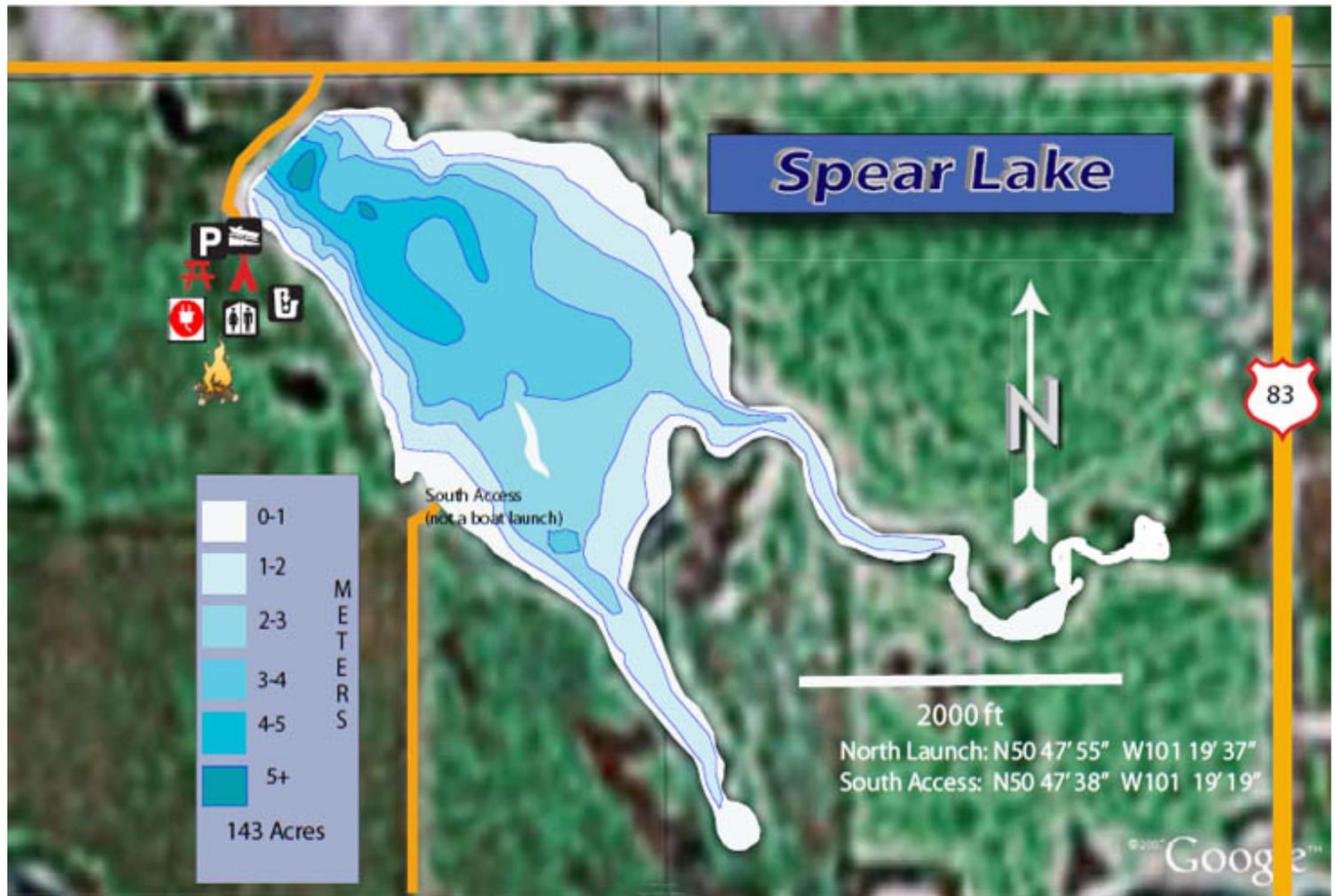
Several hotels and B&Bs are located in and nearby the town of Russell.

Directions:



Spear Lake is located at: N50 47' 58.54" W101 19' 37.34"

Click here to download the [Lake Contour/Information Map PDF](#) for Spear Lake



[Download the PDF](#)

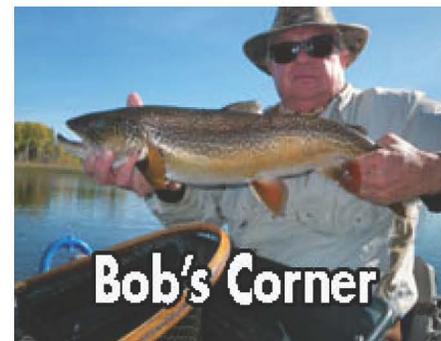
Contact FLIPPR Email: FLIPPR@flippr.ca - or - Mail Box 368, Russell, MB R0J 1W0



Fish and Lake Improvement Program for the Parkland Region

World Class Trout Fishery in Manitoba's Parkland

~ on the fly ~



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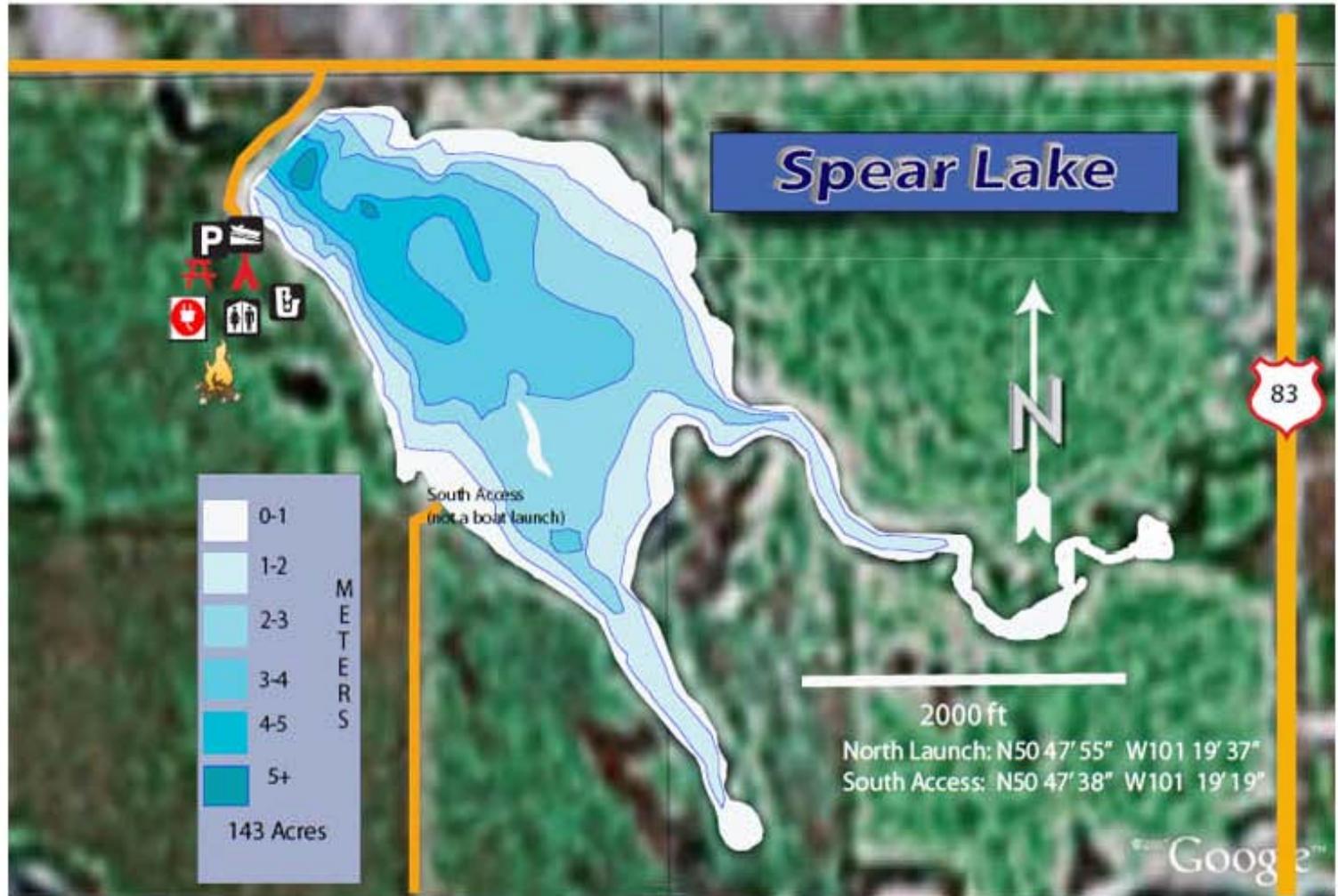
Several hotels and B&Bs are located in and nearby the town of Russell.

Directions:



Spear Lake is located at: N50 47' 58.54" W101 19' 37.34"

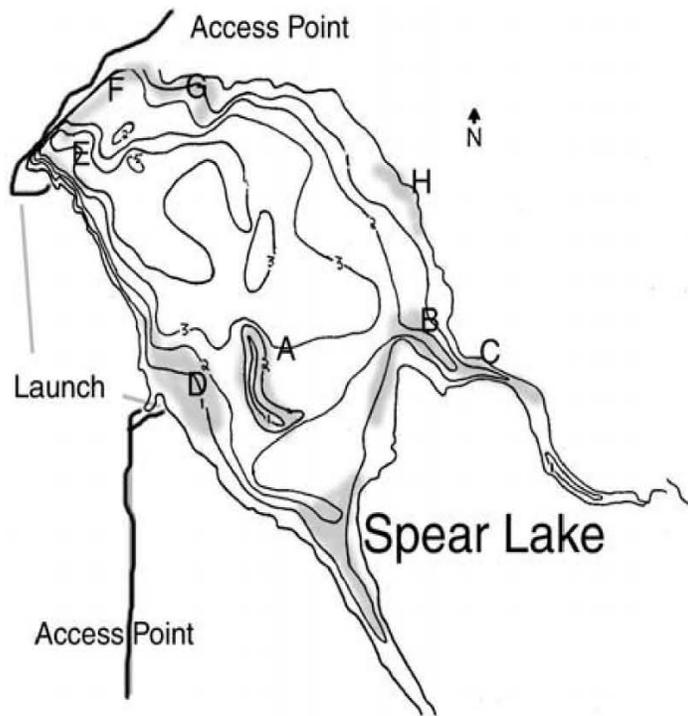
Click here to download the [Lake Contour/Information Map PDE](#) for Spear Lake



[Download the PDE](#)

Contact FLIPPR Email: FLIPPR@flippr.ca - or - Mail Box 368, Russell, MB R0J 1W0

Spear Lake



LOCATION:

1 mile North of Russell and one mile west.
Look for sign on Highway 83.

MORPHOLOGY:

Max. Depth: 4 metres - 17 feet.

Surface Area: 205 Acres - 90 Hectares

Sechi: Variable according to algae content.
2.1m - 7 ft max.

Thermocline: Nil. Entire lake turns over on windy days

Spear is no pushover. It can be cranky. On windy days it can be outrightly nasty.

Spear has recovered naturally from an encroachment of yellow perch, further helped by annual transfers

STARTING AREAS:

- A - The sunken island regularly hosts the largest fish. In summer the cupules along its weed edges are the feed table. In spring and fall, when weeds are down, the flanks become an excellent concentrator that must be covered every few hours.
- B - Mouth of the creek. A very broad flat that concentrates unbelievable numbers of feeding trout.
- C - The creek. A moderate current attracts minnows and offers the last deep water prior to entering the creek. Best in water flows but can be good any time. The largest trout are often taken here.
- D - Weed edges along a flat. Trout gather primarily to feed on snails and daphnia.
- E - The launch. What can we say? The best place in the lake is often right at one's toes. A gravelled area that hosts spawning activity in early spring, but a smorgasbord of forage year round. Fish from deep to shallow.
- F - The rip rap. Boulders attract forage. Forage attracts trout, especially when it lies adjacent to the deepest, coolest water in the lake. When minnows stack, this is the hotspot. We often hunker on the rock, break up our outlines and cast from shore.
- G - Weeds, beaches and flats. An excellent wading area. A point truncates the zone and offers some excellent fishing. Bulrushes and sedge grasses attract forage at any time, but this is a hotspot during the annual damsel hatches.
- H - Watch for cupules, (dished structures that go back into the weeds or even as far as shore). Work them. Trout pin minnows in them and then predate them. These are areas they love to pin perch fry and further reduce their population

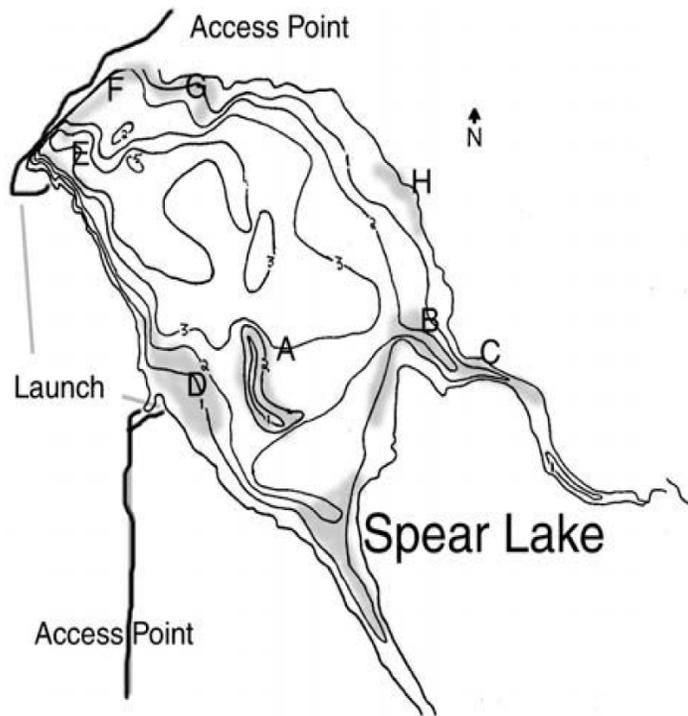
STARTING PATTERNS:

Caddis dries and emergers. Some great dry fly action can be had during the spring hatch of small black caddis.

Olive and black Woolly Buggers, Bead-head Beaver and Tans, Copper Coachmen, Crystal P-Q uads, Psychedelic P-Q uads, backswimmer and scud patterns.

In the autumn when trout feed directly on daphnia we fish a rusty-pink Woolly Bugger we are ashamed to show to anyone.

Spear Lake



LOCATION:

1 mile North of Russell and one mile west.
Look for sign on Highway 83.

MORPHOLOGY:

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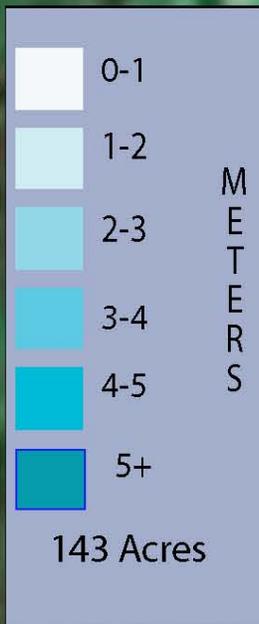
STARTING PATTERNS:

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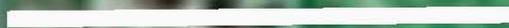
Olive and black Woolly Buggers, Bead-head Beaver and Tans, Copper Coachmen, Crystal P-Q uads, Psychedelic P-Q uads, backswimmer and scud patterns.

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Spear Lake



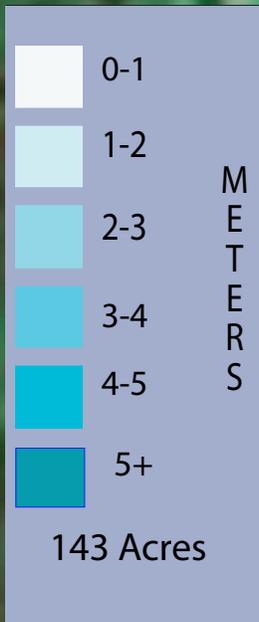
South Access
(not a boat launch)



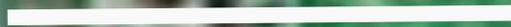
2000 ft

North Launch: N50 47' 55" W101 19' 37"
South Access: N50 47' 38" W101 19' 19"

Spear Lake



South Access
(not a boat launch)



2000 ft

North Launch: N50 47' 55" W101 19' 37"
South Access: N50 47' 38" W101 19' 19"



Duck Mountain Provincial Park

Dauphin

Shellmouth Reservoir/ Asessippi Provincial Park

Russell

Russell, MB R0J Binscarth

Riding Mountain National Park (RMNP)

Clear Lake at RMNP

Lake Manitoba

Brandon
Brandon

Winnipeg

Image Landsat
© 2015 Google

Google earth

Imagery Date: 4/9/2013 50°26'55.89" N 99°37'04.52" W elev 443 m eye alt 452.01 km



Duck Mountain Provincial Park

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Imagery Date: 4/9/2013 50°26'55.89" N 99°37'04.52" W elev 443 m eye alt 452.01 km



Town of Russell - Water Treatment Plant
ATTN: STEVEN SMITH
Russel Water Plant
Box 10
Russell MB R0J 1W0

Date Received: 08-AUG-13
Report Date: 13-AUG-13 15:27 (MT)
Version: FINAL

Client Phone: 204-773-2253

Certificate of Analysis

Lab Work Order #: L1344556
Project P.O. #: NOT SUBMITTED
Job Reference: RUSSELL - PWS 189.00
C of C Numbers:
Legal Site Desc: 17511

Lisa Page
Account Manager

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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 A Campbell Brothers Limited Company

ANALYTICAL REPORT

Physical Tests (WATER)

		ALS ID		L1344556-1	L1344556-2
		Sampled Date		07-AUG-13	07-AUG-13
		Sampled Time		14:00	14:00
		Sample ID		RUSSELL 1-RAW	RUSSELL 2-TREATED
Analyte	Unit	Guide Limit #1	Guide Limit #2		
Colour, True	CU	15	-	<5.0	<5.0
Conductivity	umhos/cm	-	-	1120	679
Hardness (as CaCO3)	mg/L	-	-	601	159
Langelier Index (4 C)	No Unit	-	-	0.47	-0.35
Langelier Index (60 C)	No Unit	-	-	1.2	0.41
pH	pH units	6.5-8.5	-	7.39	8.09
Total Dissolved Solids	mg/L	500	-	813	468
Transmittance, UV (254 nm)	% T	-	-	88.3	94.9
Turbidity	NTU	-	-	38.3	0.39

Federal Guidelines for Canadian Drinking Water Quality (AUG, 2012)

#1: GCDWQ - Aesthetic Objective

#2: GCDWQ - Maximum Acceptable Concentrations (MACs)

Anions and Nutrients (WATER)

		ALS ID		L1344556-1	L1344556-2
		Sampled Date		07-AUG-13	07-AUG-13
		Sampled Time		14:00	14:00
		Sample ID		RUSSELL 1-RAW	RUSSELL 2-TREATED
Analyte	Unit	Guide Limit #1	Guide Limit #2		
Alkalinity, Total (as CaCO3)	mg/L	-	-	481	95
Ammonia, Total (as N)	mg/L	-	-	1.20 ^{DLA}	<0.010
Bicarbonate (HCO3)	mg/L	-	-	587	116
Bromide (Br)	mg/L	-	-	<0.10	<0.10
Carbonate (CO3)	mg/L	-	-	<12	<12
Chloride	mg/L	250	-	4.26	12.9
Fluoride	mg/L	-	1.5	0.22	0.67
Hydroxide (OH)	mg/L	-	-	<6.8	<6.8
Nitrate-N	mg/L	-	10	<0.0050	0.280
Nitrite-N	mg/L	-	1	<0.0010	<0.0010
Sulfate	mg/L	500	-	219	225

Federal Guidelines for Canadian Drinking Water Quality (AUG, 2012)

#1: GCDWQ - Aesthetic Objective

#2: GCDWQ - Maximum Acceptable Concentrations (MACs)

Organic / Inorganic Carbon (WATER)

		ALS ID		L1344556-1	L1344556-2
		Sampled Date		07-AUG-13	07-AUG-13
		Sampled Time		14:00	14:00
		Sample ID		RUSSELL 1-RAW	RUSSELL 2-TREATED
Analyte	Unit	Guide Limit #1	Guide Limit #2		
Dissolved Organic Carbon	mg/L	-	-	2.4	3.0
Total Organic Carbon	mg/L	-	-	3.1	3.0

Federal Guidelines for Canadian Drinking Water Quality (AUG, 2012)

#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

Total Metals (WATER)

		ALS ID		L1344556-1	L1344556-2
		Sampled Date		07-AUG-13	07-AUG-13
		Sampled Time		14:00	14:00
		Sample ID		RUSSELL 1- RAW	RUSSELL 2- TREATED
Analyte	Unit	Guide Limit #1	Guide Limit #2		
Aluminum (Al)-Total	mg/L	0.1	-	<0.0050	<0.0050
Antimony (Sb)-Total	mg/L	-	0.006	<0.00020	<0.00020
Arsenic (As)-Total	mg/L	-	0.01	0.0341	0.00703
Barium (Ba)-Total	mg/L	-	1	0.0131	0.00132
Beryllium (Be)-Total	mg/L	-	-	<0.00020	<0.00020
Bismuth (Bi)-Total	mg/L	-	-	<0.00020	<0.00020
Boron (B)-Total	mg/L	-	5	0.174	0.150
Cadmium (Cd)-Total	mg/L	-	0.005	0.000027	0.000026
Calcium (Ca)-Total	mg/L	-	-	151 ^{DLA}	19.4
Cesium (Cs)-Total	mg/L	-	-	<0.00010	<0.00010
Chromium (Cr)-Total	mg/L	-	0.05	<0.0010	<0.0010
Cobalt (Co)-Total	mg/L	-	-	0.00075	<0.00020
Copper (Cu)-Total	mg/L	1	-	0.00838	0.00888
Iron (Fe)-Total	mg/L	0.3	-	3.50	<0.10
Lead (Pb)-Total	mg/L	-	0.01	0.000331	0.000171
Lithium (Li)-Total	mg/L	-	-	0.115	0.109
Magnesium (Mg)-Total	mg/L	-	-	54.1	26.8
Manganese (Mn)-Total	mg/L	0.05	-	0.463	0.00298
Molybdenum (Mo)-Total	mg/L	-	-	0.00817	0.00800
Nickel (Ni)-Total	mg/L	-	-	<0.0020	<0.0020
Phosphorus (P)-Total	mg/L	-	-	0.14	<0.10
Potassium (K)-Total	mg/L	-	-	6.72	7.49
Rubidium (Rb)-Total	mg/L	-	-	0.00148	0.00248
Selenium (Se)-Total	mg/L	-	0.01	<0.0010	<0.0010
Silicon (Si)-Total	mg/L	-	-	14.3	7.23
Silver (Ag)-Total	mg/L	-	-	<0.00010	<0.00010
Sodium (Na)-Total	mg/L	200	-	39.1	83.0 ^{DLA}
Strontium (Sr)-Total	mg/L	-	-	0.607	0.108
Tellurium (Te)-Total	mg/L	-	-	<0.00020	<0.00020
Thallium (Tl)-Total	mg/L	-	-	<0.00010	<0.00010
Thorium (Th)-Total	mg/L	-	-	<0.00010	<0.00010
Tin (Sn)-Total	mg/L	-	-	<0.00020	<0.00020
Titanium (Ti)-Total	mg/L	-	-	0.00310	0.00325

Federal Guidelines for Canadian Drinking Water Quality (AUG, 2012)

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		Sampled Date		07-AUG-13	07-AUG-13
		Sampled Time		14:00	14:00
		Sample ID		RUSSELL 1-RAW	RUSSELL 2-TREATED
Analyte	Unit	Guide Limit #1	Guide Limit #2		
Tungsten (W)-Total	mg/L	-	-	<0.00010	<0.00010
Uranium (U)-Total	mg/L	-	0.02	0.00415	<0.00010
Vanadium (V)-Total	mg/L	-	-	<0.00020	<0.00020
Zinc (Zn)-Total	mg/L	5	-	0.0071	<0.0020
Zirconium (Zr)-Total	mg/L	-	-	<0.00040	<0.00040

Federal Guidelines for Canadian Drinking Water Quality (AUG, 2012)

#1: GCDWQ - Aesthetic Objective

#2: GCDWQ - Maximum Acceptable Concentrations (MACs)

Volatile Organic Compounds (WATER)

		ALS ID		L1344556-1
		Sampled Date		07-AUG-13
		Sampled Time		14:00
		Sample ID		RUSSELL 1-RAW
Analyte	Unit	Guide Limit #1	Guide Limit #2	
Benzene	ug/L	-	5	<0.50
1,1-Dichloroethylene	ug/L	-	14	<0.50
Dichloromethane	ug/L	-	50	1.63
Ethyl Benzene	ug/L	2.4	-	<0.50
MTBE	ug/L	15	-	<0.50
Tetrachloroethylene	ug/L	-	30	<0.50
Toluene	ug/L	24	-	<0.50
Trichloroethylene	ug/L	-	5	<0.50
Xylenes (Total)	ug/L	300	-	<1.1
Surrogate: 4-Bromofluorobenzene	%	-	-	111.6
Surrogate: 1,2-Dichloroethane d4	%	-	-	108.7
Surrogate: Toluene-d8	%	-	-	101.1

Federal Guidelines for Canadian Drinking Water Quality (AUG, 2012)

#1: GCDWQ - Aesthetic Objective

#2: GCDWQ - Maximum Acceptable Concentrations (MACs)

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

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLA	Detection Limit Adjusted For required dilution

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TOT-WP	Water	Alkalinity	APHA 2320B
Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. It is determined by titration with a standard solution of strong mineral acid to the successive HCO ₃ ⁻ and H ₂ CO ₃ endpoints indicated electrometrically.			
BR-IC-WP	Water	Bromide by Ion Chromatography	EPA 300.1 (modified)
Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.			
C-TC,TIC,TOC-WP	Water	Carbons	APHA 5310 B-INSTRUMENTAL
This method is applicable to the analysis of ground water, wastewater, and surface water samples. The form detected depends upon sample pretreatment: Unfiltered sample = TC, 0.45um filtered = TDC. Samples are injected into a combustion tube containing an oxidation catalyst. The carrier gas containing the combustion product from the combustion tube flows through an inorganic carbon reactor vessel and is then sent through a halogen scrubber into a sample cell set in a non-dispersive infrared gas analyzer (NDIR) where carbon dioxide is detected. For total inorganic carbon and dissolved inorganic carbon, the sample is injected into an IC reactor vessel where only the IC component is decomposed to become carbon dioxide.			
The peak area generated by the NDIR indicates the TC/TDC or TIC/DIC as applicable. The total organic carbon content of the sample is calculated by subtracting the TIC from the TC. TOC = TC-TIC, DOC = TDC-DIC, Particulate = Total - Dissolved.			
C-TDC,DIC,DOC-WP	Water	Carbons Dissolved	APHA 5310 B-INSTRUMENTAL
This method is applicable to the analysis of ground water, wastewater, and surface water samples. The form detected depends upon sample pretreatment: Unfiltered sample = TC, 0.45um filtered = TDC. Samples are injected into a combustion tube containing an oxidation catalyst. The carrier gas containing the combustion product from the combustion tube flows through an inorganic carbon reactor vessel and is then sent through a halogen scrubber into a sample cell set in a non-dispersive infrared gas analyzer (NDIR) where carbon dioxide is detected. For total inorganic carbon and dissolved inorganic carbon, the sample is injected into an IC reactor vessel where only the IC component is decomposed to become carbon dioxide.			
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CL-L-IC-WP	Water	Chloride by Ion Chromatography	EPA 300.1 (modified)
Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.			
COLOUR-TRUE-WP	Water	Colour, True	APHA 2120C
True colour in water is analyzed by discrete analyzer using the platinum-cobalt colourimetric method. Colour is pH dependant; unless otherwise indicated, reported colour results pertain to the pH of the sample as received to within +/- 1 pH unit.			
EC-WP	Water	Conductivity	APHA 2510B
Conductivity of an aqueous solution refers to its ability to carry an electric current. Conductance of a solution is measured between two spatially fixed and chemically inert electrodes.			
ETL-HARDNESS-TOT-WP	Water	Hardness Calculated	HARDNESS CALCULATED
ETL-LANGELIER-4-WP	Water	Langelier Index 4C	Calculated
ETL-LANGELIER-60-WP	Water	Langelier Index 60C	Calculated
F-IC-WP	Water	Fluoride by Ion Chromatography	EPA 300.1 (modified)
Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.			
IONBALANCE-CALC-WP	Water	Ion Balance Calculation	APHA 1030E
MET-T-L-MS-WP	Water	Total Metals by ICP-MS	U.S. EPA 200.8-TL

Total Metals by ICP-MS: This analysis is carried out using sample preparation procedures adapted from Standard Methods for the examination of Water and Wastewater Method 3030E and analytical procedures adapted from U.S EPA Method 200.8 for analysis of metals by inductively coupled-

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
		mass spectrometry.	
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.	
NO2-L-IC-WP	Water	Nitrite as N by Ion Chromatography	EPA 300.1 (modified)
		Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.	
NO3-L-IC-WP	Water	Nitrate as N by Ion Chromatography	EPA 300.1 (modified)
		Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.	
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-WP	Water	Sulfate by Ion Chromatography	EPA 300.1 (modified)
		Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.	
SOLIDS-TDS-WP	Water	Total Dissolved Solids	APHA 2540 C (modified)
		Total dissolved solids in aqueous matrices is determined gravimetrically after evaporation of the filtrate at 180°C.	
TRANSM-UV-WT	Water	Transmittance, UV (254 nm)	APHA 5910 B-Spectrophotometer
TURBIDITY-WP	Water	Turbidity	APHA 2130B (modified)
		Turbidity in aqueous matrices is determined by the nephelometric method.	
VOC-ROU-WT	Water	Volatile Organic Compounds	SW846 8260
		The purge and trap method purges Volatile Organic Compounds (VOC) from aqueous samples by bubbling an inert gas through the sample. Once in the gaseous phase, the analytes are swept from the purging device and trapped in a short column. The compounds are that are trapped on the column are thermally desorbed and transferred to the analytical column of the GC/MS.	
XYLENES-SUM-CALC-WT	Water	Sum of Xylene Isomer Concentrations	CALCULATION
		Total xylenes represents the sum of o-xylene and m&p-xylene.	

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

Chain of Custody Numbers:

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
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

Reference Information

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.

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information.

Manitoba Conservation Water Stewardship
Office of Drinking Water
1007 Century Street, Winnipeg, Manitoba,
Canada R3H 0W4

Chain of Custody (COC)
Manitoba Drinking Water Systems
ONLY FOR: Regulatory General Chemistry &



L1344556-COFC

Report to Operator (email pdf):				Owner billing (Email):				Regular Service (is 5-7 Days):			
Contact:	Steve Smith			Contact:	Wally Melnyk			Unless otherwise requested:	<input type="checkbox"/> 1 Day, rush / priority		
Address:	Box 10 Russell MB R0J 1W0			Address:	Box 10 Russell MB R0J 1W0				<input type="checkbox"/> 2 Day, rush / priority		
Phone:	204-773-3185			Phone:	204-773-2253				<input type="checkbox"/> 3 Day, rush / priority		
Email:	russellwaterplant@hotmail.com			Email:	wally@russellmb.com						
Operator contact update (if different then above):				Owner contact update (if different then above):				Email pdf copy to:			
Contact:				Contact:				DWO:	Glen Robertson		
Address:				Address:				DWO Address:	1129 Queens Ave. Brandon MB R7A 1L9		
Phone:				Phone:				DWO Phone:	204-726-6563		
Email:				Email:				DWO Email:	glen.robertson@gov.mb.ca		
Account:	00W7260	ODW Report type:	EMS (Lab-MWS)	Client / Project Information:				Analysis Request			
Agency Code:	382	Project:	DWQ-C	Operation Name:	RUSSELL - PWS				MB-CH-PWS-V2013	MB-VOC-PWS-V2013	Number of Containers
Lab:	ALS	Lab Work Order # / Job # (lab use only)		Operation Code (com code):	189.00						
				Operation Id:	17511						
				Sampled by:	Steve Smith						
Lab Sample # (lab use only)	Sample Number (YYMMII9999)	Station Number (MB99XXD999) / (MB99XXY999)	Sample Identification	Date dd-mmm-yyyy	Time hh:mm	Sample Matrix	Sample Type				
	1308GR0022	MB05MED051	Russell 1 - Raw	07-08-13	2 PM	6	1	X	X	8	
	1308GR0023	MB05MED052	Russell 2 - Treated	07-08-13	2 PM	10	1	X		5	
Failure to complete all portions of this form may delay analysis.								Sample Matrix:		Sample Type:	
Please fill in this form LEGIBLY.								6-Raw Water, 10-Treated Water		1-Grab Sample	
By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified by the Laboratory.											
For ALL other testing, please use Laboratory specific forms.											
DO NOT COPY or RE-USE this form. Sample Numbers are unique to the Office of Drinking Water and provided by DWO.											
Relinquished By:	Steven Smith	Date & Time: 2 PM Aug 7/13		Received By: (lab use only)	GH	Date & Time: (lab use only)	Aug. 8/13 12:00	Sample Condition (lab use only)			
Relinquished By:		Date & Time:		Received By: (lab use only)		Date & Time: (lab use only)		Temperature	Samples Received in Good Condition? Y / N (if no provide details)		
								13.9°C			

Operator mandatory

Operator optional

Operator to fill, if information above has changed

Opr to fill, Lab specific

pre-filled by DWO

Note: Cyanide and Mercury are not required and have been removed from the list.

Please use the Rev. July 29, 2013 Water System Chemistry List.



Town of Russell - Water Treatment Plant
ATTN: STEVEN SMITH
Russel Water Plant
Box 10
Russell MB R0J 1W0

Date Received: 08-AUG-13
Report Date: 13-AUG-13 15:27 (MT)
Version: FINAL

Client Phone: 204-773-2253

Certificate of Analysis

Lab Work Order #: L1344556
Project P.O. #: NOT SUBMITTED
Job Reference: RUSSELL - PWS 189.00
C of C Numbers:
Legal Site Desc: 17511

Lisa Page
Account 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 A Campbell Brothers Limited Company

ANALYTICAL REPORT

Physical Tests (WATER)

		ALS ID		L1344556-1	L1344556-2
		Sampled Date		07-AUG-13	07-AUG-13
		Sampled Time		14:00	14:00
		Sample ID		RUSSELL 1-RAW	RUSSELL 2-TREATED
Analyte	Unit	Guide Limit #1	Guide Limit #2		
Colour, True	CU	15	-	<5.0	<5.0
Conductivity	umhos/cm	-	-	1120	679
Hardness (as CaCO3)	mg/L	-	-	601	159
Langelier Index (4 C)	No Unit	-	-	0.47	-0.35
Langelier Index (60 C)	No Unit	-	-	1.2	0.41
pH	pH units	6.5-8.5	-	7.39	8.09
Total Dissolved Solids	mg/L	500	-	813	468
Transmittance, UV (254 nm)	% T	-	-	88.3	94.9
Turbidity	NTU	-	-	38.3	0.39

Federal Guidelines for Canadian Drinking Water Quality (AUG, 2012)

#1: GCDWQ - Aesthetic Objective

#2: GCDWQ - Maximum Acceptable Concentrations (MACs)

Anions and Nutrients (WATER)

		ALS ID		L1344556-1	L1344556-2
		Sampled Date		07-AUG-13	07-AUG-13
		Sampled Time		14:00	14:00
		Sample ID		RUSSELL 1-RAW	RUSSELL 2-TREATED
Analyte	Unit	Guide Limit #1	Guide Limit #2		
Alkalinity, Total (as CaCO3)	mg/L	-	-	481	95
Ammonia, Total (as N)	mg/L	-	-	1.20 ^{DLA}	<0.010
Bicarbonate (HCO3)	mg/L	-	-	587	116
Bromide (Br)	mg/L	-	-	<0.10	<0.10
Carbonate (CO3)	mg/L	-	-	<12	<12
Chloride	mg/L	250	-	4.26	12.9
Fluoride	mg/L	-	1.5	0.22	0.67
Hydroxide (OH)	mg/L	-	-	<6.8	<6.8
Nitrate-N	mg/L	-	10	<0.0050	0.280
Nitrite-N	mg/L	-	1	<0.0010	<0.0010
Sulfate	mg/L	500	-	219	225

Federal Guidelines for Canadian Drinking Water Quality (AUG, 2012)

#1: GCDWQ - Aesthetic Objective

#2: GCDWQ - Maximum Acceptable Concentrations (MACs)

Organic / Inorganic Carbon (WATER)

		ALS ID		L1344556-1	L1344556-2
		Sampled Date		07-AUG-13	07-AUG-13
		Sampled Time		14:00	14:00
		Sample ID		RUSSELL 1-RAW	RUSSELL 2-TREATED
Analyte	Unit	Guide Limit #1	Guide Limit #2		
Dissolved Organic Carbon	mg/L	-	-	2.4	3.0
Total Organic Carbon	mg/L	-	-	3.1	3.0

Federal Guidelines for Canadian Drinking Water Quality (AUG, 2012)

#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

Total Metals (WATER)

		ALS ID		L1344556-1	L1344556-2
		Sampled Date		07-AUG-13	07-AUG-13
		Sampled Time		14:00	14:00
		Sample ID		RUSSELL 1- RAW	RUSSELL 2- TREATED
Analyte	Unit	Guide Limit #1	Guide Limit #2		
Aluminum (Al)-Total	mg/L	0.1	-	<0.0050	<0.0050
Antimony (Sb)-Total	mg/L	-	0.006	<0.00020	<0.00020
Arsenic (As)-Total	mg/L	-	0.01	0.0341	0.00703
Barium (Ba)-Total	mg/L	-	1	0.0131	0.00132
Beryllium (Be)-Total	mg/L	-	-	<0.00020	<0.00020
Bismuth (Bi)-Total	mg/L	-	-	<0.00020	<0.00020
Boron (B)-Total	mg/L	-	5	0.174	0.150
Cadmium (Cd)-Total	mg/L	-	0.005	0.000027	0.000026
Calcium (Ca)-Total	mg/L	-	-	151 ^{DLA}	19.4
Cesium (Cs)-Total	mg/L	-	-	<0.00010	<0.00010
Chromium (Cr)-Total	mg/L	-	0.05	<0.0010	<0.0010
Cobalt (Co)-Total	mg/L	-	-	0.00075	<0.00020
Copper (Cu)-Total	mg/L	1	-	0.00838	0.00888
Iron (Fe)-Total	mg/L	0.3	-	3.50	<0.10
Lead (Pb)-Total	mg/L	-	0.01	0.000331	0.000171
Lithium (Li)-Total	mg/L	-	-	0.115	0.109
Magnesium (Mg)-Total	mg/L	-	-	54.1	26.8
Manganese (Mn)-Total	mg/L	0.05	-	0.463	0.00298
Molybdenum (Mo)-Total	mg/L	-	-	0.00817	0.00800
Nickel (Ni)-Total	mg/L	-	-	<0.0020	<0.0020
Phosphorus (P)-Total	mg/L	-	-	0.14	<0.10
Potassium (K)-Total	mg/L	-	-	6.72	7.49
Rubidium (Rb)-Total	mg/L	-	-	0.00148	0.00248
Selenium (Se)-Total	mg/L	-	0.01	<0.0010	<0.0010
Silicon (Si)-Total	mg/L	-	-	14.3	7.23
Silver (Ag)-Total	mg/L	-	-	<0.00010	<0.00010
Sodium (Na)-Total	mg/L	200	-	39.1	83.0 ^{DLA}
Strontium (Sr)-Total	mg/L	-	-	0.607	0.108
Tellurium (Te)-Total	mg/L	-	-	<0.00020	<0.00020
Thallium (Tl)-Total	mg/L	-	-	<0.00010	<0.00010
Thorium (Th)-Total	mg/L	-	-	<0.00010	<0.00010
Tin (Sn)-Total	mg/L	-	-	<0.00020	<0.00020
Titanium (Ti)-Total	mg/L	-	-	0.00310	0.00325

Federal Guidelines for Canadian Drinking Water Quality (AUG, 2012)

#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

Total Metals (WATER)

		ALS ID		L1344556-1	L1344556-2
		Sampled Date		07-AUG-13	07-AUG-13
		Sampled Time		14:00	14:00
		Sample ID		RUSSELL 1-RAW	RUSSELL 2-TREATED
Analyte	Unit	Guide Limit #1	Guide Limit #2		
Tungsten (W)-Total	mg/L	-	-	<0.00010	<0.00010
Uranium (U)-Total	mg/L	-	0.02	0.00415	<0.00010
Vanadium (V)-Total	mg/L	-	-	<0.00020	<0.00020
Zinc (Zn)-Total	mg/L	5	-	0.0071	<0.0020
Zirconium (Zr)-Total	mg/L	-	-	<0.00040	<0.00040

Federal Guidelines for Canadian Drinking Water Quality (AUG, 2012)

#1: GCDWQ - Aesthetic Objective

#2: GCDWQ - Maximum Acceptable Concentrations (MACs)

Volatile Organic Compounds (WATER)

		ALS ID		L1344556-1
		Sampled Date		07-AUG-13
		Sampled Time		14:00
		Sample ID		RUSSELL 1-RAW
Analyte	Unit	Guide Limit #1	Guide Limit #2	
Benzene	ug/L	-	5	<0.50
1,1-Dichloroethylene	ug/L	-	14	<0.50
Dichloromethane	ug/L	-	50	1.63
Ethyl Benzene	ug/L	2.4	-	<0.50
MTBE	ug/L	15	-	<0.50
Tetrachloroethylene	ug/L	-	30	<0.50
Toluene	ug/L	24	-	<0.50
Trichloroethylene	ug/L	-	5	<0.50
Xylenes (Total)	ug/L	300	-	<1.1
Surrogate: 4-Bromofluorobenzene	%	-	-	111.6
Surrogate: 1,2-Dichloroethane d4	%	-	-	108.7
Surrogate: Toluene-d8	%	-	-	101.1

Federal Guidelines for Canadian Drinking Water Quality (AUG, 2012)

#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.

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLA	Detection Limit Adjusted For required dilution

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
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ALK-TOT-WP	Water	Alkalinity	APHA 2320B
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Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. It is determined by titration with a standard solution of strong mineral acid to the successive HCO₃⁻ and H₂CO₃ endpoints indicated electrometrically.

BR-IC-WP	Water	Bromide by Ion Chromatography	EPA 300.1 (modified)
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Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.

C-TC, TIC, TOC-WP	Water	Carbons	APHA 5310 B-INSTRUMENTAL
--------------------------	-------	---------	--------------------------

This method is applicable to the analysis of ground water, wastewater, and surface water samples. The form detected depends upon sample pretreatment: Unfiltered sample = TC, 0.45um filtered = TDC. Samples are injected into a combustion tube containing an oxidation catalyst. The carrier gas containing the combustion product from the combustion tube flows through an inorganic carbon reactor vessel and is then sent through a halogen scrubber into a sample cell set in a non-dispersive infrared gas analyzer (NDIR) where carbon dioxide is detected. For total inorganic carbon and dissolved inorganic carbon, the sample is injected into an IC reactor vessel where only the IC component is decomposed to become carbon dioxide.

The peak area generated by the NDIR indicates the TC/TDC or TIC/DIC as applicable. The total organic carbon content of the sample is calculated by subtracting the TIC from the TC.

TOC = TC-TIC, DOC = TDC-DIC, Particulate = Total - Dissolved.

C-TDC, DIC, DOC-WP	Water	Carbons Dissolved	APHA 5310 B-INSTRUMENTAL
---------------------------	-------	-------------------	--------------------------

This method is applicable to the analysis of ground water, wastewater, and surface water samples. The form detected depends upon sample pretreatment: Unfiltered sample = TC, 0.45um filtered = TDC. Samples are injected into a combustion tube containing an oxidation catalyst. The carrier gas containing the combustion product from the combustion tube flows through an inorganic carbon reactor vessel and is then sent through a halogen scrubber into a sample cell set in a non-dispersive infrared gas analyzer (NDIR) where carbon dioxide is detected. For total inorganic carbon and dissolved inorganic carbon, the sample is injected into an IC reactor vessel where only the IC component is decomposed to become carbon dioxide.

The peak area generated by the NDIR indicates the TC/TDC or TIC/DIC as applicable. The total organic carbon content of the sample is calculated by subtracting the TIC from the TC.

TOC = TC-TIC, DOC = TDC-DIC, Particulate = Total - Dissolved.

CL-L-IC-WP	Water	Chloride by Ion Chromatography	EPA 300.1 (modified)
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Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.

COLOUR-TRUE-WP	Water	Colour, True	APHA 2120C
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True colour in water is analyzed by discrete analyzer using the platinum-cobalt colourimetric method. Colour is pH dependant; unless otherwise indicated, reported colour results pertain to the pH of the sample as received to within +/- 1 pH unit.

EC-WP	Water	Conductivity	APHA 2510B
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Conductivity of an aqueous solution refers to its ability to carry an electric current. Conductance of a solution is measured between two spatially fixed and chemically inert electrodes.

ETL-HARDNESS-TOT-WP	Water	Hardness Calculated	HARDNESS CALCULATED
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ETL-LANGELIER-4-WP	Water	Langelier Index 4C	Calculated
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ETL-LANGELIER-60-WP	Water	Langelier Index 60C	Calculated
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F-IC-WP	Water	Fluoride by Ion Chromatography	EPA 300.1 (modified)
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Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.

IONBALANCE-CALC-WP	Water	Ion Balance Calculation	APHA 1030E
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MET-T-L-MS-WP	Water	Total Metals by ICP-MS	U.S. EPA 200.8-TL
----------------------	-------	------------------------	-------------------

Total Metals by ICP-MS: This analysis is carried out using sample preparation procedures adapted from Standard Methods for the examination of Water and Wastewater Method 3030E and analytical procedures adapted from U.S EPA Method 200.8 for analysis of metals by inductively coupled-

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
		mass spectrometry.	
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.	
NO2-L-IC-WP	Water	Nitrite as N by Ion Chromatography	EPA 300.1 (modified)
		Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.	
NO3-L-IC-WP	Water	Nitrate as N by Ion Chromatography	EPA 300.1 (modified)
		Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.	
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-WP	Water	Sulfate by Ion Chromatography	EPA 300.1 (modified)
		Anions in aqueous matrices are analyzed using ion chromatography with conductivity and/or UV absorbance detectors.	
SOLIDS-TDS-WP	Water	Total Dissolved Solids	APHA 2540 C (modified)
		Total dissolved solids in aqueous matrices is determined gravimetrically after evaporation of the filtrate at 180 °C.	
TRANSM-UV-WT	Water	Transmittance, UV (254 nm)	APHA 5910 B-Spectrophotometer
TURBIDITY-WP	Water	Turbidity	APHA 2130B (modified)
		Turbidity in aqueous matrices is determined by the nephelometric method.	
VOC-ROU-WT	Water	Volatile Organic Compounds	SW846 8260
		The purge and trap method purges Volatile Organic Compounds (VOC) from aqueous samples by bubbling an inert gas through the sample. Once in the gaseous phase, the analytes are swept from the purging device and trapped in a short column. The compounds are that are trapped on the column are thermally desorbed and transferred to the analytical column of the GC/MS.	
XYLENES-SUM-CALC-WT	Water	Sum of Xylene Isomer Concentrations	CALCULATION
		Total xylenes represents the sum of o-xylene and m&p-xylene.	

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

Chain of Custody Numbers:

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
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

Reference Information

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.

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information.

Manitoba Conservation Water Stewardship
Office of Drinking Water
1007 Century Street, Winnipeg, Manitoba,
Canada R3H 0W4

Chain of Custody (COC)
Manitoba Drinking Water Systems
ONLY FOR: Regulatory General Chemistry &



L1344556-COFC

Report to Operator (email pdf):				Owner billing (Email):				Regular Service (is 5-7 Days):			
Contact:	Steve Smith			Contact:	Wally Melnyk			Unless otherwise requested:	<input type="checkbox"/> 1 Day, rush / priority		
Address:	Box 10 Russell MB R0J 1W0			Address:	Box 10 Russell MB R0J 1W0				<input type="checkbox"/> 2 Day, rush / priority		
Phone:	204-773-3185			Phone:	204-773-2253				<input type="checkbox"/> 3 Day, rush / priority		
Email:	russellwaterplant@hotmail.com			Email:	wally@russellmb.com						
Operator contact update (if different then above):				Owner contact update (if different then above):				Email pdf copy to:			
Contact:				Contact:				DWO:	Glen Robertson		
Address:				Address:				DWO Address:	1129 Queens Ave. Brandon MB R7A 1L9		
Phone:				Phone:				DWO Phone:	204-726-6563		
Email:				Email:				DWO Email:	glen.robertson@gov.mb.ca		
Account:	00W7260	ODW Report type:	EMS (Lab-MWS)	Client / Project Information:				Analysis Request			
Agency Code:	382	Project:	DWQ-C	Operation Name:	RUSSELL - PWS				MB-CH-PWS-V2013	MB-VOC-PWS-V2013	Number of Containers
Lab:	ALS	Lab Work Order # / Job # (lab use only)		Operation Code (com code):	189.00						
				Operation Id:	17511						
				Sampled by:	[Signature] - Steven Smith						
Lab Sample # (lab use only)	Sample Number (YYMMII9999)	Station Number (MB99XXD999) / (MB99XXY999)	Sample Identification	Date dd-mmm-yyyy	Time hh:mm	Sample Matrix	Sample Type				
	1308GR0022	MB05MED051	Russell 1 - Raw	07-08-13	2 PM	6	1	X	X	8	
	1308GR0023	MB05MED052	Russell 2 - Treated	07-08-13	2 PM	10	1	X	X	5	
Failure to complete all portions of this form may delay analysis.						Sample Matrix:		Sample Type:			
Please fill in this form LEGIBLY.						6-Raw Water, 10-Treated Water		1-Grab Sample			
By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified by the Laboratory.											
For ALL other testing, please use Laboratory specific forms.											
DO NOT COPY or RE-USE this form. Sample Numbers are unique to the Office of Drinking Water and provided by DWO.											
Relinquished By:	Steven Smith	Date & Time: 2 PM Aug 7/13		Received By: (lab use only)	GH	Date & Time: (lab use only)	Aug. 8/13 12:00	Sample Condition (lab use only)			
Relinquished By:		Date & Time:		Received By: (lab use only)		Date & Time: (lab use only)		Temperature	Samples Received in Good Condition? Y / N (if no provide details)		
								13.9°C			

Operator mandatory

Operator optional

Operator to fill, if information above has changed

Opr to fill, Lab specific

pre-filled by DWO

Note: Cyanide and Mercury are not required and have been removed from the list.

Please use the Rev. July 29, 2013 Water System Chemistry List.



Municipality of Russell Binscarth - Russell
ATTN: PAUL OLARTE
PO Box 10
Russell MB R0J 1W0

Date Received: 16-DEC-15
Report Date: 07-JAN-16 07:08 (MT)
Version: FINAL REV. 2

Client Phone: 204-773-2253

Certificate of Analysis

Lab Work Order #: L1715122
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Comments:

7-JAN-2016 Revised report - Date analyzed on Ph, EC and Alkalinity corrected.

Hua Wo
Chemistry Laboratory Manager

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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 A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1715122-1 SPEAR LAKE WATER SAMPLE							
Sampled By: CLIENT on 14-DEC-15 @ 13:00							
Matrix:							
MB Chemistry for PWS							
% Transmittance by Spectrometry							
Transmittance, UV (254 nm)	21.3		1.0	% T		17-DEC-15	R3347340
Alkalinity, Bicarbonate							
Bicarbonate (HCO ₃)	397		1.2	mg/L		04-JAN-16	
Alkalinity, Carbonate							
Carbonate (CO ₃)	<0.60		0.60	mg/L		04-JAN-16	
Alkalinity, Hydroxide							
Hydroxide (OH)	<0.34		0.34	mg/L		04-JAN-16	
Alkalinity, Total (as CaCO₃)							
Alkalinity, Total (as CaCO ₃)	325		1.0	mg/L		31-DEC-15	R3353767
Ammonia by colour							
Ammonia, Total (as N)	0.073		0.010	mg/L		21-DEC-15	R3343635
Bromide in Water by IC							
Bromide (Br)	<0.10		0.10	mg/L		16-DEC-15	R3339238
Chloride in Water by IC (Low Level)							
Chloride (Cl)	9.13		0.10	mg/L		16-DEC-15	R3339238
Colour, True							
Colour, True	45.2		5.0	CU		17-DEC-15	R3339614
Conductivity							
Conductivity	1040		1.0	umhos/cm		02-JAN-15	R3353767
Dissolved Organic Carbon by Combustion							
Dissolved Organic Carbon	22.6		0.50	mg/L		22-DEC-15	R3350893
Fluoride in Water by IC							
Fluoride (F)	0.234		0.020	mg/L		16-DEC-15	R3339238
Hardness Calculated							
Hardness (as CaCO ₃)	567		0.30	mg/L		22-DEC-15	
Langelier Index 4C							
Langelier Index (4 C)	0.85					04-JAN-16	
Langelier Index 60C							
Langelier Index (60 C)	1.6					04-JAN-16	
Nitrate in Water by IC (Low Level)							
Nitrate (as N)	0.0796		0.0050	mg/L		16-DEC-15	R3339238
Nitrite in Water by IC (Low Level)							
Nitrite (as N)	0.0021		0.0010	mg/L		16-DEC-15	R3339238
Sulfate in Water by IC							
Sulfate (SO ₄)	264		0.30	mg/L		16-DEC-15	R3339238
Total Dissolved Solids (TDS)							
Total Dissolved Solids	743		15	mg/L		22-DEC-15	R3351519
Total Metals by ICP-MS							
Aluminum (Al)-Total	0.166		0.0050	mg/L	21-DEC-15	21-DEC-15	R3342995
Antimony (Sb)-Total	0.00029		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Arsenic (As)-Total	0.00476		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Barium (Ba)-Total	0.0670		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Beryllium (Be)-Total	<0.00020		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Bismuth (Bi)-Total	<0.00020		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Boron (B)-Total	0.113		0.010	mg/L	21-DEC-15	21-DEC-15	R3342995
Cadmium (Cd)-Total	0.000011		0.000010	mg/L	21-DEC-15	21-DEC-15	R3342995
Calcium (Ca)-Total	108		0.10	mg/L	21-DEC-15	21-DEC-15	R3342995
Cesium (Cs)-Total	<0.00010		0.00010	mg/L	21-DEC-15	21-DEC-15	R3342995
Chromium (Cr)-Total	<0.0010		0.0010	mg/L	21-DEC-15	21-DEC-15	R3342995
Cobalt (Co)-Total	0.00066		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Copper (Cu)-Total	0.00181		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995

* 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
L1715122-1 SPEAR LAKE WATER SAMPLE							
Sampled By: CLIENT on 14-DEC-15 @ 13:00							
Matrix:							
Total Metals by ICP-MS							
Iron (Fe)-Total	0.224		0.010	mg/L	21-DEC-15	21-DEC-15	R3342995
Lead (Pb)-Total	0.000255		0.000090	mg/L	21-DEC-15	21-DEC-15	R3342995
Lithium (Li)-Total	0.124		0.0020	mg/L	21-DEC-15	21-DEC-15	R3342995
Magnesium (Mg)-Total	71.9		0.010	mg/L	21-DEC-15	21-DEC-15	R3342995
Manganese (Mn)-Total	0.0458		0.00030	mg/L	21-DEC-15	21-DEC-15	R3342995
Molybdenum (Mo)-Total	0.00212		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Nickel (Ni)-Total	0.0026		0.0020	mg/L	21-DEC-15	21-DEC-15	R3342995
Phosphorus (P)-Total	0.11		0.10	mg/L	21-DEC-15	21-DEC-15	R3342995
Potassium (K)-Total	12.2		0.020	mg/L	21-DEC-15	21-DEC-15	R3342995
Rubidium (Rb)-Total	0.00326		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Selenium (Se)-Total	<0.0010		0.0010	mg/L	21-DEC-15	21-DEC-15	R3342995
Silicon (Si)-Total	3.03		0.10	mg/L	21-DEC-15	21-DEC-15	R3342995
Silver (Ag)-Total	<0.00010		0.00010	mg/L	21-DEC-15	21-DEC-15	R3342995
Sodium (Na)-Total	47.4		0.030	mg/L	21-DEC-15	21-DEC-15	R3342995
Strontium (Sr)-Total	0.459		0.00010	mg/L	21-DEC-15	21-DEC-15	R3342995
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Thallium (Tl)-Total	<0.00010		0.00010	mg/L	21-DEC-15	21-DEC-15	R3342995
Thorium (Th)-Total	<0.00010		0.00010	mg/L	21-DEC-15	21-DEC-15	R3342995
Tin (Sn)-Total	<0.00020		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Titanium (Ti)-Total	0.00468		0.00050	mg/L	21-DEC-15	21-DEC-15	R3342995
Tungsten (W)-Total	<0.00010		0.00010	mg/L	21-DEC-15	21-DEC-15	R3342995
Uranium (U)-Total	0.00582		0.00010	mg/L	21-DEC-15	21-DEC-15	R3342995
Vanadium (V)-Total	0.00459		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Zinc (Zn)-Total	0.0028		0.0020	mg/L	21-DEC-15	21-DEC-15	R3342995
Zirconium (Zr)-Total	0.00044		0.00040	mg/L	21-DEC-15	21-DEC-15	R3342995
Total Organic Carbon by Combustion							
Total Organic Carbon	22.0		0.50	mg/L		22-DEC-15	R3350875
Turbidity							
Turbidity	6.54		0.10	NTU		17-DEC-15	R3338809
pH							
pH	8.08		0.10	pH units		31-DEC-15	R3353767

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

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-CO3CO3-CALC-WP	Water	Alkalinity, Carbonate	CALCULATION
The Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. The fraction of alkalinity contributed by carbonate is calculated and reported as mg CO ₃ ²⁻ /L.			
ALK-HCO3HCO3-CALC-WP	Water	Alkalinity, Bicarbonate	CALCULATION
The Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. The fraction of alkalinity contributed by bicarbonate is calculated and reported as mg HCO ₃ ⁻ /L.			
ALK-OHOH-CALC-WP	Water	Alkalinity, Hydroxide	CALCULATION
The Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. The fraction of alkalinity contributed by hydroxide is calculated and reported as mg OH ⁻ /L.			
ALK-TITR-WP	Water	Alkalinity, Total (as CaCO ₃)	APHA 2320B
The Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. Total alkalinity is determined by titration with a strong standard mineral acid to the successive HCO ₃ ⁻ and H ₂ CO ₃ endpoints indicated electrometrically.			
BR-IC-N-WP	Water	Bromide in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
C-DOC-HTC-WP	Water	Dissolved Organic Carbon by Combustion	APHA 5310 B-WP
Filtered (0.45 um) sample is acidified and purged to remove inorganic carbon, then injected into a heated reaction chamber where organic carbon is oxidized to CO ₂ which is then transported in the carrier gas stream and measured via a non-dispersive infrared analyzer.			
C-TOC-HTC-WP	Water	Total Organic Carbon by Combustion	APHA 5310 B-WP
Sample is acidified and purged to remove inorganic carbon, then injected into a heated reaction chamber where organic carbon is oxidized to CO ₂ which is then transported in the carrier gas stream and measured via a non-dispersive infrared analyzer.			
CL-L-IC-N-WP	Water	Chloride in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
COLOUR-TRUE-WP	Water	Colour, True	APHA 2120C
True Colour is measured spectrophotometrically by comparison to platinum-cobalt standards using the single wavelength method (450 - 465 nm) after filtration of sample through a 0.45 um filter. Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.			
EC-WP	Water	Conductivity	APHA 2510B
Conductivity of an aqueous solution refers to its ability to carry an electric current. Conductance of a solution is measured between two spatially fixed and chemically inert electrodes.			
ETL-HARDNESS-TOT-WP	Water	Hardness Calculated	HARDNESS CALCULATED
ETL-LANGELIER-4-WP	Water	Langelier Index 4C	Calculated
ETL-LANGELIER-60-WP	Water	Langelier Index 60C	Calculated
F-IC-N-WP	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
IONBALANCE-CALC-WP	Water	Ion Balance Calculation	APHA 1030E
MET-T-L-MS-WP	Water	Total Metals by ICP-MS	APHA 3030E/EPA 6020A-TL
This analysis involves preliminary sample treatment by hotblock acid digestion (APHA 3030E). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).			
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.			
NO2-L-IC-N-WP	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-WP	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
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.			
TDS-WP	Water	Total Dissolved Solids (TDS)	APHA 2540 SOLIDS C,E
A well-mixed sample is filtered through a glass fiber filter paper. The filtrate is then evaporated to dryness in a pre-weighed vial and dried at 180 – 2C. The increase in vial weight represents the total dissolved solids.			
TURBIDITY-WP	Water	Turbidity	APHA 2130B (modified)
Turbidity in aqueous matrices is determined by the nephelometric method.			
UV-%TRANS-WP	Water	% Transmittance by Spectrometry	APHA 5910B
This method indicates the total concentration of UV-absorbing compounds found in water and wastewater. The analysis is carried out using procedures adapted from APHA 5910 B. The sample is filtered through a 0.45 um filter and measured for % transmittance in a quartz cell at 254 nm and reported as % Transmittance .The analysis is carried out without pH adjustment.			

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

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

Laboratory Definition Code	Laboratory Location
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.



Report To		Report Format / D		<small>(Rush Turnaround Time (TAT) is not available for all tests)</small>			
Company: Municipality of Russell/Binscarth		Select Report Format: <input type="checkbox"/> PDF <input type="checkbox"/> []		R <input type="checkbox"/> Regular (Standard TAT if received by 3pm)			
Contact:		Quality Control (QC) Report with Report <input type="checkbox"/> Yes <input type="checkbox"/> No		P <input type="checkbox"/> Priority (2-4 business days if received by 3pm)			
Address: Box 10 Russell, MB R0J 1W0		<input type="checkbox"/> Criteria on Report - provide details below if box checked		E <input type="checkbox"/> Emergency (1-2 business days if received by 3pm)			
Phone: 204-773-2253 FAX: 204-773-3970		Select Distribution: <input type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX		E2 <input type="checkbox"/> Same day or weekend emergency if received by 10am - contact ALS for surcharge.			
Email 1 or Fax: russellwaterplant@hotmail.com		Email 2: coru.vitto@gov.mb.ca		Specify Date Required for E2, E or P:			
Invoice To Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Invoice Distribution		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below			
Copy of Invoice with Report <input type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX					
Company:		Email 1 or Fax:					
Contact:		Email 2:					
Project Information		Oil and Gas Required Fields (client use)					
ALS Quote #:		Approver ID:				Number of Containers	
Job #:		Cost Center:					
PO / AFE:		GI Account:					
LSD:		Routing Code:					
ALS Lab Work Order # (lab use only)		ALS Contact:				Sampler: Paul Olarte	
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)	Sample Type			
	Spear Lake water sample						
1	1 L. Routine						
2	250 ml. Metals						
3	250 ml. Nutrients						
4	DOC						
Spear Lake water full chemistry required							
Drinking Water (DW) Samples ¹ (client use)		Special Instructions / Specify Criteria to add on report (client use)		SAMPLE CONDITION AS RECEIVED (lab use only)			
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No				Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>			
Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No				Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>			
				Cooling Initiated <input type="checkbox"/>			
				INITIAL COOLER TEMPERATURES °C			
				FINAL COOLER TEMPERATURES °C			
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)			
Released by: [Signature]	Date: Dec 14/15	Time: 3:00 pm	Received by: CTS	Date: 16-Dec-15	Time: 8:00		

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-0206-v00 Form 01 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

14C



Municipality of Russell Binscarth - Russell
ATTN: PAUL OLARTE
PO Box 10
Russell MB R0J 1W0

Date Received: 16-DEC-15
Report Date: 07-JAN-16 07:08 (MT)
Version: FINAL REV. 2

Client Phone: 204-773-2253

Certificate of Analysis

Lab Work Order #: L1715122
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Comments:

7-JAN-2016 Revised report - Date analyzed on Ph, EC and Alkalinity corrected.

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
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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1715122-1 SPEAR LAKE WATER SAMPLE							
Sampled By: CLIENT on 14-DEC-15 @ 13:00							
Matrix:							
MB Chemistry for PWS							
% Transmittance by Spectrometry							
Transmittance, UV (254 nm)	21.3		1.0	% T		17-DEC-15	R3347340
Alkalinity, Bicarbonate							
Bicarbonate (HCO ₃)	397		1.2	mg/L		04-JAN-16	
Alkalinity, Carbonate							
Carbonate (CO ₃)	<0.60		0.60	mg/L		04-JAN-16	
Alkalinity, Hydroxide							
Hydroxide (OH)	<0.34		0.34	mg/L		04-JAN-16	
Alkalinity, Total (as CaCO₃)							
Alkalinity, Total (as CaCO ₃)	325		1.0	mg/L		31-DEC-15	R3353767
Ammonia by colour							
Ammonia, Total (as N)	0.073		0.010	mg/L		21-DEC-15	R3343635
Bromide in Water by IC							
Bromide (Br)	<0.10		0.10	mg/L		16-DEC-15	R3339238
Chloride in Water by IC (Low Level)							
Chloride (Cl)	9.13		0.10	mg/L		16-DEC-15	R3339238
Colour, True							
Colour, True	45.2		5.0	CU		17-DEC-15	R3339614
Conductivity							
Conductivity	1040		1.0	umhos/cm		02-JAN-15	R3353767
Dissolved Organic Carbon by Combustion							
Dissolved Organic Carbon	22.6		0.50	mg/L		22-DEC-15	R3350893
Fluoride in Water by IC							
Fluoride (F)	0.234		0.020	mg/L		16-DEC-15	R3339238
Hardness Calculated							
Hardness (as CaCO ₃)	567		0.30	mg/L		22-DEC-15	
Langelier Index 4C							
Langelier Index (4 C)	0.85					04-JAN-16	
Langelier Index 60C							
Langelier Index (60 C)	1.6					04-JAN-16	
Nitrate in Water by IC (Low Level)							
Nitrate (as N)	0.0796		0.0050	mg/L		16-DEC-15	R3339238
Nitrite in Water by IC (Low Level)							
Nitrite (as N)	0.0021		0.0010	mg/L		16-DEC-15	R3339238
Sulfate in Water by IC							
Sulfate (SO ₄)	264		0.30	mg/L		16-DEC-15	R3339238
Total Dissolved Solids (TDS)							
Total Dissolved Solids	743		15	mg/L		22-DEC-15	R3351519
Total Metals by ICP-MS							
Aluminum (Al)-Total	0.166		0.0050	mg/L	21-DEC-15	21-DEC-15	R3342995
Antimony (Sb)-Total	0.00029		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Arsenic (As)-Total	0.00476		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Barium (Ba)-Total	0.0670		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Beryllium (Be)-Total	<0.00020		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Bismuth (Bi)-Total	<0.00020		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Boron (B)-Total	0.113		0.010	mg/L	21-DEC-15	21-DEC-15	R3342995
Cadmium (Cd)-Total	0.000011		0.000010	mg/L	21-DEC-15	21-DEC-15	R3342995
Calcium (Ca)-Total	108		0.10	mg/L	21-DEC-15	21-DEC-15	R3342995
Cesium (Cs)-Total	<0.00010		0.00010	mg/L	21-DEC-15	21-DEC-15	R3342995
Chromium (Cr)-Total	<0.0010		0.0010	mg/L	21-DEC-15	21-DEC-15	R3342995
Cobalt (Co)-Total	0.00066		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Copper (Cu)-Total	0.00181		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995

* 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
L1715122-1 SPEAR LAKE WATER SAMPLE							
Sampled By: CLIENT on 14-DEC-15 @ 13:00							
Matrix:							
Total Metals by ICP-MS							
Iron (Fe)-Total	0.224		0.010	mg/L	21-DEC-15	21-DEC-15	R3342995
Lead (Pb)-Total	0.000255		0.000090	mg/L	21-DEC-15	21-DEC-15	R3342995
Lithium (Li)-Total	0.124		0.0020	mg/L	21-DEC-15	21-DEC-15	R3342995
Magnesium (Mg)-Total	71.9		0.010	mg/L	21-DEC-15	21-DEC-15	R3342995
Manganese (Mn)-Total	0.0458		0.00030	mg/L	21-DEC-15	21-DEC-15	R3342995
Molybdenum (Mo)-Total	0.00212		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Nickel (Ni)-Total	0.0026		0.0020	mg/L	21-DEC-15	21-DEC-15	R3342995
Phosphorus (P)-Total	0.11		0.10	mg/L	21-DEC-15	21-DEC-15	R3342995
Potassium (K)-Total	12.2		0.020	mg/L	21-DEC-15	21-DEC-15	R3342995
Rubidium (Rb)-Total	0.00326		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Selenium (Se)-Total	<0.0010		0.0010	mg/L	21-DEC-15	21-DEC-15	R3342995
Silicon (Si)-Total	3.03		0.10	mg/L	21-DEC-15	21-DEC-15	R3342995
Silver (Ag)-Total	<0.00010		0.00010	mg/L	21-DEC-15	21-DEC-15	R3342995
Sodium (Na)-Total	47.4		0.030	mg/L	21-DEC-15	21-DEC-15	R3342995
Strontium (Sr)-Total	0.459		0.00010	mg/L	21-DEC-15	21-DEC-15	R3342995
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Thallium (Tl)-Total	<0.00010		0.00010	mg/L	21-DEC-15	21-DEC-15	R3342995
Thorium (Th)-Total	<0.00010		0.00010	mg/L	21-DEC-15	21-DEC-15	R3342995
Tin (Sn)-Total	<0.00020		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Titanium (Ti)-Total	0.00468		0.00050	mg/L	21-DEC-15	21-DEC-15	R3342995
Tungsten (W)-Total	<0.00010		0.00010	mg/L	21-DEC-15	21-DEC-15	R3342995
Uranium (U)-Total	0.00582		0.00010	mg/L	21-DEC-15	21-DEC-15	R3342995
Vanadium (V)-Total	0.00459		0.00020	mg/L	21-DEC-15	21-DEC-15	R3342995
Zinc (Zn)-Total	0.0028		0.0020	mg/L	21-DEC-15	21-DEC-15	R3342995
Zirconium (Zr)-Total	0.00044		0.00040	mg/L	21-DEC-15	21-DEC-15	R3342995
Total Organic Carbon by Combustion							
Total Organic Carbon	22.0		0.50	mg/L		22-DEC-15	R3350875
Turbidity							
Turbidity	6.54		0.10	NTU		17-DEC-15	R3338809
pH							
pH	8.08		0.10	pH units		31-DEC-15	R3353767

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

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-CO3CO3-CALC-WP	Water	Alkalinity, Carbonate	CALCULATION
The Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. The fraction of alkalinity contributed by carbonate is calculated and reported as mg CO ₃ ²⁻ /L.			
ALK-HCO3HCO3-CALC-WP	Water	Alkalinity, Bicarbonate	CALCULATION
The Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. The fraction of alkalinity contributed by bicarbonate is calculated and reported as mg HCO ₃ ⁻ /L.			
ALK-OHOH-CALC-WP	Water	Alkalinity, Hydroxide	CALCULATION
The Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. The fraction of alkalinity contributed by hydroxide is calculated and reported as mg OH ⁻ /L.			
ALK-TITR-WP	Water	Alkalinity, Total (as CaCO ₃)	APHA 2320B
The Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. Total alkalinity is determined by titration with a strong standard mineral acid to the successive HCO ₃ ⁻ and H ₂ CO ₃ endpoints indicated electrometrically.			
BR-IC-N-WP	Water	Bromide in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
C-DOC-HTC-WP	Water	Dissolved Organic Carbon by Combustion	APHA 5310 B-WP
Filtered (0.45 um) sample is acidified and purged to remove inorganic carbon, then injected into a heated reaction chamber where organic carbon is oxidized to CO ₂ which is then transported in the carrier gas stream and measured via a non-dispersive infrared analyzer.			
C-TOC-HTC-WP	Water	Total Organic Carbon by Combustion	APHA 5310 B-WP
Sample is acidified and purged to remove inorganic carbon, then injected into a heated reaction chamber where organic carbon is oxidized to CO ₂ which is then transported in the carrier gas stream and measured via a non-dispersive infrared analyzer.			
CL-L-IC-N-WP	Water	Chloride in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
COLOUR-TRUE-WP	Water	Colour, True	APHA 2120C
True Colour is measured spectrophotometrically by comparison to platinum-cobalt standards using the single wavelength method (450 - 465 nm) after filtration of sample through a 0.45 um filter. Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.			
EC-WP	Water	Conductivity	APHA 2510B
Conductivity of an aqueous solution refers to its ability to carry an electric current. Conductance of a solution is measured between two spatially fixed and chemically inert electrodes.			
ETL-HARDNESS-TOT-WP	Water	Hardness Calculated	HARDNESS CALCULATED
ETL-LANGELIER-4-WP	Water	Langelier Index 4C	Calculated
ETL-LANGELIER-60-WP	Water	Langelier Index 60C	Calculated
F-IC-N-WP	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
IONBALANCE-CALC-WP	Water	Ion Balance Calculation	APHA 1030E
MET-T-L-MS-WP	Water	Total Metals by ICP-MS	APHA 3030E/EPA 6020A-TL
This analysis involves preliminary sample treatment by hotblock acid digestion (APHA 3030E). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).			
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.			
NO2-L-IC-N-WP	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-WP	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
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.			
TDS-WP	Water	Total Dissolved Solids (TDS)	APHA 2540 SOLIDS C,E
A well-mixed sample is filtered through a glass fiber filter paper. The filtrate is then evaporated to dryness in a pre-weighed vial and dried at 180 – 2C. The increase in vial weight represents the total dissolved solids.			
TURBIDITY-WP	Water	Turbidity	APHA 2130B (modified)
Turbidity in aqueous matrices is determined by the nephelometric method.			
UV-%TRANS-WP	Water	% Transmittance by Spectrometry	APHA 5910B
This method indicates the total concentration of UV-absorbing compounds found in water and wastewater. The analysis is carried out using procedures adapted from APHA 5910 B. The sample is filtered through a 0.45 um filter and measured for % transmittance in a quartz cell at 254 nm and reported as % Transmittance .The analysis is carried out without pH adjustment.			

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

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

Laboratory Definition Code	Laboratory Location
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.



L1715122-COFC

Report To		Report Format / D		<small>(Rush Turnaround Time (TAT) is not available for all tests)</small>										
Company: Municipality of Russell/Binscarth		Select Report Format: <input type="checkbox"/> PDF <input type="checkbox"/> []		Regular (Standard TAT if received by 3pm)										
Contact:		Quality Control (QC) Report with Report <input type="checkbox"/> Yes <input type="checkbox"/> No		Priority (2-4 business days if received by 3pm)										
Address: Box 10 Russell, MB R0J 1W0		<input type="checkbox"/> Criteria on Report - provide details below if box checked		Emergency (1-2 business days if received by 3pm)										
Phone: 204-773-2253 FAX: 204-773-3970		Select Distribution: <input type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX		Same day or weekend emergency if received by 10am - contact ALS for surcharge.										
Email 1 or Fax: russellwaterplant@hotmail.com		Email 2: coru.vitto@gov.mb.ca		Specify Date Required for E2, E or P:										
Invoice To Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Invoice Distribution		Analysis Request										
Copy of Invoice with Report <input type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below										
Company:		Email 1 or Fax:		Number of Containers										
Contact:		Email 2:												
Project Information		Oil and Gas Required Fields (client use)												
ALS Quote #:		Approver ID:												
Job #:		Cost Center:												
PO / AFE:		GI Account:												
LSD:		Routing Code:												
Activity Code:		Activity Code:												
Location:		Location:												
ALS Lab Work Order # (lab use only)		ALS Contact:												Sampler: Paul Olarte
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type										
	Spear Lake water sample													
1	1 L. Routine													
2	250 ml. Metals													
3	250 ml. Nutrients													
4	DOC													
Spear Lake water full chemistry required														
Drinking Water (DW) Samples (client use)			Special Instructions / Specify Criteria to add on report (client use)							SAMPLE CONDITION AS RECEIVED (lab use only)				
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No										Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>				
Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No										Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>				
										INITIAL COOLER TEMPERATURES °C				
										FINAL COOLER TEMPERATURES °C				
SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)							FINAL SHIPMENT RECEPTION (lab use only)				
Released by: [Signature] Date: Dec 14/15 Time: 3:00 pm			Received by: CTS Date: 16-Dec-15 Time: 8:00							Received by: _____ Date: _____ Time: _____				

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-0206-v06 From 04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

14C



ROSA HYPOTHETICAL CHEMISTRY

The water quality and chemistry of reject water from a Reverse Osmosis (RO) membrane system is dependent on the chemistry of the raw water (including the source type such as groundwater or surface water), the chemistry of the water entering the RO (cases with pre-treatment prior to RO), and the type of RO system including the equipment manufacturer.

This is hypothetical chemistry of the reject water from a RO system for the Municipality of Russell Binscarth. The software program utilized is called "ROSA" from the DOW company.

Parameter	Unit	GCDWQ		Sampled: June 4, 2015	ROSA
		AO/OG	MAC	INPUT Raw Well Water	OUTPUT RO Reject
Total Dissolved Solids	mg/L	500		896.63*	1063.79
pH	pH	6.5 to 8.5		7.72	7.76
Ammonium (NH ₄ ⁺ + NH ₃)	mg/L			0.72	0.84
Potassium (K)	mg/L			5.85	6.77
Sodium (Na)	mg/L	200		19.7	41.67
Magnesium (Mg)	mg/L			47.8	55.82
Calcium (Ca)	mg/L			124	144.81
Strontium (Sr)	mg/L			0.502	0.59
Barium (Ba)	mg/L		1	0.018	0.02
Carbonate (CO ₃)	mg/L			2.693*	3.65
Bicarbonate (HCO ₃)	mg/L			536	622.93
Nitrate (NO ₃)	mg/L		10	0.019	0.02
Chloride (Cl)	mg/L	250		1.44	1.68
Fluoride (F)	mg/L		1.5	0.205	0.24
Sulfate (SO ₄)	mg/L	500		142	166.52
Silica (SiO ₂)	mg/L			15	17.54
Boron (B)	mg/L			0.119	0.12

* Refers to INPUT numbers that are generated automatically.

The Guidelines for Canadian Drinking Water Quality (GCDWQ) do not apply in this case with wastewater effluent discharge since these guidelines deal with drinking water and not effluent. There are two governing bodies and regulations that can be used to determine if the wastewater parameters meet the requirements. They are the Canadian Council of Ministers of the Environment (CCME) and the "Manitoba Water Quality Standards, Objectives, and Guidelines - November 2011" from Manitoba Water Stewardship.



Parameter	Unit	Sampled:	Sampled:	ROSA	CCME	MB
		December 14, 2015	June 4, 2015	RO Reject		
		Spear Lake	Raw Well Water			
Total Dissolved Solids	mg/L	743	688	1063.79	3000	3000
Calcium (Ca)	mg/L	108	124	144.81	1000	1000
Nitrate (NO ₃)	mg/L	0.0796	<0.020	0.02	13	13
Chloride (Cl)	mg/L	9.13	1.44	1.68	NA	100 to 900
Fluoride (F)	mg/L	0.234	0.205	0.24	1	1 to 2
Sulfate (SO ₄)	mg/L	264	142	166.52	1000	1000
Boron (B)	mg/L	0.113	0.119	0.12	1.5	1.5

In comparison of the chemistry parameters available for the Reverse Osmosis (RO) reject water from the proposed Russell Binscarth WTP to the regulatory limits (both national and provincial), all parameters are well below limits.

Thus, there will be no adverse environmental effects due to water quality.



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MWSB WATERCOURSE CROSSING GUIDELINES

Mitigation Measure:

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

Reclamation:

- Restore all disturbed areas to original contours.
- 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:
 - A record of drilling progress will be maintained to always know the location of the drill head relative to the point of entry.
 - A record of drilling component usage (type and quantity) will be maintained throughout each drilling operation.
 - 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 construction field supervisor.
 - 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:

- 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.
- The contractor will notify the MWSB construction field supervisor of the frac-out condition or potential condition and decide on the appropriate action as follows:
- Assign a person to visually monitor for the presence of muddy plume.
- 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.
- 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.
- 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.
- If the frac-out is not contained within this time, MWSB 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.



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