Environment Act Proposal Form

Name of the development: Town of Pilot Mound Water Treatment Plant Upgrade	
Type of development per Classes of Development Regulation (Manitoba Regulation 164/88): Treatment, Transportation and Transmission	
Legal name of the proponent of the development: Town of Pilot Mound	Mailing address: 219 Broadway Ave, Box 39 Pilot Mound, MB R0G 1P0
Location (street address, city, town, municipality, legal description) of the development: RM of Louise, Pilot Mound Municipal Right-of-Ways - See Plan Water Treatment Plant located at 338 Frazer Street, Pilot Mound, MB.	
Name of proponent contact person for purposes of the environmental assessment: Nathan Wittmeier, P.Eng.	
Phone: 204-726-6081 Fax: 204-726-7196	Mailing address: Box 22080 2010 Currie Blvd, Brandon, MB R7A 6Y9
Email address: nathan.wittmeier@gov.mb.ca	
Webpage address:	
Date: November 12, 2013	Signature of proponent, or corporate principal of corporate proponent:  Printed name: Nathan Wittmeier

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	$500
Class 2 Developments	$5,000
Class 3 Developments:	
Transportation and Transmission Lines	$5,000
Water Developments	$50,000
Energy and Mining	$100,000

Submit the complete EAP to:

Director
Environmental Assessment and Licensing Branch
Manitoba Conservation
Suite 160, 123 Main Street
Winnipeg, Manitoba R3C 1A5

For more information:
Phone: (204) 945-7100
Fax: (204) 945-5229
Toll Free: 1-800-282-8069, ext. 7100
http://www.gov.mb.ca/conservation/eal

Environment Act Proposal
Town of Pilot Mound Water Treatment Plant Upgrade

November 2013

The Manitoba Water Services Board

Table of Contents

Executive Summary

The Town of Pilot Mound has requested The Manitoba Water Services Board (MWSB) to prepare an Environment Act Proposal for a Class 2 Development License under the Manitoba Environment Act for an upgrade of the Water Treatment Plant (WTP).

The Town of Pilot Mound is located in the Rural Municipality (RM) of Louise, west of the Town of Morden and has a population of approximately 635 people. Water for the system is supplied by the Town's WTP. The WTP was originally built in 1963 and uses a Lime/Soda Ash softening, re-carbonation, gravity filtration, and disinfection treatment process. The WTP receives raw water from a dam at the Goudney Reservoir. The distribution system within the Town of Pilot Mound currently services approximately 322 households in the Town with eight expected future connections. The current peak-day treated water demand for the Town of Pilot Mound is 4.2 L/s and sufficient capacity for the proposed expansion is available from the current WTP.

The plant treatment equipment is approaching the end of the expected service life. The treated water for the current PWS of the Town of Pilot Mound is high in hardness, pH, sodium, sulfate, Total Dissolved Solids, Trihalomethanes and turbidity. Given that the current treatment system fails to reduce these parameters to acceptable limits under GCDWQ, a treatment system upgrade is necessary to meet the guidelines. The proposed development includes the construction of a new raw water supply with a supply well within the Glenora aquifer at the Marringhurst site located at NW 20-3-12W. The well will deliver water through a 16.3 km, 200 mm raw water pipeline to the WTP which will undergo the installation of a Reverse Osmosis (RO) membrane unit. The proposed membrane filtration process is effective in protection against viruses and cysts such as Cryptosporidium oocysts and Giardia lamblia cysts as well removing nitrates, Total Dissolved Solids (TDS), iron/manganese and softening the treated water. A preliminary raw water pipeline route is included in Appendix A.

The 20-year projected treated water demand for the Town is 5.5 L/s. With an anticipated 20% reject for the new treatment system, the total raw water demand for the Town is approximately 6.9 L/s. The reject flow will be redirected to the Goudney reservoir through the existing raw water line.

The Town is responsible for operation and maintenance of the WTP and will be responsible for maintaining the new raw water pipeline and well site. An operator is required to maintain the RO membrane unit, conduct Clean-In-Place (CIP) cleans, change pre-filters, carry out water and bacteriological testing, etc. to ensure system performance is maintained. In addition, the operator will be required to submit bi-weekly water samples for bacteriological testing in accordance with the Manitoba *Drinking Water Quality Standards Regulation*. The operator will be responsible to read water meters on a quarterly basis and respond to maintenance issues related to the system.

The Pembina River is the major river that runs through the Town. The waterways within the proposed pipeline system are the creeks: Cypress Creek, Crystal Creek, Pilot Creek, the Pembina River and associated tributaries. There is 1 proposed river crossing involved with the new raw water pipeline.

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

1.0 Introduction

The Town of Pilot Mound requested The Manitoba Water Services Board (MWSB) to prepare an Environment Act Proposal for a Class 2 Development License under the Manitoba Environment Act for an Upgrade of the Water Treatment Plant (WTP) in the Town. This document provides the compiled information required on Manitoba Conservation's Environment Act Proposal Report Guidelines and Supplementary Guidelines for Municipal Water Supply Systems. This Environment Act Proposal includes components of the raw water supply pipeline and reject disposal.

1.1 Background Information

The Town of Pilot Mound is located in the RM of Louise, west of the Town of Morden and has a population of approximately 635 people. The Town's WTP receives raw water from a dam at the Goudney Reservoir located approximately three kilometres west of the Town. A 100 mm cast iron raw water pipeline delivers water from the reservoir to the WTP. Raw water is treated by the Town's WTP originally constructed in 1963 with a treatment capacity of 4.4 L/s. The maximum day demand from the Town was recorded at 302.8 m^3 in 2010.

The 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 492m^3 two-cell concrete reservoir and a 198m^3 pump well. The WTP supplies the Town with treated water via 322 service connections with an additional eight connections anticipated in the future.

The raw water source at the Goudney reservoir is a surface water source and has issues with cysts such as Cryptosporidium and viruses and high levels of nitrates, TDS, iron/manganese, organics, and hardness. The lime soda ash treatment plant becomes extremely difficult to maintain beyond the anticipated life expectancy. The WTP is therefore 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 GCDWQ and DWSA.

1.1.1 Previous Studies

An engineering assessment for the Town of Pilot Mound's PWS was conducted in May 2010 to assess and review the existing infrastructure and water supply source in the Town of Pilot Mound. The assessment was reviewed in writing this report. The engineering assessment recommended upgrades to the WTP that included the need for;

- Short term Upgrades:
  - Installation of a UV disinfection system;
  - Installation of an online Chlorine Analyzer and Turbidimeter;
  - Installation of Spill containment systems for chemical and storage tanks as well as storage areas;

- Distribution Piping in Reservoir: replacing the leaking cast iron piping;
- VFD Pump Control;
- Floor Drain Piping in Reservoir: replacing the corroded floor drain piping that was leaking into the reservoir;
- THM reduction to regulatory levels.

➢ Long terms upgrades:

- Improving Water Quality and Upgraded Treatment Capacity
- Genset (a fire pump equipped with a backup power source)
- Distribution System Upgrades: maintenance of chlorine residual in all areas and a watermain renewal since the piping may be approximately 45 years old

The assessment mentioned that if a membrane system was installed there may be no need for an alternative disinfection system. It also noted that membrane filtration will lower other parameters, including sodium and other ions, thus significantly improving the treated water quality.

1.1.2 Population

Based on the 2011 Census, the Town of Pilot Mound has an estimated population of 635, a slight decreased from 630 in 2001. The population of the Town declined from 1961 to 1976 and from 1981 to 2006; however, the population appears to be steady from 2006 to 2011. Although the population has been shown to be fairly steady over the past 5 years, some allowance for a future population should be designed in the system. The Town has approximately 322 service connections to the water system with eight proposed future connections. Based on the assumption that the population in the Town will increase over the next few years at an annual population growth rate factor of 0.5% per year, a 20-year population of approximately 702 for the Town may be assumed.

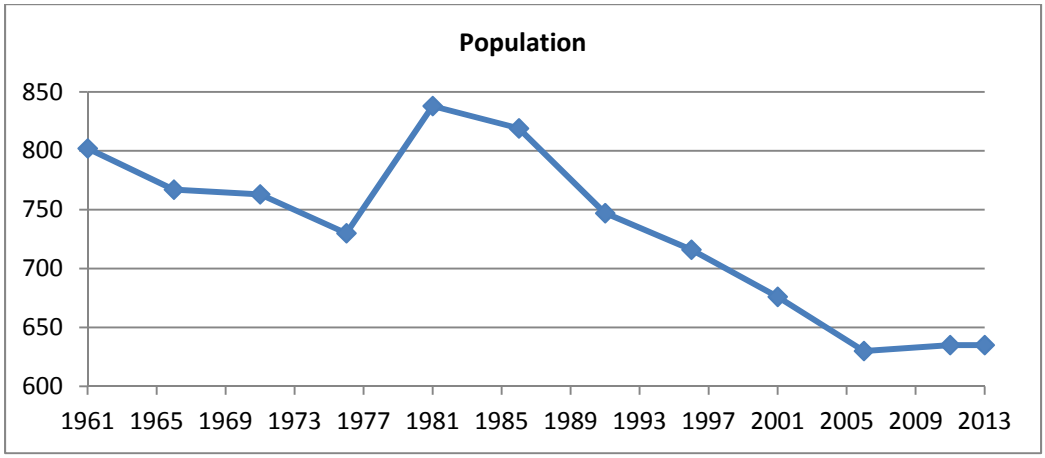

FIGURE 1.1 –TOWN OF PILOT MOUND POPULATION TRENDS

1.1.3 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 1.8 were used for this study. The projected treated water demands are summarized in Table 1.1.

TABLE 1.1 – PROJECTED TREATED WATER DEMAND FOR THE TOWN OF PILOT MOUND

Projected Treated water demand for the Town population		
	Units	Quantity
Town of Town of Pilot Mound Current Connections:	322	
Future Connections:	8	
Total Connections:	330	
Current Population		635
20 year future population(@0.5% /yr)		702
Consumption/capita/day	L/c/day	300.0
Average Day Consumption	L/day	210,600.0
Average Day Demand	L/s	2.93
Peak Day factor		x1.8
Peak Day Consumption	L/day	379,080.0
Peak Day Demand (20 hr operating day)	L/s	5.3

The current peak treated water demand for the Town is 4.2 L/s as listed in the PWS Assessment by J.R. Cousin Consultants Ltd. The projected 20-Year peak day demand for the Town is 5.3 L/s.

The average day 20-year projected demand for the Town is 210,600 L/day. Based on the 690,000 L storage capacity of the plant, the Town's WTP provides sufficient storage to accommodate the projected 20-year peak day demands. The existing reservoir provides sufficient capacity to satisfy the requirements of the Class 2 fire protection (population 500-800 residents).

1.1.4 Raw Water Source

The Goudney reservoir provides a surface water source located three kilometres west of the WTP. The raw water intake and wet well were installed in 1965. Raw water enters a 1.83 metre concrete wet well through an intake screen and a 300mm diameter

Corrugated Metal Pipe (CMP). Raw water is injected with potassium permanganate and pumped through a 100mm pipeline to the WTP by a 3 hp pump at an average flow rate of 3.6 L/s. There is no backup water source but a back-up raw water pump is on site in case of pump failure.

1.1.5 Water Rights Act

The Town of Pilot Mound *Water Rights Act* Licence No. 2006-033 allows a maximum withdrawal rate of 3 L/s and the total quantity of water diverted in any year not to exceed 100 cubic decametres (81.07 acre-feet).

It is estimated that the Town's 20-year demand will be 2.93 L/s on an average day and 5.3 L/s on a peak day.

TABLE 1.2 –PROJECTED TOTAL WATER DEMAND FOR THE TOWN OF PILOT MOUND WTP

Demand	Units
2.93	L/s
76,869,000	L/yr
76,869.0	m^3/yr
76.9	Dm^3/yr

Based on table 1.2, the Town's WTP is capable of supplying the average day demands while remaining in compliance with the Water Rights Licence. A new WRL will be applied for in conjunction with the installation of the new raw water supply system.

1.1.6 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. The following table outlines water quality parameters of concern which include hardness, manganese, pH, sodium, true colour, sulfate, Total Dissolved Solids (TDS), Trihalomethanes (THMs) and turbidity. In addition the operator tests chlorine residuals daily on the treated water.

TABLE 1.3 WATER QUALITY RESULTS (2012 & 2013 CERTIFICATE OF ANALYSIS AND 2012 AUDIT REPORT)

Parameter	Unit	GCDWQ	Raw Water	Treated water
Arsenic	mg/L	≤ 0.01	0.00486	0.00147
Fluoride	mg/L	≤ 1.5	0.34	0.19
Hardness(Total) $CaCO_3$	mg/L	200/500a	**726**	**262**
Iron	mg/L	≤ 0.3	0.20	<0.10
Manganese	mg/L	≤ 0.05	**3.23**[DLA]	0.00155
Nitrate-N	mg/L	≤ 10	<0.157	0.194
pH	pH units	6.5-8.5	8.30	**8.98**
Sodium	mg/L	200	**222**[DLA]	**346**[DLA]
Sulfate	mg/L	500	**663**	**660**
Total Dissolved Solids	mg/L	500	**1390**	**1270**
Total Organic Carbon	mg/L	-	**19.6**	**13.2**
Total THMs	mg/L	≤ 0.001	**<0.5225**	**0.385**
True Color	CU	15	**29.6**	5.3
Turbidity	NTU	≤ 0.3 / 0.1c	**13.7**	0.11
Uranium	mg/L	≤ 0.02	0.00610	0.0010

[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

[DLA] Detected Limit Adjusted for required dilution

Raw water quality parameters exceeding the GCDWQ include hardness, manganese, sodium, sulfate, TDS, turbidity and true color. Treated water quality parameters exceeding the GCDWQ include hardness, pH, sodium, sulfate, TDS, THMs and turbidity. 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, sodium, sulfate, TDS, TOCs, and THMs in the treated water.

Considering the issues with the water quality, the Town requested MWSB assistance to develop a ground water source located at the Marringhurst House site at NW 20-3-12W and necessary infrastructure to supply the raw water for present and future demands to the Town.

1.1.7 Compliance Plan

According to the 2012 ODW Audit, a compliance plan addressing THM's was submitted by the Town and is currently under review.

The Town of Pilot Mound requested the MWSB's assistance to complete an assessment of a groundwater sources in the area with the potential of developing a water supply for

the Town. The MWSB contracted W.L. Gibbons & Associates Inc. to complete an investigation for a groundwater supply on behalf of the Town.

This proposal submission requests environmental approval to develop a groundwater source located at the Marringhurst House site at NW 20-3-12W and to construct and operate a raw water pipeline shown in Appendix A and membrane water treatment unit at the WTP in the Town.

2.0 Description of Proposed Development

2.1 Project Description

The proposed development includes the construction of a new raw water supply that includes a groundwater well within the Glenora aquifer at the Marringhurst site located at NW 20-3-12W, approximately 16.3 km of 200 mm raw water pipeline, and the installation of a 5.0 L/s Reverse Osmosis (RO) membrane treatment system with UV treatment. The existing lime/soda ash treatment system will be decommissioned once the proposed membrane treatment system is operational. Figure 2.1 shows the location of the new well site with respect to the WTP. The development also requires approval to discharge concentrate water to Pilot Creek via the Goudney reservoir.

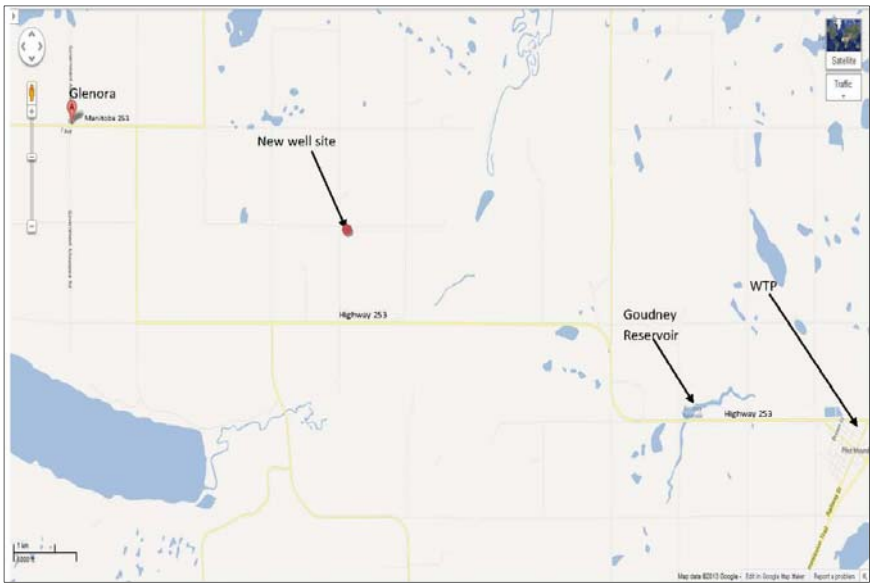

FIGURE 2.1 –LOCATION OF WTP AND NEW WELL

2.1.1 Water Source

The groundwater will be pumped from the Glenora aquifer located beneath NW 20-3-12W at Marringhurst House. This source was selected following a groundwater study of the potential options and field testing to confirm the availability of suitable groundwater resources.

2.1.1.1 Well Installations

A 125 mm test well, TW 13-01, was installed as part of the long term pumping test for groundwater studies at the site leading up to this proposal. The test well consisted of a 125 mm PVC casing installed to a depth of 11.3 m and No. 15 slot, stainless steel screen to a depth of 4.6 m. The ground water levels were measured periodically during the pumping test in the test well. Analysis of the

data from the test well provided a preliminary estimate of transmissivity for the aquifer of 46,000 Igpd/ft.

As part of the upgrade there will be the installation of one production well with a pumping capacity of approximately 10 L/s and a full scale pump test to verify the suitability of the site. There is a second standby production well to be constructed at a later date. Two bore holes will be drilled between the test well TW 13-01 and Marringhurst Creek to verify the thickness and stratigraphy of the aquifer in that area. A 50mm diameter monitoring well will be installed in one of the test holes to provide a monitoring location for the full-scale pump test. A shallow well will be installed at a depth of 4.6 to 7.6 metres.

A 200mm pumping well will be installed TW 13-01 with a screen set at a depth of 11.3 to 15.8 metres. A 24-hour pump test will be conducted at a rate of at least 15 L/s and the groundwater level response monitored at the two new monitoring wells, TW 13-01 and observation well OB-023, and at the Marringhurst House well if permission is granted by the owner.

When the above test work is complete, the 200mm well will be developed to provide water to the town.

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 results indicated that the Glenora aquifer has a high water quality. The results of the water analysis are consistent with the historic water quality results from the provincial monitoring wells located across the aquifer, indicating that high water quality is pervasive across the aquifer. The wells however have been confirmed as GUDI wells. Development of groundwater at the test well site is therefore unlikely to induce changes to the water quality as there are no apparent sources of poor quality water in the area. The complete raw water analysis can be found in Appendix F.

TABLE 2.1 WATER QUALITY RESULTS (2013)

Parameter	Unit	GCDWQ	Raw Water
2.1.1.3 Raw Water Pipeline			
Alkalinity	mg/L		245
Arsenic	mg/L	≤ 0.01	0.00176
Conductivity	µS/cm		517
Fluoride	mg/L	≤ 1.5	< 0.10
Hardness(Total) $CaCO_3$	mg/L	200/500a	**281**
Iron	mg/L	≤ 0.3	0.20
Manganese	mg/L	≤ 0.05	**0.417**
Nitrate-N	mg/L	≤ 10	<0.050
pH	pH units	6.5-8.5	8.03
Sodium	mg/L	200	9.69
Sulfate	mg/L	500	37.4
Total Dissolved Solids	mg/L	500	309
Total Organic Carbon	mg/L	-	1.9
True Color	CU	15	< 5.0
Turbidity	NTU	≤ 0.3 / 0.1c	2.19
Uranium	mg/L	≤ 0.02	0.00097

[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

[DLA] Detected Limit Adjusted for required dilution

raw water pipeline was sized using 20-year projected water demand. The raw water pipeline will be constructed on provincial and municipal road right-of-ways as well as private easements if required. The proposed route is shown in Appendix A.

A 200 mm diameter pipeline of high density polyethylene (HDPE) or poly vinyl chloride (PVC) will be installed in accordance with MWSB Standard Construction Specifications 2000. Installation will involve an open cut trench with horizontal drilling where required. The pipeline will be buried a minimum depth of 2.4 metres and 3.0 metres through roadway crossings and private driveways. Excavated soil will be stock piled, adjacent to the work area and 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 (Appendix F), MWSB Standard Construction Specifications January 2000, and 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 PR road crossings will be directionally drilled and encased in accordance with Manitoba Infrastructure and Transportation regulations. Excavations required for boring equipment set-up will be restored to original grades and seeded.

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

2.1.1.4 Water Treatment Plant

The Town of Pilot Mound WTP is classified as a Class 3 Water Treatment Facility. The existing lime/soda ash treatment system will be replaced with a 5.0 L/s reverse osmosis membrane unit. The proposed membrane filtration process 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 projected 20-year population demand of the Town while treating water that meets the GCDWQ and the Drinking Water Safety Act.

Preliminary plans for the equipment layout of the RO membrane unit in the existing WTP were compiled by J.R. Cousin Consultants. The design 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 is fully operational and commissioned. The discharge from the existing plant to the lime sludge ponds will be repurposed to accept membrane reject water, and the existing raw water line will be reversed for the discharge of membrane reject. Membrane reject accounts for 20-30 % of the total raw water flow through the WTP. Using a 20% reject rate and a 10% by-pass through a pressure filter will result in an instantaneous raw water demand of 6.9 L/s. Figure 2.2 illustrates a schematic of the treatment process producing 5.5 L/s of treated water to satisfy the projected 20-year demand.

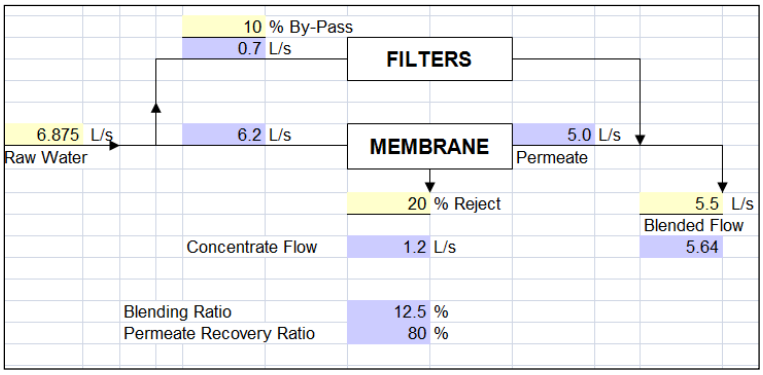

FIGURE 2.2 –FILTER AND MEMBRANE BLENDED FLOW

The membrane system will be designed to reduce hardness ions 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 sand pressure filter to be blended with treated membrane permeate. Membrane permeate is generally chemically unstable and benefits from the addition of filtered bypass water or caustic soda to adjust the pH to a suitable level within the distribution system. Upon determination of the water quality of the by-pass flow, a method of treatment will be determined for the by-pass flow to increase the longevity of the membranes and decrease operational costs.

According to the Water Rights Act Licence, the maximum rate at which water may be diverted shall not exceed 3 L/s and the total quantity of water diverted in any one year shall not exceed 100 cubic decametres. As Table 2.1 indicates the RO unit demand will exceed the allowable withdrawal rate of the current Water Rights Licence, the request for the new WRL at the proposed well site will be sized to meet adequate demands.

TABLE 2.1 –PROJECTED TOTAL RAW WATER DEMAND FOR RO UNIT

Demand	Units
6.875	L/s
216,810,000	L/yr
216,810.0	m^3/yr
216.8	Dm^3/yr

For design purposes, RO system projections from ROSA Design software has been used to predict ion concentrations in the treated permeate, blended, and

reject water. Raw water quality from the production well was used as inputs for the model. A detailed projected analysis is included in Appendix G.

2.1.1.5 Backwash and Concentrate Disposal

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

It is proposed that membrane concentrate be discharged to the Goudney reservoir through the existing raw water intake and pipeline. The Goudney reservoir is fed by the Pilot Creek. The Town lagoon also discharges to the Pilot Creek via the Goudney Reservoir. The lagoon is located downstream of the Goudney reservoir.

2.1.1.6 Operation and Maintenance

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

The operator(s) will be required to operate the facility in a safe and efficient manner in accordance with relevant operations manuals and Drinking Water Safety Act regulations. Operation requirements will include measurements, monitoring, sampling, testing, record-keeping and reporting. Operators will be required to do Clean-In-Place (CIP) maintenance and changing of pre-filters. In addition, the operator(s) must ensure the equipment is inspected and properly maintained. The operator(s) will receive training during the commissioning phase by the selected equipment supplier.

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

2.2 Certificate of Title

It is proposed to locate the raw water pipeline partially within municipal and provincial road right-of-ways which are owned by the Crown. If necessary, private easements will be obtained to accommodate the pipeline installation. The primary well will be located on municipal owned land in NW 20-3-12W.

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 road right-of-ways. Adjacent land is used for agriculture. Existing and adjacent land use will not change as a result of this development.

2.5 Land Use Designation and Zoning

The proposed land for development will be government road allowances and land adjacent to the development is predominately agricultural. Zoning designation for this development is not applicable.

2.6 Project Schedule

The development of the water supply project is anticipated to occur as a two phase process. The project is scheduled to commence in the 2014/2015 construction year depending on the availability of funding and the receipt of all approvals.

2.7 Project Funding

This project is eligible for cost sharing between the Province of Manitoba and the Town of Pilot Mound subject to all approvals and the availability of funding.

2.8 Regulatory Approvals

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

Manitoba Conservation and Water Stewardship
Office of Drinking Water
Manitoba Infrastructure and Transportation

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

2.9 Public Consultation

A public consultation will be held in the near future to discuss the proposed WTP upgrade to the residents of the Town of Pilot Mound. It is not expected that there will be major concerns forwarded to the Town regarding the upgrades.

2.10 Storage of Petroleum Products and Other Chemicals

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

There will be no storage of petroleum products or other chemicals at any of the well sites during operation of the proposed development. Maintenance activities for the wells do not require refuelling on-site. Chemicals associated with the operation of the existing plant (lime, soda ash, alum, hypochlorite and potassium permanganate) and new plant (antiscalant, hypochlorite, cleaning chemicals, sodium hydroxide) will be stored in designated areas within the plant complete with spill containment. General household cleaning products will also be stored at this site.

3.0 Physical Environment

3.1 Physiographic Setting and Climate

The Town of Pilot Mound is located in the RM of Louise, west of the Town of Morden. The Town will be serviced through the distribution system but by a new raw water source and treatment system. The topography of the area has small elevation changes varying between 465m and 472m.

Based on Environment Canada climatic data, the mean annual temperature in the area is 2.3 degrees Celsius with below zero average daily temperatures from November through March. Mean annual precipitation is approximately 530.9 mm.

TABLE 3.1 PILOT MOUND - MONTHLY DATA REPORT 2007

Monthly Data Report for 2007

	Mean Max Temp °C	Mean Min Temp °C	Mean Temp °C	Extr Max Temp °C	Extr Min Temp °C	Total Rain mm	Total Snow cm	Total Precip mm	Snow Grnd Last Day cm	Dir of Max Gust 10's deg	Spd of Max Gust km/h
Month											
Jan	-8.2E	-20.9E	-14.6E	5.6	-36.5	0.0					
Feb	-13.0	-22.8	-17.9	-2.5	-36.3	0.0					
Mar	0.2	-9.6	-4.7	11.1	-27.5	23.8E	1.2E	25.0E			
Apr	10.6	-3.4	3.6	24.8	-14.9	2.3E	0.9E	3.2E			
May	15.6*	4.1*	9.9*	26.3*	-1.5*	97.4	0.0	97.4	0		
Jun	22.0	10.7	16.4	28.9	2.4S	124.4	0.0	124.4	0		
Jul	26.8	13.7	20.3	34.9	7.3	81.2	0.0	81.2	0		
Aug	23.2E	9.5E	16.4E	32.3	2.6	11.8	0.0	11.8	0		
Sept	19.7	5.0E	12.4E	32.5	-1.0	15.0	0.0	15.0	0		
Oct	12.0	-0.3	5.8	22.0	-8.4	13.8	0.0	13.8	0		
Nov	-0.3	-10.2	-5.2	13.5	-27.6	3.2	0.0	3.2			
Dec											
Sum						M	M	M			
Avg	M	M	M								
Xtrm				M	M						

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

3.2 Hydrogeology

Early investigations of the hydrogeology of the area have identified the area to be under the Western Canada Sedimentary Basin hydrogeological region of Canada. The bedrock beneath the Town of Pilot Mound consists of Palaezoic limestone and Cretaceous shale. The key aquifer in this area is the Assiniboine delta aquifer.

The investigations of the hydrogeology of the area northwest of Pilot Mound have identified an aquifer with properties suitable for use as a water supply for the Town. The investigated aquifer has a width in excess of 5 kilometers, a length in excess of 11 kilometers, and a thickness of up to 21.3 meters. This aquifer is overlain by sand with intertill clay tills, sand, shale and gravel layers.

Investigations of this aquifer have identified the transmissivity of the aquifer as 6.6 x 10^{-3} m^2/s (46,000 Igpd/ft). The full range of the aquifer's transmissivity, its storativity value, project pumping rate, recharge mechanism, discharge mechanism, drawdown and sustainability of the well will be determined upon the installation of the full scale pumping well.

3.3 Hydrology

The Pembina River is the major river that runs through the Town of Pilot Mound. The waterways involved with the proposed pipeline system are the Crystal Creek, Cypress Creek and Pilot Creek.

Within the immediate area of the well site, all lands amenable to agricultural use have been cultivated. The exception is the numerous potholes that exist through the area and the associated drainage courses. These features are not amenable to agriculture and are therefore in a near natural vegetative state.

The accumulation of water is common in these depressions and supports a "wetland" type of vegetative community.

The Goudney Reservoir has a gross drainage area of approximately 153 km^2 and water levels fluctuate between 452.2 m and 451.2 m. The reservoir is fed by two inlet drains; one second order drain and one third order drain. (See figure 3.1) The outlet of the reservoir is through the Pilot Creek via a fourth order drain. The reservoir is monitored by the Water Survey of Canada at a station 05BO34 north of the reservoir where the dam is located.

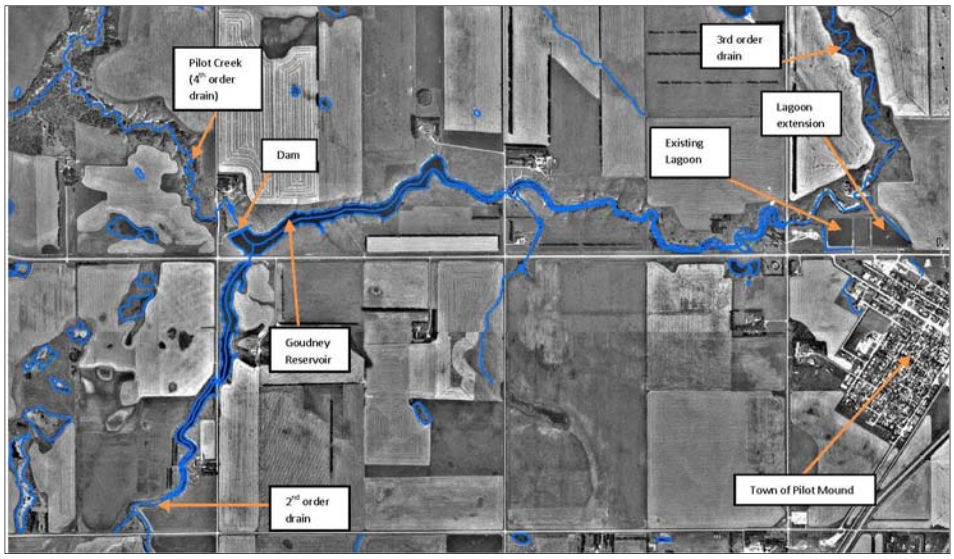

FIGURE 3.1 DRAINAGE

The available information indicates that the likely natural discharge point for groundwater flowing through the Goudney reservoir is the Pilot Creek. Flows on the Pilot Creek are monitored by the Water Survey of Canada at a station 05OB025. Pilot Creek has a drainage area of 154 km^2. Mean flows vary from 883 L/s in April to 28 L/s in September with the lowest mean monthly flow recorded as 6 L/s in October.

TABLE 3.2.1 PILOT CREEK- MEAN DISCHARGE

Month	Mean flow(L/s)
March	106
April	883
May	238
June	62
July	49
August	33
September	28
October	6

Pilot Creek is a seasonal river that typically flows from March to October. Figure 3.1 below shows a daily discharge characteristic for the Creek.

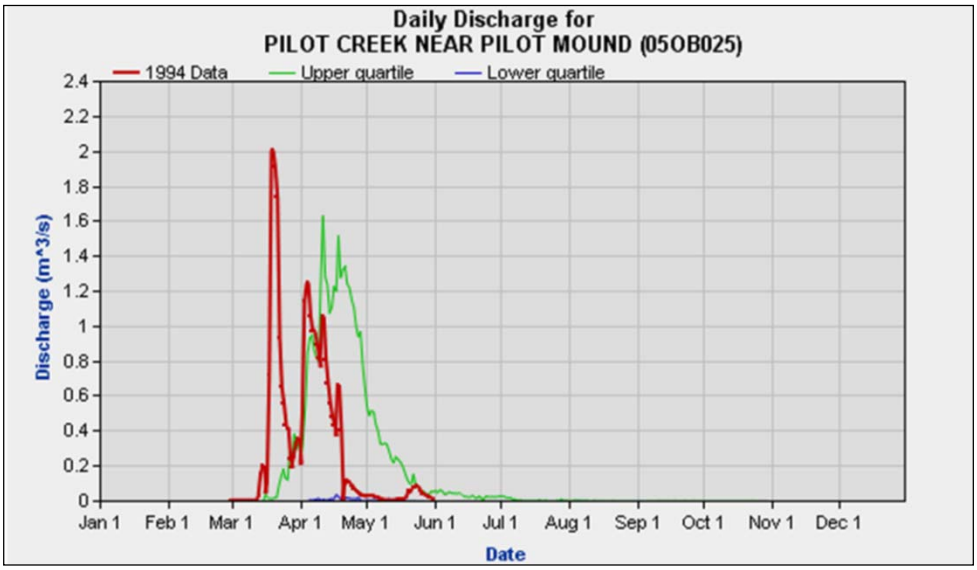

FIGURE 3.2 WATER SURVEY OF CANADA STATISTICS CORRESPONDING TO 32 YEARS OF DATA RECORDED FROM 1963 TO 1994

The projected discharge concentrate flow rate for the RO membrane unit is 1.2 L/s. Given that Pilot Creek is a seasonal river with a flow that ranges between from 883 L/s in April to 28 L/s in September and with a recorded maximum as high as 2010 L/s in March 1994, the 1.2 L/s concentrate is negligible flow rate during peak flow periods. The concentrate will be discharged to the Goudney Reservoir and will undergo significant mixing prior to entering Pilot Creek as discharge from the reservoir. The contributions at low flow have an almost unnoticeable influence and in certain minerals improve the overall water quality. Thus, the concentrate can be considered to be a minor contributor to the overall base flow of Pilot Creek. Water chemistry from the Goudney Reservoir is used for the concentrate blend analysis below.

Table 3.2.2 – Combined Flow Concentrations

Parameter	Raw Water (mg/L)	Membrane Concentrate (mg/L)	Goudney Reservoir 2013 (mg/L)	Combined Flow (mg/L)
Flow rate (L/s)	6.8	1.2	28	29.2
Ca	81.5	301.44	141	147.6
Mg	18.8	69.53	90.8	89.9
Na	9.69	35.76	222	214.3
K	2.37	3.88	18.7	18.1
NH4	-	0.0	-	-
Ba	0.0931	0.34	0.0857	0.10
Sr	0.191	0.71	0.770	0.77
CO3	<12	7.91	<12	<12
HCO3	299	1093.53	449	475.5

SO4	37.4	138.46	663	641.4
Cl	2.42	52.73	49.9	50.0
F	<0.10	0	0.34	0.33
NO3	<0.50	0	0.157	0.15
SiO2	13.1	102.70	14.0	17.6
CO2	14.35	17.33	n/a	n/a
TDS	309	1812.44	1410	1426.5
pH	8.03	8.01	8.30	8.29

3.4 Fish and Fish Habitat

Potential fish habitat in the project area includes the Pembina River, Crystal Creek, Cypress Creek, Pilot Creek and associated tributaries. A list of fish species found in the Pembina River, Crystal Creek, Cypress Creek and Pilot Creek has been included in Appendix B.

3.5 Wildlife Habitat and Vegetation

The project area is located within the Southwest Manitoba Uplands Eco-region of the Prairie Eco-zone (Agriculture and Agri-Food Canada). The Rocky Mountains to the west impede easy access of moisture-bearing winds from the Pacific producing a continental climate, sub humid to semiarid with short hot summers, long cold winters, low levels of precipitation, and high evaporation. The northern edge of the Prairie eco-zone is mainly associated with groves of trembling aspen, balsam poplar and intermittent grasslands. On drier sites yellow cactus and prickly pear are dominant. Sagebrush is abundant. The soils in the zone are mainly Chernozemic soils. The major land use in the prairies Landscape is Agriculture. Other main activities on the Prairie landscape include mining, and oil and gas production. Characteristic mammals include; wapiti (elk), coyote, pronghorn antelope, badger, white-tailed jack rabbit, Richardson's ground squirrel, and northern pocket gopher. Bird species include ferruginous hawk, Swainson's hawk, American avocet, burrowing owl, great blue heron, black-billed magpie, northern oriole, veery, and brown thrasher (National Ecological Framework Report).

3.6 Socioeconomic

The project area is located within the Town of Pilot Mound. The Town has an area of approximately 2.7 km^2 and a population of approximately 635 (2011 Census). The main economic base is agriculture and associated agricultural support services.

3.7 Heritage Resources

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

4.0 Potential Environmental Effects

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

4.1 Air Quality

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

4.2 Soils

During construction, there is a risk of fuel or lubricant spills from heavy equipment and vehicle operation. The storage of fuel or lubricants within the area of the well construction site will not be allowed. Therefore, the potential spills will be very small in size and standard construction spill clean-up procedures, including the removal of any impacted soil, will be used to prevent impact.

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

4.3 Surface Water, Fish and Fish Habitat

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

Figure 3.1 describes the drainage in the area of Pilot Mound. Water quality samples were taken from the Goudney Reservoir, the waterway to be used for the reject disposal. The results were analyzed and impacts on wildlife habitat are considered negligible.

All pipeline watercourse crossings will be conducted by directional drilling from outside of the riparian zone.

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 changes 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 system operation to be made.

4.5 Groundwater Levels

A new WRL will be applied for related to the installation of the new production wells. 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 of the groundwater levels will be required to identify any such adverse effects and allow the appropriate adjustments in the system operation to be made.

4.6 Vegetation

Construction will occur primarily within municipal right of ways or easements that are previously disturbed, regularly managed, and comprised primarily of grasses. As the areas are already disturbed, they are unlikely to contain rare plant species, and the amount of vegetation disturbance is expected to be minimal.

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

4.7 Wildlife Habitat and Vegetation

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

4.8 Noise and Vibration

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

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

4.9 Employment/Economy

Socio-economic implications are not expected as a result of environmental impacts as impacts are considered minor and short-term. Some economic implications may exist for the Town due to the costs of developing the water system; however, the Town 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 a chronic issue of varying water quality for the area and address the issue of high THMs in the treated water. The potential effects of the project on employment and the economy are assessed to be positive.

4.10 Human Health and Well Being

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

The project will result in the construction of the pipeline designed and operated to produce a treated water supply to meet current water quality standards. This will produce a higher standard of living in Pilot Mound. The effects of this on human health and wellbeing are considered positive.

4.11 Climate Change

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

5.0 Environmental Management Measures

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

5.1 Air Quality

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

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

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 include preparation of an emergency response plan for potential spills, use of spill clean-up equipment and materials, using properly maintained equipment, and using appropriate fuelling equipment.

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

5.3 Surface Water

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

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

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

The proponent will conduct long term monitoring of the Goudney Reservoir to verify impacts on water quality.

5.4 Groundwater

Groundwater is primarily protected by the natural hydrogeology in the area. Mitigation of potential groundwater impacts from petroleum products can be mitigated as described in Section 5.3. 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 water quality and water level changes.

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 a minimum of annually. The laboratory analyses should include electrical conductivity, hardness, alkalinity, total dissolved solids, major cations and anions (Calcium, Sodium, Magnesium, hydrogen carbonate, sulfate, chloride), dissolved metals (including Arsenic), and total 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. [Note: This sampling is separate from any routine sampling program required as part of the operation from the water treatment plant].

The recommended groundwater level monitoring program would include the use of an existing 125 mm well (TW 13-01) and three existing groundwater monitoring stations maintained by the province (OB-036, OB-033 and OB-015). The 125 mm 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. It is assumed at this stage that the Province will continue to maintain the existing three groundwater monitoring stations (OB-036, OB-033 and OB-015) and will make the information available on an annual basis.

The availability of groundwater usage for potential future users will be assessed through the Water Rights Act Licensing process.

5.5 Vegetation and Wildlife

Displacing whole portions of topsoil with any known rare or endangered plant species can be implemented if necessary such that this material and plants can be placed back in its original location with minimal disturbance. Re-establishment of vegetation will occur as soon as possible on disturbed areas. Impacts to wildlife habitat can be limited by minimizing the area of construction, soil disturbance and vegetation disturbance. Other impacts resulting from dust or

smoke will be minimized as previously indicated. Noise disturbance will be limited by use of muffling vehicles and equipment, limiting idling and limiting the construction area.

Any potential loss and disturbance to vegetation and wildlife during operation may be mitigated by restricting vehicular traffic to designated and previously disturbed areas, and by limiting monitoring and maintenance activities to previously disturbed areas.

5.6 Fisheries

Fisheries impacts will be minimized by implementing practices to reduce soil and contaminate runoff as previously mentioned in Sections 5.3 and 5.5. In addition, horizontal directional drilling will occur under all watercourses containing water. The required excavation needed to introduce the drilling equipment will be maintained outside watercourse riparian zones.

Water quality monitoring on Pilot Creek will provide data for the assessment of any water quality impacts affecting fish species. The proponent will work with the provincial officials should any concerns arise.

5.7 Noise and Vibration

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

5.8 Water Conservation

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

5.9 Socio-Economic Implications

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

6.0 References

1. Agriculture and Agri-Food Canada. A National Ecological Framework for Canada 04 July 2013 <http://sis.agr.gc.ca/cansis/nsdb/ecostrat/index.html>

2. Ecological Framework For Canada. National Ecological Framework Report. 1995. http://sis.agr.gc.ca/cansis/publications/ecostrat/intro.html

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4. J.R. Cousin Consultants Ltd., May 2010, Town of Pilot Mound Assessment of Water System Infrastructure and Water Supply Source for Pilot Mound Public Water System, P-405.02.

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7. Statistics Canada. 2012. Pilot Mound, Manitoba (Code 4604044) and Manitoba (Code 46) (table). Census Profile. 2011 Census. Statistics Canada Catalogue no. 98-316-XWE. Ottawa Releases October 24, 2012. http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/index.cfm?Lang=E (accessed July 5, 2013).

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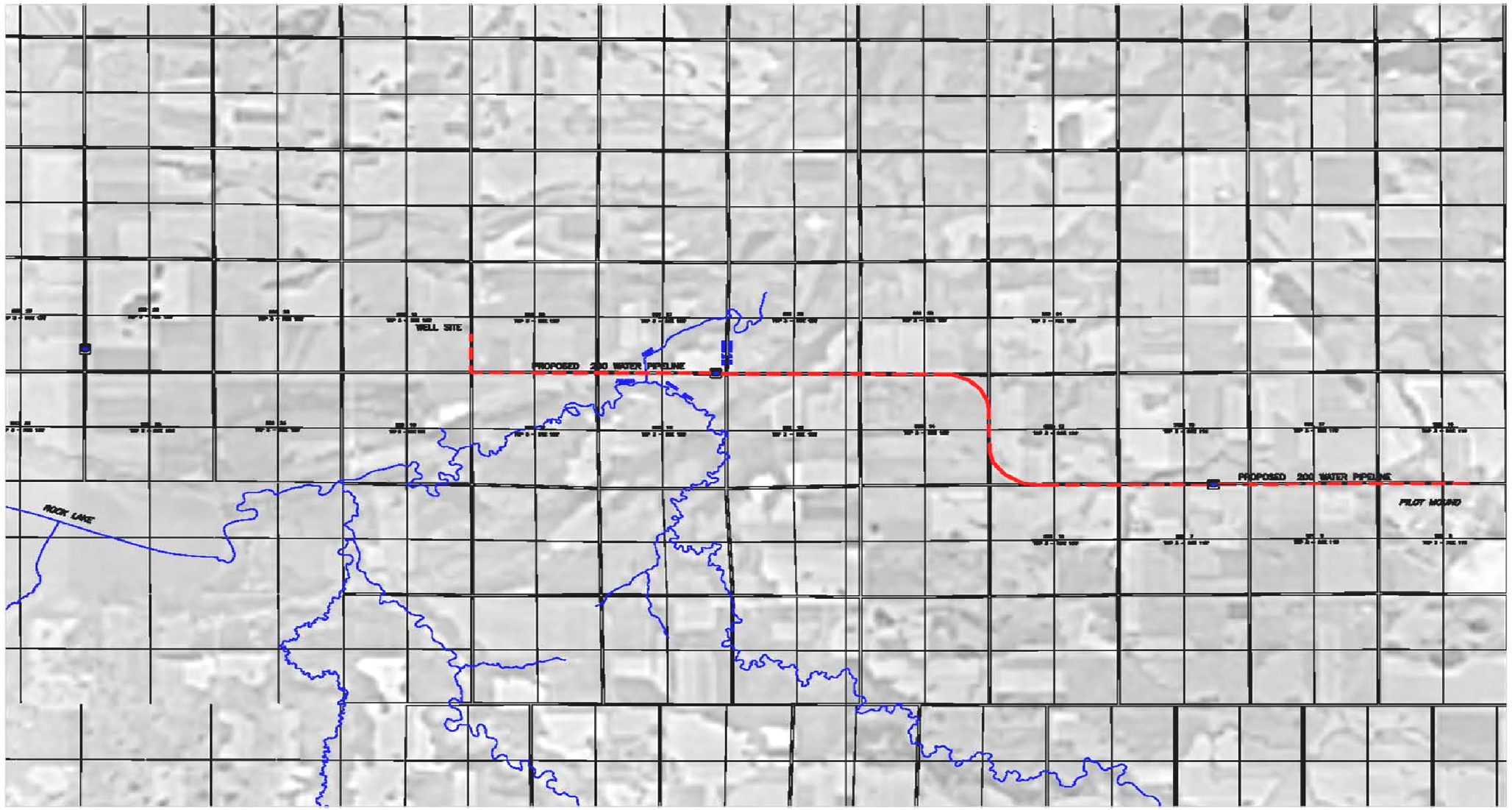
9. Environment Canada, Climate http://climate.weather.gc.ca/climateData/monthlydata_e.html?timeframe=3&Prov=&StationID=3649&mlyRange=1957-01-01%7C2007-11-01&Year=2007&cmdB1=Go

Appendix A

Proposed Raw Water Pipeline Route



NO.	REMARKS	BY	DATE

L.P.S.
CIAPALA

DRAWN: ABC
CHECKED: L. CIAPALA
APPROVED:
REVISED:

PROVINCE OF MANITOBA
THE MANITOBA WATER SERVICES BOARD
MANITOBA LOCAL GOVERNMENT

PILOT MOUND
WATER SUPPLY PIPELINE

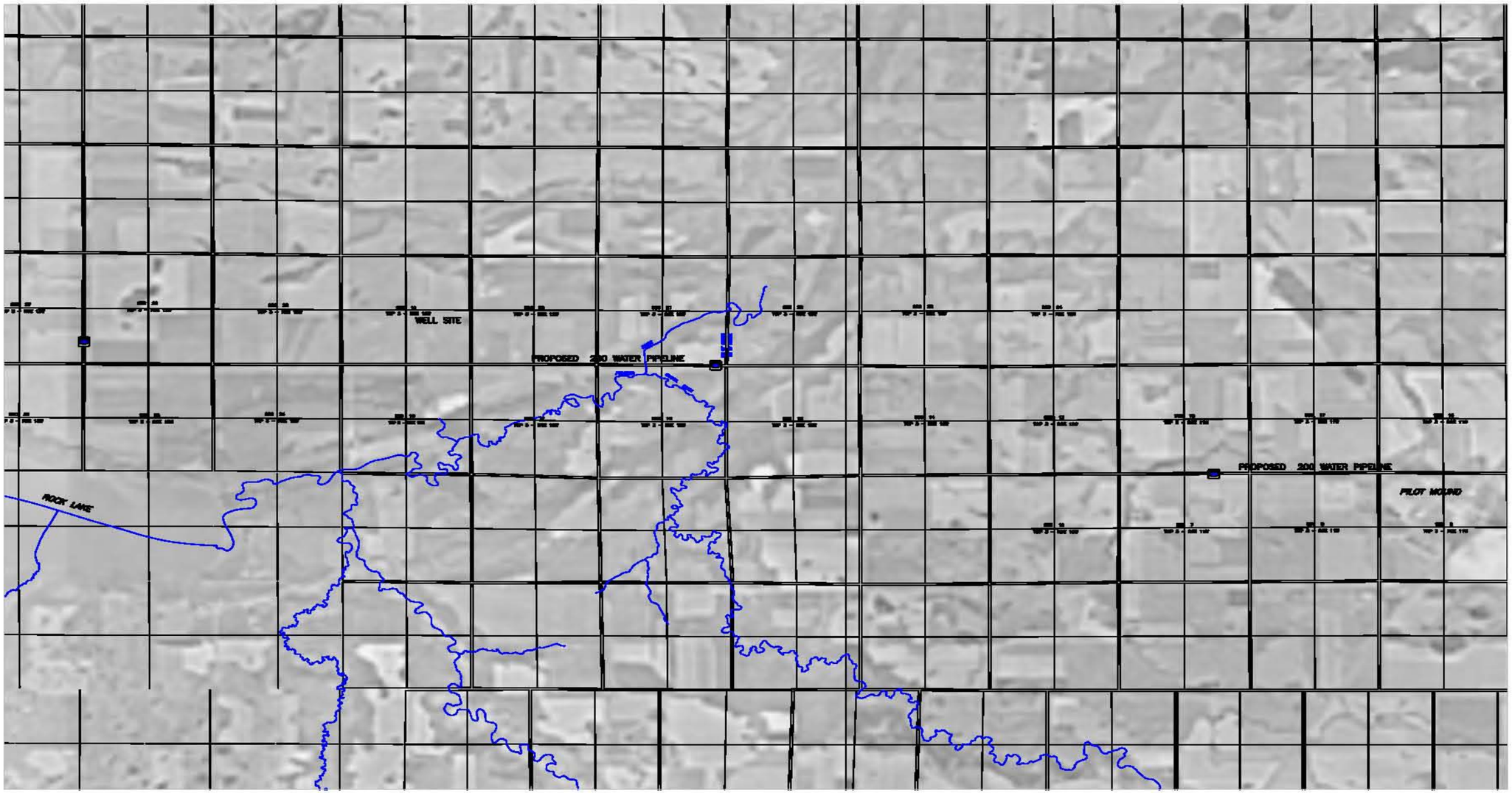
LOCATION PLAN

2013 PIPELINE ROUTE

SCALE	DATE	PROJECT NUMBER	REVISION	SHEET
AS SHOWN	13-06-26			1 of 1

Appendix B

Hydrology of the Town of Pilot Mound



NO.	REMARKS	BY	DATE				

L.P.S. CIAPALA

ASC

L. CIAPALA

PROVINCE OF MANITOBA

THE MANITOBA WATER SERVICES BOARD

MANITOBA LOCAL GOVERNMENT

PILOT MOUND

WATER SUPPLY PIPELINE

LOCATION PLAN

2013 PIPELINE ROUTE

AS SHOWN | 13-06-26 | 1 of 1

Appendix C

Fish Species in the Pembina River, Pilot Creek, Crystal Creek, and Cypress Creek

Waterbody: Pembina River

Provincial Waterbody Id #	Watershed	Region	District	Map Sheet	Latitude:	49 0 1
2243.00	5OBA	Western	Manitou	62G01	Longitude:	98 12 23

BIOLOGY

	Presence
BIGMOUTH SHINER *Notropis dorsalis*	Unknown
BLACK BULLHEAD *Ictalurus melas*	Unknown
BLACKNOSE DACE *Rhinichthys atratulus*	Common
BLACKSIDED DARTER *Percina maculata*	Unknown
BRASSY MINNOW *Hybognathus hankinsoni*	Common
BROOK STICKLEBACK *Culaea inconstans*	Unknown
CARP *Cyprinus carpio*	Unknown
COMMON SHINER *Notropis cornutus*	Common
CREEK CHUB *Semotilus atromaculatus*	Common
FATHEAD MINNOW *Pimephales promelas*	Common
FINESCALE DACE *Phoxinus neogaeus*	Unknown
IOWA DARTER *IOWA DARTER exile*	Unknown
JOHNNY DARTER *Etheostoma nigrum*	Unknown
LONGNOSE DACE *Rhinichthys cataractae*	Unknown
NORTHERN PIKE *Esox lucius*	Unknown
NORTHERN REDBELLY DACE *Chrosomus eos*	Unknown
ROCK BASS *Amblopites rupestris*	Unknown
SAND SHINER *Notropis stramineus*	Common
SHORTHEAD REDHORSE *Moxostoma*	Unknown
SILVER REDHORSE *Moxostoma anisurum*	Unknown
TADPOLE MADTOM *Noturus gyrinus*	Unknown
TROUT PERCH *Percopsis omiscomaycus*	Unknown
WALLEYE *Stizostedion vitreum*	Unknown
WHITE SUCKER *Catostomus commersoni*	Common

Creel

Year	Species	Catch/Unit Effort*

*Catch/Unit Effort = Catch/Hour

13-07-26 Page 1 of 1 Manitoba

Waterbody: Pembina River

Provincial Waterbody Id #	Watershed	Region	District	Map Sheet	Latitude:	49 16 29
2244.00	5OAA	Western	Manitou	62G01	Longitude:	99 28 19

BIOLOGY

	Presence
BIGMOUTH SHINER *Notropis dorsalis*	Common
BLACK BULLHEAD *Ictalurus melas*	Unknown
BLACKNOSE DACE *Rhinichthys atratulus*	Common
BLACKSIDED DARTER *Percina maculata*	Common
BRASSY MINNOW *Hybognathus hankinsoni*	Uncommon
BROOK STICKLEBACK *Culaea inconstans*	Common
BROWN BULLHEAD *Ictalurus nebulosus*	Common
CARP *Cyprinus carpio*	Uncommon
COMMON SHINER *Notropis cornutus*	Common
CREEK CHUB *Semotilus atromaculatus*	Common
FATHEAD MINNOW *Pimephales promelas*	Abundant
IOWA DARTER *IOWA DARTER exile*	Unknown
JOHNNY DARTER *Etheostoma nigrum*	Common
LONGNOSE DACE *Rhinichthys cataractae*	Common
NORTHERN PIKE *Esox lucius*	Uncommon
ROCK BASS *Amblopites rupestris*	Common
SAND SHINER *Notropis stramineus*	Common
TROUT PERCH *Percopsis omiscomaycus*	Uncommon
WALLEYE *Stizostedion vitreum*	Uncommon
WHITE SUCKER *Catostomus commersoni*	Common
YELLOW PERCH *Perca flavescens*	Uncommon

Creel

Year	Species	Catch/Unit Effort*
1968	Brown Bullhead	0.08
	Northern Pike	0.16
	Yellow Perch	0.02

*Catch/Unit Effort = Catch/Hour

13-07-26 Page 1 of 1 Manitoba

Waterbody: Pilot Creek

Provincial Waterbody Id #	Watershed	Region	District	Map Sheet	Latitude:	49 15 27
2360.00	5OBA	Western	Manitou	62G06	Longitude:	99 0 16

Habitat Suitability

Seasonal Habitat Suitability*

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

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

Resource Access

Resource	Distance (km)

Habitat Classifications

Habitat Class	Class

*

General Uses

General Use	Harvest Weight

Needed Improvements

Year	Improvements	Comments
2004	Note: There has been a name change; blacknose dace (Rhinichthys atratulus) is now known as western blacknose dace (Rhinichthys obtusus) according to Stewart and Watkinson.	
2005	Nearby cattle have had impacts on the creek. The creek has a shale substrate and some undercut banks. The creek has some methane production and some shale and sand deposition.	
	1999	
	Milani's "2002-2004 Agricultural Drain Inventory" in addition to Barbour et al. which may also be found online at http://www.epa.gov/OWOW/monitoring/techmon.html .	
	1999	"Rapid Bioassessment Protocols For Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish, Second Edition" by Barbour, Gerritsen, Snyder and Stribling. For the condition category of each habitat parameter consult (continued)
	Note: Milani conducted a visual-based habitat assessment on this waterbody. The parameters of this assessment are outlined in (continued)	

BIOLOGY

	Presence
BLACK BULLHEAD *Ictalurus melas*	Unknown
BLACKNOSE DACE *Rhinichthys atratulus*	Unknown
BRASSY MINNOW *Hybognathus hankinsoni*	Common
BROOK STICKLEBACK *Culaea inconstans*	Common
COMMON SHINER *Notropis cornutus*	Unknown
CREEK CHUB *Semotilus atromaculatus*	Unknown
FATHEAD MINNOW *Pimephales promelas*	Common
YELLOW PERCH *Perca flavescens*	Unknown

Creel

Year	Species	Catch/Unit Effort*

*Catch/Unit Effort = Catch/Hour

13-07-26 Page 1 of 1 Manitoba

Waterbody: Crystal Creek

Provincial Waterbody Id #	Watershed	Region	District	Map Sheet	Latitude:	49 13 15
2280.00	5OBA	Western	Manitou	62G03	Longitude:	99 2 4

BIOLOGY

	Presence
BLACKNOSE DACE *Rhinichthys atratulus*	Unknown
COMMON SHINER *Notropis cornutus*	Unknown
CREEK CHUB *Semotilus atromaculatus*	Unknown
FATHEAD MINNOW *Pimephales promelas*	Unknown
NORTHERN PIKE *Esox lucius*	Unknown
WHITE SUCKER *Catostomus commersoni*	Unknown

Creel

Year	Species	Catch/Unit Effort*

*Catch/Unit Effort = Catch/Hour

13-07-26

Page 1 of 1

Manitoba

Waterbody: Cypress Creek

Provincial Waterbody Id #	Watershed	Region	District	Map Sheet	Latitude:	49 12 24
2281.00	5OBC	Western	Manitou	62G03	Longitude:	99 5 18

BIOLOGY

	Presence
BIGMOUTH SHINER *Notropis dorsalis*	Unknown
BLACK BULLHEAD *Ictalurus melas*	Common
BLACKNOSE DACE *Rhinichthys atratulus*	Unknown
BROOK STICKLEBACK *Culaea inconstans*	Unknown
COMMON SHINER *Notropis cornutus*	Unknown
CREEK CHUB *Semotilus atromaculatus*	Unknown
FATHEAD MINNOW *Pimephales promelas*	Common
JOHNNY DARTER *Etheostoma nigrum*	Unknown
NORTHERN REDBELLY DACE *Chrosomus eos*	Unknown
SPOTFIN SHINER *Cyprinella spiloptera*	Unknown
WHITE SUCKER *Catostomus commersoni*	Unknown

Creel

Year	Species	Catch/Unit Effort*

*Catch/Unit Effort = Catch/Hour

13-07-26 Page 1 of 1 Manitoba

Appendix D

Water Rights Licence

Licence to Use Water for Municipal-Distribution System Purposes

Manitoba Water Stewardship
Infrastructure and Operations Division
200 Saulteaux Cresc.
Winnipeg, Manitoba
R3J 3W3

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

Licence No.: **2006-033**

U.T.M.: Zone 14 508792 E
5451655 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 Pilot Mound** in the Province of Manitoba (hereinafter called "the LICENSEE")to divert raw water from the **Pilot Creek (Goudney) Reservoir** by means of a pumping installation, pipeline(s) and any other appurtenances (hereinafter called "the WORKS"), located on the following described lands:

the Southwest Quarter of Section 18, in Township 3 and Range 11, West of the Principal Meridian in Manitoba, more particularly described on Certificate of Title No. 1845611,

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 within:

the Town of Pilot Mound.

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 raw 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 raw water may be diverted pursuant hereto shall not exceed **0.003 cubic metres per second (0.1 cubic feet per second)**

   b) The total quantity of raw water diverted in any one year shall not exceed **100 cubic decametres (81.07 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. If for any reason whatsoever the Minister deems it advisable to cancel this Licence, he may do so by letter addressed to the LICENSEE at **Box 39, Pilot Mound, MB, R0G 1P0, 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 raw water shall be used.
10. The term of this Licence shall be **twenty (20) 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 the raw 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 raw 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. The LICENSEE shall install and maintain, on the raw water pumping WORKS, a water measuring device acceptable to the Executive Director, Infrastructure and Operations Division, that will accurately measure the instantaneous water flow and the accumulated annual volume of water diverted from the raw water source.

14. The LICENSEE shall comply with all instructions and specifications that may be issued by Fisheries and Oceans Canada under the fish habitat protection provisions of Canada's Fisheries and Oceans Act concerning the construction, maintenance, and operation of the WORKS.

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 16 day of OCTOBER A.D. 20 06.

SIGNED, SEALED AND DELIVERED
in the presence of

Witness

x [signature] MAYOR (Seal)
Licensee [signature] CAO

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
in and for the Province of Manitoba

Witness

My Commission expires _____

Issued at the City of Winnipeg, in the Province of Manitoba, this 24 day of October A.D. 20 06.

[signature]
The Honourable the Minister of Water Stewardship

Pilot Mound Water Supply Project

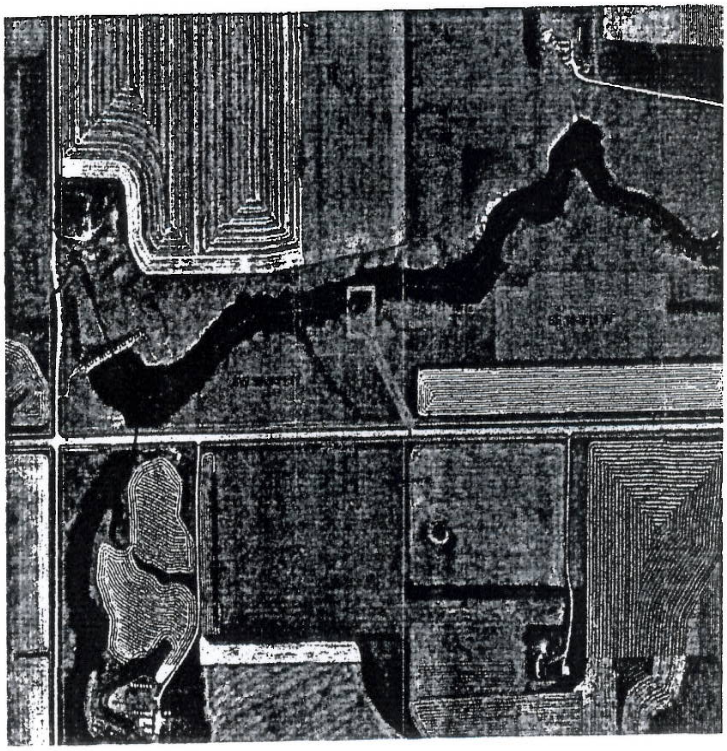


EXHIBIT "A"
THIS PLAN IS AN INTEGRAL PAR
LICENSE NO 2006-033
ISSUED UNDER THE WATER RIGHT

N
W E
S

0.4 0 0.4 Miles

Appendix E

MWSB Guidelines for Watercourse Crossings

WATERCOURSE CROSSINGS

Mitigation Measure

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

Reclamation

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

Pressure Loss/Fluid Loss Response

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

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

Loss of Fluid and Frac-out Response Plan

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

b) Make adjustments to the mud mixture; add lost circulation material (LCM) to the drilling fluid in an attempt to prevent further loss of fluid to the ground formation and/or watercourse.

c) Where conditions warrant and permit (i.e., shallow depth, clear water, low water velocity, potentially sensitive habitat) and where a frac-out has been visually detected, attempt to isolate the fluid release using a large diameter short piece of culvert.

d) Under circumstances where a frac-out has occurred, and where conditions do not permit containment and the prevention of drilling fluids release to the watercourse, attempts to plug the fracture by pumping LCM are not to continue for more than 10 minutes of pumping time.

e) If the frac-out is not contained within this time, MWSB/PFRA construction supervisor will halt any further attempts until a course of action (either abandon directional drilling or further consultation with MWSB engineers) is decided upon.

Appendix F

Glenora Aquifer Raw Water Quality Analysis

WL Gibbons & Associates Inc.
ATTN: STEVE WIECEK
64 St. Andrew Road
Winnipeg MB R2M 3H6

Date Received: 06-JUN-13
Report Date: 13-JUN-13 15:24 (MT)
Version: FINAL

Client Phone: 204-771-4389

Certificate of Analysis

Lab Work Order #: L1312388
Project P.O. #: NOT SUBMITTED
Job Reference: PILOT MOUND
C of C Numbers:
Legal Site Desc:

Paul Nicolas
Account Manager

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

PILOT MOUND

L1312388 CONTD....
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Version: FINAL

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1312388-1 TW 13-01							
Sampled By: SJW on 05-JUN-13 @ 15:00							
Matrix: WATER							
Miscellaneous Parameters							
Silica, Reactive (as SiO2)	27.8		1.0	mg/L		07-JUN-13	R2628779
MB Conservation test 72D							
Alkalinity							
Alkalinity, Total (as CaCO3)	245		20	mg/L		06-JUN-13	R2627429
Bicarbonate (HCO3)	299		24	mg/L		06-JUN-13	R2627429
Carbonate (CO3)	<12		12	mg/L		06-JUN-13	R2627429
Hydroxide (OH)	<6.8		6.8	mg/L		06-JUN-13	R2627429
Ammonia by colour							
Ammonia, Total (as N)	0.097		0.010	mg/L		08-JUN-13	R2628735
Carbons							
Total Carbon	64.3		1.0	mg/L		13-JUN-13	R2631182
Total Inorganic Carbon	62.4		1.0	mg/L		13-JUN-13	R2631182
Total Organic Carbon	1.9		1.0	mg/L		13-JUN-13	R2631182
Chloride by Ion Chromatography							
Chloride	2.42		0.50	mg/L		06-JUN-13	R2628772
Colour, True							
Colour, True	<5.0		5.0	CU		06-JUN-13	R2627467
Conductivity							
Conductivity	517		20	umhos/cm		06-JUN-13	R2627429
Fluoride by Ion Chromatography							
Fluoride	<0.10		0.10	mg/L		06-JUN-13	R2628772
Hardness Calculated							
Hardness (as CaCO3)	281		0.30	mg/L		11-JUN-13	
Ion Balance Calculation							
Cation - Anion Balance	3.0			%		11-JUN-13	
Anion Sum	5.75			me/L		11-JUN-13	
Cation Sum	6.10			me/L		11-JUN-13	
Langelier Index 4C							
Langelier Index (4 C)	0.64					11-JUN-13	
Langelier Index 60C							
Langelier Index (60 C)	1.4					11-JUN-13	
Nitrate as N by Ion Chromatography							
Nitrate-N	<0.050		0.050	mg/L		06-JUN-13	R2628772
Nitrate+Nitrite							
Nitrate and Nitrite as N	<0.071		0.071	mg/L		10-JUN-13	
Nitrite as N by Ion Chromatography							
Nitrite-N	<0.050		0.050	mg/L		06-JUN-13	R2628772
Sulfate by Ion Chromatography							
Sulfate	37.4		0.50	mg/L		06-JUN-13	R2628772
Total Dissolved Solids							
Total Dissolved Solids	309		5.0	mg/L		11-JUN-13	R2630190
Total Kjeldahl Nitrogen							
Total Kjeldahl Nitrogen	<0.40	DLM	0.40	mg/L	07-JUN-13	11-JUN-13	R2630247
Total Metals by ICP-MS							
Aluminum (Al)-Total	<0.0050		0.0050	mg/L	10-JUN-13	10-JUN-13	R2629290
Antimony (Sb)-Total	<0.00020		0.00020	mg/L	10-JUN-13	10-JUN-13	R2629290
Arsenic (As)-Total	0.00176		0.00020	mg/L	10-JUN-13	10-JUN-13	R2629290
Barium (Ba)-Total	0.0931		0.00020	mg/L	10-JUN-13	10-JUN-13	R2629290
Beryllium (Be)-Total	<0.00020		0.00020	mg/L	10-JUN-13	10-JUN-13	R2629290
Bismuth (Bi)-Total	<0.00020		0.00020	mg/L	10-JUN-13	10-JUN-13	R2629290
Boron (B)-Total	0.042		0.010	mg/L	10-JUN-13	10-JUN-13	R2629290
Cadmium (Cd)-Total	<0.000010		0.000010	mg/L	10-JUN-13	10-JUN-13	R2629290

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

PILOT MOUND

L1312388 CONTD....
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Version: FINAL

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1312388-1 TW 13-01							
Sampled By: SJW on 05-JUN-13 @ 15:00							
Matrix: WATER							
Total Metals by ICP-MS							
Calcium (Ca)-Total	81.5		0.10	mg/L	10-JUN-13	10-JUN-13	R2629290
Cesium (Cs)-Total	<0.00010		0.00010	mg/L	10-JUN-13	10-JUN-13	R2629290
Chromium (Cr)-Total	<0.0010		0.0010	mg/L	10-JUN-13	10-JUN-13	R2629290
Cobalt (Co)-Total	<0.00020		0.00020	mg/L	10-JUN-13	10-JUN-13	R2629290
Copper (Cu)-Total	0.00031		0.00020	mg/L	10-JUN-13	10-JUN-13	R2629290
Iron (Fe)-Total	0.20		0.10	mg/L	10-JUN-13	10-JUN-13	R2629290
Lead (Pb)-Total	<0.000090		0.000090	mg/L	10-JUN-13	10-JUN-13	R2629290
Lithium (Li)-Total	0.0165		0.0020	mg/L	10-JUN-13	10-JUN-13	R2629290
Magnesium (Mg)-Total	18.8		0.010	mg/L	10-JUN-13	10-JUN-13	R2629290
Manganese (Mn)-Total	0.417		0.00030	mg/L	10-JUN-13	10-JUN-13	R2629290
Molybdenum (Mo)-Total	0.00080		0.00020	mg/L	10-JUN-13	10-JUN-13	R2629290
Nickel (Ni)-Total	<0.0020		0.0020	mg/L	10-JUN-13	10-JUN-13	R2629290
Phosphorus (P)-Total	<0.20		0.20	mg/L	10-JUN-13	10-JUN-13	R2629290
Potassium (K)-Total	2.37		0.020	mg/L	10-JUN-13	10-JUN-13	R2629290
Rubidium (Rb)-Total	0.00142		0.00020	mg/L	10-JUN-13	10-JUN-13	R2629290
Selenium (Se)-Total	<0.0010		0.0010	mg/L	10-JUN-13	10-JUN-13	R2629290
Silicon (Si)-Total	13.1		0.050	mg/L	10-JUN-13	10-JUN-13	R2629290
Silver (Ag)-Total	<0.00010		0.00010	mg/L	10-JUN-13	10-JUN-13	R2629290
Sodium (Na)-Total	9.69		0.030	mg/L	10-JUN-13	10-JUN-13	R2629290
Strontium (Sr)-Total	0.191		0.00010	mg/L	10-JUN-13	10-JUN-13	R2629290
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	10-JUN-13	10-JUN-13	R2629290
Thallium (Tl)-Total	<0.00010		0.00010	mg/L	10-JUN-13	10-JUN-13	R2629290
Thorium (Th)-Total	<0.00010		0.00010	mg/L	10-JUN-13	10-JUN-13	R2629290
Tin (Sn)-Total	<0.00020		0.00020	mg/L	10-JUN-13	10-JUN-13	R2629290
Titanium (Ti)-Total	0.00070		0.00050	mg/L	10-JUN-13	10-JUN-13	R2629290
Tungsten (W)-Total	<0.0010		0.0010	mg/L	10-JUN-13	10-JUN-13	R2629290
Uranium (U)-Total	0.00097		0.00010	mg/L	10-JUN-13	10-JUN-13	R2629290
Vanadium (V)-Total	<0.00020		0.00020	mg/L	10-JUN-13	10-JUN-13	R2629290
Zinc (Zn)-Total	<0.0050		0.0050	mg/L	10-JUN-13	10-JUN-13	R2629290
Zirconium (Zr)-Total	<0.00040		0.00040	mg/L	10-JUN-13	10-JUN-13	R2629290
Transmittance, UV (254 nm)							
Transmittance, UV (254 nm)	95.3		1.0	% T	10-JUN-13	10-JUN-13	R2628870
Turbidity							
Turbidity	2.19		0.10	NTU		06-JUN-13	R2627394
pH							
pH	8.03		0.10	pH units		06-JUN-13	R2627429

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

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Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
DLA	Detection Limit Adjusted For required dilution
DLM	Detection Limit Adjusted For Sample Matrix Effects
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

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.

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.

CL-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 analyis of metals by inductively coupled-mass spectrometery.

N-TOTKJ-WP	Water	Total Kjeldahl Nitrogen	Quickchem method 10-107-06-2-E Lachat

Samples are digested with a sulphuric acid solution, cooled, diluted with water, and analyzed for ammonia. Total Kjeldahl nitrogen is the sum of free-ammonia and organic nitrogen compounds which are converted to ammonium sulphate through this digestion process. Analysis is performed by Flow Injection
Analysis (FIA). The pH of the digested sample is raised to a known, basic pH by neutralization with a concentrated buffer solution. This neutralization converts the ammonium cation to ammonia. The ammonia produced is heated with saliclyate and hypochlorite to produce blue colour which is proportional to the ammonia concentration.

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.

PILOT MOUND

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Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
NO2+NO3-CALC-WP	Water	Nitrate+Nitrite	CALCULATION
NO2-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-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.			
SIO2-COL-WP	Water	Reactive Silica by colour	APHA 4500 SIO2
This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 "Silica". Molybdate Reactive Silica is determined by analysis of the sample using the heteropoly blue colourimetric method.			
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.			

** 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
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, 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.

Summary

Table 1
Town of Pilot Mound
Water Quality Data

	TW 13-01	OB-036	OB-033	OB-015
Parameters	05/06/2013	31/07/2006	01/08/2006	01/08/2006
Silica, Reactive (as SiO2)	27.8			
Total Alkalinity (as CaCO3)	245	216	186	166
Bicarbonate (HCO3)	299	264	227	202
Carbonate (CO3)	<12	<0.5	<0.5	<0.5
Hydroxide (OH)	<6.8	<0.5	<0.5	<0.5
Ammonia, Total (as N)	0.097	0.12	0.09	0.13
Total Carbon	64.3			
Total Inorganic Carbon	62.4			
Total Organic Carbon	1.9	2.3	1.7	1.5
Chloride (Cl)	2.42	2.5	3.6	1.55
Colour, True (CU)	<5.0			
Conductivity (umhos/cm)	517	514	424	337
Flouride (F)	<0.10	0.14	0.16	0.18
Hardness (as CaCO3)	281	295	242	179
Langelier Index (4 C)	0.64			
Langelier Index (60 C)	1.4			
Nitrate-N	<0.050			
Nitrate and Nitrite as N	<0.071	<0.01	<0.01	<0.01
Nitrite-N	<0.050			
Sulphate (SO4)	37.4	62	37.3	12.3
Total Dissolved Solids	309	350	297	233
Total Kjedahl Nitrogen	<0.40	0.4	0.3	0.4
Transmittance, UV (254 nm)	95.3			
Turbidity (NTU)	2.19			
pH (pH units)	8.03	7.49	7.58	7.68
Total Metals				
Aluminum (Al)	<0.0050	<0.001	<0.001	<0.001
Antimony (Sb)	<0.00020	0.0005	0.0006	0.0005
Arsenic (As)	0.00176	0.0055	0.0062	0.0011
Barium (Ba)	0.0931	0.105	0.11	0.059
Beryllium (Be)	<0.00020	<0.0002	<0.0002	<0.0002
Bismuth (Bi)	<0.00020	<0.0002	<0.0002	<0.0002
Boron (B)	0.042	0.05	0.03	0.07
Cadmium (Cd)	<0.000010	<0.00004	<0.00004	<0.00004
Calcium (Ca)	81.5	85.2	72.4	52.5
Cesium (Cs)	<0.00010	<0.0001	<0.0001	<0.0001
Chromium (Cr)	<0.0010	<0.0002	<0.0002	<0.0002
Cobalt (Co)	<0.00020	0.0002	<0.0002	<0.0002
Copper (Cu)	0.00031	0.0002	<0.0002	<0.0002
Iron (Fe)	0.2	0.71	0.02	0.81
Lead (Pb)	<0.000090	<0.0002	<0.0002	<0.0002
Lithium (Li)	0.0165	0.022	0.016	0.014
Magnesium (Mg)	18.8	19.8	14.6	11.7
Manganese (Mn)	0.417	0.492	0.361	0.271
Molybdenum (Mo)	0.0008	0.0015	0.0013	0.002
Nickel (Ni)	<0.0020	0.0036	0.0005	0.0009
Phosphorous (P)	<0.2	0.016	0.005	0.018
Pottasium (K)	2.37	3	2.41	2.45
Rubidium (Rb)	0.00142	0.0012	0.001	0.0009
Selenium (Se)	<0.0010	<0.0002	<0.0002	<0.0002
Silicon (Si)	13.1	11.8	11.6	11.1
Silver (Ag)	<0.00010	<0.00005	<0.00005	<0.00005
Sodium (Na)	9.69	7.2	2.8	6.1
Strontium (Sr)	0.191	0.23	0.119	0.169
Tellurium (Te)	<0.00020	<0.0002	<0.0002	<0.0002
Thallium (Tl)	<0.00010	<0.00002	<0.00002	<0.00002
Thorium (Th)	<0.00010	<0.0001	<0.0001	<0.0001
Tin (Sn)	<0.00020	<0.0002	<0.0002	<0.0002
Titanium (Ti)	0.0007	0.0005	0.0004	0.0004
Tungsten (W)	<0.0010			
Uranium (U)	0.00097	2.2	1	1.9
Vanadium (V)	<0.00020	<0.0002	<0.0002	<0.0002
Zinc (Zn)	<0.0050	0.02	0.003	0.003
Zirconium (Zr)	<0.00040	<0.002	<0.002	<0.002

Notes: 1. All units in mg/L, except as noted.

Appendix G

Reject Water Quality Projection

Reverse Osmosis System Analysis for FILMTEC™ Membranes — ROSA 9.1 ConfigDB u399339_282
Project: Pilot Mound Reject — Case: 2
NW, MWSB — 11/7/2013

Project Information:

Case-specific:

System Details

Feed Flow to Stage 1	79.25 gpm	Pass 1 Permeate Flow	50.43 gpm	Osmotic Pressure:	
Raw Water Flow to System	90.35 gpm	Pass 1 Recovery	63.63 %	Feed	2.83 psig
Feed Pressure	150.00 psig	Feed Temperature	5.0 C	Concentrate	7.48 psig
Flow Factor	0.85	Feed TDS	491.91 mg/l	Average	5.15 psig
Chem. Dose (100% H2SO4)	0.00	Number of Elements	16	Average NDP	121.97 psig
Total Active Area	6400.00 ft²	Average Pass 1 Flux	11.35 gfd	Power	6.46 kW
Water Classification: Well Water SDI < 3		Bypass Blending Flow	11.10 gpm	Specific Energy	1.75 kWh/kgal
System Recovery	68.10 %	Total Blended Product	61.53 gpm		

Stage	Element	#PV	#Ele	Feed Flow (gpm)	Feed Press (psig)	Recirc Flow (gpm)	Conc Flow (gpm)	Conc Press (psig)	Perm Flow (gpm)	Avg Flux (gfd)	Perm Press (psig)	Boost Press (psig)	Perm TDS (mg/l)
1	LE-400	2	4	79.25	145.00	0.00	52.01	126.92	27.24	12.26	0.00	150.00	1.62
2	LE-400	2	4	52.01	121.92	0.00	28.82	112.79	23.19	10.43	0.00	0.00	2.95

Pass Streams (mg/l as Ion)								
Name	Feed	Adjusted Feed	Concentrate		Permeate			
			Stage 1	Stage 2	Stage 1	Stage 2	Total	Blended Total
NH4+ + NH3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
K	2.37	2.37	3.61	6.49	0.01	0.02	0.02	0.44
Na	9.69	9.69	14.75	26.54	0.04	0.08	0.06	1.80
Mg	18.80	18.80	28.63	51.58	0.04	0.09	0.06	3.44
Ca	81.50	81.50	124.10	223.63	0.17	0.38	0.27	14.92
Sr	0.19	0.19	0.29	0.52	0.00	0.00	0.00	0.03
Ba	0.09	0.09	0.14	0.26	0.00	0.00	0.00	0.02
CO3	0.56	0.56	1.35	4.46	0.00	0.00	0.00	0.02
HCO3	299.00	299.00	454.21	814.19	1.08	1.86	1.42	55.08
NO3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cl	2.42	14.26	21.71	39.12	0.03	0.07	0.05	2.61
F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SO4	37.40	37.40	56.96	102.70	0.05	0.11	0.08	6.81
SiO2	27.80	27.80	42.31	76.20	0.10	0.19	0.14	5.13
Boron	0.04	0.04	0.05	0.08	0.02	0.03	0.02	0.03
CO2	14.35	14.33	14.68	15.94	14.19	14.81	14.48	14.55
TDS	480.07	491.91	748.38	1346.16	1.62	2.95	2.22	90.44
pH	7.60	7.60	7.75	7.94	5.27	5.48	5.38	6.91

*Permeate Flux reported by ROSA is calculated based on ACTIVE membrane area. DISCLAIMER: NO WARRANTY, EXPRESSED OR IMPLIED, AND NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, IS GIVEN. Neither FilmTec Corporation nor The Dow Chemical Company assume any obligation or liability for results obtained or damages incurred from the application of this information. Because use conditions and applicable laws may differ from one location to another and may change with time, customer is responsible for determining whether products are appropriate for customer's use. FilmTec Corporation and The Dow Chemical Company assume no liability, if, as a result of customer's use of the ROSA membrane design software, the customer should be sued for alleged infringement of any patent not owned or controlled by the FilmTec Corporation nor The Dow Chemical Company.

Reverse Osmosis System Analysis for FILMTEC™ Membranes ROSA 9.1 ConfigDB u399339_282
Project: Pilot Mound Reject Case: 2
NW, MWSB 11/7/2013

Design Warnings

-None-

Solubility Warnings

Langelier Saturation Index > 0
Stiff & Davis Stability Index > 0
BaSO4 (% Saturation) > 100%
Antiscalants may be required. Consult your antiscalant manufacturer for dosing and maximum allowable system recovery.

Stage Details

Stage 1 Element	Recovery	Perm Flow (gpm)	Perm TDS (mg/l)	Feed Flow (gpm)	Feed TDS (mg/l)	Feed Press (psig)
1	0.09	3.59	1.38	39.63	491.91	145.00
2	0.10	3.46	1.52	36.04	540.69	139.46
3	0.10	3.34	1.70	32.58	597.85	134.63
4	0.11	3.24	1.93	29.24	665.88	130.47
Stage 2 Element	**Recovery**	**Perm Flow (gpm)**	**Perm TDS (mg/l)**	**Feed Flow (gpm)**	**Feed TDS (mg/l)**	**Feed Press (psig)**
1	0.12	3.02	2.27	26.00	748.38	121.92
2	0.13	2.94	2.64	22.98	846.34	118.92
3	0.14	2.86	3.15	20.04	969.69	116.43
4	0.16	2.78	3.84	17.19	1129.87	114.40

Scaling Calculations

	Raw Water	Adjusted Feed	Concentrate
pH	7.60	7.60	7.94
Langelier Saturation Index	-0.05	-0.05	1.11
Stiff & Davis Stability Index	0.67	0.67	1.47
Ionic Strength (Molal)	0.01	0.01	0.03
TDS (mg/l)	480.07	491.91	1346.16
HCO3	299.00	299.00	814.19
CO2	14.35	14.35	15.93
CO3	0.56	0.56	4.46
CaSO4 (% Saturation)	0.78	0.78	4.39
BaSO4 (% Saturation)	114.82	114.82	865.22
SrSO4 (% Saturation)	0.21	0.21	0.74
CaF2 (% Saturation)	0.00	0.00	0.00
SiO2 (% Saturation)	32.71	32.71	85.16
Mg(OH)2 (% Saturation)	0.00	0.00	0.01

To balance: 11.84 mg/l Cl added to feed.