



***Engineering Ltd.***

*Executive Summary for Pre-Design Report:*

**MACKENZIE COUNTY**

**RURAL POTABLE WATER INFRASTRUCTURE**

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Project: 5223-082-00

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## EXECUTIVE SUMMARY

Mackenzie County has become very concerned about the quality of water being used by some rural residents due to human induced eutrophication (the excessive growth of plant and algae species associated with excessive nutrients from agricultural operations). The use of chemicals, fertilizers and livestock operations in agricultural operations could result in contamination of dugout and/or groundwater sources from spring runoff, stormwater runoff and groundwater movements, which poses a serious health risk to the rural residents.

In the recent past, the County has invested significantly in potable water infrastructure (including the upgrading of the La Crete Water Treatment Plant (a regional water transmission pipeline between Fort Vermilion and La Crete, etc.), to expand their ability to deliver potable water to rural residents. The installation with a new waterline between Lac Crete and Buffalo Head Prairie (with accommodation to expand service to the Blue Hills/Tompkins Landing area), along with the development of truckfills at Buffalo Head Prairie and near Fort Vermilion, is now possible due to the reception of a grant under the Small Communities Fund. This will greatly enhance the County's ability to supply sustainable and high quality potable water.

The purpose of this Pre-Design Report is to provide design recommendations and to identify the associated design constraints and opportunities.

### Project Goals

The completion of this work will expand the existing regional waterline infrastructure and develop two new truckfills in the Buffalo Head Prairie and Fort Vermilion areas. The goals set to successfully complete this project and deliver potable water infrastructure that will satisfy future demands are:

- 1. Ensure the waterline sizing will be capable of delivering potable water to the Buffalo Head Prairie and Blue Hills/Tompkins Landing areas for a period of 75 years (projected life span of modern pipe materials).**
- 2. Select a waterline alignment that will minimize the need to acquire easements and/or right-of-ways.**

- 3. Select waterline material that will both ease construction and minimize the operation and maintenance costs for the life of the waterline.**
- 4. Standardize the design of both truckfills with respect to building type, equipment, electronics, etc., to maximize construction cost effectiveness and ease the operation/maintenance requirements.**
- 5. Meet with Alberta Transportation and Alberta Environment and Parks to ensure they are aware of the project, which will enable the application/notification process to proceed smoothly.**
- 6. Conduct a risk assessment to identify all potential risks that could be encountered during the construction phase, ensure the design mitigates these risks and transfers the risks to the contractors to the greatest extent possible.**
- 7. Prepare accurate cost estimates.**
- 8. Prepare complete and effective tendering documents.**
- 9. Provide full-time construction inspection.**
- 10. Regular and effective meeting and reporting procedures.**

### Funding Conditions

Mackenzie County has received a grant under the Small Communities Fund, which carries certain restrictions and obligations, and those regarding provincial and federal contributions deserve special consideration. These are:

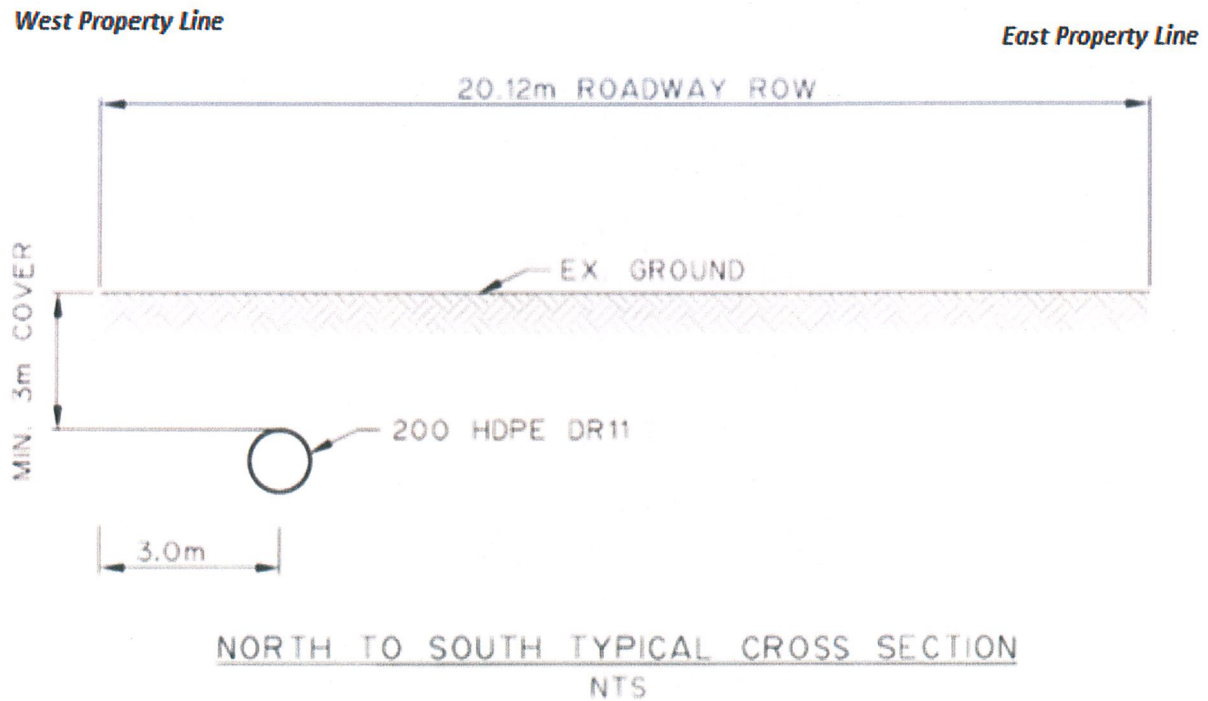
1. the provincial and federal contributions are limited to \$110,044 for the year ending March 31, 2016; and,
2. the maximum provincial and federal funding will be \$1,764,033 respectively, but the maximum annual funding allocation will be subject to approvals by the Alberta Legislature and Parliament of Canada.

These conditions may require the County to pay costs “up front” and wait for the delayed payment of funds by the federal and provincial government.

Under the New West Partnership Trade Agreement there is a general exception for water and services/investments pertaining to water, so this should not be an issue.

**Alignment Selection**

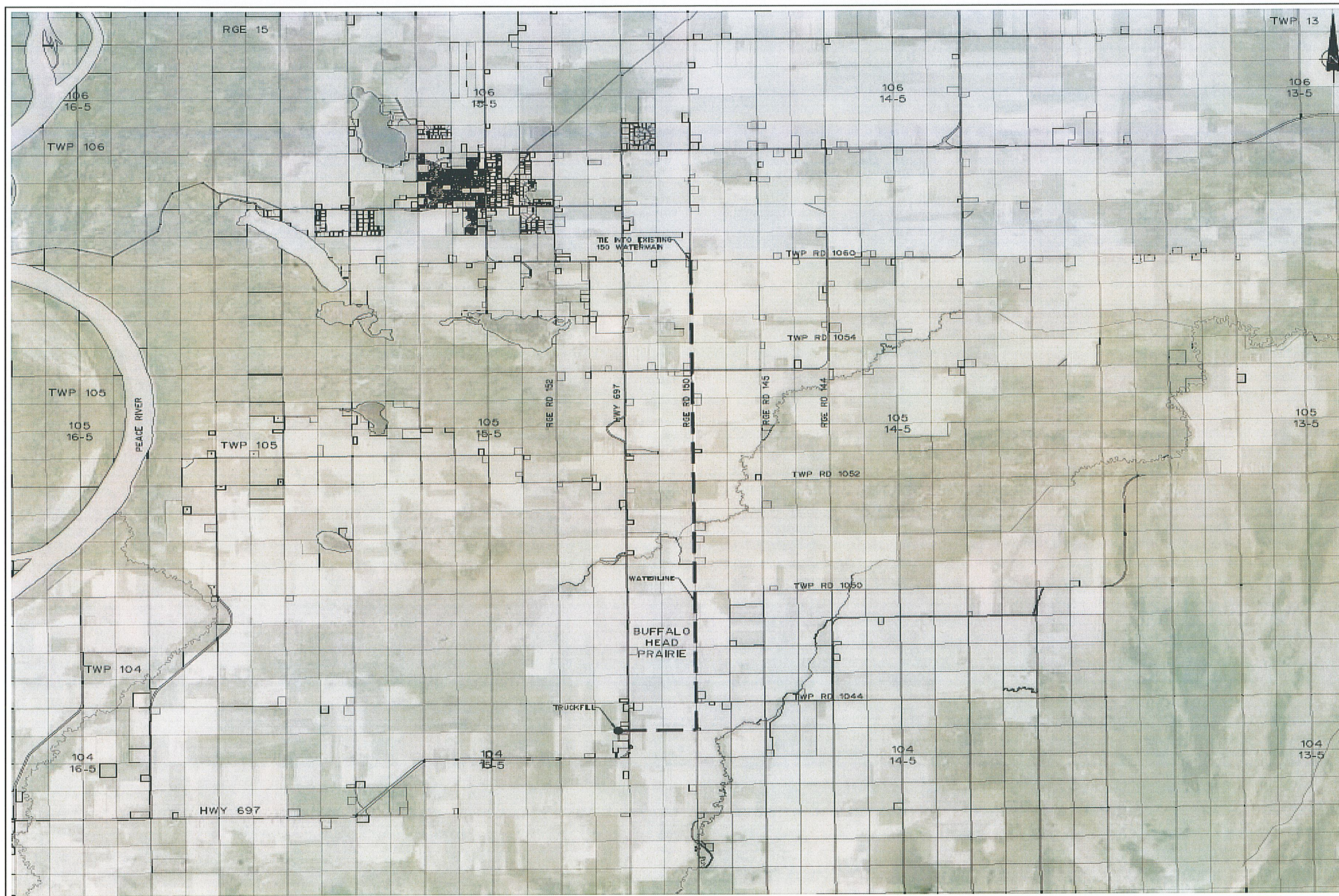
The general alignment for the waterline (see following page) was selected according to Option 4 in the Request for Decision presented to the Public Works Committee on September 7, 2015, with some minor re-alignment on the north end of the project. The right-of-way of Range Road 150 has been utilized to the greatest extent possible in order to minimize property acquisition. The location of the waterline in the right-of-way is shown below.



**FIGURE E.1: LOCATION OF WATERLINE IN RANGE ROAD 150 RIGHT-OF-WAY**

The west side of the right-of-way was selected to avoid conflict with power infrastructure located on the east side of the right-of-way.





THIS DRAWING MAY HAVE BEEN MODIFIED FROM ITS ORIGINAL SIZE. ALL SCALE NOTATIONS INDICATED (i.e. 1:1000 etc) ARE BASED ON 22"x34" FORMAT DRAWINGS

ISSUE	YY-MM-DD	REVISION
1	15-12-16	FOR PRELIMINARY APPROVAL



MACKENZIE COUNTY  
RURAL POTABLE WATER  
INFRASTRUCTURE  
OVERALL AND INDEX PLAN

DESIGNED	B.L.	JOB	5223-082-00
DRAWN	J.P., A.E.	SCALE	1:500000
DATE	DECEMBER 2015	DRAWING	C1.1



## Environment

The proposed waterline alignment will cross two creeks which are arms of the Bear Creek system. Alberta Environment and Parks have designated these two creeks as Class “C” water bodies, and the “Code of Practice for Pipelines and Telecommunication Lines Crossing a Water Body”, published by the Alberta Government, details the requirements for these crossings. Special attention is being paid to potential environmental impacts, in order to comply with the requirements of Alberta Environment and Parks.

The requirements of the Code of Practice are:

1. no work can be carried out during the activity period (April 16 to July 15), unless the creek is frozen or dry at the time of construction;
2. open cut and isolation methods can be employed outside of the activity period, but will require recommendations of a qualified aquatic environment specialist; and
3. plans of the proposed work must be submitted at least 14 days before the construction is started.

This restricted activity period is not expected to affect the installation of the waterline using the trenchless technology installation method (i.e. directional drilling).

Meeting with the Alberta Environment and Parks representative for Mackenzie County well in advance of tendering, submitting plans as early as possible, and stipulating that all creek crossings be performed by directional drilling will minimize chances that construction will be impeded.

The Migratory Birds Act prevents the detriment of migratory bird nests or eggs during nesting season, which officially begins on May 1<sup>st</sup>, and ends on August 15<sup>th</sup>. This requirement can have a significant effect on project costs and schedule, therefore, MPE Engineering Ltd. (MPE) recommends that clearing activities for the pipeline alignment be conducted during the winter months when migratory birds are not present.



The new Alberta Wetlands Policy requires that any permanent damage to wetland areas be restored, or that an equivalent amount of wetland be replaced with wetland of an equivalent quality. At present, it appears that there will be no impacts to existing wetlands, but plans will be submitted to Alberta Environment and Parks for their assessment.

MPE has identified a number of opportunities to mitigate the environmental impact of the construction, operation, and maintenance of the new waterline.

### Water Modeling

Water modeling was completed with WaterCAD v8i Software and the final route, as seen on Page v, was selected in consultation with the County and has only been modified slightly from Option 4 presented to the Public Works Committee to lessen land acquisition requirements. These modifications generally included keeping the waterline within the boundaries of Range Road 150, up to Township Road 1060 (the tie-in location to the existing 150 mm waterline). The route may change during detailed design due to unforeseen constraints or difficulties with land acquisition in the southern end of the project, but is expected to remain similar. The pipe material that was modeled was High-Density Polyethylene (HDPE) pipe. HDPE is suitable for directional drilling and open cut installation, which are the proposed construction methods for this project.

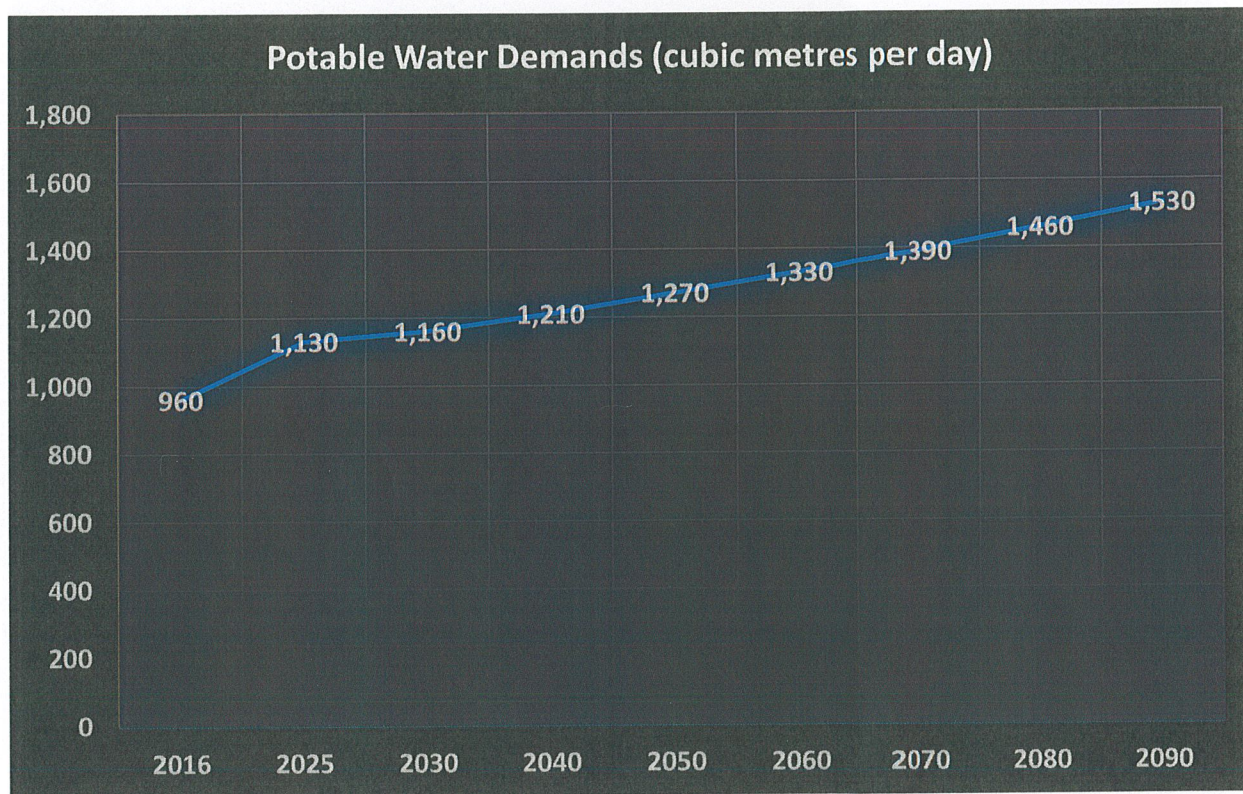
The water modeling has assumed that:

- in the immediate future the new truckfills and waterline would only have a limited impact on the water demands from the water treatment plants, as the majority of users of the new infrastructure currently obtain their potable water from the existing plants;
- the existing water treatment plants will be upgraded as required to meet demand;
- the existing waterline on the north end of the project (currently 150 mm diameter) will be upsized and/or looped in in approximately 5 to 10 years in order to meet the demand;
- there will be a very large increase in demand during the summer months due to use of potable water for farm operations (i.e. spraying), and a peaking factor of 4.9 has been used to account for this use;
- an average flow of 100 cubic metres per day (equivalent population of approximately 300) has been used to account for users along the new waterline, which would connect via a trickle feed system.

It is assumed that the demand at Buffalo Head Prairie will increase 2% from 2016 to 2025 and at 0.5% from 2025 to 2090. To account for the demand at the new truckfill for farm operations, a peaking factor of 4.9 has been used. The projected water demands for the 75-year design life of the waterline is shown below.

Figure A

E.2: Graph of Projected Water Demands



The waterline pressures will vary with elevation changes, and will therefore generally diminish over length due to the increase in elevation from the tie-in location on Township Road 1050 and the proposed Buffalo Head Prairie truckfill. The table below shows the anticipated pressures at different locations in the system.

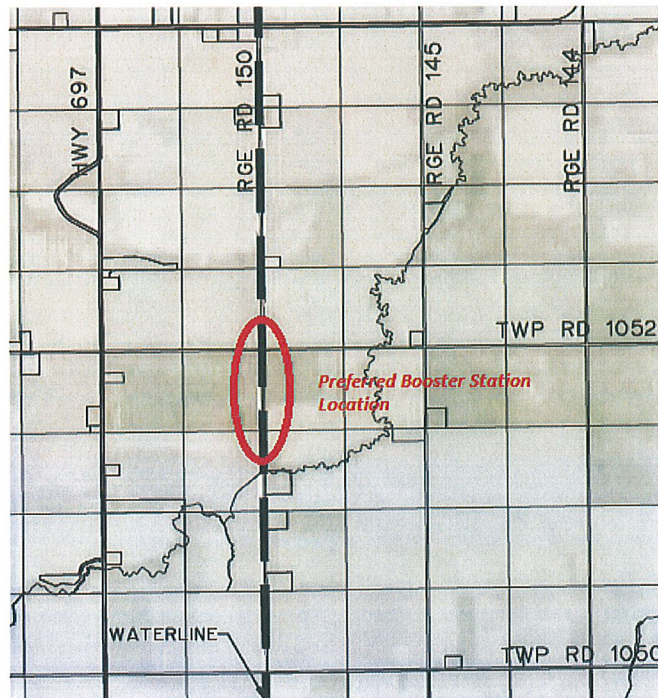


**Table E.1: Assumed Waterline Pressures**

LOCATION	ANTICIPATED PRESSURE (PSI)
Tie-in at 150 mm waterline on Township Road 1050	65
Entering proposed booster station	30
Leaving proposed booster station	125
Entering Buffalo Head Prairie Truckfill	30

The primary material used in the model is HDPE DR11, which is very common and relatively inexpensive pipe material, with a pressure rating of 1,105 kPa (160 psi). A booster station will be required for this waterline and its preferred location is shown below. This location is approximate only, and will remain flexible to account for variables such as land availability, availability of 3 phase power, and access for operation/maintenance, etc.

**Figure E.3: Preferred Booster Station Location**





Using these pressure characteristics, it has been determined that the maximum flow that could be delivered by a 200 mm waterline would be 1,750 cubic metres per day, which is 220 cubic metres more than the projected 2090 demand of 1,530 cubic metres per day.

If a 250 mm waterline was installed it could deliver 2,500 cubic metres per day, which far exceeds the projected 2090 demand. Although this does allow the opportunity to satisfy a much larger potable water demand growth, the major drawback of installing the larger diameter pipe is that it would increase the cost of the project by approximately 15%.

### Design Considerations

MPE Engineering Ltd. evaluated two separate pipe materials for the construction of the waterline. Fusible HDPE DR11/9 pipe was evaluated for installation using directional drilling, while Blue Brute PVC DR18/14 pipe was evaluated for installation using open cut construction. Of these materials, HDPE showed a clear advantage due to a significant reduction in the amount of excavation and restoration that is required over the course of the project. The difference in cost between the two pipe materials is estimated to be as much as 16% of the overall project cost. Installation by directional drilling using HDPE pipe also allows for the mitigation of environmental impacts caused by the installation of the line.

Directional drilling lends itself to the use of DR11 HDPE pipe over thinner walled classifications due to required pulling strength. One section of the line was determined to require the use of DR9 pipe, which will be the crossing of Secondary Highway 697, in order to avoid the need to install casing for the thinner walled pipe.

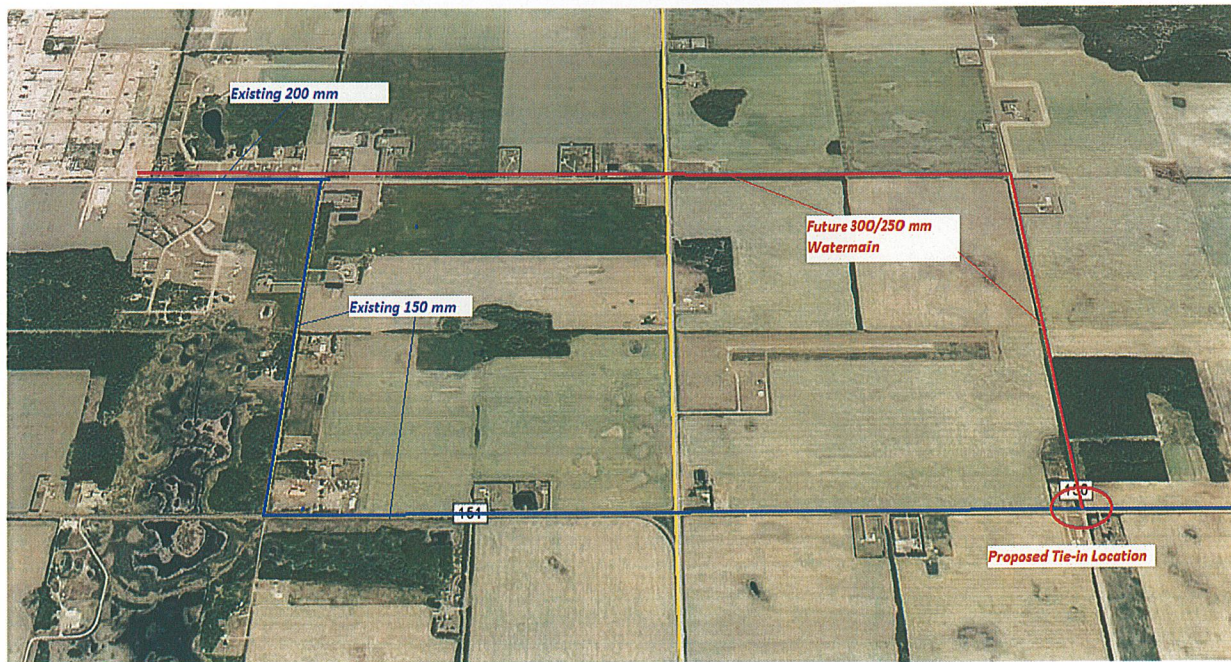
Based upon demand projections for the Buffalo Head Prairie and Blue Hills/Tompkins Landing, the existing 150 mm pipe being tied into on the north end of the project will only have the capacity to supply water to the new waterline for a period of 5 years to 10 years, at which time it will require upsizing and/or looping.

One possible option will be to leave the existing waterline and provide looping as shown in red on the following page. The recently completed Infrastructure Master Plans contemplate the installation of these waterlines to service the future industrial/commercial area of La Crete.





Moving forward with the design and tendering of this project, the geotechnical investigation and topographic survey are important tasks and should be undertaken as soon as possible. In order to complete these tasks, clearing and grubbing will be required on the treed portions of the alignment. Consideration needs to be given to the issuance of a separate clearing and grubbing tender so the design work can proceed unimpeded.



One of the goals of this project will be to standardize the design of the truckfills with respect to structure type, make of equipment, type of electronics, etc. Checklists will be reviewed with County staff during the design process to ensure their preferences are specified.

The advantages of this standardization will be:

- only one design needs to be completed and this can be used for future truckfills;
- an opportunity to reduce construction costs due to the economy of scale, as suppliers will generally give discounts for multiples of the same product; and,
- streamlining of the operation/maintenance functions, as personnel will be familiar with the requirements at each station.

The only feature that will be variable will be the size of reservoirs, as these need to be based upon projected water demands and will be performed during the detail design stage.

### Tendering Strategies

In order to compress the overall schedule, three separate tendering packages should be considered for this project, including clearing and grubbing (Contract 1), waterline (Contract 2) and truckfills (Contract 3).

Clearing and grubbing should be completed in the near future in order to permit the collection of data pertaining to geotechnical and topography. This information is required for the completion of the detailed design. Due to the limited amount of work and the availability of contractors in the La Crete area, it may be best to tender this work via a tender in the local papers.

Due to the distinct nature of the construction of the waterline and truckfills, they should be tendered separately, with Contract 2 being the waterline, and Contract 3 being the truckfills. This provides the advantage of attracting tenderers that specialize in each type of work and have close connections to suppliers and sub-contractors, which can result in lower bid prices.

For this type of work, two methods of tendering can generally be employed:

1. **Open tendering** is one of the most popular methods of tendering and has the advantage of attracting the greatest amount of attention and therefore the greatest number of bid submissions, with the result being the lowest possible price. Given the current economic climate, it is anticipated that this project will have numerous bid submissions. The disadvantages of this type of bid process will be that the contractor submitting the lowest bid could be from anywhere in North America, with little or no knowledge of the area and the type of work involved. The results of selecting this contractor could be extended schedules, poor quality of work and/or general lack of performance.
2. **Request for Qualification/Short List/Submissions** can have distinct advantages such as contractors having:
  - experience in the type of work being contemplated;
  - local knowledge and experience;
  - ability to meet project schedules;



- experience of key personnel; and,
- references.

It is recommended that the Request for Qualification/Short List/Bidding process be used for the tenders relating to the waterline and truckfills.

### Schedule

Given the number of infrastructure projects being anticipated in Alberta, it is important to tender this project as soon as possible to gain the largest advantage of the competitive market.

Key dates required to meet the project schedule are outlined below.

- |   |                   |
|---|-------------------|
| 1. Finalization of Pre-Design Report (30% Design) | January 22, 2016  |
| 2. Completion of 60% Design                       | February 19, 2016 |
| 3. Completion of 90% Design                       | March 25, 2016    |
| 4. Final Design and Tendering Documents           | March 31, 2016    |
| 5. Tendering                                      | April 2016        |
| 6. Construction Completion                        | November 30, 2016 |

### Cost Estimate

ITEM	DESCRIPTION	COST
	Site Works and Miscellaneous Items	\$ 145,000
Schedule A	Miscellaneous Site Works	\$ 127,000
Schedule B	Waterline	\$ 4,152,050
Schedule C	Fort Vermilion Truckfill	\$ 775,000
Schedule D	Buffalo Head Prairie Truckfill	\$ 775,000
Subtotal		\$ 5,974,050
	Engineering	\$ 525,000
	Contingency	\$ 600,000
<b>Total</b>		<b>\$ 7,099,050</b>