Associated Engineering | 75 YEARS

REPORT

qathet Regional District

Water System Extension Feasibility Study

JUNE 2021

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1 BACKGROUND

1.1 Existing System

The qathet Regional District (the District or qRD) is a local government authority which encompasses 5,000 km^2 on the west coast of British Columbia within the traditional territory of the Tla'amin Nation. It incorporates five electoral areas and one municipality (the City of Powell River) with a total population of about 20,000. The Southern Region consists of a relatively densely populated strip along Highway 101, whereas further inland, agricultural holdings prevail.

The District retained Associated Engineering (B.C.) Ltd., (AE) to conduct a feasibility assessment of the supply of potable water from the City of Powell River Water System to commercial and residential users along Highway 101. The City of Powell River Water System is currently supplied water from the Haslam Lake Water Treatment Plant, located within the city boundary. AE assessed the capacity and means of the City of Powell River Water System to supply to the District's Pilot Area as well as the possible extension to Saltery Bay.

1.2 Pilot Phase & Saltery Bay Extension

The Pilot Phase Area is located in Electoral Area B and comprises a small coastal area approximately 3.5 km in length that extends approximately one kilometre (1 km) inland. The area starts at the City of Powell River boundary (Rifle Range Road) and extends to the end of Centennial Drive in the east. Information provided by the District indicates that there are currently 246 properties within the Pilot Area. According to Census data, there is an average of 2.1 people per dwelling in Electoral Area B, suggesting a population of approximately 520 within the Pilot Area. This area is supplied drinking water via the existing Myrtle Pond Water System and Centennial Drive Water Utilities Society or, where not connected to these water systems, are presumed to have private wells.

The Saltery Bay Extension area commences from the eastern end of Centennial Drive and extends eastwards for approximately 21 km to Saltery Bay. The western part of this area is within Electoral Area B, but the majority of the area sits within Electoral Area C. Water is currently provided by a number of independent community water systems, such as the Brew Bay, Pinetree and Stillwater Water Systems, as well as from private water sources.

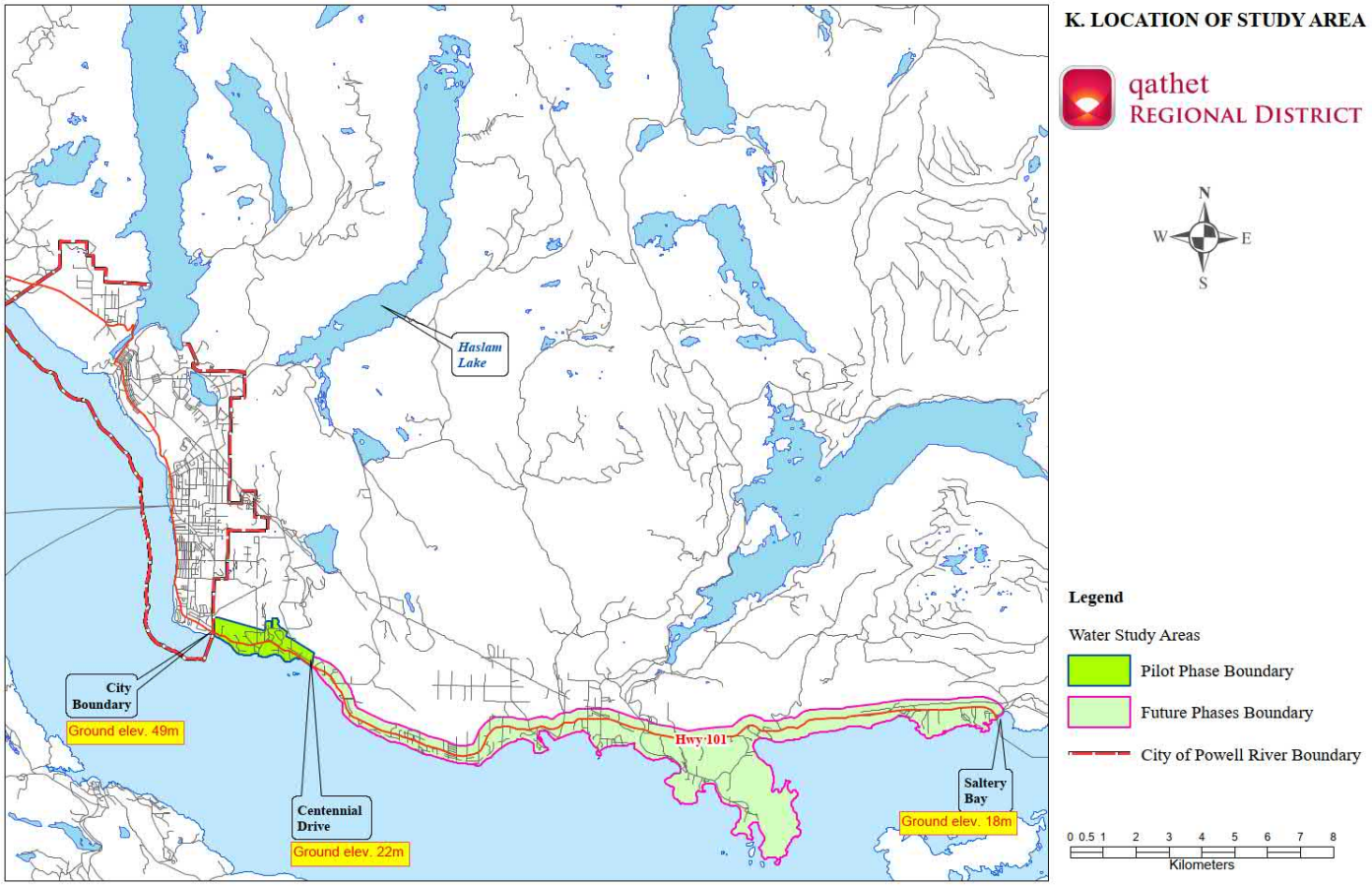


Figure 1-1
The District Area Map Indicating the Pilot Area (qRD, 2019)

The study focuses on supplying water to a 'Pilot Phase' area adjacent to the southeast boundary of the City of Powell River, but will also consider a 'Saltery Bay Extension' area that includes the area further east to Saltery Bay.

2 REGIONAL WATER DEMAND

2.1 Potable Water Demand

The maximum daily demand (MDD) for Powell River, the Pilot Phase area and the Saltery Bay Extension area were assessed to determine whether existing water supply, treatment, storage and distribution infrastructure can accommodate the projected future demands of the Pilot Area while maintaining future supply to the City of Powell River. AE reviewed per capita water demands for areas similar to or close to the Pilot Phase Area within BC to determine a per capita demand suitable for the Pilot Phase Area. A summary of reference per capita demands from available data is shown in **Table 2-1** and an explanation of the conceptual-level demand calculations for this study is provided immediately following.

Table 2-1
Summary of Per Capita Demand Data in British Columbia

Description	Per Capita Demand [lpcd]
City of Powell River per capita usage in 2019[1]	729
Minimum per Capita Demand from Selected BC Data	494
Maximum per Capita Demand from Selected BC Data	1008
Average per Capita Demand from Selected BC Data	662

AE determined conceptual-level design basis demands for the Pilot Phase Area based on the following:

1. Per capita demand represents the average potable water consumption per person residing in the Pilot Area. Based on a range of per capita demands for similar communities in BC, **AE estimates an average per capita daily demand of 662 litre per capita per day (lpcd)**. This average per capita demand is assumed based on data available for comparable communities and considering that the Pilot Area is not entirely metered and is primarily residential, with minimal industrial or agricultural lands. Some data available for comparison was from areas with high-impact land use (e.g. heavy industrial, agricultural, etc.) that resulted in much higher per capita demands.
2. AE conservatively estimated the population growth for the Pilot Phase Area for the years 2041 to 2051 based on a maximum population growth rate of 4.4% contained in the *Electoral Areas A, B, C, & D Population Analysis and Projections 2016 – 2041* (qRD, 2019). Using a maximum population growth rate of 4.4%, **AE estimates a population of 636 consumers in 2051**. The projected population growth between 2021 and 2051 is shown in **Figure 2-1**.
3. AE calculated the average daily demand (ADD) as the product of the estimated population in 2051 (636 consumers) and per capita (individual consumer) demand (662 lpcd). **AE estimates an ADD of 4.9 L/s in 2051**.

$$ADD = Population \times Per\ Capita\ Demand$$

4. The MDD is the single highest total daily water consumption over a one-year period and is used as a design parameter for sizing treatment and water supply infrastructure (MLFNRO, 2012).

[1] 2019 per capita demand (from usage data at the WTP) is reported as higher than most recent 2020 usage data.

AE calculated the MDD by multiplying the ADD (4.9 L/s) by a peaking factor of 2.5, appropriate for rural areas with less than 5000 consumers (MLFNRO, 2012). **AE calculated an MDD of 12.2 L/s in 2051**.

$$MDD_{calc} = 2.5 \times ADD$$

5. AE applied a contingency, or safety factor, of 20% to the calculated MDD. After applying the contingency factor, **AE estimates an MDD of 14.6 L/s in 2051** for the Pilot Phase Area.

$$MDD_f = MDD_{calc} + (MDD_{calc} \times Contingency\ Factor)$$

The projected MDD between 2021 and 2051 is shown in Figure 2-1; these projections are based on population projections provided for the electoral areas of the District (qRD, 2019) and MDDs calculated based on the steps above for the years 2021 to 2051. Using steps one through five above, the MDD projected for the Saltery Bay Extension Area, as in the whole Coastal Strip, including the Pilot Area is anticipated to be 76.0 L/s.

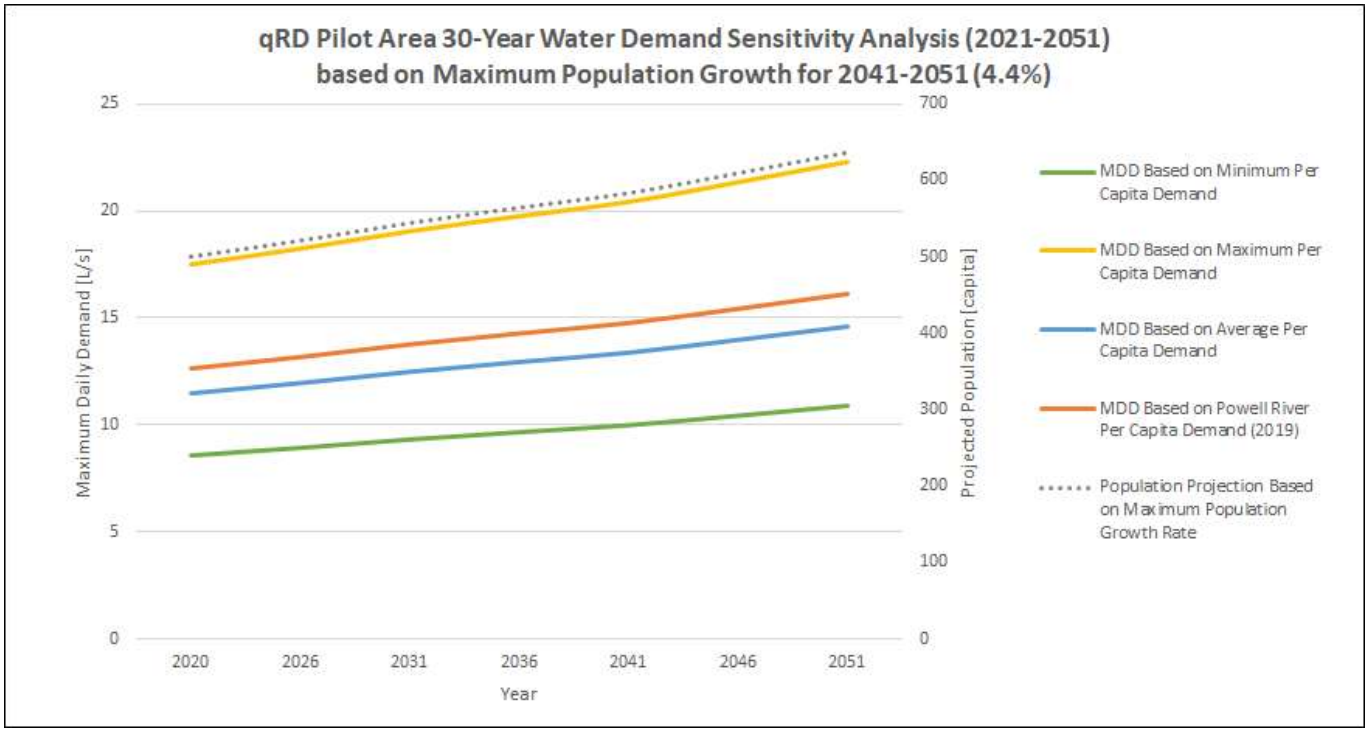


Figure 2-1
Pilot Area MDD from 2021 to 2051

Using the same approach as steps three through five above, **AE estimates a water demand of 335 L/s in 2051** for the City of Powell River based on the City of Powell River and Teehohsum (Tla'amin First Nation) population projection of

The combined projected demand for the year 2051 for the City of Powell River, Pilot Area and Saltery Bay Extension (Coastal Strip) is 411.0 L/s.

It is important to note that fire flows were not included in the demand calculations for the Pilot Phase and Saltery Bay Extension. Fire flows were included in the initial round of hydraulic modeling with a target rate of 225 L/s as per the City of Powell River's fire flow system. The results identified an incapability to maintain the existing hydrant flow rate in Myrtle Pond at the current level of service and resulting pressure deficiencies, which would present challenges that would need to be addressed by additional infrastructure (e.g. storage and pumping) to make this approach feasible. Please refer to **Appendix A** for more detail. District staff noted that in November 2014, the District Board endorsed the concept and principle of Superior Tanker Shuttle Service and that the Regional District Fire Services pursue such accreditation. The Malaspina Volunteer Fire Department, serving most properties in Electoral Areas B and C, has since invested in a fleet of water tender and is working towards Superior Tanker Shuttle Service accreditation to improve the delivery of water for fire protection to areas not serviced by fire hydrants. Continuing with this approach for fire protection is logical, given the investments to-date and the potential challenges in delivering piped fire flows from the City's system, as noted in the hydraulic modeling results. It is therefore assumed that fire protection will continue to be provided by the District's tanker shuttle system, which relies on water from existing reservoirs, hydrants and surface waters for filling.

Filling of the Myrtle Pond reservoir was considered as part of the hydraulic modeling; refer to subsequent sections and the report by GeoAdvice for details (**Appendix A**). Supply of sufficient pressure to hydrants within the Myrtle Pond System was also considered and will be an important parameter for design.

3 WATER AVAILABILITY STUDY

3.1 Haslam Lake Water Treatment Plant Capacity

The City of Powell River has a conditional license to withdraw up to 708 L/s from Haslam Lake, while maintaining a minimum flow of 425 L/s at the source. The Haslam Lake Water Treatment Plant (WTP) is currently capable of treating up to 448 L/s, limited by the maximum capacity that the ultraviolet (UV) reactors can treat. The WTP could treat a greater flowrate if the UV reactors were up-sized (based on their remaining service life and replacement schedule) or if additional reactors were incorporated. Based on the water demand projections presented in **Section 2**, a review of the City's water license, and a review of the Haslam Lake WTP treatment capacity, there is capacity to supply treated water to the City of Powell River, the Pilot Area and the Saltery Bay Extension (i.e. Coastal Strip).

For the purpose of this feasibility study, the potential of future climate change impacts on Haslam Lake WTP's water license are not considered, including the consideration of watershed health, significant storm events, and dry periods in summer affecting minimum creek flow. These should be investigated as part of future phases of the project.

3.2 Haslam Lake Water Quality

Haslam Lake water quality data was recorded throughout 2020. Detailed water quality test results are appended this report. The local regulatory body, Vancouver Coastal Health (VCH), refers to the Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ) and the Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies in British Columbia for filtration exempt surface water sources. Key treated water quality parameters are compared against the Health Canada GCDWQ below in **Table 3-1.**

Table 3-1
Haslam Lake Water Quality Summary 2020

PARAMETER		UNITS	GCDWQ (Health Canada, 2020)	TREATED WATER
Turbidity	Low	NTU	1.0	0.12
	Average	NTU	1.0	0.31
	High	NTU	1.0	19 [3]
UV Transmittance (UVT)	Low	%	-	45.8 [4]
	Average	%	-	88.62
	High	%	-	100
Free Available Chlorine	Low	mg/L	-	0.82
	Average	mg/L	-	1.15
	High	mg/L	-	1.39
Total Chlorine	Low	mg/L	-	0.89
	Average	mg/L	-	1.25
	High	mg/L	-	1.49
Total Coliforms		MPN/100mL	0	0
Total E. Coli		MPN/100mL	0	0

Haslam Lake is an unfiltered surface water source; therefore, it has to meet the BC Surface Water Requirements. To be considered filtration exempt, the water must meet the following guidelines:

1. Overall inactivation is met using a minimum of two disinfections, providing four (4)-log reduction of viruses and three (3)-log reduction of Cryptosporidium and Giardia.
2. The number of E. coli in raw water does not exceed 20/100 mL (or if E. coli data are not available less than 100/100 mL of total coliform) in at least 90% of the weekly samples from the previous six months. Treatment target for all water systems is to contain no detectable E. coli or fecal coliform per 100 ml. Total coliform objectives are also zero based on one sample in a 30-day period. For more than one (1) sample in a 30-day period, at least 90% of the samples should have no detectable total coliform bacteria per 100 ml and no sample should have more than 10 total coliform bacteria per 100 ml.
3. Average daily turbidity levels measured at equal intervals (at least every four hours) immediately before the disinfectant is applied are around one (1) NTU, but do not exceed five (5) NTU for more than two (2) days in a 12-month period.
4. A watershed control program is maintained that minimizes the potential for fecal contamination in the source water. (Health Canada, 2012b)

[3] Highest recorded reading is 19 NTU, second highest recorded reading is 0.47 NTU
[4] Lowest recorded reading is 45.8%, second lowest recorded reading is 81.5%.

All measured water parameters presented in **Table 3-1** currently meet the GCDWQ regulations. Turbidity is less than one (1.0) NTU except for one instance where it is measured at 19 NTU. However, the second highest reading is measured to be 0.47 NTU. This indicates that there is a relatively low level of particles in the water, which is often confirmed by a surrogate parameter, such as a high ultraviolet transmittance (UVT) measurement.

Total coliforms as well as E. coli in the treated water are measured to be 0 MPN/100 mL, which satisfies the GCDWQ regulations. Data from a single sample of raw water collected showed total coliforms measured at 49.5 MPN/100mL, and E. coli to be less than 1 MPN/100 mL. Using this data provided by the City of Powell River, the levels appear to conform with the requirements of the Health Canada's GCDWQ and the BC Surface Water Requirements, however, AE recommends that the City of Powell River continue to monitor raw water from Haslam Lake, particularly over a 12-month period to capture seasonal variability and to confirm continued compliance with the drinking water standards.

3.3 Future Water Supply Implications and Improvements

Based on the findings of the previous section, the qRD could consider the supply of treated water from the City of Powell River. Should the qRD proceed with this concept, capacity of the existing infrastructure should be confirmed in more detail. In particular, the age and expected service life of the existing UV reactors should be reviewed as part of the project planning (in addition to confirming treatment capacity). The replacement schedule for the existing reactors could potentially provide an opportunity to increase the capacity of the WTP to treat flows up to the licensed allowance (708 L/s) should further distribution expansion be considered in future.

Further design development of water supply for the Pilot Phase Area should consider potential changes to water quality and quantity patterns stemming from climate change impacts. This evaluation should include consideration of watershed health (including wildfire risk), potential for significant storm events, and frequency and duration of dry periods. Climate change impacts to surface water sources in British Columbia may include increased organics and turbidity loading due to more intense storm events (i.e. increased runoff from the watershed), degraded water quality following a wildfire in the watershed, as well as changing quantity patterns due to longer dry periods. The addition of a filtration step with pre-treatment at the Haslam Lake WTP would improve resiliency to such water quality impacts and should be considered as part of future upgrades.

4 WATER DISTRIBUTION PIPELINE CONCEPT DEVELOPMENT

4.1 Proposed Water Supply Solution

The objective of this assessment is to propose a viable solution for water supply from the City of Powell River to the Pilot Phase Area and potentially further down the coastal strip to Saltery Bay. The proposed concept for water supply to the qRD Pilot Phase Area is to connect to the City of Powell River's Haslam Lake WTP to serve users along Highway 101, including those currently supplied by the Myrtle Pond Water System, up to and including Centennial Drive. A proposed watermain (distribution main) would provide potable water from the City of Powell River's system, extending to the Pilot Phase Area and potentially onwards to Saltery Bay. The existing Haslam Lake WTP is evaluated to have sufficient capacity to supply potable water to the Pilot Phase Area until the year 2051, as described in **Section 2**.

Section 4 herein discusses the recommended option for water supply.

4.1.1 Water Distribution System and Hydraulic Model

AE collaborated with our subconsultant, GeoAdvice, to examine the feasibility of extending the existing water distribution system from the City to the areas of interest. GeoAdvice confirmed that the City's existing distribution system can provide enough pressure to drive the required flows for potable water to the Pilot and Saltery Bay Extension Areas. GeoAdvice's findings suggest that in addition to some existing pressure deficiencies within the City's existing water system, there will be pressure deficiencies expected in localized spots within the existing distribution system resulting from this supply extension to the District. It is likely that these localized pressure deficiencies could be addressed through improvements (e.g. flow control and pressure control devices) within the City's distribution system, mitigating impacts from supplying the District with water. These should be investigated, through more detailed hydraulic modeling and other means, during further stages of design.

GeoAdvice completed capacity analysis and hydraulic modelling with and without the proposed extension in a steady-state scenario. The MDD estimated by GeoAdvice and by AE (as described in **Section 2.1**) were calculated independently and vary slightly (i.e. 362 L/s for a design horizon of 2036 versus 411 L/s for 2051). AE understands that GeoAdvice's calculations include potential future developments within the City limits, which were not reflected in the information AE used as inputs for this study. Both estimates are considered to be appropriately conservative for purposes of this feasibility study.

The hydraulic model assesses two criteria: minimum static pressure (40 psi) and minimum residual pressure (20 psi). The model also examines the flow available to fill the Myrtle Pond Reservoir with maximum water elevation of 80.9 m geodetic. GeoAdvice assume that there is no additional demand included along the length of the proposed extension to Saltery Bay. The model excludes fire flow supply as described in **Section 4.3**.

GeoAdvice recommends that the proposed watermain is constructed using a 300 mm diameter pipe. For further details, the GeoAdvice report can be found in **Appendix A**.

4.2 Alignment Concepts for Water Distribution Pipeline

We reviewed two concept alignments for the water distribution system to the Pilot Phase area and one alignment option for the Saltery Bay extension. The concept alignments are discussed below:

Pilot Phase – Option 1 (See Figure 4-1)

- Potential connection point to the City of Powell River water distribution system is to the 350 mm Ductile Iron watermain at Tie-In #1 location in Yew Kwum Place and Toba Street intersection. The existing 350 mm diameter main will provide adequate capacity to feed the watermain extension to the Pilot Phase area.
- The new Pilot Phase area water distribution system will comprise of the proposed 300 mm diameter watermain from Tie-in #1, along Rifle Range Road, Highway 101 and Centennial Drive. In addition, a service line is proposed to supply the existing Myrtle Pond Reservoir.
- At Tie-in #2 there is also an opportunity to connect the proposed 300 mm diameter watermain to the City of Powell River's existing 150 mm asbestos cement watermain. Not only will this provide a second supply source for the Pilot Phase area but will also create a loop in the City's water distribution system adding significant benefit to the City system with little additional cost.
- The proposed 300 mm watermain alignment along Rifle Range Road may require property acquisition or permanent right of way and possibly a temporary easement to allow access and space for construction. It may also require extensive clearing of thick vegetation in the northern portion of the required right-of-way or easement as Rifle Range Road does not go through to this northern area. Consideration must also be given to potential construction constraints with BC Hydro power lines. These aspects will need to be reviewed in detail during the next stage of design.

Figure 4-1
Option 1 Alignment in Pilot Phase Area

Pilot Phase – Option 2 (See Figure 4-2)

- Potential connection point to the City of Powell River water distribution system is at the Cariboo PRV Station located at Thunder Bay Street and Cariboo Avenue intersection.
- The new Pilot Phase area water distribution system will comprise of the proposed 300 mm diameter watermain from the Cariboo PRV Station, along Thunder Bay Street, Highway 101 and Centennial Drive. In addition, a service line is proposed to supply the existing Myrtle Pond Reservoir.
- There is already an existing City 150 mm asbestos cement (AC) watermain along Thunder Bay Street between Cariboo PRV Station and the intersection of Rifle Range Road, however it is too small to provide sufficient capacity to feed the extension to the Pilot Phase area. The 150 mm AC watermain can either remain in service or be abandoned and existing water service(s) be transferred over to the proposed 300mm watermain.
- The proposed 300 mm watermain alignment along Thunder Bay Street and Highway 101 is unlikely to require property acquisition or right of way but consideration must be given to potential construction constraints with BC Hydro power lines and the existing roadside ditches. These aspects along with any other utility constraints will need to be reviewed in detailed during the next stage of design.

Figure 4-2
Option 2 Alignment in Pilot Phase Area

Saltery Bay Extension (See Figure 1-1)

- The Saltery Bay Extension will require the continuation of the proposed 300 mm watermain from the Pilot Phase area along Highway 101 from Centennial Drive to Saltery Bay.
- The majority of the proposed alignment appears to be within Ministry of Transportation and Infrastructure (MOTI) right-of-way (ROW). This will need to be verified during the next stage of design.

4.2.1 Design Criteria

The proposed watermain design criteria is based on Master Municipal Construction Documents (Platinum edition) and Design Guidelines. The watermain is proposed to be a 300 mm diameter pipe, fully restrained. The pipe material could be HDPE, PVC, or ductile iron. The pipe cover depth will be approximately 1.2 m at minimum. The pipe grade shall have minimum slope of 0.1% distribution. The proposed alignment utilizes a single pipe configuration that is preferred from a cost efficiency perspective. Unlike a twinned pipeline configuration, this single pipe alignment does not include a loop at the downstream end at either Centennial Drive or Saltery Bay. To alleviate stagnant water, a blow down (sized 100 mm) is recommended at the dead end. Isolation valves are typically spaced every 800 m along the alignment. Air valves are proposed at global high points.

4.2.2 Climate Change Resiliency and Seismic Considerations

As noted previously, climate change impacts must be considered in more detail during subsequent stages of design. The proposed watermain would be expected to maintain its level of service as long as the water supply volume remains as is (e.g. not impacted). Climate change impacts could result in increased wildfire activity in the area, which in turn may increase the risk of subsequent flooding and geotechnical instabilities (erosion) along the watermain route. Furthermore, geotechnical assessment should be conducted to determine sensitive subsurface areas.

Consideration should also be given to impacts from increased heavy rainfall events. The impacts could affect the highway corridor in general, for example, causing localized flooding and/or erosion.

Given the project area is located along the coastal shoreline, it is vulnerable to sea level rise and coastal flooding events. Pipe protection or armouring should be considered to mitigate impacts from pipe exposure to such an event. In addition, the watermain would need to be fully restrained at all pipe joints along its entire alignment. The detailed design of the pipe restraints and other appurtenances should address the seismic vulnerability of the watermain over its service lifetime.

4.2.3 Construction Methodology

Geotechnical investigation / assessment is not available at this stage. Without geotechnical information, there is insufficient background data/information to recommend a construction methodology, but a conventional trenching methodology is assumed to be feasible. Also, based on the provided utility information, there does not appear to be any large or critical crossing with existing utility necessitating trenchless methodology. Trenchless installation will be required at creek crossings. Trenchless installation techniques should be reviewed during future design stages, when a geotechnical assessment is available. In addition, along the Saltery Bay Extension alignment, there may be a number of bridge crossings to consider.

4.3 Fire Flow Supply

Based on information provided by the qRD, fire flows are gravity-fed to 17 hydrants within the boundary of the Myrtle Pond Water System from the Myrtle Pond Reservoir (444,448 L) at a maximum flow of 90 L/s at 70 psi. When additional fire flows are required, a tanker shuttle system operated by the Malaspina Volunteer Fire Department supplements flows. Using the existing reservoir, along with continuation of the tanker shuttle system, Myrtle Pond can continue to maintain the current level of service and meet the fire flow requirements for the Pilot Area.

5 COST ESTIMATE

5.1 Capital Cost Estimate (Class D)

A Class D cost estimate for the Pilot Phase watermain, per the conceptual alignment presented herein, is summarized in Table 5-1, along with the corresponding assumptions. For the cost estimates of the extended alignment up to Saltery Bay and combined costs, refer to Appendix B.

Table 5-1
Class 'D' Capital Cost Estimate for Pilot Phase

Description	Option 1 Cost [1,2]	Option 2 Cost [1,2]
GENERAL		
Mobilization, demobilization, construction management	662,000	652,000
UTILITY CIVIL PIPING		
300mm dia. Watermain (3,220m in length) incl. Excavation, material, installation	4,025,000	3,963,000
Allowance for fittings, valves, air valves, blow downs	202,000	199,000
ROADWORKS		
Pavement and line marking	185,000	182,000
OPTIONAL: Transfer existing watermain service to 300 WTM	-	20,000
Direct Cost Subtotal	**5,074,000**	**5,016,000**
Class 'D' Contingency (50%)	2,537,000	2,508,000
Sub-total Cost	**7,611,000**	**7,524,000**
Indirect Costs - Engineering (15%)	1,142,000	1,129,000
TOTAL (including Optional item)	**8,753,000**	**8,653,000**

Notes:

1. Rounded up to nearest $1,000.
2. The cost estimate is a preliminary estimate which, due to little or no site information, indicates the approximate magnitude of cost of the proposed project, based on the client's broad requirements.
3. No geotechnical information is provided at the time of writing.
4. The cost estimate does not include allowance for any rock excavation.
5. Assume all works are within MOTI road ROWs.
6. Assume no retaining walls are required and excavation is a vertical cut using shoring box.
7. Option 1: Cost for property acquisition or easement has not been included in the estimate.
8. Option 2: Assume existing 150 mm asbestos cement watermain pipe is left in place (either remain in service or be abandoned).

5.2 Cost Recovery Model (by WaterWorth)

This section provides a preliminary outline for a cost-recovery model. This is a preliminary outline since it is based on some information provided by the District, as well as some assumptions about City of Powell River (CoPR) costs.

At this point, there have been limited discussion with the CoPR about cost-recovery for the District. This analysis is therefore not intended to be exhaustive but rather to stimulate a constructive conversation between the District and CoPR as they explore the potential for an arrangement that works for both sides.

There are four components to the revenue requirements for full cost recovery. These are outlined and discussed below:

1. Capital Cost for connecting to CoPR water supply as outlined in **Table 5-1**.
    a) Assumption: The District does not have any cash reserves to contribute towards this project.
    b) Therefore, it is assumed that construction will be debt financed. [Or perhaps there could be some grant funding available to offset the construction cost. However, grant funding will typically require metering to be included in the project which will also drive up capital and operating costs.]
    c) Annual debt servicing cost for a 30-year amortization at 4.5% interest is ~$514,000. (MFA current rate is approx.. 3.09%)
    d) Divided equally between 245 properties: Approximately $2,100 / year / property.
    e) Eventual replacement of new infrastructure: $8,700,000 = @1% / year / 245 properties = $355 / yr.
    f) Notes about cost for new connections:
        i. If properties currently on wells are required to connect to the new system, then the owners of those properties may be required to pay the direct costs for those connections. Costs would vary depending on factors including location relative to side of the road, lateral line diameter and length, and in some cases landscape-related obstacles could increase costs. Costs would range and could be as high as $5,000 or higher.
        ii. Senior government grant funding occasionally requires that recipients have metering and other sound water conversation plans in effect. It is therefore standard practice for new connection installations to be built with a meter chamber and meter setter in place to facilitate future meter installation, regardless of whether metering is currently a policy in effect or not.
    g) Notes about cost for metering:
        i. If a property is meter-ready, if it has a chamber + setter, then metering that property requires replacing the setter with a meter which is a relatively inexpensive operation. So, the cost is really the cost of the meter which is $300 - $450 range for small residential meters. Larger meters cost more.
        ii. A connected property that is not meter-ready may require additional construction to install a meter chamber. This cost varies depending on the circumstances of each property, how deep the connection is and whether it is a greenfield or brownfield situation. Previously, the Myrtle Pond Water System installed meters for 35 properties for $95,000, the average being $2,700 per property.

2. CoPR Operating Costs.
    a) CoPR Water Utility Expenses (from Consolidated Financial Statements for 2019) were $1,950,000, up from $1,600,000 in 2018.

b) It is reasonable for CoPR to apportion some of this operating cost to the District rate payers.

c) There are different methods for allocation of this cost. For example, if using the basis of 2051 MDD as discussed in **Section 2.1**, then the District would be responsible for ~4% of operating costs (14.6 L/s from total 350L/s)

d) Based on 2019 annual operating costs of $1,950,000, the portion allocated to the District could be about $80,000.

e) Divided equally between 245 properties: ~$326 / year / property.

f) Compare this with the CoPR 2019 rates for Single Family Dwelling: $318 / year / dwelling.

3. The District's Operating Costs associated with Myrtle Pond Water System.

a) The District's annual operating costs are currently about $115,000.

b) Those costs may increase in this new configuration (additional testing, flushing, inspection requirements).

c) Suppose that the District's operating costs are in the order of $150,000/year.

d) Divided equally between 245 properties: $612 / year / property.

e) There may be some opportunity to combine the CoPR and the District's operations in a way that enables the District's properties access to economies of scale.

4. The District's Capital Improvements.

a) The District also needs to maintain the existing infrastructure.

b) The District infrastructure has an estimated value of $2.7 million (a detailed asset replacement schedule has not yet been completed) which accounts for existing distribution, Myrtle Pond storage and associated fire flow mechanisms.

c) At a 1% Capital Reinvestment rate, approximately $27,000 additional annual capital improvements and/or transfers to reserves seems a reasonable target. With a 2% reinvestment rate, target amount increases to $54,000 per year. The District current analysis suggests an annual reinvestment rate of $70,000.

d) If the annual reinvestment rate is $70,000 then divided equally between 245 properties: $286 / year / property.

e) Connecting to CoPR system will likely render the Myrtle Pond Treatment Plant irrelevant. This could reduce the Capital Reinvestment rate noted above in half to $35,000 per year thus reducing the rate payer infrastructure investment charge from $286 to $143. The effect on the total cost to rate payers is <4%.

Table 5-2
Rate Payer Cost Summary ($)

Expense Item	Annual Fee
City Connection Costs (Table 5-1)	$2,100
New Connection Renewal Reserves (1%x$8,000,000)/245 Properties	355
City Operating Costs	326
District Operating Costs	612
District Infrastructure Improvements	143
TOTAL, rounded	**$3,500 / year**

Table 5-3
Additional Potential Costs to Individual Properties

Expense Item	One-time Fee
New connection, including meter chamber and setter	Varies, budget $5,000
New residential meter for property that is not meter-ready	Varies, budget $2,700
New residential meter for meter-ready property	$300 - $450

Note: these costs may vary depending on circumstances of individual properties.

These revenue requirements for full cost recovery should be expanded upon and refined during future stages of the project, as financial inputs are developed and / or confirmed.

6 CONCLUSIONS & RECOMMENDATIONS

Water demand projections up to the year 2051 were developed using population data and other information provided by the qRD for the areas of interest: the Pilot Phase Area and the Saltery Bay Extension Area (or Coastal Strip to Saltery Bay). These were examined alongside the City's current and future projected demands. The combined projected potable water demands for the City as well as the areas of study within the qRD, up to the year 2051, are estimated to be 411.0 L/s.

This demand was evaluated against the available capacity of the Haslam WTP, considering both the water license for Haslam Lake and the design (i.e. process equipment) capacity of the WTP. It was determined that there is an ability to increase the draw of raw water and adequate treatment to meet these projected future demands, without requiring upgrades (upsizing) at the WTP. It should be noted that some of the equipment in the WTP may require replacement within this time horizon. It is also important to note that it has been assumed that the filtration exemption criteria will continue to be met and additional treatment processes, such as filtration, will not be required.

Potential changes to water quantity and quality due to impacts from climate change were not evaluated as part of this feasibility study but should be considered as part of the next steps, with an aim to evaluate and / or improve the adaptability and resiliency of the treatment and supply systems.

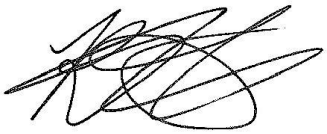
The hydraulic modeling results demonstrate that there is adequate pressure available to supply the noted flows to the District's area of interest and fill the existing Myrtle Pond Reservoir. The results did flag some potential localized pressure deficiencies expected to result from this supply extension. It is likely that these could be mitigated through improvements (e.g. flow and pressure control), which should be investigated during future design phases.

We have reviewed two concept alignments in Pilot Phase area and one alignment for Saltery Bay Extension. The design criteria of the watermain design is based on Master Municipal Construction Documents (Platinum Edition) and Design Guidelines. The watermain is proposed to be a 300 mm diameter pipe, fully restrained. Suitable pipe materials are HDPE, PVC, or ductile iron. Outside of the City boundary, the proposed concept alignment generally follows Highway 101 and utilizes a single pipe configuration, which is preferred from a cost efficiency perspective. The alignment does not include a loop at the downstream end. To alleviate stagnant water, a blow down is recommended at the dead end.

Class D cost estimates for the Pilot Phase watermain, per the conceptual alignment options presented herein, total $8.75M and $8.65 M for Option 1 and Option 2, respectively, in 2021 dollars. This estimate is based on the information available to-date, which does not include geotechnical information, as well as the assumptions noted.

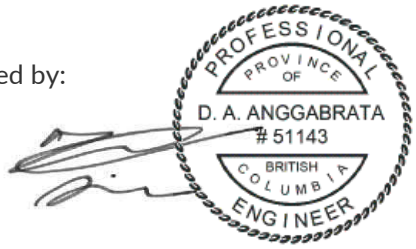
A preliminary outline for a cost-recovery model was completed, based on information provided by the District in a workshop format, as well as some assumptions about City of Powell River costs. The analysis is intended to inform conversations between the District and CoPR should they elect to explore the potential for a cost-recovery arrangement that works for both sides. The four components to the revenue requirements for cost-recovery are presented herein and can be expanded upon and refined during future stages of the project, as financial inputs are developed and / or confirmed.

Prepared by:



Rachel Trower, E.I.T.
Water Process Engineer-in-Training

Prepared by:



Della Anggabrata, P.Eng.
Civil Engineer
2021-06-30

Reviewed by:

Quinn Crosina, M.A.Sc., P.Eng.
Project Manager

Reviewed by:

Siu Fung Ma, C.Eng., P.Eng., M.I.C.E
Senior Civil Engineer

APPENDIX A - HYDRAULIC MODELLING (GEOADVICE)

Technical Memorandum

Feasibility Study on the Extension of the City of Powell River Water Distribution System to Supply qathet Regional District

FINAL

project:	Feasibility Study on the Extension of the City of Powell River Water Distribution System to Supply qathet Regional District
project ID:	2020-074-POW
date:	June 10, 2021
issued to:	Associated Engineering (B.C.) Ltd. (AE) qathet Regional District
issued by:	GeoAdvice Engineering Inc. (GeoAdvice)

1. Introduction

GeoAdvice was retained by AE to assess the hydraulic impact of the proposed extension of the City of Powell River (City) water distribution system to supply qathet Regional District (qRD).

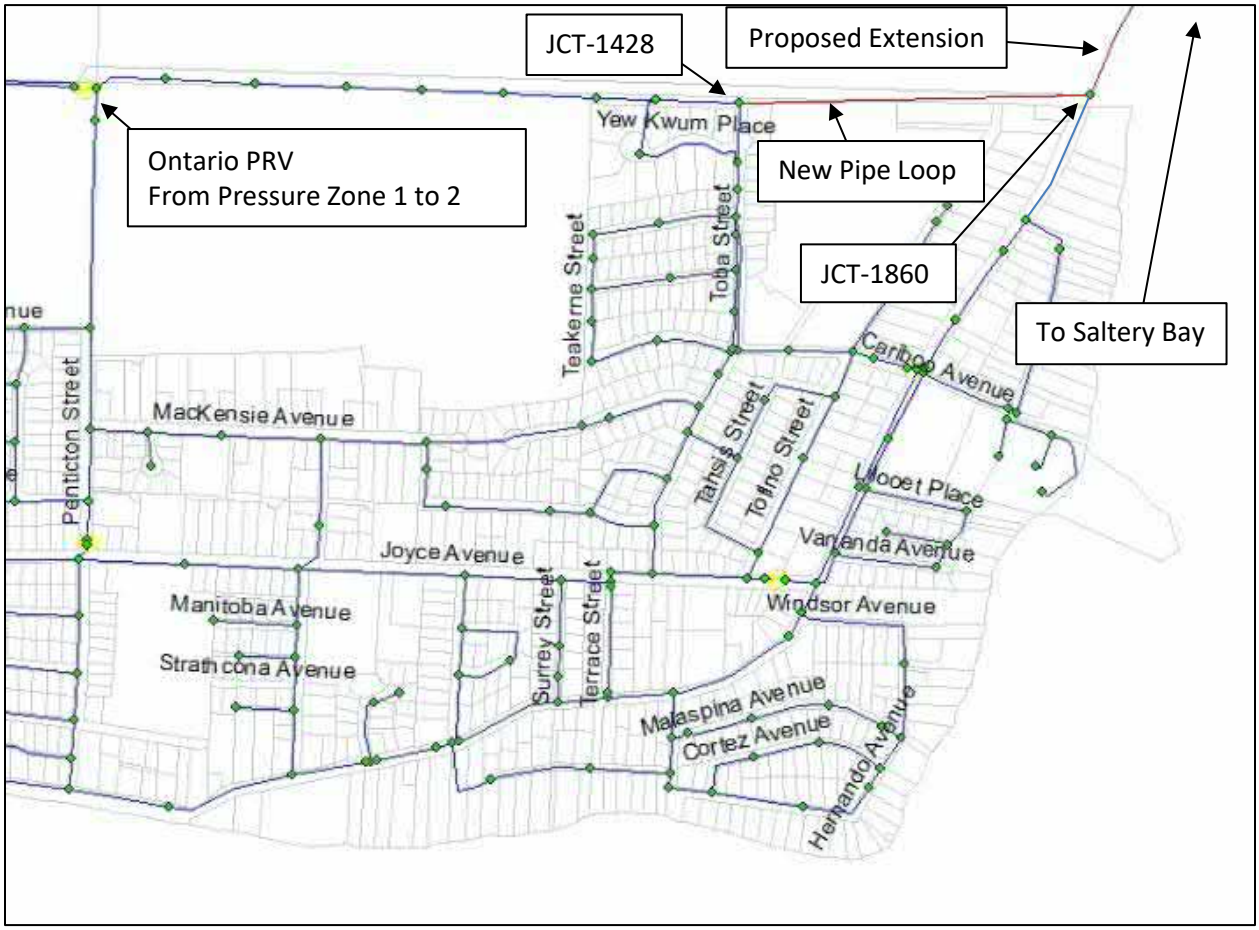
This memo describes the assumptions and results of the hydraulic modeling and capacity analysis using InfoWater (Innovyze Software). InfoWater is a GIS-based water system modeling and management software application.

2. Water Capacity Analysis

2.1. Study Area

The proposed extension consists of a 300 mm, 2.1 km pipe to Centennial Drive and a 300 mm, 24.1 km pipe to Saltery Bay, BC. The proposed extension is connected to Pressure Zone 2 (HGL of 130 m) at junction JCT-1860. Additionally, a new 300 mm, 578 m pipe connects junctions JCT-1860 and JCT-1428, creating a new loop in Pressure Zone 2. The connection to the existing City network is shown in **Figure 2.1.**

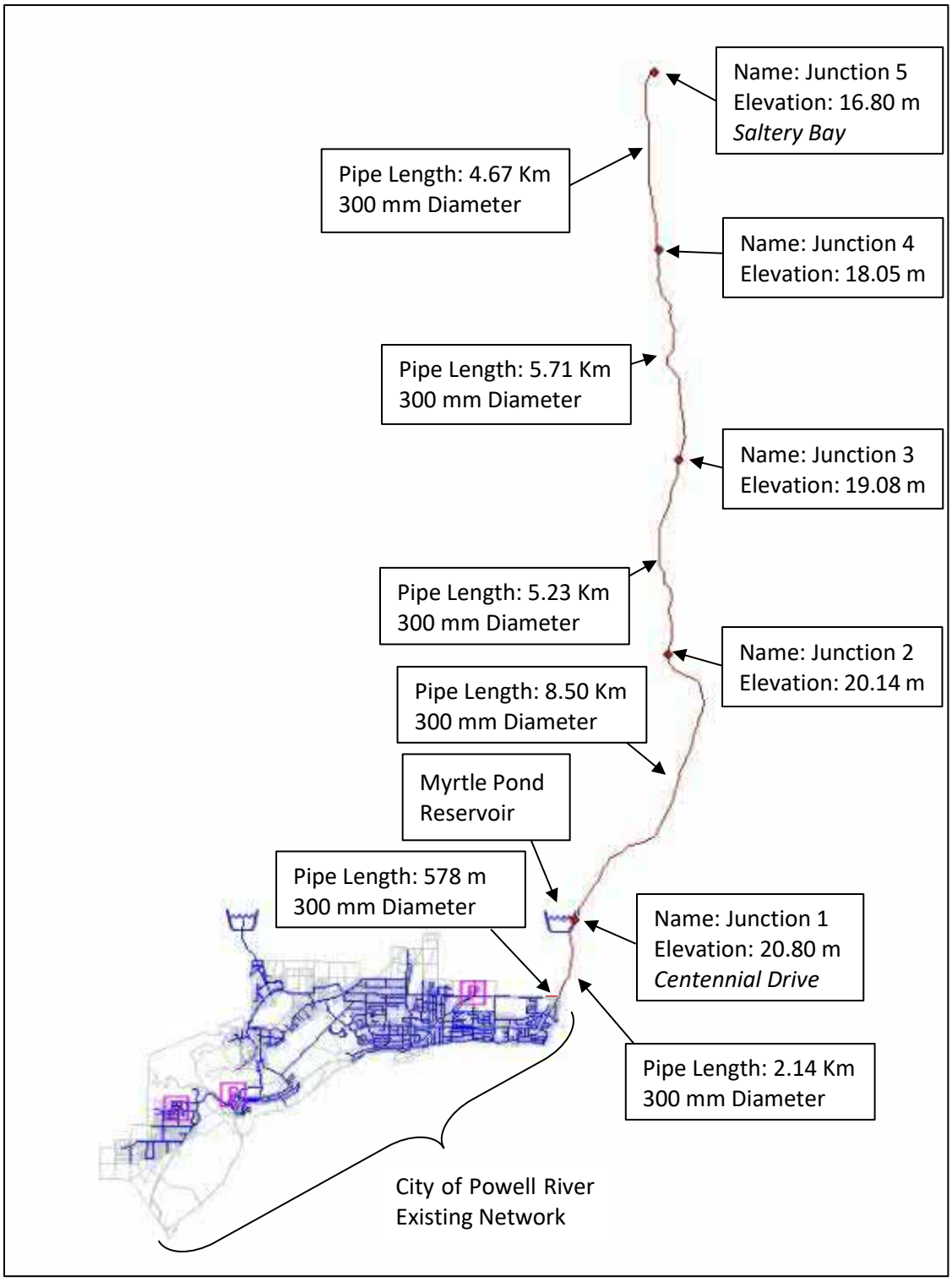
Figure 2.1: Connection to City of Powell River Water Distribution System



A schematic of the City water distribution system and the proposed extension are shown in **Figure 2.2**. The key junctions evaluated in this analysis, are listed below:

- Myrtle Pond Reservoir
- Junction 1 (Centennial Drive)
- Junction 2
- Junction 3
- Junction 4
- Junction 5 (Saltery Bay)

Figure 2.2: Network Schematic – Existing Network and Proposed Extension



2.2. Hydraulic Performance Criteria

The criteria listed in **Table 2.1** were used to assess the hydraulic impact of the proposed extension on the City water distribution system.

Table 2.1: Hydraulic Performance and Design Criteria

Criteria	Analysis Scenario	Parameter Value
Minimum Static Pressure	MDD*	40 psi
Minimum Residual Pressure	MDD	20 psi

*MDD = Maximum Day Demand

Hydraulic simulations were run with and without the proposed extension under the future 2036 MDD steady-state scenario. This scenario includes the City future maximum day (MDD = 362 L/s). However, no additional demands were included along the length of the proposed extension to Saltery Bay.

The results of these simulations were used to assess the impact of the proposed extension on the City water distribution system and its ability to supply flow to qRD.

2.3. Available Flow

Hydraulic simulations were run under the future scenario to assess the flow available to fill the Myrtle Pond Reservoir and to assess the available flow at each analysis junction (Junctions 1 to 5).

Modeling parameters provided by AE are summarized in **Table 2.2** below.

Table 2.2: Myrtle Pond Reservoir Modeling Parameters

Parameter	Value
Maximum Water Elevation	80.90 m
Tank Overflow Elevation	81.10 m
Base Tank Elevation	62.36 m
Inlet Reservoir Control Valve	None (No Restriction)

Under the future MDD scenario, the City water distribution system provides enough head to drive a flow of 154.1 L/s to the Myrtle Pond Reservoir when full.

As headlosses along the length of the proposed extension accumulate, the available flow decreases. **Table 2.3** summarizes the flow available at each analysis junction while maintaining a specified residual pressure at the node.

Table 2.3: Available Flow at Analysis Junctions

Analysis Junction	Available Flow (L/s)	
	@ 20 psi	@ 40 psi
Junction 1	238.7	218.8
Junction 2	93.3	78.1
Junction 3	73.5	62.0
Junction 4	62.0	52.5
Junction 5	56.0	47.7

2.4. Pressure Impact Analysis

Hydraulic simulations were run without and with the proposed extension under the future MDD scenario. There are sixteen (16) pressure deficiencies (P < 40 psi) in the City water distribution system without the proposed extension.

Table 2.4 summarizes the impact on the future City system with the proposed extension.

Table 2.4: Hydraulic Impact of Filling Myrtle Pond Reservoir

Flow to Reservoir (L/s)	New Pressure Deficiencies (< 40 psi)
154.1	+ 4

These four (4) new deficiencies are triggered by the flow of water filling the Myrtle Pond Reservoir.

Table 2.5 summarizes the impact on the future City system when the available flow at 20 psi is applied at each analysis junction.

Table 2.5: Hydraulic Impact of Available Flow at Analysis Junctions

Analysis Junction	Flow at Junction (L/s)	Flow to Reservoir (L/s)	New Pressure Deficiencies (< 40 psi)
Junction 1	238.7	0.0	+ 48
Junction 2	93.3	70.5	+ 10
Junction 3	73.5	88.8	+ 10
Junction 4	62.0	99.3	+ 8
Junction 5	56.0	104.7	+ 7

These new pressure deficiencies are triggered by the demand applied at each node. That is, if the new watermain extends to the analysis junction and the available flow at 20 psi is applied, additional pressure deficiencies will be triggered in the City system. Under each flow scenario, the City system is attempting to supply MDD demands in the City, the demand at the analysis junction, and flow to the Myrtle Pond Reservoir.

- At Junction 1, when a demand of 238.7 L/s is applied while maintaining 20 psi at the junction no flow is directed to the reservoir and forty-eight (48) new pressure deficiencies are triggered in the City system (total deficiencies: 64 = 48 + 16). In addition, the head at the Myrtle Pond Reservoir falls below 80.9 m.
- At Junction 2, when a demand of 93.3 L/s is applied while maintaining 20 psi at the junction 70.5 L/s flows to the reservoir and ten (10) new pressure deficiencies are triggered in the City system (total deficiencies: 26 = 10 + 16).
- At Junction 3, when a demand of 73.5 L/s is applied while maintaining 20 psi at the junction 88.8 L/s flows to the reservoir and ten (10) new pressure deficiencies are triggered in the City system (total deficiencies: 26 = 10 + 16).
- At Junction 4, when a demand of 62.0 L/s is applied while maintaining 20 psi at the junction 99.3 L/s flows to the reservoir and eight (8) new pressure deficiencies are triggered in the City system (total deficiencies: 24 = 8 + 16).
- At Junction 5, when a demand of 56.0 L/s is applied while maintaining 20 psi at the junction 104.7 L/s flows to the reservoir and seven (7) new pressure deficiencies are triggered in the City system (total deficiencies: 23 = 7 + 16).

2.5. Pressure Reducing Valve Capacity Analysis

Pressure Zone 2 is fed by four (4) pressure reducing valves (PRV) from Pressure Zone 1. These PRVs were also reviewed in terms of their peak velocities under the future scenario. To limit the amount of “wear and tear”, the recommended peak velocity through a PRV should be less than or equal to 6 m/s.

Table 2.6 summarizes the maximum velocity through the PRVs when the available flow at 20 psi is applied at each analysis junction.

Table 2.6: PRV Peak Velocity Modeling Results

PRV Name	Location	Diameter	Maximum Velocity	Flow Scenario
Algerine PRV	Westview Ave & Algerine Pl	152 mm	0 m/s	*All scenarios*
Kemano PRV	Westview Ave & Kemano St	102 mm	0 m/s	*All scenarios*
Manson PRV	Manson Ave & Penticton St	355 mm	2.7 m/s	238.7 L/s at Junction 1
Ontario PRV	Ontario Ave & Duncan St	152 mm	1.4 m/s	238.7 L/s at Junction 1

None of the PRVs are predicted to be velocity deficient with the proposed extension to supply qRD.

3. Conclusions and Recommendations

GeoAdvice has completed a hydraulic modeling analysis of the proposed extension of the City of Powell River's water distribution system to qathet Region District. Results are summarized below.

Ability to supply qRD

- The City water distribution system provides enough head to drive a flow of 154.1 L/s to the Myrtle Pond Reservoir.
- The City water distribution system can provide Centennial Drive (Junction 1) with flows of 238.7 L/s at 20 psi or 218.8 L/s at 40 psi.
- The City water distribution system can provide Saltery Bay (Junction 5) with flows of 56.0 L/s at 20 psi or 47.7 L/s at 40 psi.

Impacts on the City of Powell River

- The proposed extension triggers four (4) new pressure deficiencies in the City system when filling the Myrtle Pond Reservoir.
- The proposed extension triggers forty-eight (48) new pressure deficiencies in the City system when the available flow at 20 psi (238.7 L/s) is applied at Junction 1, Centennial Drive.
- The proposed extension triggers seven (7) new pressure deficiencies in the City system when the available flow at 20 psi (56.0 L/s) is applied at Junction 5, Saltery Bay.
- No upgrades to the City water supply network have been considered to resolve the pressure deficiencies.
- No analysis of fire flow deficiencies in the City system was conducted.
- The proposed extension does not trigger any PRV deficiencies.

The water modeling results presented in this memo are based on the analysis of steady-state simulations. The predicted available flows, as calculated by the InfoWater model, represent the flow available in the water main while maintaining a specified residual pressure at the node. No extended period simulations were completed in this analysis.

Submission

Prepared by:

Marc Cheneval, E.I.T.
Hydraulic Modeler

Reviewed and Approved by:

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA W. de SCHAETZEN # 30759

June 10 2021

Werner de Schaetzen, Ph.D., P.Eng.
Senior Modeling Review

Confidentiality and Copyright

Statement of Qualifications and Limitations

This document represents the best professional judgment of GeoAdvice Engineering Inc. based on the information available at the time of its completion and as appropriate for the project scope of work. Services performed in developing the content of this document have been conducted in a manner consistent with that level and skill ordinarily exercised by a member of the engineering profession currently practicing under similar conditions. No warranty, expressed or implied is made.

APPENDIX B - DETAILED COST ESTIMATES

Associated Engineering | GLOBAL PERSPECTIVE LOCAL FOCUS.

Cost Estimate

Client: **Qathet Regional District**
Subject: **Feasibility Study**

Date: Jun 18, 2021
Project Number: 2020-2027-00
Prepared By: D. Anggabrata
Checked by: Siu Fung Ma
Type of Estimate: Class D (±50%)

Feasibility Study of City of Powell River's Water System to Supply to qRD (Option 1 - Combined)

Item	Description	Qty.	Units	Unit Price	Extension
	GENERAL				
1	Mobilization, demobilization, cons. management	1	LS	5,614,000	$ 5,614,000
	UTILITY CIVIL PIPING				
2	300mm dia. Watermain - Pilot Area	2,720	meter	1,250	$ 3,400,000
3	300mm dia. Watermain - Service to Myrtle Pond Reservoir	500	meter	1,250	$ 625,000
4	300mm dia. Watermain - Extended Alignment to Saltery Bay	24,100	meter	1,250	$ 30,125,000
5	Allowance for fittings, isolation valves, air valves, blow downs	1	LS	1,708,000	$ 1,708,000
	ROADWORKS				
6	Pavement and line marking	17,415	tonne	90	$ 1,568,000
	Note: Extension cost is rounded up to nearest $1,000.				
	This cost estimate is a preliminary estimate which, due to little or no site information, indicates the approximate magnitude of cost of the proposed project, based on the client's broad requirements.				
	Watermain unit price includes material, installation, and excavation.				
	No geotechnical exploration is completed yet.				
	Cost estimate does not include allowance for any rock excavation.				
	Assume all works are within MOTI road ROWs, except the northern portion of Rifle Range Road.				
	Assume no retaining walls are required.				
	Subtotal				**$ 43,040,000**
	Contingency - Class D	50%			$ 21,520,000
	Subtotal				$ 64,560,000
	Engineering	15%			$ 9,684,000
	Total				**$ 74,244,000**

Associated Engineering | GLOBAL PERSPECTIVE LOCAL FOCUS.

Cost Estimate

Client: **Qathet Regional District**
Subject: **Feasibility Study**

Date: Jun 18, 2021
Project Number: 2020-2027-00
Prepared By: D. Anggabrata
Checked by: Siu Fung Ma
Type of Estimate: Class D (±50%)

Feasibility Study of City of Powell River's Water System to Supply to qRD (Option 1 Pilot Phase Only)

Item	Description	Qty.	Units	Unit Price	Extension
	GENERAL				
1	Mobilization, demobilization, cons. management	1	LS	662,000	$ 662,000
	UTILITY CIVIL PIPING				
2	300mm dia. Watermain - Pilot Area	2,720	meter	1,250	$ 3,400,000
3	300mm dia. Watermain - Service to Myrtle Pond Reservoir	500	meter	1,250	$ 625,000
4	300mm dia. Watermain - Extended Alignment to Saltery Bay	-	meter	1,250	$ -
5	Allowance for fittings, isolation valves, air valves, blow downs	1	LS	202,000	$ 202,000
	ROADWORKS				
6	Pavement and line marking	2,053	tonne	90	$ 185,000
	Note: Extension cost is rounded up to nearest $1,000.				
	This cost estimate is a preliminary estimate which, due to little or no site information, indicates the approximate magnitude of cost of the proposed project, based on the client's broad requirements.				
	Watermain unit price includes material, installation, and excavation.				
	No geotechnical exploration is completed yet.				
	Cost estimate does not include allowance for any rock excavation.				
	Assume all works are within MOTI road ROWs, except the northern portion of Rifle Range Road.				
	Assume no retaining walls are required.				
	Subtotal				**$ 5,074,000**
	Contingency - Class D	50%			$ 2,537,000
	Subtotal				$ 7,611,000
	Engineering	15%			$ 1,142,000
	Total				**$ 8,753,000**

Associated Engineering | GLOBAL PERSPECTIVE LOCAL FOCUS.

Cost Estimate

Client: **Qathet Regional District**
Subject: **Feasibility Study**

Date: Jun 18, 2021
Project Number: 2020-2027-00
Prepared By: D. Anggabrata
Checked by: Siu Fung Ma
Type of Estimate: Class D (±50%)

Feasibility Study of City of Powell River's Water System to Supply to qRD (Option 1 Saltery Bay Extension only)

Item	Description	Qty.	Units	Unit Price	Extension
	GENERAL				
1	Mobilization, demobilization, cons. management	1	LS	4,953,000	$ 4,953,000
	UTILITY CIVIL PIPING				
2	300mm dia. Watermain - Pilot Area	-	meter	1,250	$ -
3	300mm dia. Watermain - Service to Myrtle Pond Reservoir	-	meter	1,250	$ -
4	300mm dia. Watermain - Extended Alignment to Saltery Bay	24,100	meter	1,250	$ 30,125,000
5	Allowance for fittings, isolation valves, air valves, blow downs	1	LS	1,507,000	$ 1,507,000
	ROADWORKS				
6	Pavement and line marking	15,364	tonne	90	$ 1,383,000
	Note: Extension cost is rounded up to nearest $1,000.				
	This cost estimate is a preliminary estimate which, due to little or no site information, indicates the approximate magnitude of cost of the proposed project, based on the client's broad requirements.				
	Watermain unit price includes material, installation, and excavation.				
	No geotechnical exploration is completed yet.				
	Cost estimate does not include allowance for any rock excavation.				
	Assume all works are within MOTI road ROWs.				
	Assume no retaining walls are required.				
	Subtotal				**$ 37,968,000**
	Contingency - Class D	50%			$ 18,984,000
	Subtotal				$ 56,952,000
	Engineering	15%			$ 8,543,000
	Total				**$ 65,495,000**

Associated Engineering | GLOBAL PERSPECTIVE LOCAL FOCUS.

Cost Estimate

Client: **Qathet Regional District**
Subject: **Feasibility Study**

Date: Jun 18, 2021
Project Number: 2020-2027-00
Prepared By: D. Anggabrata
Checked by: Siu Fung Ma
Type of Estimate: Class D (±50%)

Feasibility Study of City of Powell River's Water System to Supply to qRD (Option 2 - Combined)

Item	Description	Qty.	Units	Unit Price	Extension
	GENERAL				
1	Mobilization, demobilization, cons. management	1	LS	5,605,000	$ 5,605,000
	UTILITY CIVIL PIPING				
2	300mm dia. Watermain - Pilot Area	2,670	meter	1,250	$ 3,338,000
3	300mm dia. Watermain - Service to Myrtle Pond Reservoir	500	meter	1,250	$ 625,000
4	300mm dia. Watermain - Extended Alignment to Saltery Bay	24,100	meter	1,250	$ 30,125,000
5	Allowance for fittings, isolation valves, air valves, blow downs	1	LS	1,705,000	$ 1,705,000
	ROADWORKS				
6	Pavement and line marking	17,415	tonne	90	$ 1,568,000
Optional	Transfer existing water service(s) to the new 300mm WTM	1	LS	20,000	$ 20,000
	on Thunder Bay St				
	Note: Extension cost is rounded up to nearest $1,000.				
	This cost estimate is a preliminary estimate which, due to little or no site information, indicates the approximate magnitude of cost of the proposed project, based on the client's broad requirements.				
	Watermain unit price includes material, installation, and excavation.				
	No geotechnical exploration is completed yet.				
	Cost estimate does not include allowance for any rock excavation.				
	Assume all works are within Ministry of Transportation road ROWs.				
	Assume no retaining walls are required.				
	Subtotal				**$ 42,986,000**
	Contingency - Class D	50%			$ 21,493,000
	Subtotal				$ 64,479,000
	Engineering	15%			$ 9,672,000
	Total				**$ 74,151,000**

Associated Engineering | GLOBAL PERSPECTIVE LOCAL FOCUS.

Cost Estimate

Client: **Qathet Regional District**
Subject: **Feasibility Study**

Date: Jun 18, 2021
Project Number: 2020-2027-00
Prepared By: D. Anggabrata
Checked by: Siu Fung Ma
Type of Estimate: Class D (±50%)

Feasibility Study of City of Powell River's Water System to Supply to qRD (Option 2 Pilot Phase Only)

Item	Description	Qty.	Units	Unit Price	Extension
	GENERAL				
1	Mobilization, demobilization, cons. management	1	LS	652,000	$ 652,000
	UTILITY CIVIL PIPING				
2	300mm dia. Watermain - Pilot Area	2,670	meter	1,250	$ 3,338,000
3	300mm dia. Watermain - Service to Myrtle Pond Reservoir	500	meter	1,250	$ 625,000
4	300mm dia. Watermain - Extended Alignment to Saltery Bay	-	meter	1,250	$ -
5	Allowance for fittings, isolation valves, air valves, blow downs	1	LS	199,000	$ 199,000
	ROADWORKS				
6	Pavement and line marking	2,021	tonne	90	$ 182,000
Optional	Transfer existing water service(s) to the new 300mm WTM	1	LS	20,000	$ 20,000
	on Thunder Bay St				
	Note: Extension cost is rounded up to nearest $1,000.				
	This cost estimate is a preliminary estimate which, due to little or no site information, indicates the approximate magnitude of cost of the proposed project, based on the client's broad requirements.				
	Watermain unit price includes material, installation, and excavation.				
	No geotechnical exploration is completed yet.				
	Cost estimate does not include allowance for any rock excavation.				
	Assume all works are within Ministry of Transportation road ROWs.				
	Assume no retaining walls are required.				
	Subtotal				**$ 5,016,000**
	Contingency - Class D	50%			$ 2,508,000
	Subtotal				$ 7,524,000
	Engineering	15%			$ 1,129,000
	Total				**$ 8,653,000**

Associated Engineering | GLOBAL PERSPECTIVE LOCAL FOCUS.

Cost Estimate

Client: **Qathet Regional District**
Subject: **Feasibility Study**

Date: Jun 18, 2021
Project Number: 2020-2027-00
Prepared By: D. Anggabrata
Checked by: Siu Fung Ma
Type of Estimate: Class D (±50%)

Feasibility Study of City of Powell River's Water System to Supply to qRD (Option 2 Saltery Bay Extension only)

Item	Description	Qty.	Units	Unit Price	Extension
	GENERAL				
1	Mobilization, demobilization, cons. management	1	LS	4,953,000	$ 4,953,000
	UTILITY CIVIL PIPING				
2	300mm dia. Watermain - Pilot Area	-	meter	1,250	$ -
3	300mm dia. Watermain - Service to Myrtle Pond Reservoir	-	meter	1,250	$ -
4	300mm dia. Watermain - Extended Alignment to Saltery Bay	24,100	meter	1,250	$ 30,125,000
5	Allowance for fittings, isolation valves, air valves, blow downs	1	LS	1,507,000	$ 1,507,000
	ROADWORKS				
6	Pavement and line marking	15,364	tonne	90	$ 1,383,000
	Note: Extension cost is rounded up to nearest $1,000.				
	This cost estimate is a preliminary estimate which, due to little or no site information, indicates the approximate magnitude of cost of the proposed project, based on the client's broad requirements.				
	Watermain unit price includes material, installation, and excavation.				
	No geotechnical exploration is completed yet.				
	Cost estimate does not include allowance for any rock excavation.				
	Assume all works are within Ministry of Transportation road ROWs.				
	Assume no retaining walls are required.				
	Subtotal				**$ 37,968,000**
	Contingency - Class D	50%			$ 18,984,000
	Subtotal				$ 56,952,000
	Engineering	15%			$ 8,543,000
	Total				**$ 65,495,000**