

## Technical Memorandum

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**DATE:** March 1, 2015

**TO:** Mr. John Lord, P. Eng. Project Engineer, Regional District of North Okanagan

**FROM:** Mark Forsyth, P.Eng.

**RE: REGIONAL DISTRICT OF NORTH OKANAGAN  
Delcliffe Water System Upgrade Options Assessment  
Our File 0773.131-300**

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### 1. Introduction

Kerr Wood Leidal and Associates Ltd. (KWL) was retained by the RDNO to assess options for upgrading the Greater Vernon Water Utility (GVWU) Delcliffe Water System to meet *Drinking Water Protection Act – BC* standards and IH's 4-3-2-1-0 Guidelines. Two options that exist are:

1. Upgrading components of the existing Delcliffe water treatment system to meet current standards; or
2. Supplying treated water to the Delcliffe system externally from one of the larger systems in the area.

The purpose of this report is to develop feasibility level assessment, options ranking and Class D comparative costs for the various options.

The capital cost of upgrading the existing treatment system has been used as a basis to compare the options for supplying the system from external sources. The external supply options have been assessed based on the least cost of construction, and potential for contributing funding provided by other properties connecting.

### 2. Existing System

#### 2.1 Description of Water System

The existing Delcliffe Water System is comprised of a lake intake (upgraded in 2012), a lake pumpstation which lifts water to a reservoir, and a piped system which feeds some properties by gravity and others with the aid of a booster station located near the reservoir. Primary disinfection is provided by addition of sodium hypochlorite prior to the reservoir.

Details of the system components are outlined in the table below. Photos of the components are contained in Appendix A.



**Table 1: Delcliffe Water System Components**

Component	Description
Lake Intake	<ul style="list-style-type: none"> <li>• intake is located offshore of 9729 Delcliffe Rd;</li> <li>• RDNO upgraded the lake intake in 2012 to include a new fish friendly intake;</li> <li>• intake pipe is 100 mm dia. PVC pipe from the pump station to the shoreline, then 90 mm dia. HDPE irrigation pipe to the intake;</li> <li>• intake consists of two stainless steel barrel screens. Meets fisheries guidelines. Installed in 2012;</li> <li>• screens are raised off the bottom of the lake by 1 m; and</li> <li>• screens are located approximately 160 m offshore at an approximate depth of between 3.4 m and 6.4 (due to lake level fluctuations).</li> </ul>
Lake Pumpstation	<ul style="list-style-type: none"> <li>• Lake pumpstation is a buried concrete chamber located on the north side of Delcliffe Road between 9729 and 9735 Delcliffe Rd;</li> <li>• comprised of two 7.5 HP AE Motor pumps connected in parallel for redundancy;</li> <li>• piping is galvanized steel;</li> <li>• pumpstation chamber has no sump pump - chamber drains by gravity to lake;</li> <li>• electrical controls and panel are located within pumpstation chamber with an external pole mounted emergency electrical shutoff;</li> <li>• pumpstation chamber is heated, vented and secured; and</li> <li>• pumpstation chamber is considered a confined space.</li> </ul>
Disinfection & Turbidity Monitoring Equipment	<ul style="list-style-type: none"> <li>• disinfection is provided by sodium hypochlorite injection located in the Reservoir Pumpstation building and controlled by a LMI Milton Roy controller (Model #A771-351TI) with HACH CL17 Chlorine Analyzer monitoring and recording. Chlorine analyzer installed in 2014 (no prior chlorine information available);</li> <li>• turbidity monitoring equipment is located within the Reservoir Pumpstation building and turbidity is monitored and recorded with HACH 1720C Low Range Turbidimeter; and</li> <li>• both chlorine and turbidity monitors are connected to GVWU SCADA and monthly site checks are performed by operator, daily checks through SCADA.</li> </ul>



Component	Description
Reservoir	<ul style="list-style-type: none"> <li>• reservoir is in-ground and located at the end of Cameron Road;</li> <li>• material is a concrete tank lined with a swimming pool liner and a wood truss roof with aluminum sheeting and wood siding;</li> <li>• estimated capacity is 90,000 L with approximate dimensions 6.0 m wide, 10 m long and 1.5 m deep;</li> <li>• screens are installed on all openings to reduce rodent access; and</li> <li>• reservoir level is monitored with a float connected to a low level alarm located at the Lake Pumpstation.</li> </ul>
Reservoir Booster Pumpstation	<ul style="list-style-type: none"> <li>• Reservoir Booster Pumpstation is a wood frame and concrete building located near the reservoir at the end of Cameron Road;</li> <li>• comprised of two pumps connected in parallel for redundancy and two pneumatic pressure tanks for low flow periods;</li> <li>• pump #1 is a five hp AE Motor CT60-5S VFD pump;</li> <li>• pump #2 is a five hp pump without a VFD;</li> <li>• pressure tank #1 is a small tank approximately 8 L;</li> <li>• pressure tank #2 is a large Well-Rite WR240R 310 L total capacity tank;</li> <li>• piping is galvanized steel;</li> <li>• electrical controls and panel are located within the building; and</li> <li>• building is heated, vented and secured with no reported rodent problems.</li> </ul>
Distribution System Piping	<ul style="list-style-type: none"> <li>• supply main pipe material from the Lake Pumpstation to Reservoir Booster Pumpstation is 150 mm C900 PVC; and</li> <li>• distribution pipe material type throughout the system is unknown</li> </ul>

## 2.2 Safety

It should be noted that the lake pumpstation is considered a confined space. The operator must enter the Lake Pumpstation once a week to check the pumps, requiring entering a confined space over 50 times per year.

Although safety is not further discussed in this memorandum, it may be part of the consideration given to the various options outlined at the end of this memorandum.



### 3. Options

The following is a summary of the options for upgrading the existing Delcliffe Water System or connecting to nearby water systems. Each option includes the cost of a new reservoir except Option 1c. It was assumed that a new reservoir can be sited above the existing subdivision and will allow for delivery of water by gravity, eliminating at least the upper pumpstation.

#### Option 1 - Upgrade Existing System

Interior Health (IH) has mandated that drinking water systems be upgraded to meet the 4-3-2-1-0 guidelines. The existing Delcliffe Water System does not meet IH's drinking water treatment standards.

##### Option 1a – No Filtration and New Reservoir

A significant factor in the costing and option selection is whether IH will grant a filtration deferral for the source. If we assume that filtration deferral will be granted, the only upgrade necessary is to add UV disinfection and modify where the chlorine is injected to increase the contact time. The Class 'D' cost estimate for design and construction of a new treatment and pumping building, is \$480,000. A detailed cost breakdown can be found in Appendix B.

##### Option 1b - Filtration and New Reservoir

This option includes the addition of filtration, if a filtration deferral cannot be secured. The Class 'D' cost estimate for a larger building and filtration as well as chlorination and UV is \$1,050,000. A detailed breakdown can be found in Appendix B.

##### Option 1c – No filtration, Modified Reservoir No Extra Storage

This option involves extending the intake, adding UV disinfection and upgrading the reservoir with a new liner and roof (no additional storage). Filtration deferral would be pursued with this option. This option would not increase the storage in the reservoir. This option is considered short-term as it will increase the water quality but does not address the water storage deficit. The estimate for this option is \$570,000. A detailed breakdown can be found in Appendix B.

##### Reservoir

The current reservoir is approximately 90,000 L. The reservoir is undersized for fire storage. Following the RDNO bylaws for sizing with adequate fire storage, the reservoir should have a minimum capacity of 700,000 L. The Class D cost estimate for a 700,000 L reservoir is \$1,000,000.

The current reservoir does not meet accepted practice for exclusion of rodents. The operator has indicated that mice and frogs are periodically found in the reservoir.

Options 1a and 1b include the cost of upgrading the reservoir to meet RDNO standards for fire storage.

#### Option 2 - Connection to GVWU System at Eastside Road

Connecting to the existing GVWU system at the intersection of Okanagan Landing Road and Eastside Road would require the installation of approximately 4,300 m of 250 to 300 diameter watermain within the Eastside Road Right-of-Way. This option provides the most potential for additional lots connecting to the system as listed in the table below. These lots currently draw untreated water from Okanagan Lake.



**Table 2: Eastside Road – Potential Lots Connected**

Area	Lot Count
Smith Road Area	18
Peters Road	11
Existing Eastside Road Lots (including Whitepoint)	39
Eastside Road Undeveloped District Lots - Estimated	15
Delcliffe Lots above Eastside Road	6
Delcliffe Subdivision – Existing (32) and Undeveloped (2)	34
Cameron Point	15
<b>Total</b>	<b>138</b>

There is potential for 138 properties, including Delcliffe and Cameron Point subdivisions, connecting to this main extension. Since the Delcliffe lots *may* be charged a latecomer fee we have based our numbers on both 104 lots and 138 lots.

The Class 'D' cost for constructing this option is \$5.13M, or \$50,000/lot based on 104 lots contributing. If the Delcliffe lots contribute the \$5.13M distributed to \$37,000/lot.

Potential construction issues relating to this option are:

- Forecast cost of the watermain within the Eastside Road roadway is highly variable due to road reconstruction costs, and as large sections of Eastside Road along this alignment are cut through bedrock hence sections the watermain installation would be in bedrock; and
- An existing sanitary forcemain, gas line and services exist within Eastside Road along this alignment which would have to be accounted for in detailed design.

### Options 3 and 4 - Connection to GVWU System at 'The Outback'

Connection to the GVWU system at The Outback has two alternate alignments, either via Eastside Road, or underwater via the Okanagan Lake shoreline.

#### Option 3 - Via Eastside Road

Connecting to the existing GVWU system at The Outback via Eastside Road would require the installation of approximately 2,350 m of 250 to 300 diameter watermain within the Eastside Road Right-of-Way. This option provides the potential for additional lots connecting to the system along Eastside Road with an additional 15 lots assigned to the 3 large undeveloped District Lots. There are 36 potential properties including Cameron Point subdivisions serviced along this route.

The Class 'D' cost for constructing this option is \$2.8M, or \$78,000/lot.

Potential construction issues relating to this option are:

- Installation of the watermain within Eastside Road has a high unit cost due to likelihood of road structure reconstruction over watermain, and traffic control.

#### Option 4 - Underwater Via Okanagan Lake

Connecting to the existing GVWU system at The Outback via Okanagan Lake shoreline would require the installation of approximately 3,300 m of 200 diameter watermain. There is no potential for additional lots



connecting to the system along this alignment. There are potentially 21 lots serviced, including Cameron Point subdivision.

The estimated Class 'D' cost for constructing this option is \$2.9M, or \$140,000/lot.

Potential construction issues relating to this option are:

- Installation of the watermain underwater may be challenging due to the steep stepping rock shelves that exist along this portion of the Okanagan Lake shoreline. Installing the watermain along these rock shelves may produce an undulating pipe profile with multiple high points for collection of air; and
- Installation of the watermain at the shoreline connections will require Water Act Section 9 approval.

### 3.1 Connection to GVWU System at Predator Ridge

Connecting to the GVWU system at Predator Ridge is a high cost option involving substantial property acquisition, hence detailed costs have not been developed. This connection would require:

- delaying the watermain installation until the ultimate build out of the Predator Ridge development and/or installing a temporary watermain alignment to suit;
- pumping of the water up to the Predator Ridge Reservoir and then reducing the head down to the Delcliffe area; and
- right-of-way acquisition of private land between Predator Ridge and Delcliffe;

The City of Vernon OCP indicates that in 25 years+ the Mackay Connector may be constructed connecting Predator Ridge with Eastside Road.

This option does not provide the potential for any additional lots connecting to the system.

## 4. Cost Recovery Options for Connection to External Systems

The feasibility of any cost recovery mechanism depends on the value to property owners of the option to connect to the water system, and the level of service available from the system. All options require the consent of at least a majority of the land owners that would share the costs of the interconnecting main.

The mere potential to connect to a local government water system usually has significant value, providing immediate and lasting benefit to property owners by providing a secure water service and increasing the value of their land. The owners of homes with marginal wells or subdivision potential will receive the greatest and most immediate benefit, while the owners of unoccupied lots that have development constraints unrelated to water supply (e.g., ALR or unsuitable conditions for onsite wastewater systems) may see little value in such service. These conditions must be considered in defining the proposed service area boundary, and designing the tax and fee structure.

## 5. Comparison of Options

### 5.1 Feasibility and Cost

All of the options discussed in this memorandum are feasible but most are not financially viable as the cost per lot versus benefit gained is high. The analysis is also a best-case scenario, assuming that all lots connect to the system.



Each option has a new reservoir, except 1c, included as the current reservoir is undersized for the existing Delcliffe subdivision. Table 3: Option Costs, outlines the capital costs for each of the options. The cost opinions in Table 3 are Capital Costs and do not take into account life cycle costs.

Options 1a and 1b have a per lot cost associated with them as we assume the rates would increase to cover costs rather than a connection fee.

**Table 3: Option Costs**

Option		Total Capital Cost	Capital Cost Per Lot
1a	Upgrade Existing System (no filtration, new reservoir)	\$1.48M	\$43,500
1b	Upgrade Existing System (filtration, new reservoir)	\$2.05M	\$60,300
1c	Upgrade Existing System (no filtration, modified Reservoir no extra storage)	\$0.57M	\$16,800
2a	Connect to GWWU at Eastside Road (near Smith Rd) <b>Delcliffe lots do not contribute</b>	\$5.13M	\$50,000
2b	Connect to GWWU at Eastside Road (near Smith Rd) <b>All lots contribute</b>	\$5.13M	\$37,000
3	Connect to GWWU at The Outback (Road Alignment)	\$2.80M	\$78,000
4	Connect to GWWU at The Outback (Lake Alignment)	\$2.93M	\$140,000

The least cost option is Option 1: upgrade the existing water system. It is possible that filtration deferral will be granted, as Lake Okanagan is a well-known, high quality water source. For Options 1a and 1b, costs must be borne directly by the Delcliffe subdivision properties and there are no additional possible connections other than Cameron Point. The benefit of Options 1a and 1b are that a new, appropriately sized, reservoir would be installed above Eastside Road allowing the elimination of the Reservoir Booster Pumpstation. The reservoir could be sited at an elevation consistent with the long-term pressure zoning for this area.

Option 2: Connecting to the larger GWWU system has benefits including high water quality and centralized control. It is assumed that centralizing control of the system would result in operational benefits. Option 2 offers a high capital cost but has the highest potential for connecting additional lots. This option reduces the complexity of the water system and should result in a more robust system for Delcliffe. If lot owner buy-in can be obtained and coupled with the payback options discussed in Section 4, this may be the best long-term option.

Options 3 and 4 offer very few potential lot connections, thus the per lot cost is very high. The Lake Alignment for connection to The Outback water system carries a high risk. The pipe must be installed on a difficult lake bottom at a constant grade to avoid high points. The road alignment connection to The Outback system will need to be pumped over a high point where significant trench rock is expected.

## 6. Recommendations

We recommend that the feasibility of achieving consent from the property owners for Option 2 be further explored. If a significant number of property owners are willing to buy-in, it may be feasible to go forward with connecting the GWWU system to the Delcliffe water system.



If further analysis indicates that financial contribution toward Option 2 is unlikely to be successful, we recommend pursuing Option 1a.

**KERR WOOD LEIDAL ASSOCIATES LTD.**

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Encl Appendix A – Photos  
Appendix B – Cost Estimates

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## Revision History

Revision #	Date	Status	Revision Description	Author
0	March 1, 2015	Final	Incorporate comments from client and technical reviewer	MHF / BV
B	November 13, 2014	Draft	Incorporated comments from client and technical reviewer	MHF / BV
A	October 24, 2014	Draft		MHF / BV





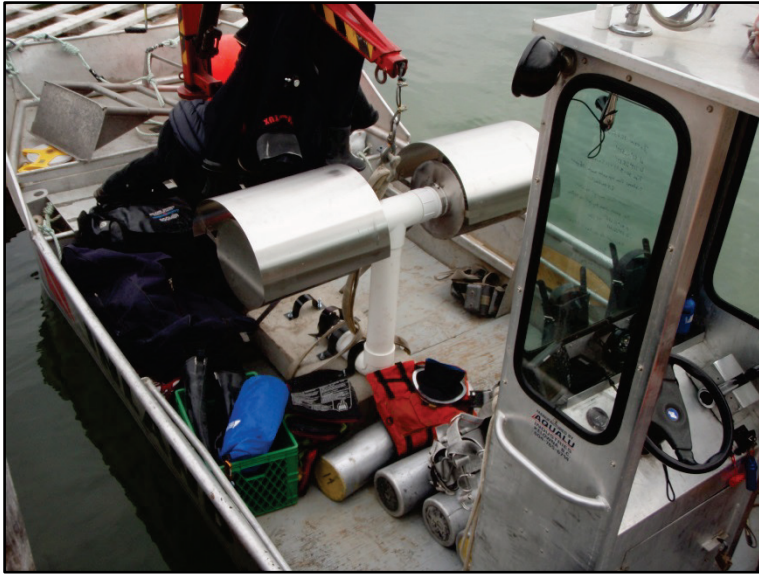
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Appendix A

# Photographs



## Appendix A - Photographs



**Photo 1:** Fish friendly lake intake just prior to installation in 2012.



**Photo 2:** Lake intake location (white buoy).



## Appendix A - Photographs



**Photo 3:** Lake Pumpstation.



**Photo 4:** Lake Pumpstation emergency electrical cut-off switch located outside of the pump chamber.



## Appendix A - Photographs



**Photo 5:** Lake Pumpstation pumps.



**Photo 6:** Lake Pumpstation electrical (in the chamber).



## Appendix A - Photographs



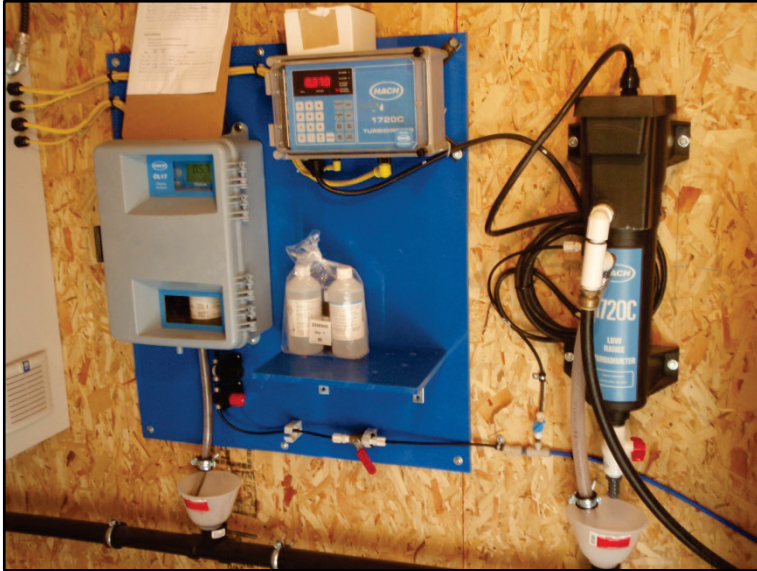
**Photo 7:** Reservoir Pumpstation.



**Photo 8:** Reservoir Pumpstation including chlorine injection equipment.



## Appendix A - Photographs



**Photo 9:** Chlorine residual and turbidity instrumentation in the Reservoir Pumpstation.



**Photo 10:** Hydropneumatic tank in the Reservoir Pumpstation.



## Appendix A - Photographs



Photo 11: Reservoir roof structure.



Photo 12: Reservoir.





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Appendix B

# Cost Estimates

**Option 1a****Installation of UV and Chlorine Disinfection  
No Filtration and New Reservoir  
Class 'D' Capital Cost Opinion****Regional District of North Okanagan  
Delcliff Water System Upgrade Options Assessment**

March 2015

Item	Description	Unit	Estimated Quantity	Material Unit Rate \$	Material Cost \$	Crew	Duration (Days)	Crew Rate \$/day	LabourEquip Cost \$	TOTAL PRICE \$
<b>1</b>	<b>General Requirements</b>									
1.01	Bonding & Insurance	%	1.0%							\$3,000
1.02	Mobilization & Demobilization	%	5.0%							\$14,000
1.03	Commissioning	LS	1	12,000	12,000					\$12,000
<b>General Requirements SUBTOTAL</b>										<b>\$29,000</b>
<b>2</b>	<b>Treatment Buildings</b>									
2.01	Treatment Building (incl. site preparation)	m2	20	3,100	62,000	incl				\$62,000
2.02	Treatment Building Lot Procurement (RDNO)	allow								\$50,000
<b>Treatment Buildings SUBTOTAL</b>										<b>\$112,000</b>
<b>3</b>	<b>Equipment</b>									
3.01	UV Disinfection	ea	2	10,000	20,000	Crew	1	2,500	2,500	\$22,500
3.02	Chlorination - Duplex Metering Pumps	LS	1	10,000	10,000	Crew	1.5	2,500	3,750	\$13,750
<b>Equipment SUBTOTAL</b>										<b>\$36,250</b>
<b>4</b>	<b>Mechanical &amp; Piping</b>									
4.01	Valves	allow	1	5,000	5,000	Crew	1.5	2,500	3,750	\$8,750
4.02	Treatment Plant - Piping	allow	1	12,000	12,000	Crew	3	2,500	7,500	\$19,500
4.03	Emergency eyewash and shower	ea	1	10,000	10,000	incl.				\$10,000
4.04	Extension of intake pipe	LS	1	20,000	20,000					\$20,000
<b>Mechanical &amp; Piping SUBTOTAL</b>										<b>\$58,250</b>
<b>5</b>	<b>Electrical</b>									
5.01	Building - Electrical	LS	1	30,000	30,000	incl				\$30,000
5.02	Control Panel	LS	1	30,000	30,000	incl				\$30,000
5.03	Flow Meter	ea	1	2,000	2,000	incl				\$2,000
<b>Electrical SUBTOTAL</b>										<b>\$62,000</b>
<b>TOTAL ITEMS 1 TO 5</b>							(rounded)			<b>\$298,000</b>
Engineering							(rounded)		20%	\$60,000
Contingency							(rounded)		40%	\$119,000
<b>TOTAL AMOUNT (excl. GST)</b>							(rounded)			<b>\$480,000</b>

*This estimate is a reflection of the expected capital cost for budgeting purposes only. Estimates reflect KWL's recent experience with similar work, and therefore represent a reasonable forecast of 2014 capital costs. They were made with limited site information in order to indicate the approximate magnitude of cost of the proposed project, based on the Owner's broad requirements. They have been prepared primarily for planning purposes; caution should therefore be exercised in using these estimates for establishing capital budgets.*

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**Option 1b**

**Installation of UV and Chlorine Disinfection**

**Filtration and New Reservoir**

**Class 'D' Capital Cost Opinion**

**Regional District of North Okanagan  
Delcliffe Water System Upgrade Options Assessment**

**March 2015**

Item	Description	Unit	Estimated Quantity	Material Unit Rate \$	Material Cost \$	Crew	Duration (Days)	Crew Rate \$/day	LabourEquip Cost \$	TOTAL PRICE \$
<b>1</b>	<b>General Requirements</b>									
1.01	Bonding & Insurance	%	1.0%							\$6,000
1.02	Mobilization & Demobilization	%	5.0%							\$31,000
1.03	Commissioning	LS	1	20,000	20,000					\$20,000
<b>General Requirements SUBTOTAL</b>										<b>\$57,000</b>
<b>2</b>	<b>Treatment Buildings</b>									
2.01	Treatment Building (incl site preparation)	m2	50	3,100	155,000	incl				\$155,000
2.02	Treatment Building lot procurement (RDNO)	allow								\$65,000
<b>Treatment Buildings SUBTOTAL</b>										<b>\$220,000</b>
<b>3</b>	<b>Equipment</b>									
3.01	Chemical Pre-Treatment & Filtration Skid	ea	1	200,000	200,000	incl.				\$200,000
3.02	UV Disinfection	ea	2	10,000	20,000	Crew	1	2,500	2,500	\$22,500
3.03	Chlorination - Duplex Metering Pumps	LS	1	10,000	10,000	Crew	2	2,500	5,000	\$15,000
<b>Equipment SUBTOTAL</b>										<b>\$237,500</b>
<b>4</b>	<b>Mechanical &amp; Piping</b>									
4.01	Valves	allow	1	7,500	7,500	Crew	4	2,500	10,000	\$17,500
4.02	Treatment Plant - Piping	allow	1	15,000	15,000	Crew	2	2,500	5,000	\$20,000
4.03	Emergency eyewash and shower	ea	1	10,000	10,000	incl.				\$10,000
4.04	Extension of intake pipe	LS	1	20,000	20,000					\$20,000
<b>Mechanical &amp; Piping SUBTOTAL</b>										<b>\$67,500</b>
<b>5</b>	<b>Electrical</b>									
5.01	Building - Electrical	LS	1	30,000	30,000	incl				\$30,000
5.02	Control Panel	LS	1	40,000	40,000	incl				\$40,000
5.03	Flow Meter	ea	1	4,000	4,000	incl				\$4,000
<b>Electrical SUBTOTAL</b>										<b>\$74,000</b>
<b>TOTAL ITEMS 1 TO 5</b>								(rounded)		<b>\$656,000</b>
Engineering								(rounded)	20%	\$131,000
Contingency								(rounded)	40%	\$262,000
<b>TOTAL AMOUNT (excl. GST)</b>								(rounded)		<b>\$1,050,000</b>

*This estimate is a reflection of the expected capital cost for budgeting purposes only. Estimates reflect KWL's recent experience with similar work, and therefore represent a reasonable forecast of 2014 capital costs. They were made with limited site information in order to indicate the approximate magnitude of cost of the proposed project, based on the Owner's broad requirements. They have been prepared primarily for planning purposes; caution should therefore be exercised in using these estimates for establishing capital budgets.*

**KERR WOOD LEIDAL ASSOCIATES LTD.**

Consulting Engineers

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**Option 1c**

**Installation of UV and Chlorine Disinfection  
No filtration, Modified Reservoir No Extra Storage  
Class 'D' Capital Cost Opinion**

**Regional District of North Okanagan  
Delcliffe Water System Upgrade Options Assessment**

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Item	Description	Unit	Estimated Quantity	Material Unit Rate \$	Material Cost \$	Crew	Duration (Days)	Crew Rate \$/day	LabourEquip Cost \$	TOTAL PRICE \$
<b>1</b>	<b>General Requirements</b>									
1.01	Bonding & Insurance	%	1.0%							\$3,000
1.02	Mobilization & Demobilization	%	5.0%							\$17,000
1.03	Commissioning	LS	1	12,000	12,000					\$12,000
<b>General Requirements SUBTOTAL</b>										<b>\$32,000</b>
<b>2</b>	<b>Treatment Buildings and Reservoir Modifications</b>									
2.01	Treatment Building (incl. site preparation)	m2	20	3,100	62,000	incl				\$62,000
2.02	Treatment Building Lot Procurement (RDNO)	allow								\$50,000
2.03	Reservoir Liner	allow								\$20,000
2.04	Reservoir Roof	allow								\$35,000
<b>Treatment Buildings and Reservoir Modifications SUBTOTAL</b>										<b>\$167,000</b>
<b>3</b>	<b>Equipment</b>									
3.01	UV Disinfection	ea	2	10,000	20,000	Crew	1	2,500	2,500	\$22,500
3.02	Chlorination - Duplex Metering Pumps	LS	1	10,000	10,000	Crew	1.5	2,500	3,750	\$13,750
<b>Equipment SUBTOTAL</b>										<b>\$36,250</b>
<b>4</b>	<b>Mechanical &amp; Piping</b>									
4.01	Valves	allow	1	5,000	5,000	Crew	1.5	2,500	3,750	\$8,750
4.02	Treatment Plant - Piping	allow	1	12,000	12,000	Crew	3	2,500	7,500	\$19,500
4.03	Emergency eyewash and shower	ea	1	10,000	10,000	incl.				\$10,000
4.04	Extension of intake pipe	LS	1	20,000	20,000					\$20,000
<b>Mechanical &amp; Piping SUBTOTAL</b>										<b>\$58,250</b>
<b>5</b>	<b>Electrical</b>									
5.01	Building - Electrical	LS	1	30,000	30,000	incl				\$30,000
5.02	Control Panel	LS	1	30,000	30,000	incl				\$30,000
5.03	Flow Meter	ea	1	2,000	2,000	incl				\$2,000
<b>Electrical SUBTOTAL</b>										<b>\$62,000</b>
<b>TOTAL ITEMS 1 TO 5</b>								(rounded)		<b>\$356,000</b>
Engineering								(rounded)	20%	\$71,000
Contingency								(rounded)	40%	\$142,000
<b>TOTAL AMOUNT (excl. GST)</b>										<b>\$570,000</b>

*This estimate is a reflection of the expected capital cost for budgeting purposes only. Estimates reflect KWL's recent experience with similar work, and therefore represent a reasonable forecast of 2014 capital costs. They were made with limited site information in order to indicate the approximate magnitude of cost of the proposed project, based on the Owner's broad requirements. They have been prepared primarily for planning purposes; caution should therefore be exercised in using these estimates for establishing capital budgets.*

**KERR WOOD LEIDAL ASSOCIATES LTD.**

Consulting Engineers

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**Option 2**

Service Connections to GVWU at Eastside Road (near Smith Rd)  
Class 'D' Capital Cost Option

Regional District of North Okanagan  
Delcliffe Water System Upgrade Options Assessment  
March 2015

Description	Unit	Est. Quantity	Unit Price	Total
<b>Cost Estimate Per Lot from Delcliffe to Smith Road (Option 2)</b>				
1	Bare lands - hydrants, services, valves, pipe	m		\$ 215.00
2	Road Structure - asphalt, base, subbase	m		\$ 195.00
3	Trench bedrock contingency			\$ 80.00
<b>Subtotal</b>				<b>\$ 490.00</b>
4	Length of main from Delcliffe to Smith	m	4,300	\$ 2,107,000.00
5	Pumpstation and Controls upgrade	Lump Sum		\$ 100,000.00
6	Reservoir and upgraded chlorination	Lump Sum		\$ 1,000,000.00
<b>Subtotal</b>				<b>\$ 3,207,000.00</b>
7			Class D Contingency 40%	\$ 1,282,800.00
8			Engineering 20%	\$ 641,400.00
<b>Total</b>				<b>\$ 5,131,200.00</b>
<b>Delcliffe to Smith - \$5.13M divided by 93 Lots = \$55,000/Lot</b>		each	93	<b>\$ 5,131,200.00</b>
				<b>\$ 55,174.19</b>

Prepared by:

KERR WOOD LEIDAL ASSOCIATES LTD.  
Consulting Engineers

Seal

**Option 3**

Service Connects to GVWU at The Outback (Road Alignment)  
Class 'D' Capital Cost Option

Regional District of North Okanagan  
Delcliffe Water System Upgrade Options Assessment  
March 2015

Description	Unit	Est. Quantity	Unit Price	Total
<b>Cost Estimate Per Lot from Delcliffe to The Outback (Option 3)</b>				
1	Bare lands - hydrants, services, valves, pipe	m		\$ 215.00
2	Road Structure - asphalt, base, subbase	m		\$ 195.00
3	Trench bedrock contingency			\$ 80.00
<b>Subtotal</b>				<b>\$ 490.00</b>
4	Length of main from Delcliffe to The Outback	m	2,350	\$ 1,151,500.00
5	Pump Station and Control Upgrades	Lump Sum		\$ 100,000.00
6	Reservoir and upgraded Chlorination	Lump Sum		\$ 1,000,000.00
<b>Subtotal</b>				<b>\$ 2,251,500.00</b>
7	Class D Contingency - 40%			\$ 460,600.00
8	Engineering 20%			\$ 92,120.00
<b>Total</b>				<b>\$ 2,804,220.00</b>
<b>Delcliffe to The Outbak - \$2.8M divided by 36 Lots = \$78,000/Lot</b>		each	36	<b>\$ 2,804,220.00</b>

Prepared by:

Seal

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Consulting Engineers

Option 4  
 Connect to GVWU at The Outback (Lake Alignment)  
 Class 'D' Capital Cost Opinion

Regional District of North Okanagan  
 Delcliff Water System Upgrade Options Assessment  
 March 2015

Description	Unit	Est. Quantity	Unit Price	Total
<b>Cost Estimate Pipe Via Lake Okanagan (from The Outback) - Option 4</b>				
1	250 - 300 dia HDPE Pipe in lake (incl anchors/appurtanences - \$180/m	m		
2	250 - 300 dia PVC in road/overland (incl tie-ins) - \$490/m	m		
	Length of pipe in lake = 3,100 m x \$185/m = \$575,000	m	3100	\$ 185.00 \$ 573,500.00
	Length of pipe in overland = 200 m x \$490/m = \$98,000	m	200	\$ 490.00 \$ 98,000.00
3	Environmental Approval Process	Lump Sum		\$ 60,000.00
4	Pump and control upgrades	Lump Sum		\$ 100,000.00
5	Reservoir and upgraded Chlorination	Lump Sum		\$ 1,000,000.00
			<b>Subtotal</b>	<b>\$ 1,831,500.00</b>
6			Class D Contingency - 40%	\$ 732,600.00
7			Engineering 20%	\$ 366,300.00
			<b>Total</b>	<b>\$ 2,930,400.00</b>
<b>Lot Service Costs from Delcliff to The Outback via lake - \$2.9M divided by 55 Lots = \$140,000/Lot</b>		each	21	<b>\$ 2,930,400.00</b> <b>\$ 139,542.86</b>
<i>Prepared by:</i>				<i>Seal</i>
KERR WOOD LEIDAL ASSOCIATES LTD. Consulting Engineers				