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1.0 INTRODUCTION

The Grandview Bench Area is a rural residential/farm community located North of the City of Enderby. The study area consists of approximately seven square miles (18 square kilometers) of undulating topography. The area is generally forest covered lands with some areas cleared for homes, farming, and other uses. There are approximately 160 homes in the Grandview Bench area. There appears to be a few subdivided parcels that do not have homes built on them.

Water supply for the area consists primarily of individual shallow dug wells. Some residences have deeper drilled wells. In general, the water supply in the Grandview Bench area is limited with some areas experiencing poor water quality and loss of water supply during summer months.

The Regional District of North Okanagan (RDNO) retained Stantec Consulting Ltd. and EBA Engineering Consultants Ltd. to conduct a study to develop a strategic water supply plan for the Grandview Bench Area. The primary objective of the study is to determine the most optimum long-term water supply solution for the area. The study is to evaluate:

- the current water supply systems
- the issues and needs of the community
- the Options for water supply
- the development of an implementation strategy

The following report will outline the design criteria utilized to develop a community water system, expected demands, results of groundwater investigations, and options/costs for community water systems, and a potential implementation program if the residents of Grandview Bench wish to proceed further with developing a long-term community water supply.

2.0 DESIGN CRITERIA

2.1 GENERAL

This section contains the pertinent design criteria upon which the design of a community water system will be based. These criteria have been derived from Okanagan Community's subdivision servicing bylaws and typical standards for small rural water systems.

2.2 WATER DEMANDS

The demand for water within the Grandview Bench area will vary hourly, daily, weekly, monthly, and seasonally and is dependent on the type of property serviced. The primary water users within the District are domestic (single family homes) with some agricultural uses. It is expected that demands will remain relatively constant through the fall, winter and early spring months based on domestic or in home use. Demands for these months will range between 250 and 350 litres per capita per day. At three persons per household this relates to a water demand of 750 to 1050 litres per lot per day. In home water conservation measures could help to reduce these volumes.

During summer months, water use will increase as watering of gardens and lawns around the homes is undertaken. As there currently is limited water supply in most areas and the nature of the Grandview Bench area is rural residential leaving most areas in a natural state around homes, the amount of "outside" water use is probably limited. However, it has been our experience in other similar areas that if a community water supply system is installed, the exterior water use will increase if a consistent supply is available.

With private water sources, subdivision servicing bylaws in other regional districts in the Okanagan require lots to have wells that are capable of supplying a minimum of 2300 l/day. The well must also be able of providing a flow rate of at least 20 l/min for a period of one hour. Typical bylaw requirements for Maximum Day Demands (MDD) for single-family homes on community systems vary but generally are in the range of 8000 to 9000 litres per day. The Provincial Design Guidelines for rural residential community water systems gives design MDD's between 4700 and 6100 litres per day.

For the purpose of this study, we have used 8000 litres per day per household as a MDD for sizing components of a community water system. While this volume may be significantly more than the current private supply on many of the homes on Grandview Bench, we believe it is a reasonable flow rate for initial planning purposes. It is however important that users in a community water system make every effort to conserve water and reduce demands to much lower levels. Locating a ground water supply that can meet project demands of 8000 litres per household may be very difficult. Multiple wells may be required to meet system demands. We would recommend that any new community water system installed should have all connections metered. This could help to reduce MDD to 5000 to 6000 litres per household per day. If detailed design of the water supply system proceeds, careful consideration of demands must be undertaken to ensure the water system will meet the needs of the community.

2.3 HYDRAULIC DESIGN

The water system predesign prepared for each supply option is based on the following criteria.

2.3.1 Supply

The source must be capable of supplying the total area demands. This would apply to sources either from new wells, surface water supplies, or adjacent municipalities. The source must have capacity to meet maximum day demands during peak days and provide a year-long reliable source of water supply.

The supply pumps must be capable of pumping the maximum day demand with the largest pump out of service in a multiple pumping system. With systems with well supplies, pumping capacity is sometimes set at meeting maximum day demand in 18 hours with all pumps operating. However, for the purpose of initial system sizing we have utilized pumping capacity meeting MDD in 24 hours.

2.3.2 Balancing Storage & Fire Demands

In typical municipal water systems, balancing storage is provided to meet peak hour demands where supply systems are designed to meet maximum day demand. Balancing storage is also provided to control the Hydraulic Grade Line (HGL) in a water system and control starting and stopping of pumps. In some small water supply systems, reservoirs are not provided. In these cases, pumps must either run continuously with pressures controlled by valves or varying the speed of the pumps. In some cases, pressure tanks are provided to allow starting/stopping of pumps during low-demand periods.

For the overall community systems for Grandview, we have included reservoir storage in the system predesign. For the individual systems, we have proposed some reservoir storage and some continuous pumping systems.

Reservoir capacity should equal the peak hour demands plus the total fire flow requirements, where applicable. The peak hour volume in communities generally varies between 15 and 30 percent of the total domestic maximum day demand. For this study a storage volume of 25 percent of the total domestic maximum day demand has been used.

In addition to meeting normal system demands, reservoir storage facilities and distribution mains are designed to meet possible fire demands. There is a wide variation in standards set by various agencies and municipalities for duration and volume of fire flows. As this area is a rural residential development, fire demands would be recommended to be set at minimum levels of 2000 l/min if fire protection is included. We have not included fire protection in the predesign of the various options in this report. If fire protection was required, it would increase the size and cost of the reservoirs (add 120m³ to reservoirs for fire storage), some distribution main sizes may need to be upsized, and hydrants would need to be added. The community should consider adding fire protection if it is affordable and fire-fighting service can be provided from an adjacent community.

2.3.3 Pressures

The service pressures should normally be maintained between 275 and 690 kpa (40 and 100 psi) during a maximum day. Due to the large variation of topography in Grandview, we have increased the pressure zone range to 275 to 970 kpa (40 to 140 psi). This will maintain distribution pressures within the design limits for standard PVC pipe and reduce the number of pressure zones.

2.3.4 Distribution System

The distribution system must be capable of conveying peak hour demand and still maintain the system pressures above the minimum. If fire protection were to be included, then the distribution system must be capable of maximum day demand plus fire flows. Velocities of the water in pipelines should be kept less than 1.8 meters per second except near a fire where velocities to 4 meters per second are permitted. Mains should be looped wherever possible.

For Grandview main sizing will be 150mm for the majority of the mains with 100mm provided on some dead end lines servicing a limited number of homes. If fire protection was included some mains would increase to 200mm.

2.4 SERVICE REQUIREMENTS

Based on the design criteria noted above, we have identified the following service requirements.

2.4.1 Pressure Zones

The study area has been divided into four pressure zones as shown on ***Drawing #1***. Zones are identified by their HGL. The majority of homes are serviced within the pressure zones. There are however a few homes that are outside the normal pressure requirements that will require individual pumping systems to service their home, or additional pressure reducing. These have been minimized wherever possible.

Table 2.1 provides a list of each zone, the top and bottom service elevations and the number of homes expected to be in each zone. The number of homes in Grandview was stated to be approximately 160. There are however additional addresses noted on the base plans provided by RDNO (approximately 190). In order to allow for some growth if a community water system was installed, we have based our initial design on a total of 200 lots.

Table 2.1
Grandview Pressure Zones

Zone HGL	Service Elevations	Number of Homes
810m	780m – 710m	78
740m	710m – 640m	57
670m	640m – 570m	50
600m	570m – 510m	15

2.4.2 Maximum Day Demands

Table 2.2 provides Maximum Day Demands for each zone and the overall system. The MDD's are based on 8000 l/day per residence. Water Conservation (metering) should help to reduce these demands, however for this initial study we have used the larger demands. The ability to create a community water supply will be very much dependent upon finding a ground water source(s) that could supply the Grandview Area.

Table 2.2
Maximum Day Demands

Zones	# of Homes	MDD
810m	78	7.2 l/s
740m	57	5.3 l/s
670m	50	4.6 l/s
600m	15	1.4 l/s
Total	200	18.5 l/s (295usgpm)

If maximum day demands could be reduced to 5000 l/residence/day, then MDD would be in the order of 12 l/s (190 usgpm).

Peak hour demands are expected to be in the order of 30 l/s for a MDD of 18.5 l/s. Peak hour demands are supplied from reservoir storage (where provided). In systems without reservoir storage, peak hour demands must be met by the water source pumping.

3.0 WATER SYSTEM

3.1 GENERAL

Drawing #1 provided an indication of the various pressure zones in Grandview Bench as well as overall water supply options for the area. The following sections outline the work done by EBA Engineering on the existing water supply systems (onsite wells), their recommendations for possible groundwater sources, and various options we have developed for community water systems.

3.2 EXISTING GROUND WATER SYSTEMS AND POTENTIAL FOR EXPANSION

EBA Engineering Consultants conducted a Water Well Baseline Condition Survey and Groundwater Resource Assessment for Grandview Bench. Their report is included in Appendix A. The scope of their work included:

- Request and review well data from property and well owners
- Reviewed BC Ministry of Environment (MoE) well records for the Grandview Bench and surrounding area
- Reviewed available web-based geology and ground water data including several well test reports provided by MoE
- Conducted field inspections of wells and potential groundwater source areas
- Compiled available data into a spreadsheet-based database
- Reviewed available data for wells or areas where improvements to existing sources could be made
- Analyzed groundwater occurrence and identified potential areas for further assessment
- Developed recommendations for additional groundwater investigation

The results of the EBA investigation are that in general, most property owners within the Grandview Bench Area reported low yields and poor quality from their drilled or dugwells. EBA stated that there appears to be limited potential for adequate groundwater resources in the central study area. There are however spring discharges in the Larch Hills area (North end of Grandview) and several productive water wells within the western, southwestern, and southeastern parts of the study area that indicate groundwater resources suitable for exploitation may be available in these areas.

If groundwater sources were proposed for a community water system for Grandview, EBA recommended:

- Conducting an exploratory drilling program in the Mara Meadows/Shuswap River Valley on the south east side of the study area, and in the Saltwell Lake area (Central Study)
- Investigate the springs and reported artesian conditions in the Northern study area (Larch Hills)
- Complete remote sensing followed by exploratory drilling at target locations along the western fault area

These investigations may or may not produce a groundwater source (or series of sources) that would be capable of supplying a community water system for Grandview.

3.3 WATER SOURCE OPTIONS

There are a number of sources of water that may be available to the residents of Grandview Bench. These sources are outlined below and presented in each of the Water Supply Options which follow this section.

3.3.1 Groundwater

As noted above, there are a number of potential sources for groundwater in the Grandview Bench Area. The general areas of interest are shown on ***Drawing #1***. At this stage, it is not possible to predict the likelihood of obtaining a groundwater source(s) that will meet the needs of the community. The areas southwest and southeast of Grandview appear to be the most feasible as there are a number of production wells in these areas. Wells located in the southwest area will however have much less elevation to overcome in pumping water to Grandview. It may be possible to utilize one or more sources if wells are close to the distribution system.

3.3.2 Surface Water

There are some local streams and small lakes in the Grandview Bench area. As the drainage basin areas of these water bodies are small and unlikely to consistently supply water at volumes needed for a community water system, they are not considered to be feasible water supply options.

The Shuswap River is located adjacent to Grandview Bench and could provide an adequate water supply. The community of Grindrod has a river intake and water treatment plant that draws water from the Shuswap River. A review of the sizing of their intake, wetwell, and Water Treatment Plant (WTP) indicates there is not adequate capacity to supply demands of both Grindrod and Grandview Bench. Therefore a new intake and WTP will be required. A water license would also be required to draw water from the Shuswap River.

3.3.3 Adjacent Municipalities

The District of Salmon Arm's south boundary is located approximately 3 km from the North West corner of Grandview. Pressure Zone 5 of the District of Salmon Arm supplies water to the industrial park at the south boundary of the municipality. The HGL of this zone is 615 m. It is supplied from the Zone 5 Booster Station.

In order to obtain water from Salmon Arm, upgrading the Zone 5 Booster Station would be required. The District of Salmon Arm has recently updated its Development Cost Charge (DCC) Bylaw. This bylaw included an upgrade of this station. Salmon Arm has also just completed the design of a water treatment plant and is currently out to tender for this work.

For the purpose of this initial study, we have assumed any upgrading of the Salmon Arm supply system would be included in DCC funds that would be paid by Grandview as a cost of obtaining water from Salmon Arm. Pumping and supply mains from Salmon Arm would however be paid by Grandview residents.

The City of Enderby's water supply system could also be extended to Grandview. There is however significant upgrading required to Enderby's supply system as it is close to capacity. A main extension of over 8 km would also be required. Due to the length of main extension, the upgrades of Enderby's supply system and the additional pumping head from Enderby versus the Salmon Arm system, the option of supplying water from Enderby will not be as economical as tying to Salmon Arm.

3.4 COMMUNITY WATER SYSTEM OPTIONS

Utilizing the sources available to Grandview Bench, we have prepared four options for Community Water Supplies. These are shown on **Drawings 2** to **5** and outlined below. Pressure Zones for all options are the same.

3.4.1 Option 1 – Groundwater Supply from Southwest Corner – Drawing #2

This option includes a groundwater supply for the entire community located in or adjacent to the southwest corner of the study area. As it is unlikely that a single supply source can be located with sufficient capacity for the entire community, we have assumed two well sources will be required.

The water supply system consists of the following:

- Well supplies – (2 @ 9.5 l/s – 30 hp) pumps to Zone 670 Reservoir (60m^3)
- Zone 740 Pump Station (17 l/s – 25 hp) pumps to Zone 740 Reservoir (185 m^3)
- Zone 810 Pump Station (8 l/s – 10 hp) pumps to Zone 810 Reservoir (150 m^3)
- PRV Stations to supply Zone 670 and Zone 600 on east side of Grandview
- Water Supply Mains

Zone 810	10,170 m
Zone 740	6,500 m
Zone 670	6,080 m
Zone 600	1,725 m
TOTAL	23,855 m

3.4.2 Option 2 – Groundwater Supply from Southeast Corner or from Shuswap River – Drawing #3

The supply source for Option 2 can come either from a groundwater well(s) in the Shuswap River Valley or from an intake from the River itself. Similar to Option 1, it is anticipated multiple wells would be required to meet the supply needs. A water treatment plant (filtration) would be required for the river source. The supply system is similar for either option and would consist of the following:

- Well supplies or river intake and Treatment system that pumps to an intermediate booster station – source pumps 19 l/s – 60 hp (or 2 – 9.5 l/s – 30 hp), booster pumps 19 l/s – 50 hp. Pump operation must be interlinked.
- Booster Pumps pump through Zone 600 to Zone 670 Reservoir (80m^3). Zone 600 supplied from a PRV through Zone 670.

- Zone 740 Pump Station (15 l/s – 25 hp) pumps to Zone 740 Reservoir (200 m^3). Zone 670 (west) supplied from PRV through Zone 740.

- Zone 810 Pump Station (8 l/s – 10 hp) pumps to Zone 810 Reservoir (155 m^3).

- Water Supply Mains

Zone 810	10,170 m
Zone 740	6,500 m
Zone 670	7,200 m
Zone 600	3,000* m
TOTAL	26,870 m

* if Shuswap River used add 1300 m pipe

3.4.3 Option 3 – Water Supply from Salmon Arm – Drawing #4

Water Supply from Salmon Arm is Option 3. Water from Zone 5 of their water system (HGL 615 m) would be pumped to the top end of Grandview Bench (PZ 810 m). This is the shortest route via roadways but requires all water to be pumped to the highest elevations. There may be more energy-efficient pumping alternatives to consider if this option were selected. For the purpose of this study, we have assumed this pumping arrangement. Water to lower zones would be fed through PRV's. The water supply system consists of:

- Connection to the District of Salmon Arm water supply mains in their industrial park.

- Pumping of water from an HGL of 615 m to 810 m. This will require 2 pump stations to maintain pressures at reasonable levels. Supply would be achieved by approximately 3 km of water supply main to the Northwest corner of Grandview Bench.

- A Zone 810 Reservoir (400 m^3).

- Distribution system with PRV's to each lower zone.

- Water Supply Mains

Zone 810	10,170 m
Zone 740	5,800 m
Zone 670	5,600 m
Zone 600	1,230 m
Offsite	3,000 m
TOTAL	25,800 m

3.4.4 Option 4 – Local Area Water Supply System – Drawing #5

This Option creates a number of small water supply systems for each development area of Grandview Bench. It relies on the ability to obtain a water source in each of the community system areas which will provide sufficient water for the number of residents serviced.

There were five separate water supply systems identified. They do not however provide water service to all residents of Grandview Bench as there are a number of areas that are remote. Watermains could be extended to each resident (similar to the previous options) but this will increase the cost per unit serviced as the distribution mains become long for the number of people serviced. Additional connections to each system also require larger capacity wells.

A description of each system is as follows:

System 1 – Southwest Grandview Bench Road

- 21 connections
- well supply/pump system – (4 l/s – 7.5 hp)
- Variable speed pump or pressure tanks
- 2300 m of watermain

System 2 – Central Area – Saltwell Lake

- 51 connections
- well supply/pump system – (6 l/s – 10 hp)
- Storage tank for pump control and balancing storage – 115m^3
- 5900 m of watermain

System 3 – Black Road/Timms Road

- 31 connections
- well supply/pump system – (5 l/s – 7.5 hp)
- Variable speed pump or pressure tanks
- 2550 m of watermain

System 4 – Southeast Grandview Bench

- 26 connections
- well supply/pump system – (4 l/s – 10 hp)
- Variable speed pump or pressure tanks
- 3000 m of watermain

System 5 – Northeast Corner Grandview Bench

- 29 connections
- Groundwater source/pump station – (5 l/s – 7.5 hp) – note a surface water source (artesian) may be available in this area however it would in all likelihood require filtration.
- Variable speed pump or pressure tanks
- 2900 m of watermain

3.5 WATER SYSTEM COSTS

Our opinion of probably costs for the various Community Water System Options are outlined below. It must be noted that these costs are order of magnitude only and should be used for comparison of options. There are many unknowns at this stage which could impact the cost of the project (i.e. location, depth of water sources, number of exploratory wells drilled, number of wells required to meet demands, etc.). Costs can only be confirmed upon completion of much more detailed engineering work, tendering and construction of the works.

Basis for the estimates are outlined below.

Water well up to 6 l/s (100 usgpm) (includes one exploratory well)	\$125,000
Water well 6 l/s to 20 l/s (100 to 300 usgpm) (includes one exploratory well)	\$150,000
Well pump station to 25 hp	\$100,000
Well pump station 25 to 60 hp	\$130,000
Booster station to 25 hp	\$175,000
Booster station 25 – 60 hp	\$250,000
Reservoir up to 375 m^3 (\$2.50 us gallon)	\$660/ m^3
Reservoir 375 m^3 – 600 m^3 (\$2.25 us gallon)	\$600/ m^3
PRV Station in Chamber	\$35,000
Watermains (up to 150mm)	\$200/m

Cost estimates do not include any allowances for obtaining land for pump stations, reservoirs or waterline easements. Treatment for well suppliers is limited to disinfection with sodium hypochlorite. If the wells are considered to be under the influence of surface water further treatment will be required. This could include filtration and/or UV treatment. Watermain costs include services connections and meters. A 35%

allowance is added for Engineering and Contingencies, GST is not included. ***Table 3.1*** provides a listing of the costs for Options 1 to 3. ***Table 3.2*** provides an estimate of costs for Option 4.

For Option 3, there would be an additional cost for connection to Salmon Arm's water system. It is expected their charges would be equivalent to a DCC charge which is currently proposed to be $2,868.00 per single-family lot. Adding this cost to Option 3 construction costs, the total project cost would be $8,154,000 + (200 x 2868) = $8,728,000.

Table 3.1
Option 1, 2, 3

Cost Item	Unit Price	Option 1 Well SW Corner		Option 2 Well SE Supply		Option 3 Salmon Arm Supply	
		Units	Costs	Units	Costs	Units	Costs
Water Well to 6 l/s	$125,000						
Water Well to 20 l/s	$150,000	2	$300,000	2	$300,000		
Well Pumpstation to 25 hp	$100,000						
Well Pumpstation to 60 hp	$130,000	2	$260,000	2	$260,000		
Booster Station to 25 hp	$175,000	2	$350,000	2	$350,000		
Booster Station 25 to 60 hp	$250,000			1	$250,000	2	$500,000
Reservoir to 375 m^3	$660/$m^3$	415	$274,000	405	$267,000		
Reservoir 375 - 600 m^3	$600/$m^3$					400	$240,000
PRV Station in Chamber	$35,000	2	$70,000	2	$70,000	4	$140,000
Watermains	$200	23,855	$4,771,000	26,870	$5,374,000	25,800	$5,160,000
SUBTOTAL			$6,025,000		$6,871,000		$6,040,000
35% Engineering/Contingency			$2,109,000		$2,405,000		$2,114,000
TOTAL (plus GST)			$8,134,000		$9,276,000		$8,154,000

Table 3.2
Option 4 – Local Area Water Supply Systems

Cost Item	Unit Price	#1 SW Grandview		#2 Central Area		#3 Black/Timms Rd		#4 SE Grandview		#5 NE Grandview	
		Unit	Cost	Unit	Cost	Unit	Cost	Unit	Cost	Unit	Cost
Water Well	Varies	1	$125,000	1	$150,000	1	$125,000	1	$125,000	1	$125,000
Well Pumpstation	varies	1	$120,000	1	$150,000	1	$130,000	1	$150,000	1	$120,000
Reservoir to 375 m^3	$660/$m^3$	-	-	115	$76,000	-	-	-	-	-	-
Watermains	$200/m	2,300	$460,000	5,900	$1,180,000	2,550	$510,000	3,000	$600,000	2,900	$580,000
SUBTOTAL			$705,000		$1,556,000		$765,000		$875,000		$825,000
35% Engineering/Contingency			$247,000		$545,000		$268,000		$306,000		$289,000
TOTAL (plus GST)			$952,000		$2,101,000		$1,033,000		$1,181,000		$1,114,000

A summary of the costs are as follows:

Option 1 – Well Supply Southwest Corner	$8,134,000
Option 2 – Well Supply Southeast Corner	$9,276,000
Option 3 – Supply from Salmon Arm	$8,728,000
Option 4 - #1 SW Grandview	$952,000
#2 Central Area	$2,101,000
#3 Black Timms Road	$1,033,000
#4 SE Grandview	$1,181,000
#5 NE Grandview	$1,114,000

Table 3.3 provides a cost per year per household. This calculation is based on the total capital cost borrowed at 5% amortized over 20 years. Grants from senior governments may be available for this project. However as it cannot be determined if grants will be obtained and if they were, what amount they would be, they have not been included. Costs for Options 1 to 3 have been divided over 200 residences; for Option 4, by the number of residences serviced by each option.

Averaging costs for each option provides an annual average cost of $3,430 per household.

Table 3.3
Annual Capital Costs

Option	Household Services	Capital Cost	Annual Cost
#1 SW Well Supply	200	$8,134,000	$3,330
#2 SE Well Supply	200	$9,276,000	$3,800
#3 Supply Salmon Arm	200	$8,728,000	$3,580
#1 SW Grandview	21	$952,000	$3,720
#2 Central Area	51	$2,101,000	$3,380
#3 Black/Timms Rd	31	$1,033,000	$2,730
#4 SE Grandview	26	$1,181,000	$3,720
#5 NE Grandview	29	$1,114,000	$3,150

There are additional costs to consider for a community water system. These will include operating costs, costs for fire protection if included, and costs for extension of the water service connection from the property line to each residence. Costs for the distribution system include only a connection to the property line.

Operating costs include salaries or fees paid to a water system operator for maintaining the system, power costs, chlorination/disinfection materials, maintenance and repairs, and an allowance set aside each year for replacement of equipment as it ages. For Grandview, we would expect annual operating costs to be in the order of $70,000 per year for the community systems. This would equate to a cost of $350 per connection. Costs will vary slightly between each option based on requirements for pumping and disinfection.

If fire protection were included, the costs for community systems would increase by approximately $600,000. This includes increase reservoir size, control valves in pump station to allow stored water to cascade from upper zones to lower zones, fire hydrant installation, and increase in some distribution main size. Fire protection will add approximately $250 capital cost per year per connection. Fire protection would not be available for Option 4.

Each residence would also have to extend the water service from their property line to their home. Costs will vary widely for these connections as it depends upon the length of the connection, the route the connection follows (restoration, etc) and how it is tied into the existing system. If homeowners wish to keep their existing wells for irrigation, backflow prevention will be required. Homeowners should budget between $75 and $100 per meter for their onsite connection.

Table 3.4 provides a summary of total annual costs for community water systems. We have assumed operating costs for Option 4 would be similar to the larger community systems at this stage. We have not included costs for onsite connections.

Table 3.4
Annual Costs for Community Water System

Option	Capital Cost	Operating Cost	Total Cost	Fire Protection Addition
#1 SW Well Supply	$3,330	$350	$3,680	$250
#2 SE Well Supply	$3,800	$375	$4,175	$250
#3 Supply Salmon Arm	$3,580	$350	$3,930	$250
#4 Small Systems				
#1 SW Grandview	$3,720	$350	$4,070	-
#2 Central Area	$3,380	$350	$3,730	-
#3 Black/Timms Rd	$2,730	$350	$3,080	-
#4 SE Grandview	$3,720	$350	$4,070	-
#5 NE Grandview	$3,150	$350	$3,500	-

4.0 CONCLUSIONS AND RECOMMENDATIONS

The following sections provides the conclusion and recommendations based on the findings of this study.

4.1 CONCLUSIONS

- There are a number of homes in Grandview Bench that have poor water quality and quantity.
- There appear to be areas adjacent to Grandview Bench that could provide a productive groundwater source.
- Community water systems can be constructed to service the majority of the users in Grandview. Based on the preliminary design work completed to date, Option 1 SW Well Supply appears to be the least expensive. It also have the advantage over Option 3 Salmon Arm Supply in that it does not tie Grandview to the requirements of Salmon Arm and leaves control of the utility with local residents.
- Options 1 and 2 rely on the ability to find groundwater sources to meet the needs of the community. This may be difficult to do and may require purchase of land for wells. Multiple wells may need to be drilled to meet demands which increases both capital and operating costs.
- Option 2 costs are the highest and therefore not considered to be the preferred option.
- All options with wells assume the only water treatment that is required is disinfection. Some sources may require additional treatment systems that will increase capital and operating costs.
- Option 3, connection to Salmon Arm will have the benefit of receiving fully-treated water meeting current health standards. The distribution system could also be operated as part of the municipality's which would help to ensure proper maintenance is provided.
- Options 1, 3 and components of 4 have the same order of magnitude costs based on this level of study. More detailed work would be required to obtain more accurate cost estimates for each option.

- Without senior government grants, which may not be available for this project, the costs for community systems may be unaffordable to the majority of residents in Grandview.

4.2 RECOMMENDATIONS

- The residents of Grandview Bench be presented with this information to determine the level of affordability for the project.

- If the community wishes to move forward with an overall water supply system, undertake the following:

  - Investigate the potential for senior government grants

  - As costs for Options 1 and 3 are the same order of magnitude, have discussions with the District of Salmon Arm with regard to connection to their water system. In the long term, connection to an adjacent community's water supply system may be the best option. Treatment requirements continue to evolve which may make the Salmon Arm option the most feasible

  - If discussions with Salmon Arm are not favourable or the community decides it wishes to have its own water system, conduct further investigation/analysis of the potential for groundwater supplies. Following this study, undertake a drilling program to locate productive water wells

  - Proceed with preliminary design of a community water system to obtain more accurate cost information

- If the community does not wish to proceed with an overall water system, conduct a door-to-door survey to identify high-priority areas where water quality and quantity are the greatest concern. Once these areas have been identified, undertake more detailed investigations/analysis of the potential for a localized groundwater source that could supply priority areas. If a source is identified, conduct a drilling program to confirm water supply. Complete a preliminary design of a local community water system to confirm costs.