20 YEAR CAPITAL PLAN
THE VILLAGE OF CANAL FLATS

20 Year Capital Plan

FINAL REPORT

October 27, 2014

The Village of Canal Flats
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WSP | FOCUS

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1 Introduction

The Village of Canal Flats 20 year capital plan covers the planning period from 2013 to 2033. The 20 year capital plan will provide guidance the Village through the next twenty years of growth and should form a vital component of the comprehensive 20 Year Financial Plan.

The 20 year capital plan contains general utility projects required to maintain levels of service, preserve existing assets, and provide opportunity for growth and economic development. Several documents and plans have been used in the preparation of the *Village of Canal Flats 20 Year Capital Plan* as follows:

- Official Community Plan (OCP), Village of Canal Flats, 2005
- 2011 Road Condition Survey – (Focus Corporation)
- Eagles Nest Estates Water System Evaluation – (BelMK)
- Eagles Nest Estates Water System Preliminary Design – (Focus Corporation)
- Existing mapping and aerial photos of the Village boundary
- Zoning Mapping
- Highway 93/95 Access to Village of Canal Flats Planning Study, 2005 (Web Engineering Ltd)
- Groundwater Investigation at the Canal Flats Wastewater Lagoons, 2014 (SNC Lavalin)
- Study to Prepare for a Stormwater Master Plan, 2012 (Derek Ashford)

The Village's growth is forecast to continue to grow over the next 20 years at an average rate of approximately 2.0%. With growth and aging infrastructure, the Village needs a strategic capital plan to forecast investment in infrastructure renewal and infrastructure to accommodate growth, economic development, and modifications to meet regulatory changes (e.g. water treatment and transportation safety).

A 20 Year Capital Plan committee (made up of Councillors, staff and members of the public) was formulated on September 23, 2013 and committee meetings were held on:

- November 7, 2013
- December 5, 2013 and
- September 4, 2014

1.1 Objective of the plan

There are a number of objectives to strive for in the development of a 20 year Capital Plan, including:

- Ability to develop a plan which supports the Official Community Plan,
- Provide Council with guidance and information upon which to base current and future capital expenditure decisions.
- Work with Council and/or their 20 Year Capital Plan committee to obtain input on growth areas

1.2 Community Vision

According to the OCP 2005, the vision is a strong sense of community pride based on programs which include the provision of quality community services, expanded land use, infrastructure enhancement and beautification. Specifically the primary principles are:

- Protect and enhance the natural environment
- Support additional recreation and open space
- Support agriculture
- Manage growth
- Use limited land wisely
- Provide a diverse range of housing
- Support economic development
- Ensure safe, convenient transportation for all
- Protect infrastructure
- Support community participation and involvement

The 20 Year Capital Plan takes steps to achieve the community's vision.

Transportation projects place emphasis on complete streets, active transportation, pedestrians and cycling

Roadway projects ensured roadways support development and sustainability goals and are consistent with the 20 Year Major Road Network Plan

Economic Development projects are focused on a sustainable prosperity that maintains a positive business climate

In summary, the 20 Year Capital Plan targets many of the goals, objectives and policies in the OCP and aims to create a sustainable city where environmental concerns are addressed along with the goal of creating a place where people want to live, work and play.

1.3 Risk Factors

As with any plan, the *20 Year Capital Plan* is based on conditions that exist at the time of preparation. Using current costs and service levels can provide a reasonable estimate of future requirements. There are still several risk factors associated with this plan, including:

- Service level changes
- Increased operating costs resulting from new infrastructure
- General Revenue erosion due to economic change
- Provincial support and/or additional provincial downloading
- Projected growth rate changes
- Tax revenue reduction (e.g. economic slowdown)
- Unanticipated disasters

Any of the above factors could cause a change in the size or direction of *the 20 Year Capital Plan*. To manage these factors, the plan should be reviewed and adjusted every 5 years to coincide with prevailing demands and conditions.

2 Population

2.1 Current and Future Population (2033)

The current and 20 year projected populations are estimated and presented in the table below.

Existing and Future Population

Area of Canal Flats	Existing	Possible 20 Year Growth	Future Population
Residential Population			
Canal Flats Water System	715 people (238 units)	See Below	715
Seasonal RV and Cottage Strata (Lands north of Bighorn Estates and School Property)	Doesn't Exist	300 people (150 units)	300
Painted Ridge	No Homes Currently	90 people (60 units)	90
Eagles Nest	96 people (32 units)	Assumed Full Build Out	96
Bighorn Sheep Lane	24 people (8 homes currently)	36 people (12 units)	60
Estimated Residential Totals	**835 people**	**426 people**	**1261 people**
Other Equivalent Residential Populations			
Institutional Population	222 people	34 people	256 people
Commercial Population	65 people	245 people	310 people
Industrial Population	25 people	0	25 people
Total Estimated Population	**1,147 people**	**705 people**	**1,852 people**

The above projection includes a 2.0 to 2.1 percent population increase per year for the next 20 years.

Also, the Bighorn Sheep Lane residents are not connected to the community water system currently.

Note that a three person household for residential and two person household for RV/Cottage was established for planning and assessment purposes.

2.2 Future Development Areas

Future development areas for residential use have been identified as the existing golf course lands and property to the north of Bighorn Estates.

It is estimated that the golf course lands could produce approximately 105 single family dwelling units, however, this land is privately owned and although the golf course hasn't been open for the last few years, no steps towards any land use changes have occurred to date and as such, development units associated with these lands have not been presented in the table in 2.1. However, for completeness, if the golf course lands were to develop in the next 20 years in addition to the assumptions presented in the table in 2.1, it would represent an overall annual increase of 4.5%.

It is estimated that the property to the north of Bighorn Estates could generate an additional 150 RV and cottage style development units as reported by the current owner, Benny Boyz Ventures Ltd, at a recent public hearing to consider rezoning the lands to RES-1.

2.3 Residential/Commercial Growth Forecast

The current Official Community Plan (OCP) for the Village of Canal Flats has established a 2% annual growth for planning purposes. In discussions with the 20 Year Capital Plan Committee, it was thought that this growth rate is high, however, given the 20 Year Capital Plan should be revisited in 5 years, the 2% annual growth rate was carried with specific consideration given to the following areas of growth:

1) Painted Ridge
2) Bighorn Sheep Lane
3) Benny Boyz Ventures Ltd Property north of Bighorn Estates/School

A small increase in student population is shown and a large increase in the commercial type land use was also projected.

3 Roads

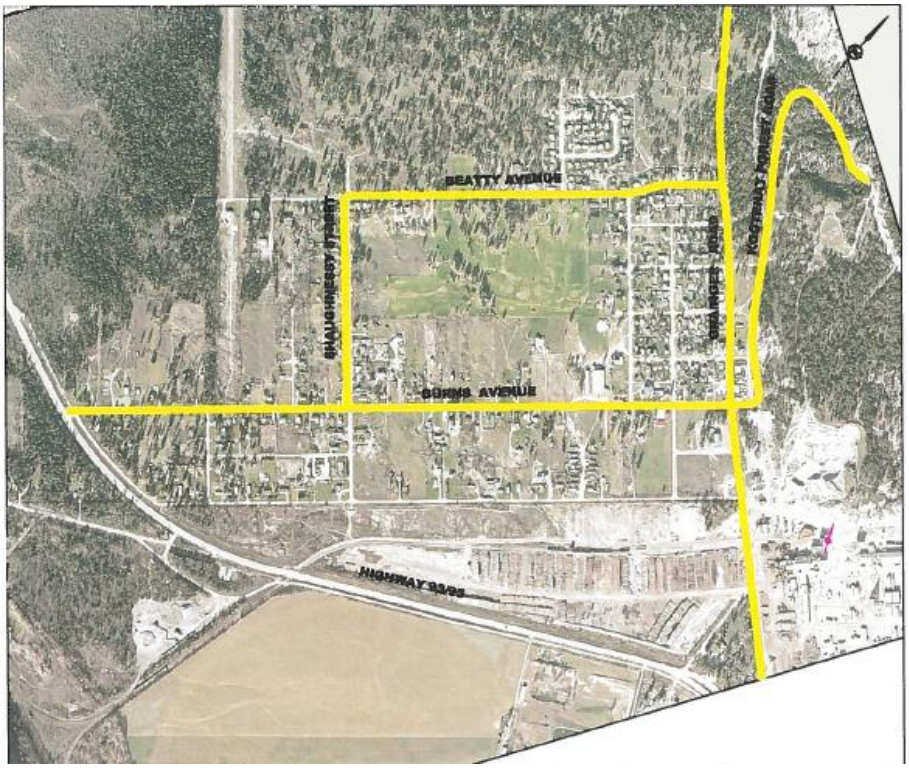
3.1 Existing Road Network Analysis

A *Highway 93/95 Access to Village of Canal Flats Planning Study* was completed by WEB Engineering Ltd in July 2005 for the Ministry of Transportation. The report contained the following objectives:

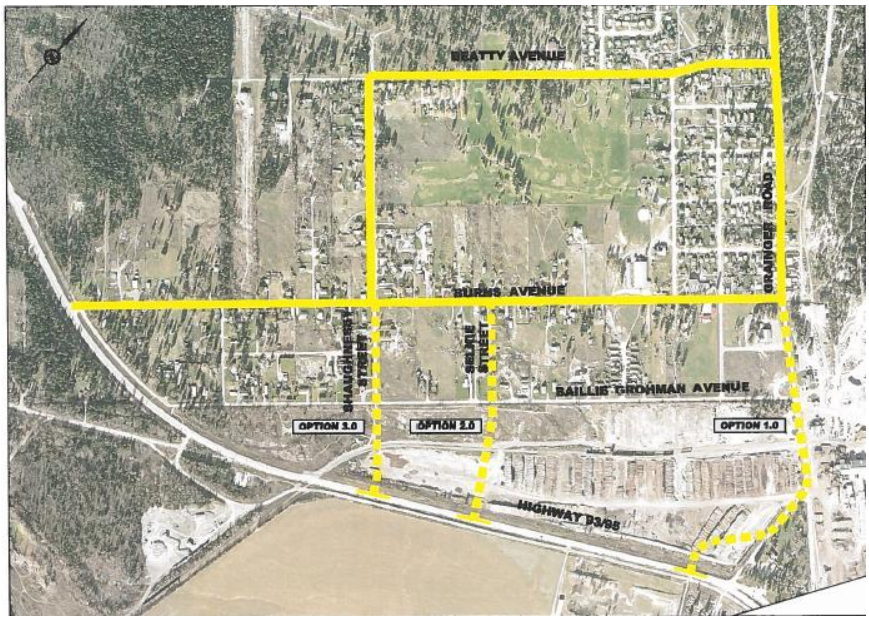
- To undertake a technical review to identify, evaluate and report on current roads entering the Village, improvements to such and the provision of alternate connections to the Highway

- Generally address access management, traffic and safety aspects along the controlled access Highway between Grainger Road in the south and Burns Avenue in the north
- To undertake a technical review of the current street network with Canal Flats and amendments necessary to the Major Street Network Plan
- To define any conceptual improvement options on the Highway

The report defines the following as the existing Canal Flats major street network plan.



The WEB report proposes the following major street network plan.



In addition to the above, Brian Woodward (CAO for the Village of Canal Flats) indicated that in previous discussions between himself and representatives of the Ministry of Transportation and Infrastructure (MoTI) Rocky Mountain District office, MoTI indicated that their policy for access to their highway corridor, Highway 93/95, should be limited and any lands developed along the frontage of their corridor should be accessed via a frontage road. This is current MoTI policy.

3.2 Road Network Recommendations

In addition to the WEB Engineering Report, Focus Corporation completed a Road Condition Survey of the Villages road network in 2011. The report concluded that road shoulders throughout the entire road network are in need of repair or do not exist. In some cases the shoulders are higher than the road surface and the gravels are uneven which does not allow for proper drainage. Cracking and potholes in combination with poor drainage promotes subsurface infiltration into the pavement structure which can create frost-heave situations. Compaction effort during construction of the shoulder is important to ensure the integrity of the surface to minimize impacts of traffic use to avoid eroding or loosening road shoulder gravels. It is essential that shoulders are constructed as per the Village of Canal Flats Subdivision & Development Servicing Bylaw (Detail SD-5) and the shoulder allows drainage to run off the road into developed ditches for stormwater discharge to controlled sites.

It should also be noted that the Village of Canal Flats staff have commented on evidence of early failure on Shaughnessy Street and Burns Avenue asphalt overlays. They have identified that there is a layer of

clay between the surface and the gravel base. A geotechnical assessment of the area is necessary to determine the rehabilitation requirements to extend the lifespan of these two roads.

Based on the visual survey of the roads and observations during the site survey, the following preventative maintenance measures were recommended:

- Crack sealing should be completed annually to ensure water does not penetrate below the asphalt surface;
- Ensure culverts are not clogged and should be free draining;
- Ensure ditches are graded to prevent pooling surface water adjacent to the roadway;
- Install roadside barriers where required (safety measure);
- Provide positive drainage away from the road surfaces; and
- Complete water and sewer assessments to maximize resources and reduce redundancy of road repairs.

It was recommended that a phased plan be implemented to replace roads in conjunction with water and sewer main replacement. In addition to review of main replacement, extension of services for infill development and potential realignment of the sewage forcemain should also be considered when coordinating surface repairs and road replacement. A geotechnical consultant should be engaged to assess the subgrade material and pavement structure for each road replacement.

An opinion of probable cost was completed for the Road Condition Survey for the various repairs based on the following:

- Crack sealing: Pressure clean the crack and fill with a rubberized and elasticized asphalt sealant. The estimate was calculated using $2.85/m based on a project length of 2500m. The unit price may increase if the quantity is less than 2500m and may decrease if the quantity is more than 2500m.
- Pothole Repair: Cost to repair potholes is estimated at $150/$m^2$. Pothole repair will include removing existing asphalt and repaving. This cost includes mobilization and demobilization as well as sawcutting for the entire pothole project (all roads). An extra $20,000 was included to repair potholes within areas that require other repairs. It is possible that dig and repair areas will be included in long term plans. Therefore, temporary pothole repairs can be done to improve the driveability of the roads until permanent repairs are completed.
- Shoulder Repair: Road shoulders throughout the entire road network are in need of repair. It was assumed that the entire 24km road network requires shoulder repair on both sides of the road. The cost to repair shoulders is estimated at $8/m.
- Edge Repair & Ravelling/Rutting: Remove the existing asphalt and repave. The cost estimate is based on $15/$m^2$ for asphalt removal & disposal and $30/$m^2$ asphalt placement (75mm thick) including sawcutting.
- Dig and repair: Remove existing road structure (asphalt, base and subbase) install new gravel subbase, base and asphalt further to geotechnical recommendations. Apavement structure of

300mm subbase, 100mm base and 75mm asphalt was assumed. The cost estimate is based on $19/m^2 for removal & disposal of asphalt and gravels, $57/m^2 for subgrade preparation and installation of gravel subbase, base and asphalt. In some cases, a lap joint may be required (cost not included in this report estimate) and a woven geotextile recommended. A geotechnical investigation is required to determine the required road cross section and assess the need for geotextile. The estimate for geotextile (fabric and grid) is $6/m^2 – this added road construction measure was included in the cost estimates for Grainger Road works only. Geotextile may be required for other roads as well.

- Ditch Work: There were some areas that were specifically noted as needing work to ensure positive drainage away from the road structure. An allowance was made at $8/m to regrade these ditches. It is anticipated that additional ditch work will be required and therefore an allowance of $10,000 was added to the estimated cost for Priority 2 and Priority 3.
- Roadside Barrier: Concrete roadside barriers are recommended where the road embankment is more than 1.5:1 and there is a vertical drop of more than 2m. The unit price used in this estimate for precast concrete barriers is $100/m. The requirement for road side barrier was noted for short sections along Grainger Road.

Road Condition Survey Opinion of Probable Cost – Maintenance and Road Repair

PRIORITY	DESCRIPTION	OPINION OF PROBABLE COST
1	Annual Crack Sealing Pothole Repairs	$18,500 plus 15% contingency $22,000 plus 15% contingency
2	Major Road Network & $10,000 for Ditch Work	$580,000 plus 10% engineering and 15% contingency
3	Other Road Repairs & $10,000 for Ditch Work	$870,000 plus 10% engineering and 15% contingency
Misc.	Shoulder Repair	$40,000 plus 15% contingency

Note: All costs exclude taxes.

Priority 1 comprises of crack sealing the entire road network and repairing potholes. The crack sealing and pothole repair costs were separated from the other required repairs in the table above. The total cost for Priority 1 is $40,500 plus 15% contingency. Priority 2 and 3 include all other recommended repairs. A crack sealing annual budget and program was established following the release of the 2011 Road Condition Survey.

Priority 2 includes repairs recommended for the major road network. It was assumed that a woven geotextile is required for all dig and repair sections on Grainger Road to stabilize the subgrade material. This will have to be confirmed by a geotechnical engineer and further site investigation (excavation or

drilling). Grainger Road was recently upgraded from the south intersection of Richardson Crescent to the base of the south hillside inclusive of:

1) the removal of the existing thin (25mm thickness) seal coat, the addition of 100mm thickness of 19mm minus crushed gravel and 50mm of asphalt above an existing 100mm thickness gravel base and existing 300mm thickness subbase (approximately 10% passing the US Size 200 sieve) above the native glacial till for the first 275 metres of Grainger Road (base of hill to the north)
2) Levelling course asphalt overlay (230 tonnes) beyond the 275 metre initial road section to a width of 6 metres
3) 50 to 65mm asphalt overlay over levelling course
4) New asphalt surface from the south end of Richardson Crescent south to the base of the Grainger Road hill

Priority 3 includes repairs recommended for the remaining roads. Priority 3 was assigned to the paving of Willow Avenue. It was assumed that the subbase and base materials would have to be replaced prior to paving these roads. This should be confirmed by a geotechnical engineer.

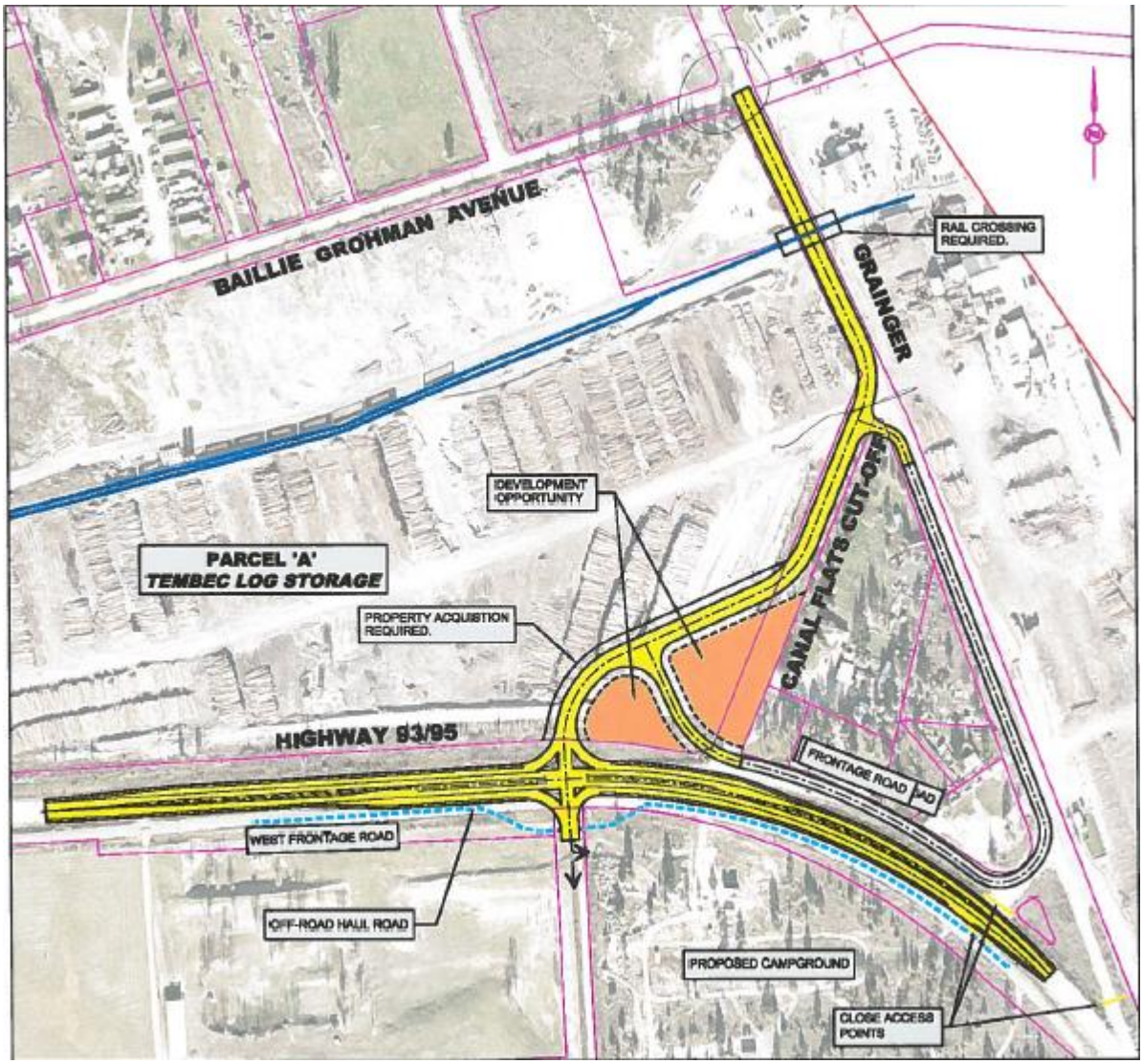
Note that the results of the road condition survey are based on observations only (ie asphalt cracking, pot holes, localized settlement). The actual cause for road surface/structure failures can only be determined by test hole excavations and materials testing analysis by a geotechnical engineer.

In addition to the above, the Disaster Financial Assistance (DFA) program has provided to the Village a $25,000 allotment for 80% of the project cost to resurface McGrath Avenue from Dunn Street to Arbuckle.

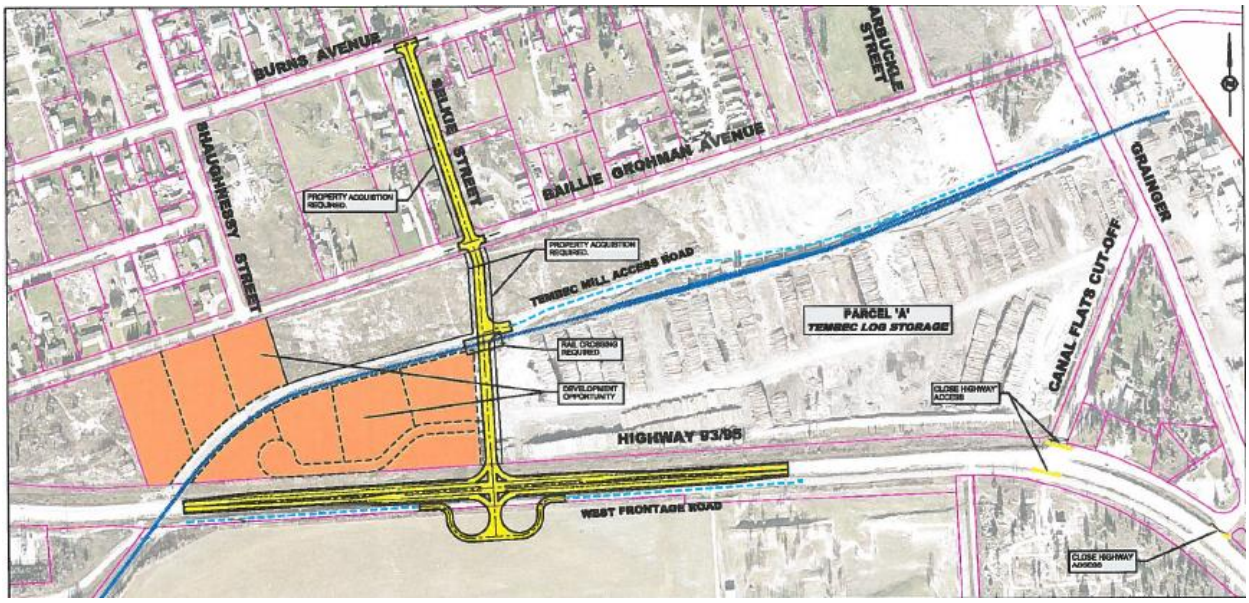
The WEB Engineering planning report developed three options for Highway 93/95 intersection improvements as follows:

Option 1) Grainger Road ($2,777,000)
Option 2) Selkie Street ($2,648,000)
Option 3) Shaughnessy Street ($2,500,000)

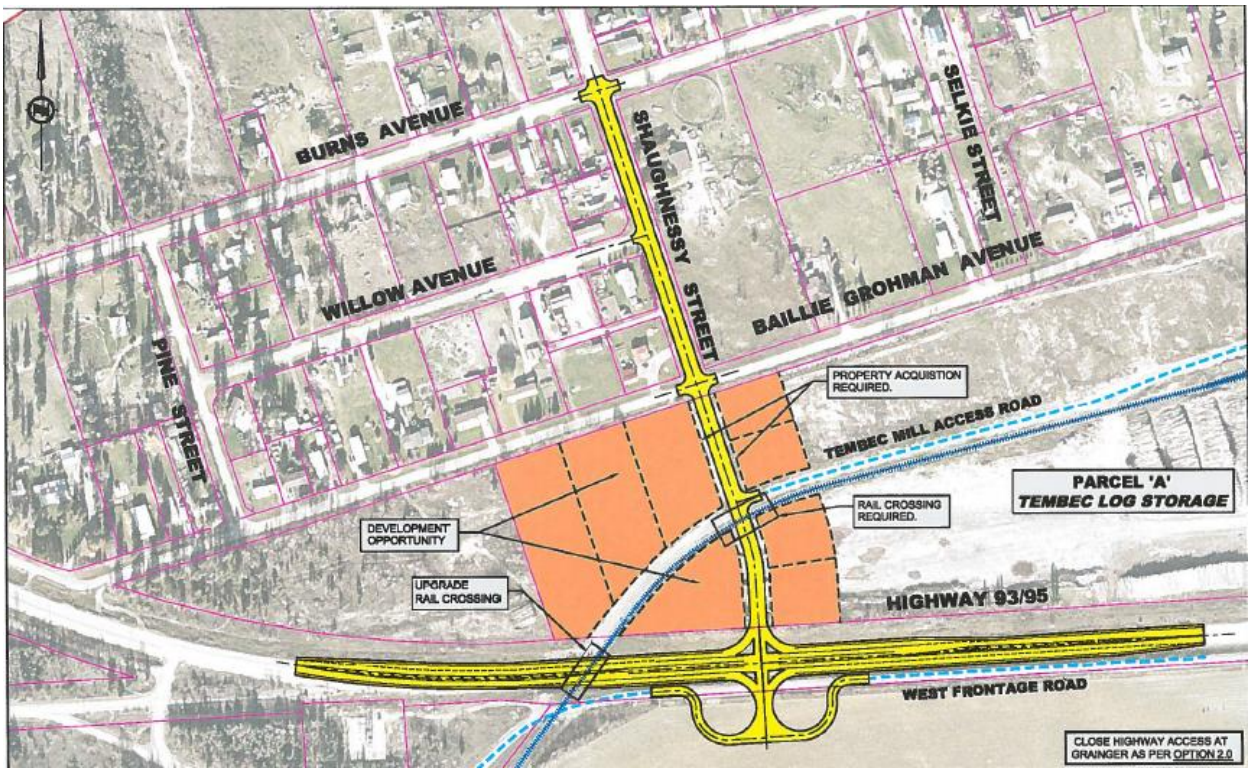
Option 1) was presented as follows:



Option 2) was presented as follows:



Option 3) was presented as follows:



To date, no formal comments regarding the WEB report have been provided by MoTI.

3.2.1 Proposed Major Road Upgrades

Based on an estimated construction cost of $1,500,000 to repair and rebuild roads identified in the Road Condition Survey, the Village should consider an annual budget of $75,000 to $100,000 (plus taxes) for road upgrades over the next 20 year period. The current council budgeting policy for annual road upgrades is $70,000.

The Road Condition Survey Major Street Network Upgrades include the following:

1) Beatty Avenue – estimated $60,000 in improvements
2) Shaughnessy Avenue – estimated $3,000 in improvements
3) Grainger Road – estimated $240,000 in improvements (includes to 170 metres north of Cottage Lane)
4) Burns Avenue - estimated $4,000 in improvements

The details of each road assessment can be found in the Road Condition Survey Report.

3.2.2 Future Road Upgrades

The future road upgrades for longterm planning are currently limited to the Highway 93/95 intersection improvements – Options 1 to 3.

4 Water System

4.1 Existing Water Supply and Distribution System

The following provides a very brief summary of the current Village water supply system located in the north end of the Village on Discovery Street. The Village water supply is derived from a gravel and sand aquifer located less than 14 meters below ground surface. The province classifies this aquifer as high productivity, high vulnerability water well. The high vulnerability indicates a potential susceptibility to contamination from surface activities. The Village currently uses two water wells equipped with vertical turbine pumps, originating back to the 1970's and subject to some mechanical maintenance since that time and ongoing maintenance issues. The water provided by the wells is sampled in accordance with the requirements of the Drinking Water Officer and meets Canadian Drinking Water Quality Guidelines. The Village does not use any filtration or disinfection systems to treat the water supply. The water is pumped from the wells to residences and concurrently travels to an elevated gunite storage tank with an approximate volume equal to 105 m^3. In 2007, the Village drilled a third water well to obtain additional capacity as recommended by an engineering consultant (Bel MK 2006). That well was equipped with a submersible pump and initial testing indicated that the safe long-term yield of this well was in the order of 25 Lps (330 Igpm), although short term yields for emergency use, such as fire flow, could be substantially higher up to 131 l/s. The Village is currently completing the Interior Health process for approved use of the third well.

Due to the shallow nature of the aquifer and urban development within the well capture zone, Interior Health has expressed concerns regarding the security of the water supply and the lack of treatment. Interior Health has requested that the Village take steps to improve the drinking water quality that includes:

- the 4-3-2-1-0 approach recommended 4-log (99.99 percent) inactivation or removal of viruses, 3-log (99.9 percent) inactivation and/or removal of Giardia and Cryptosporidia, dual treatment (filtration and disinfection), less than 1 NTU turbidity, and 0 total or fecal coliforms.
- develop an alternate, more secure supply
- develop an aquifer protection plan.

The aquifer protection plan is under development.

The following summarizes the Well Protection Area information presented in the Golder Report.

"To efficiently manage and protect a groundwater supply, an understanding of the well "capture zone" and "time of travel" zones is required. A "capture zone" is the area of an aquifer from which all groundwater will eventually arrive at the production well, even after a considerable amount of time. A "time of travel" zone is the area of an aquifer from which groundwater will be derived in a predefined amount of time. For example, if a conservative contaminant is released with the 1 – year time of travel zone, it can be expected to arrive at the production well in approximately 1 year. Once the time of travel

zones are estimated, protective measures can be implemented within the zones to ensure the safety of the water supply."

Nick Berzins, PEng of *Thunderwater Engineering and Construction Inc* identified:

> For the purpose of this study, Golder Associates completed a preliminary estimate of the 60 day time of travel capture zone for Well #3. The 60 day, rather than the 50 day, time of capture zone is typically utilized in British Columbia for the estimation of the extent of a capture zone area around a well head with vulnerability to biological risk."
>
> Based on the hydrogeological regime in the area of the Village and the limited amount of available information, particularly with regards to hydraulic properties, it was decided that an analytical solution would be the most appropriate for the determination of the 60 day time of travel for Well #3.
>
> The specific analytical solution used was developed by Ceric and Haitjema (2005) in their paper in the technical journal, Groundwater. The solution presents various options for determining the capture zone based on an initial calculation incorporating flow gradient and pumping rate. Using the groundwater flow gradient for the aquifer established in Section 3.2 and assuming the maximum sustained rate extracted from Well #3 is 25L/s, the 60 day time of travel for the well is represented by an elongated oval with a maximum dimension of approximately 460 m in the up-gradient direction (southeast) and 130 m at right angles to the maximum dimension. The capture zone extends approximately 20 m in the down-gradient direction (north).
>
> It should be noted that it is not considered feasible to determine longer period of travel capture zones for the wells in the aquifer without more detailed information on the spatial properties of the aquifer.
>
> Rather than spend financial and staff labor resources on further assessment, in what may be a very complex channel-like hydrogeological setting, a simple effective approach is to adopt the 60 day capture zone as presented and to apply a "contingency" or "factor of safety" to that calculation. Therefore, pending further aquifer testing and hydrogeology modeling a factor of safety of 1.5 will be applied to the Golder Associates calculations. The capture zone defines the "highest risk area" and may require more stringent groundwater protection actions.

The 60 day capture zone was redefined by Nick Berzins according to the above. No further investigation has been conducted to relocate the Village drinking wells, but rather a community information and education system and a heightened awareness to protect the capture zone for the wells from potential contamination has been the Village's approach to well head protection.

In addition to the Village proper water supply, the Village of Canal Flats has also purchased the existing water supply, storage and distribution system from the users of the Eagle's Nest Water System, situated north of the Village of Canal Flats proper and accessed by Grainger Road. The water source and reservoir will be abandoned and the existing Canal Flats water system extension along Grainger Road to connect to the Eagle's Nest Water System is well underway. The pipeline infrastructure is installed and the booster station and reservoir volume upgrades will be completed under the current funding.

The reservoir capacity was increased to meet the requirements of the future population needs and fire flow storage equal to municipal standards. The reservoir was sized to accommodate the Eagle's Nest Water System and the Village of Canal Flats proper residential, institutional, industrial, and commercial peak hour and balancing storage water demands for the existing conditions as well as estimated future demand projections. The reservoir sizing also provides sufficient supply of fire flow delivery equal to 100 Lps, as calculated using the Fire Underwriters Survey (FUS) guidelines for the larger fire need users (the school and the Jade Landing development). The Focus Corporation suggested that Village of Canal Flats council consider an above ground steel bolted reservoir rather than a concrete reservoir. The above ground steel reservoir option is widely used in small water systems and in municipalities and was selected for the project.

The booster station is required to provide adequate water pressure to the Eagle's Nest area. The pumps in the booster station were sized to provide peak hour demand and the required fire flows of 70 Lps.

The back up power generator for the booster station was sized to supply back up power to the well site well-pumps. The existing back up power to the well pumps is aging and requires replacement. Connection of the power from the booster station generator to the well pump house will be required as a separate project or completed with remaining funds from the Eagles Nest Water System (ENWS) project.

The design criteria used for this assessment relate to the reservoir sizing as follows:

The reservoir capacity shall not be less than the greater of:

- The one day average annual consumption of the service area, or
- The total storage requirement A+B+C where:
- A=Fire storage to meet the Fire Underwriters Survey (FUS) Guidelines with not less than the fire flows for the highest fire demand in the service area as specified in the bylaw
- B=Equalization Storage of 25% of the maximum day demand (MDD) of the service area
- C=Emergency Storage of 25% of A+B

The Village of Canal Flats Subdivision and Development Servicing Bylaw 82, 2007 in combination with the Master Municipal Contract Documents (MMCD) design criteria was used to determine the water design flows. Design flows established in other communities in the surrounding area were also

considered as part of the process to determine the appropriate design flow criteria for the Village of Canal Flats.

- District of Sparwood MDD = 1,200 Lpcd
- City of Cranbrook MDD = 1,700 Lpcd
- City of Kimberley MDD = 3,040 Lpcd

These communities allow for high consumption due to irrigation but the Eagles Nest service area has irrigation restrictions.

The design flow criteria used to calculate the MDD is as follows:

- MDD = 775 Lpcd (litres per capita per day) for residential, commercial and institutional areas
- MDD = 100 Lpcd (litres per capita per day) for industrial office

The design criteria for fire flow are as follows:

- Fire flow calculations were completed using Fire Underwriters Survey Methodology for the school and the multi-family development and it was determined that the required fire flow is 100L/s.

Service Population

The Village of Canal Flats water system services the residential, institutional, commercial and industrial population. The existing and estimated future populations are summarized in the table in Section 2.1.

The future residential population was calculated assuming a minimum 2% growth of existing population inclusive of a potential seasonal RV and cottage style development, build out of Painted Ridge and Bighorn Sheep Lane.

Institutional populations assume that for any given day, only a quarter of the population will contribute to the institutional water demand as calculated in the Bell MK report.

The existing commercial population is based on the current area with existing commercial buildings and a density of 90 people per hectare (MMCD Design Specifications). The future commercial population is calculated assuming 20% of the total commercial area within Canal Flats is developed.

The industrial sawmill's office is connected to the Village water system and the office consumption is calculated based on a population of 25 office employees (Bel MK). The MMCD design specifications suggests an average day demand of 50 Lpd per employee in an office and therefore the industrial water demand is calculated using an MDD of 100 Lpd per employee.

The estimated future population was used to calculate the ultimate reservoir storage as shown below:

Maximum Day Demand and Reservoir Sizing

Maximum Day Demand (MDD)			
	Population	MDD (Lpcd)	MDD (Lpd)
Residential	1,261	775	997,275
Institutional	256	775	198,400
Commercial	310	775	240,250
Industrial	25	100	2,500
		Total MDD (Lpd)	1,418,425
		Total MDD (Lps)	16.4
		Well #3 Pump (Lps)	25
Ultimate Reservoir Storage = A+B+C			**Volume (L)**
A = Fire Flow Storage (100 Lps for 2 hours)			720,000
B = Equalization Storage (25% of MDD)			354,606
C = Emergency Storage (25% of A+B)			268,652
Ultimate Reservoir Storage			**1,343,258 L**
Ultimate Reservoir Storage			**1,343 m^3**
20 Year Projection Reservoir Storage			**354,556 USgal**
Actual Reservoir Volume (2014 Project)			**371,600 USgal**

The existing gunite reservoir (1,238 cubic metres deficient for required reservoir volume) will be taken offline and used for back up related to maintenance of the new reservoir. The new reservoir volume is 371,600 US gallons located immediately adjacent the existing reservoir.

Note that volume can be expanded for the new above ground steel reservoir by adding panels at any time in the future to a maximum additional height of 8 feet (an additional 36,000 US gal).

4.2 Water Treatment Requirements

As mentioned above, the Village of Canal Flats currently does not treat or disinfect their potable water supply. Because the supply aquifer is shallow and under the influence of a surface water (Kootenay River), BC Interior Health generally will require that the supply be treated/protected to result in the following:

- 4-3-2-1-0 approach recommended
- 4-log (99.99 percent) inactivation or removal of viruses,
- 3-log (99.9 percent) inactivation and/or removal of Giardia and Cryptosporidium,
- dual treatment (filtration and disinfection),

- less than 1 NTU turbidity, and 0 total or fecal coliforms.

To guarantee and achieve all of the items noted above 100% of the time, the following item facilities are required:

- Filtration
- UV Disinfection and
- Chlorination

Many communities are seeking filtration treatment deferral. The filtration deferral process is governed by Section 4.3 of the *Drinking Water Treatment Objective (Microbial) for Surface Water Supplies In BC* and the Village must demonstrate they meet the criteria outlined in Section 4.3. A short summary of the requirements is provided below:

1. Overall inactivation is met using a minimum of two disinfections, providing 4-log reduction of viruses and 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. The 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 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 1 NTU, but do not exceed 5 NTU for more than two 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, 2003)

Filtration deferral is an ongoing process and water system operation must continuously show that the four items listed above are met. It should be noted that applying for exclusion of filtration criteria does not mean filtration will never be needed in the future. A consistent supply of good water quality is critical to the approach, but water supply quality can change and therefore continuous assessment of water supply conditions is necessary.

It is our understanding that the Village of Canal Flats has numerous years of continuous bacteriological testing that meets the criteria set in item 2 above. And a well head protection plan has been prepared in draft form to be finalized in 2014. The Village will have to install an online turbidity meter to handle Item 3, leaving the requirement for chlorination and UV disinfection, assuming the turbidity results are satisfactory. Based on the information Focus has seen to date relating to the water quality of the wells, we do not expect unsatisfactory turbidity results.

To plan for a UV disinfection system design, the Village should collect additional water chemistry data from the wells including the following:

- UV Transmissivity (unfiltered)
- Colour

- Total Organic Carbon
- Particle Distribution analysis
- Hydrocarbons
- Dissolved Iron
- Dissolved Manganese
- Hardness
- Hydrogen Sulfide
- Iron Bacteria
- pH
- Suspended Solids
- Turbidity
- Total Coliform

To effectively make use of a chlorination injection system, a chlorine contact time must be achieved to kill any potential viruses before reaching the first customer tap. To do this, a dedicated pipeline to the reservoir is required. The initial stage of this dedicated pipeline was installed with the Bighorn Estates subdivision. Another 415 metres of pipeline is required to complete the dedicated pipeline. The chlorine contact time is based on the difference in time from the moment the chlorine solution is added to the supply line to the reservoir and the corresponding water/chlorine solution is supplied to the first customer. The estimated chlorine contact time can be calculated based on the following formula and parameters:

$$\text{CT}_{\text{lowest actual}} = C \times \frac{T_{10}}{T} \times \frac{V_{\min}}{Q_{peak}}$$

- Reservoir baffling factor of 0.10 (T_{10} / T)
- Reservoir Volume = 1,405,000 Litres (371,000 US gallons)
- Estimated Current Peak flow rate = 25 Lps (Peak Hour)
- Estimated Average Chlorine Residual = 0.95 ppm or 0.95 mg/l

So the CT (chlorine contact time) is *0.95x0.1x(1,405,000/(25x60)* = **89 minutes.** Note that to obtain a 4-log inactivation of viruses for water with a temperature of 5 degrees Celsius and a water pH of 7.5, a chlorine contact time of only 8 minutes is necessary.

4.3 Water System Upgrades

Water distribution piping upgrades will be required to deliver fire flow to all areas within the Village of Canal Flats boundaries, unless otherwise authorized by Council policy and directives. Water modelling results, using EPAnet 2.0 software for an uncalibrated water model indicate that the 100 Lps fire flow cannot be delivered to the Jade Landing development. This is further hindered by the 150mm diameter

distribution pipes contained within the Jade Landing looped water system. Watermain connections from Shaughnessy Street and Beatty Avenue will be required to increase the flow to the Jade Landing development. It should be noted that the pipelines within the Jade Landing development are not owned and operated by the Village, but form part of the building strata common assets. As such, the Village is not responsible for upsizing the Jade Landing watermains.

In addition, should commercial land use be developed along a future new highway intersection corridor, the 150mm diameter pipelines currently supplying the area may not provide sufficient fire flow resulting in pipeline upgrades (to 200 or 250mm diameter piping) or the need for new and renovated commercial buildings to install internal fire suppression sprinkler systems with adequate service piping (ie 50mm diameter or greater). Fire flow assessments should be prepared and submitted with each development proposal.

Some properties within the Village boundary are not serviced with water distribution piping and some residents with larger parcels are serviced with groundwater wells. The areas not serviced include:

- West of Pine Street
- Baille Grohman east of Shaughnessy Street
- Selkie Street
- Don Avenue
- Flats Avenue
- Arbuckle South of Burns and
- Bighorn Sheep Lane residents

With regard to the Bighorn Sheep Lane residents, the fire pump in the new booster station will have to be upsized to provide fire flow to the end of the cul-de-sac by changing the ENWS fire pump and motor from a 40 Hp to a 100 Hp and additional stages added to the duty pumps. Servicing the Bighorn Sheep Lane residents was considered and to service each parcel, a 200 or 250mm diameter PVC pipe extension (approximately 480 metres) along the Bighorn Sheep Lane is required and a pressure reducing station to control system pressures beyond the Painted Ridge development will be required. In the interim, a new fire hydrant along Grainger Road was installed just south of the Bighorn Sheep Lane intersection on the new pipe supply line.

A number of existing watermains within the Village of Canal Flats are currently undersized to deliver fire flow to residential areas. These watermains are 100mm and 50mm in diameter and existing along:

- Cedar Crescent east of Tamarack Street (approximately 390 metres)
- Stevens Avenue (approximately 260 metres)
- Luck Avenue (approximately 260 metres)
- Service to the Trailer Park (50mm)

4.3.1 Immediate Water System Upgrades

The 2013-2014 water system upgrades remove the immediate water system upgrades related to supply and reservoir storage.

In the case of the undersized 50mm and 100mm diameter piping, where possible, any fire hydrants connected to the smaller pipes should be disconnected and reconnected to the nearest existing 150mm diameter watermain and the watermain replacements can then be considered beyond the 20 year capital plan or with planned road rehabilitation projects, which again, are not proposed within the next 20 years.

For example, upgrading the undersized watermains can be avoided as follows:

1) Cedar Crescent Fire Hydrant – connect it to the Bighorn Meadows 150mm diameter watermain or install a pipeline along the existing lane situated between Tamarack Street and the eastern leg of Cedar Crescent – work case scenario 140 metres of new piping and fire hydrant
2) Stevens Avenue – reconnect fire hydrant to Dunn Road 150mm diameter watermain
3) Luck Avenue – no record of fire hydrant on Luck Avenue 100mm diameter watermain
4) Service to Trailer Park – not a concern of the Village, but should be upgraded as a condition of any further development and related approvals on the site.

Village staff have indicated that as part of the Eagles Nest Water System (ENWS) connection project, the grant funding conditions require a water meter installation at the well head.

4.3.2 Future Water System Upgrades

It is likely that BC Interior Health will require a minimum dual barrier disinfection system for the Village of Canal Flats potable Water supply. It is estimated the costs associated with the supply and installation of a chlorine and UV disinfection system will be between $750,000 and $950,000. This project should include upgrading the current well pump building(s) into one inclusive structure.

5 Sanitary Sewer System

5.1 Existing Sanitary Sewer System

A majority of the existing sanitary sewage collection system was constructed in 1980 with a mix of 200mm diameter and 250mm diameter PVC pipe constructed in a high groundwater table at a 0.4% grade in a majority of the service area. Village staff indicated that some of the piping was installed in the 1960's, however evidence of this was not provided to Focus for the purposes of this report.

Only a few smaller subdivision developments have been added to the sewage collection system since the early 1980's, all within the last 10 years, including:

- Columbia View Crescent (11 units)
- Jade Landing on Quinn Street, Emerald Avenue, Doherty Street and McArthur Avenue (66 Units)
- Bighorn Estates on Ponderosa Crescent, Columbia Springs Drive and Mountain View Street (42 Units)
- Rundle Place (10 units) and
- A few 2 to 3 lot panhandle type subdivisions

The sewage collection system is relatively new with a majority of the piping system at 34 years of aging and the newer piping at 10 years or less. The lifespan of PVC sewage gravity piping can be 50 or 60 years or longer. Replacement of any gravity sewer piping is not expected to occur within the next 20 years.

The sewage is collected by two sewage lift stations. The first sewage lift station is located on Shaughnessy Street approximately 110 metres north of Alder Avenue. Approximately one third of the Village's sewage drains to the Shaughnessy sewage lift station (SSLS). The SSLS pumps sewage to a gravity manhole situated at the intersection of Beatty Avenue and Tamarack Street through a 100mm diameter PVC sewage forcemain, a distance of approximately 876 metres at a lift of approximately 4.5 metres. From the gravity manhole discharge, the sewage flows north to the end of Tamarack Street where it discharges to the main sewage lift station (MSLS). The MSLS collects sewage from the eastern portion of the Village – east of the school, golf course, Dunn Street and Arbuckle Road as well as all of the sewage from the SSLS. The MSLS pumps the sewage from all of Canal Flats to the sewage treatment ponds, which are located south of Highway 93/95, just north of the Kootenay River and immediately west of the Kootenay River RV Resort. The MSLS sewage forcemain is a 150mm diameter asbestos cement pressure pipe totaling a length of approximately 2.2 kilometres and a total estimate lift of approximately 7.4 metres. The sewage lift stations were also constructed in and around 1980. The condition of the sewage forcemain is unknown and replacement of the forcemain is not expected to occur within the next 20 year time horizon.

In the decade leading to the installation of the Canal Flats sewage collection system, sludge ponds were developed and used for septic tank disposal in the same location as the existing aeration ponds. Following the installation of the community sewage collection system, aeration lagoons were developed to treat the sewage prior to discharge to ground infiltration basins. The lagoons were initially constructed complete with a fine bubble aeration system. The aeration system was replaced in 1996 with a coarse bubble aeration system.

The lagoon system contains two aerated cells that discharge to a ground exfiltration cell. Cell #1 is designed to hold an approximate volume of 13,000 cubic metres and Cell #2, approximately 8,000 cubic metres of sewage effluent.

Focus contacted Wendy Murdoch, Environmental Protection Officer for the Ministry of Environment – East Kootenay Region, on January 25, 2012 to discuss the Canal Flats Lagoons. Mrs. Murdoch indicated

that the lagoon liners must be replaced as she has recorded that vegetation is growing through the liner and the lagoons are "extremely close" to the Kootenay River. Mrs. Murdoch also indicated that it may be best to replace the liner of each pond over a two year span so as to take advantage of the existing drying beds for the sludge that would have to be carefully removed from the liners prior to full removal. The existing sludge drying beds may be too small to handle both lagoon cells in one season. The capacity of the drying beds is unknown. Mrs. Murdoch advised that prior to draining each of the cells, an increase in oxygen supply, via the blowers and aeration system, may be necessary. Again, the lagoons discharge to the ground at a location that is very close to the Kootenay River.

Asbuilts of the lagoons original construction exist (see Mecman Engineering and Testing Ltd drawings 80-6E91-2 and 80-6E91-4) and these drawings provide the lagoon cell dimensions. Focus completed a liner area quantity take off to complete the construction cost estimate to replace the liner. The lagoon cells numbered 1 and 2 were constructed with the following dimensions:

Canal Flats Sewage Lagoon Relevant Asbuilt Data

Item	Cell #1	Cell #2
Pond Base Length (metres)	106.9	62.7
Pond Base Width (metres)	28.6	28.6
Sidewall Slopes	3:1	3:1
Depth of Pond (water level)	3	3
Liquid Volume (m^3)	13,000	8,000
Estimated Liner Area (m^2)	7,500	5,200
Estimated Sludge Depth (m)	0.3	0.3
Estimated Wet Sludge Volume (m^3)	920	540

Focus visited the sewage lagoon site on May 14, 2012. Evidence of the lagoon liner ruptures along the perimeter of both cells was captured in site photos. Three sample photos are provided below.

Cell#2 - Vegetation Growing Through Liner Liner

Cell#1 – Vegetation Growing Through

Cell #1 – Illustrates Vegetation at Liner Ruptures along the Lagoon Perimeter

The Village of Canal Flats installed monitoring wells (via boreholes drilled to an 8.7 metre depth) in the spring of 2014 to collect groundwater samples in all possible directions of groundwater flow surrounding the existing sewage lagoons to determine the impact of the ruptured liner. Four monitoring wells were installed in total. The monitoring wells were sampled and analyzed by the SNC Lavalin Cranbrook office and summarized in a report released July 2014. The report concludes:

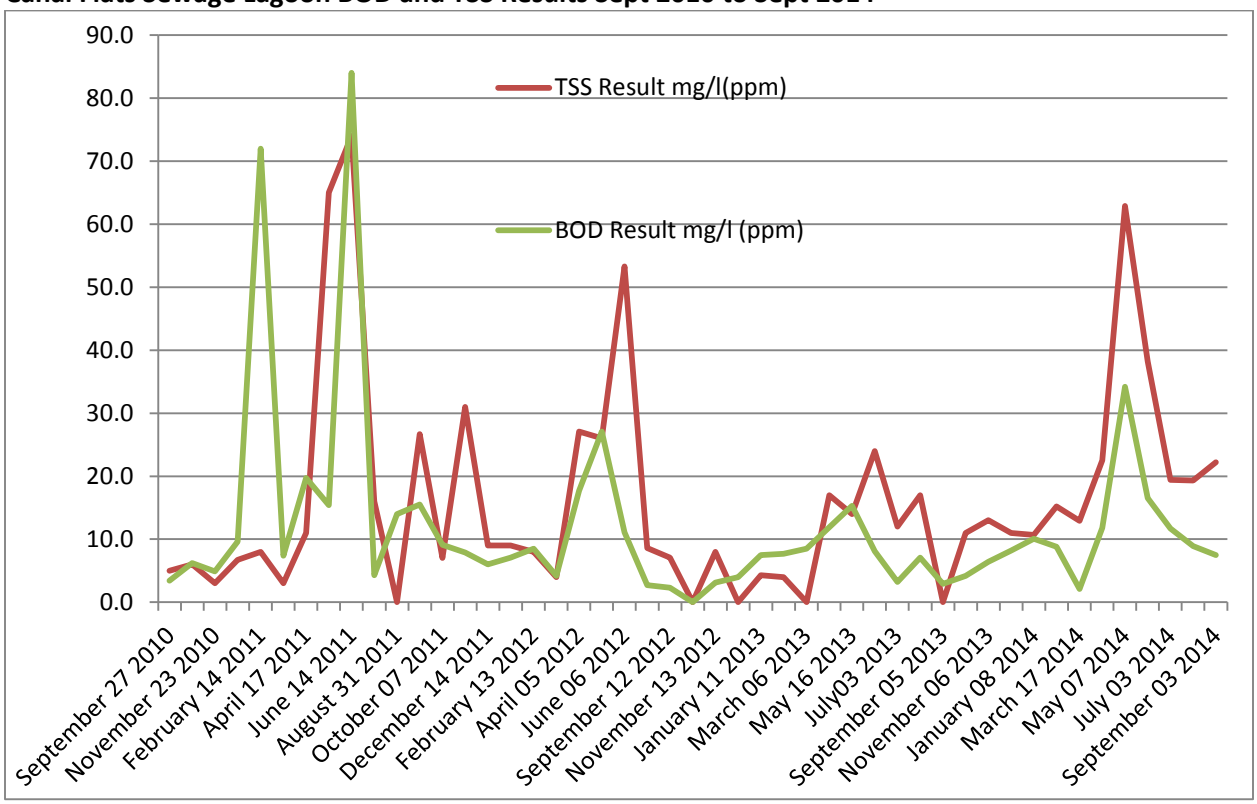
- The groundwater flow direction beneath the lagoon site is generally towards the west/northwest
- The groundwater table is approximately 6.5 to 7.5 metres deep in June and May, respectfully, at the lagoon site
- Nitrite Nitrogen and Ammonia Nitrogen were used as wastewater effluent indicators and were detected in samples taken from the monitoring wells and were found in levels less than the Contaminated Site Regulation (CSR) aquatic life and drinking water standards
- Concentrations of total coliforms were detected in two of the monitoring wells, but this was attributed to local cattle stockyard land use and not infiltration or leakage from the lagoons
- Additional sampling should be completed during three seasonal events in 2014/early 2015 to further assess groundwater quality and potential seasonal changes, and confirm that infiltration, or potential leakage from the ponds, does not result in parameters in groundwater to exist at concentrations above CSR standards protective of aquatic habitat and drinking water use.

In addition to the monitoring wells, the following BOD (biological oxygen demand) and TSS (total suspended solids) results for the lagoon effluent (sampled monthly) was provided to Focus by Wendy Murdock and ALS Laboratory Group (Analytical Chemistry and Testing Services) from September 2010 to September 2014. The results are provided in the following table:

Sample Date	BOD Result mg/l (ppm)	TSS Result mg/l(ppm)	Sample Date	BOD Result mg/l (ppm)	TSS Result mg/l(ppm)
September 27 2010	3.4	5.0	November 13 2012	3.1	8.0
October 26 2010	6.2	6.0	December 05 2012	4.0	<4.0
November 23 2010	4.9	3.0	January 11 2013	7.5	4.3
January 31 2011	9.6	6.7	February 06 2013	7.7	4.0
February 14 2011	72	8.0	March 06 2013	8.5	<4.0
March 14 2011	7.4	3.0	April 03 2013	11.9	17.0
April 17 2011	19.7	11.0	May 16 2013	15.3	14.0
May 8 2011	15.4	65.0	June 05 2013	8.1	24.0
June 14 2011	84.0	74.0	July03 2013	3.2	12.0
July 11 2011	4.3	16.0	August 08 2013	7.1	17.0
August 31 2011	14.0	<3.0	September 05 2013	2.9	<4.0
September 12 2011	15.5	26.7	October 03 2013	4.2	11.0
October 07 2011	9.1	7.0	November 06 2013	6.4	13.0
November 03 2011	7.9	31.0	December 10 2013	8.2	11.0
December 14 2011	6.0	9.0	January 08 2014	10.1	10.7
January 05 2012	7.1	9.0	February 05 2014	8.8	15.2
February 13 2012	8.5	8.0	March 17 2014	2.1	12.9
March 14 2012	4.2	4.0	April 02 2014	11.8	22.5
April 05 2012	17.7	27.1	May 07 2014	34.2	62.9
May 02 2012	27.1	26.0	June 04 2014	16.5	38.2
June 06 2012	11.1	53.3	July 03 2014	11.7	19.4
July 04 2012	2.7	8.6	August 07 2014	8.9	19.3
September 12 2012	2.3	7.1	September 03 2014	7.5	22.2
October 17 2012	<2.0	<4.0			

The following is a graphically representation of the lab results. Note that the BOD and TSS spike in May or June of each year.

Canal Flats Sewage Lagoon BOD and TSS Results Sept 2010 to Sept 2014



The lagoon discharge parameters are defined in the permit to discharge under permit number PE-00308. The PE-00308 discharge parameters are:

- BOD_5 = 45 mg/l
- TSS =65 mg/l

The lagoon aeration system was designed to produce the following parameters:

- Retention in Cell No 1 = 19.25 days
- Retention in Cell No 2 = 11.98 days
- BOD_5 Discharge Effluent – 30 mg/l (30 day average, max 7 day average)
- TSS Discharge Effluent – 45 mg/l (30 day average, max 7 day average)
- Coliforms less than 200 per 100 ml sample
- Minimum residual dissolved oxygen – 2 mg/l

Because the sampling is conducted monthly for lagoon discharge effluent BOD and TSS, it is difficult to determine if the June 2011 spike in the results exceeded the 30 day average, otherwise, the results appear to be in conformance with the permit.

The lagoon aeration system blower #2 was replaced in January 2012. Regular maintenance on both blowers is required inclusive of new belts, air filters and oil changes.

The aeration facultative lagoon system is designed to treat up to a maximum 680 cubic metres per day.

The volume of sewage generated by the Village of Canal Flats was estimated based on the following:

- Daily pump meter use readings for MSLS and SSLS, except on weekends and holidays from January 2009 to September 2013 (more data is available and can be included in the final report)
- MSLS and SSLS pump make and model and related pump curves
- Estimation of the MSLS hourly pumping rate of 79.2 cubic metres per hour for comparison
- Elevations of the pump intakes and pump discharges
- Routes for the MSLS and SSLS forcemains to determine pipe lengths

The two sewage lift stations were analyzed based on the available data. The collected information and results of the analysis are summarized as follows.

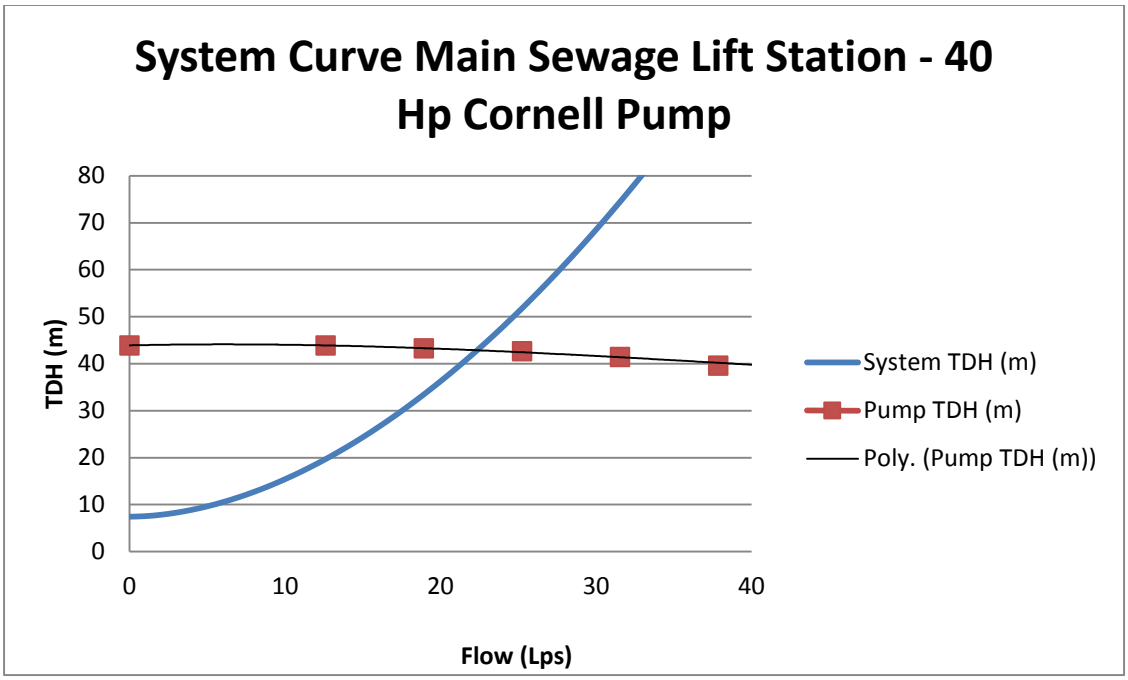
Main Sewage Lift Station (MSLS)

The main sewage lift station consists of two chambers, each 5.75 metres deep. The two chambers are weighted down against buoyancy with a concrete base with dimensions equal to 7mx3.7m by 0.4 metres thick. The gravity system discharges into the first chamber, a wet well, at close to a 4 metre depth from the surface. The first chamber is a concrete chamber with inside dimensions equal to approximately 2.4x1.5 metres. The storage volume in this chamber is an estimated depth of 2 metres below the inlet invert resulting in approximately 7.2 cubic metres (1,585 Imperial gallons) of total storage volume. Pump activation floats exist in the first chamber and activate the pump before sewage levels approach the inlet elevation and an alarm float will activate if sewage reaches the invert of the inlet.

The second chamber is dry and houses two 40 HP pumps wherein the first pump is a duty pump and the second pump acts as back up. The make and model of the pumps are Cornell 4x4x14TVM 40 HP 208 volt/3 phase/60 Hz 1725 RPM motors rated at 350 USgpm at a total dynamic head of 155 feet. The second chamber is a confined space and entry is limited to emergency situations only and to remove the pumps for replacement or repair. System operation staff have indicated that the confined space should be eliminated and the pumping system and mechanical works be relocated to the surface and housed in a heated facility. This should be considered as part of the 20 year capital improvement program.

The MSLS is not equipped with a back-up power generator. Instead, the Village operates a portable generator designed to operate both sewage lift stations in the absence of power on an alternating basis.

Based on the pump curve provided for the MSLS Cornell 40 HP vacuum pump, a system curve (flow versus total dynamic head) was generated to determine a calculated system flow with aged pipes and increased coefficient of pipe friction. The resulting system curve flow is estimated to be 22 Lps (350 USgpm) which aligns with the Regional District of East Kootenay file correspondence indicating the pump flow is 79.2 cubic metres per hour.



The five years of sewage flow data generated from the pump hour tallies is presented below.

Month	MSLS Pump Hour Flow Results - 2009		
	Total Monthly Flow (m^3/day)	Peak Daily Flow (m^3/day)	Peak Daily Pump Run Time (hours)
January	6306.96	271.92	3.43
February	6255.48	269.28	3.40
March	7110.84	448.80	5.67
April	6573.60	385.44	4.87
May	6246.24	293.04	3.70
June	6013.92	237.60	3.00
July	6336.66	253.44	3.20
August	5734.08	221.76	2.80
September	5544.00	221.76	2.80
October	5676.00	229.68	2.90
November	5554.56	205.92	2.60
December	6612.48	253.44	3.20
Max Flow	7110.84	448.80	5.67
Max Flow Month	March	March	March
Total Annual Flow	73964.82 m^3		
Average Daily Flow	202.64		

Month	MSLS Pump Hour Flow Results - 2010		
	Total Monthly Flow (m^3/day)	Peak Daily Flow (m^3/day)	Peak Daily Pump Run Time (hours)
January	6286.56	216.00	2.73
February	5406.72	219.12	2.77
March	6301.68	409.20	5.17
April	5496.48	310.01	3.91
May	5742.00	281.16	3.55
June	5765.76	213.84	2.70
July	6341.94	235.62	2.98
August	6021.18	237.60	3.00
September	5338.08	198.00	2.50
October	6008.64	205.92	2.60
November	5396.16	237.60	3.00
December	5848.92	277.20	3.50
Max Flow	6341.94	409.20	5.17
Max Flow Month	July	March	March
Total Annual Flow	69954.12 m^3		
Average Daily Flow	191.66		

Month	MSLS Pump Hour Flow Results - 2011		
	Total Monthly Flow (m^3/day)	Peak Daily Flow (m^3/day)	Peak Daily Pump Run Time (hours)
January	6181.56	221.76	2.80
February	5314.32	245.52	3.10
March	5599.44	356.40	4.50
April	4924.26	182.16	2.30
May	5443.02	249.48	3.15
June	5995.44	237.60	3.00
July	6486.48	253.44	3.20
August	5773.68	237.60	3.00
September	5108.40	213.84	2.70
October	5393.52	253.44	2.40
November	5678.64	245.52	3.10
December	5897.76	261.36	3.30
Max Flow	6486.48	356.40	4.50
Max Flow Month	July	March	March
Total Annual Flow	67796.52 m^3		
Average Daily Flow	185.74		

Month	MSLS Pump Hour Flow Results - 2012		
	Total Monthly Flow (m^3/day)	Peak Daily Flow (m^3/day)	Peak Daily Pump Run Time (hours)
January	6180.24	261.36	3.30
February	5963.76	253.44	3.20
March	6702.96	324.72	4.10
April	5513.64	253.44	3.20
May	5627.16	213.84	2.70
June	7393.32	514.80	6.50
July	8541.72	376.20	4.75
August	5916.24	213.84	2.70
September	4799.52	182.16	2.30
October	5559.84	253.44	2.70
November	5678.64	245.52	3.10
December	6011.28	293.04	3.30
Max Flow	8541.72	514.80	6.50
Max Flow Month	July	June	June
Total Annual Flow	73888.32 m^3		
Average Daily Flow	202.43		

Month	MSLS Pump Hour Flow Results - 2013		
	Total Monthly Flow (m^3/day)	Peak Daily Flow (m^3/day)	Peak Daily Pump Run Time (hours)
January	6082.56	213.84	2.70
February	5306.40	253.44	3.20
March	6364.51	261.36	3.30
April	5824.37	215.42	2.72
May	5908.32	213.84	2.70
June	7397.28	435.60	5.50
July	5852.88	332.64	4.20
August	4534.20	158.40	2.00
September	4154.04	158.40	2.00
October	Need Data	Need Data	Need Data
November	Need Data	Need Data	Need Data
December	Need Data	Need Data	Need Data
Max Flow	7397.28	435.60	5.50
Max Flow Month	June	June	June
Total Annual Flow	51424.56 m^3		
Average Daily Flow	188.37		

Upon further review of the pump meter readings, it appears that for a majority of the pump operation, only one pump operates. The second pump appears to operate for no more than 10 minutes per month on average on any given day up to 50 minutes. The lead pump is manually switched arbitrarily;

however, pump #1 has operated double the time of pump #2 in the 2009 to 2014 period. The flows tend to peak every March, with the exception of 2013, indicating possibly some level of winter melt infiltration, however, the volume of infiltration cannot be quantified from the data provided.

Based on the above, the total average daily flow is currently 195 m^3/day and the peaking factor is 2.64. In a 20 year period at 2% growth per year, the average daily flow is estimated to be 290 m^3/day with a possible peak day flow of 765 m^3/day. The maximum treatment capacity of the sewage lagoons is permitted at 680 m^3/day. If growth matches the 2% per year, the lagoons will require expansion in 2027, however, the MSLS pumps and forcemain will still be adequately sized.

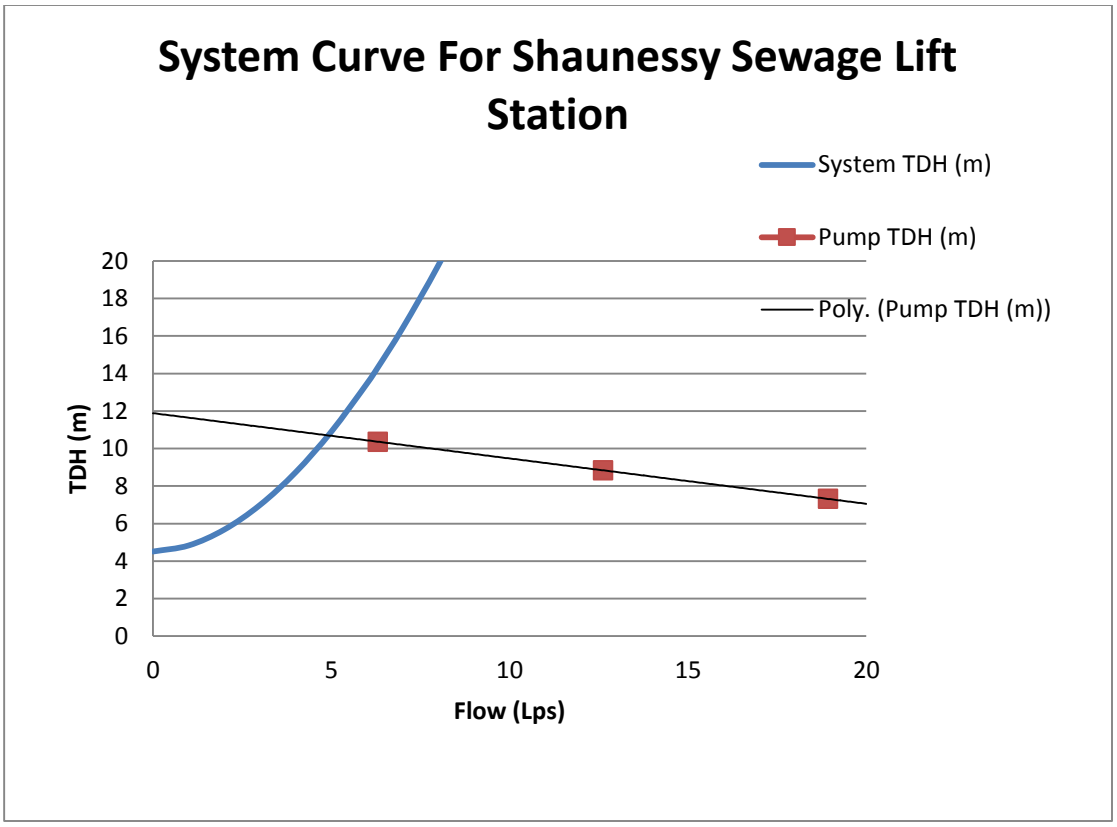
Shaughnessy Sewage Lift Station (MSLS)

The Shaughnessy sewage lift station consists of one wet well chamber that is 6 metres deep and contains two sewage handling pumps, each a 4.5 HP Barnes Series 4SE4534L pump. The chamber is weighted down against buoyancy with a concrete base with dimensions equal to 2.9m square by 0.3 metres thick. The gravity system discharges into the wet well from two directions, at close to a 4.4 and 4.3 metres depth from the surface, respectively. The storage volume in this chamber is an estimated depth of 1.5 metres below the lowest inlet invert resulting in approximately 3.8 cubic metres (836 Imperial gallons) of total storage volume, assuming an estimated wet well diameter of 1.8 metres. Pump activation floats exist in the first chamber and activate the pump before sewage levels approach the inlet elevation and an alarm float will activate if sewage reaches the invert of the lowest inlet.

The pumps are submersible pumps and motors. The make and model of the pumps are Barnes Series 4SE4534L 4.5 HP 230 volt/3 phase/60 Hz 1750 RPM motors rated at 150 USgpm at a total dynamic head of 45 feet.

The SSLS is not equipped with a back-up power generator. Instead, the Village operates a portable generator designed to operate both sewage lift stations in the absence of power on an alternating basis.

Based on the pump curve provided for the SSLS Barnes 4.5 HP solids handling pump, a system curve (flow versus total dynamic head) was generated to determine a calculated system flow with aged pipes and increased coefficient of pipe friction. The resulting system curve flow is estimated to be 5 Lps (79 USgpm) which doesn't align with the reported flow – it's half the reported flow. It also appears that the pumps in the SSLS are not the original pumps, make or model.



The five years of sewage flow data generated from the pump hour tallies for SSLS is presented below.

Month	SSLS Pump Hour Flow Results - 2009		
	Total Monthly Flow (m^3/day)	Peak Daily Flow (m^3/day)	Peak Daily Pump Run Time (hours)
January	2261.40	96.00	5.33
February	2708.10	208.20	11.57
March	2207.10	135.60	7.53
April	1805.40	72.00	4.00
May	1703.40	58.50	3.25
June	2296.20	207.60	11.53
July	1872.00	81.00	4.50
August	1987.20	95.40	5.30
September	1722.60	91.80	5.10
October	1749.00	77.40	4.30
November	1840.20	66.60	3.70
December	2405.70	103.50	5.75
Max Flow	2708.10	208.20	11.57
Max Flow Month	February	February	February
Total Annual Flow	24558.30 m^3		
Average Daily Flow	67.28		

Month	SSLS Pump Hour Flow Results - 2010		
	Total Monthly Flow (m^3/day)	Peak Daily Flow (m^3/day)	Peak Daily Pump Run Time (hours)
January	1998.30	103.50	5.75
February	1639.80	70.20	3.90
March	1809.60	121.20	6.73
April	1648.80	68.40	3.80
May	2149.20	99.00	5.50
June	1751.40	64.80	3.60
July	1680.00	68.40	3.80
August	1644.60	66.60	3.70
September	1616.40	59.40	3.30
October	1899.60	73.35	4.08
November	1866.00	194.40	10.80
December	1857.60	91.80	5.10
Max Flow	2149.20	194.40	10.80
Max Flow Month	May	November	November
Total Annual Flow	21561.3 m^3		
Average Daily Flow	59.07		
Month	SSLS Pump Hour Flow Results - 2011		
	Total Monthly Flow (m^3/day)	Peak Daily Flow (m^3/day)	Peak Daily Pump Run Time (hours)
January	1985.40	73.80	4.10
February	1830.60	86.40	4.80
March	1863.00	108.00	6.00
April	1684.80	64.80	3.60
May	1733.40	84.60	4.70
June	1773.00	70.20	3.90
July	*5627.70	355.80	19.77
August	1806.30	84.60	4.70
September	1722.60	73.80	4.10
October	1924.20	70.20	3.90
November	2062.80	86.40	4.80
December	2066.40	90.00	5.00
Max Flow	2066.40	108.00	6.00
Max Flow Month	July	July	July
Total Annual Flow	26080.2 m^3		
Average Daily Flow	71.45		

*Denotes Assumed Blockage in the System – Cleared by Village Staff as Noted in Records – Peak Flows Disregarded for July 2011

Month	SSLS Pump Hour Flow Results - 2012		
	Total Monthly Flow (m^3/day)	Peak Daily Flow (m^3/day)	Peak Daily Pump Run Time (hours)
January	2158.20	99.00	5.50
February	1726.20	75.60	9.60
March	2208.00	102.60	5.70
April	2031.00	81.00	4.50
May	1920.60	72.00	4.00
June	2213.10	122.40	6.80
July	1962.90	82.80	4.60
August	1616.40	97.20	5.40
September	1608.30	57.60	3.20
October	1946.70	83.70	4.65
November	1785.60	82.80	4.60
December	2356.20	138.60	7.70
Max Flow	2356.20	138.60	9.60
Max Flow Month	December	December	February
Total Annual Flow	23533.2 m^3		
Average Daily Flow	64.47		

Month	SSLS Pump Hour Flow Results - 2013		
	Total Monthly Flow (m^3/day)	Peak Daily Flow (m^3/day)	Peak Daily Pump Run Time (hours)
January	3060.00	153.00	8.50
February	3060.00	172.80	9.60
March	2652.48	142.20	7.90
April	3039.12	129.60	7.20
May	4417.20	171.60	9.53
June	4734.90	197.55	10.98
July	*5438.70	214.20	11.90
August	3241.80	207.00	11.50
September	1776.60	162.00	9.00
October	Need Data	Need Data	Need Data
November	Need Data	Need Data	Need Data
December	Need Data	Need Data	Need Data
Max Flow	4734.90	207.00	11.50
Max Flow Month	July	July	July
Total Annual Flow	31420.8 m^3		
Average Daily Flow	115.09		

*Denotes Assumed Blockage in the System – Must have cleared on its own – Peak Flows Disregarded for July 2013

The two pumps in the SSLS are manually alternated on a more even basis. In the data presented above, Pump #1 operated 40 hours more than Pump #2 (640 hours versus 594 hours, respectively). We cannot determine if and when both pumps may be operating at the same time. If both pumps operate together due to high flows on a regular basis, the total flows will be significantly more.

Based on the above, the SSLS average daily flow is currently estimated at 75 m^3/day and the peaking factor is 2.78, 35% of the total MSLS flow. In a 20 year period at 2% growth per year, the average daily flow for SSLS is estimated to be 111 m^3/day with a possible peak day flow of 310 m^3/day. The existing sewage pumps for SSLS are near or at their capacity and should be reviewed further to determine if upsizing the pumps are warranted in 2015 based on any localized growth.

In addition to the above, when the Shaughnessy Lift Station upgrades are considered, Village staff have again raised the issue of confined space and recommended installing the pumps above ground, however, land is not available to do so. Acquisition of land immediately west of this lift station is required to meet staff requests.

5.1.1 Immediate Sanitary Sewer Upgrades

The recommendation for immediate sewage upgrades (ie in the next 2 to 5 years) include the Shaughnessy sewage lift station pump size increase (if deemed necessary through further study – may only require an impellor size change or some infiltration prevention), the removal of the confined space Main sewage lift station and the replacement of the sewage lagoon liners, if further study of the lagoon monitoring wells in 2015 indicate leakage is a concern. If the lagoon liner leakage is deemed not a concern, the lagoon liner replacement may be extended another 10 years and staff should continue the use of herbicide spray of the plant material breaching the lagoon liner.

Other considerations should include providing automatic back up power generators to each of the lift stations and installation of flow meters in the gravity manholes immediately upstream of each sewage lift station (three manholes total), assuming they can be retrofitted for a Flo-dar open channel flow meter.

5.1.2 Future Sanitary Sewer Upgrades

Future sanitary sewage infrastructure upgrades include expansion of the sewage lagoons in or around 2027, assuming a 2% growth pattern.

6 Stormwater Management System

6.1.1 Stormwater Management

Village staff requested that a short section be included in the 20 year Capital Plan regarding stormwater management. A Stormwater Master Plan has not been developed for the community and stormwater runoff and localized flooding can be an issue and is a concern. Derek Ashford, PEng produced a "Study to Prepare for a Stormwater Master Plan" in 2012. A copy of this report was provided to Focus on September 30, 2014. The study is general in nature and requires more specific review of the village catchment and discharge areas. The report tends to focus on the concern of the village potable water well capture zone and preventing any stormwater discharge connections to this zone inclusive of a closed pipe storwmater catchment system. The image left (Attachment 3) basically illustrates where stormwater discharge to ground (areas having probably recharge capability) is likely achievable (middle zone), the area where well head protection is a must requiring a closed pipe stormwater collection system (eastern zone), and the zone where the capacity for native soils to receive stormwater for ground discharge are largely unknown (western zone).

Attachment 3 – Map of Areas within the Village of Canal Flats where Recharge 'Can Be' and 'Should Not Be' permitted.

The report provides a closed pipe stormwater system cost estimate of $6,150,000 for the existing developed areas, however, the details related to this estimate are not clear. Over a 20 year period, a budget of $310,000 annually would be required to implement this concept. A more detailed review of stormwater management is required. A $60,000 to $80,000 budget should be provided to complete a stormwater management master plan for the Village of Canal Flats.

7 Other

Some members of the 20 year Capital Plan Committee indicated this report should also include other community assets that were not part of the original scope of work. These assets included Village amenities such as:

- Community Hall addition, face lift or replacement
- Public Works office space, warm storage of inventory, cold storage, covered vehicle and mechanical equipment storage, enclosed yard area and heated work space (bays)
- Fire Hall planned expansion – additional bays and possible relocation

Village staff indicated that the new fire hall expansion costs may be approximately $600,000.

Conceptual details of the three items mentioned above are required to effectively estimate construction costs, however, these items are referenced in this report at this time such that they are a noted capital cost to be determined.

8 Capital Expenditure Budgets

8.1 Review of Capital

Focus has not received the Village of Canal Flats average annual available capital expenditure budget to assist with priority placement of projects over the 20 year capital plan projection.

What is the annual budget? This may need further review pending the results of this report.

8.1.1 Fund Resources

Funding for capital improvement projects are generally collected from development cost charges (DCC), grants (both federal and provincial), gas tax rebates, and through general taxation.

The Village of Canal Flats does not have a DCC Bylaw in place to collect monies from future developed lots (residential, commercial, institutional or industrial) to be attributable to infrastructure upgrades triggered by growth.

Grant funding for infrastructure upgrades changes from year to year and is generally best applied for with “shelf ready” projects wherein the scope of work is well defined with detailed construction cost estimates and a plan to implement the associated upgrades has been established complete with a deep understanding of the benefits to the community, growth and the environment.

8.1.2 Financial Strategies

The purpose of this report is to establish the necessary infrastructure upgrades, estimate the required capital funding and prioritize the upgrades for council consideration and input such that annual budgets can be determined based on the strategic plan.

It should be noted that Development Cost Charge applicable items, should the Village of Canal Flats choose to develop a related bylaw, include, but are not limited to the following, or a portion thereof:

- Sewage lagoon expansion
- Sewage lift station increased capacity
- Expanding water distribution network
- Implementation of oversizing water treatment works
- Stormwater management
- Highway Intersection Improvements for better access

8.1.3 Opinion of Probable Construction Costs

8.1.3.1 Roads

Based on an estimated construction cost of $1,500,000 to repair and rebuild roads identified in the Road Condition Survey, the Village should consider an annual budget of $75,000 to $100,000 (plus taxes) for road upgrades over the next 20 year period. The current council budgeting policy for annual road upgrades is $70,000.

The Road Condition Survey Major Street Network Upgrades include the following:

1) Beatty Avenue – estimated $60,000 in improvements
2) Shaughnessy Avenue – estimated $3,000 in improvements
3) Grainger Road – estimated $240,000 in improvements (includes to 170 metres north of Cottage Lane)
4) Burns Avenue - estimated $4,000 in improvements

The above works should be completed in the next 2 to 5 years.

The WEB Engineering planning report developed three options for Highway 93/95 intersection improvements as follows:

Option 1) Grainger Road ($2,777,000)
Option 2) Selkie Street ($2,648,000)
Option 3) Shaughnessy Street ($2,500,000)

The timing on the Highway Intersection improvements and village entry corridor will be dependent on available funding, available lands and a strong community interest in proceeding with this work. These projects take some time to obtain approved designs complete with stakeholder input as well as available

funding. As part of the 2 to 5 year plan associated with highway intersection improvements, we recommend selecting an option with stakeholder buy in and proceed to the detailed design and cost estimation stage to create a shelf ready project and identify what project components can be completed in advance of the full project, including staging. For the next 2 years, an annual budget of $50,000 should be allocated to the project. The actual construction of the intersection improvements should be considered spanning a timeframe (for planning purposes) 3 to 10 years from now, complete with grant funding.

8.1.3.2 Water System

The largest capital water system project for the Village of Canal Flats water system is the implementation of treatment for the shallow water surface supply when BC Interior Health enforces this requirement. To date, water quality results have not provided any reason for BC Interior Health to formulate a requirement that this treatment upgrade occur in the next five years, although it is likely this requirement will be a 5 to 10 year project. The timing of this treatment requirement is unknown, but a reserve fund should be implemented annually equal to a minimum $75,000. UV disinfection, chlorination and space for filtration if deemed - $750,000 to $950,000, inclusive of building, UV treatment, chlorine, UVT measurement, turbidity measurement, SCADA and electrical system, and a flow meter form the basic project components.

However, the flow meter must be installed according to Village staff as part of the requirements of the Eagles Nest Water System (ENWS) upgrade and an online turbidity meter and recorder should be installed now in an effort to assist with filtration deferral. In addition, Village staff have indicated that the following should be budgeted for immediate upgrade:

- Electrical system at the water well compound estimated at $70,000
- New building to house both the electrical and possible future treatment facility at an estimated $80,000

The flow meter and turbidity meter and recording equipment supply and installation costs are estimated at $60,000.

The various watermain pipe line projects to be included in the 20 Year Capital Plan include the following:

2 to 5 year Plan

- Reconnecting two fire hydrants from the existing 100mm diameter mains to the existing 150mm diameter mains (Cedar Crescent and Stevens Avenue) - $70,000

5 to 10 year Plan

- Dedicated Pipeline to Reservoir - $150,000

10 to 20 Year Plan

- Bighorn Sheep Lane Extension, PRV and Pump Upgrades - $400,000
- Watermain looping to occur with development – approximately 2,000 metres of loop and approximately 1,000 metres of watermain westerly extension on Beatty, Burns and Baille-Grohman Avenues – approximate $1,000,000 value.

8.1.3.3 Sanitary System

The proposed 20 year capital plan sewer projects are listed as follows:

2 to 5 year Plan

1) Replace Shaughnessy sewage lift station pumps - $60,000 (or find an alternative to this upgrade – ie impellor size increase review, infiltration assessment, etc)
2) Remove confined space pump set up from Main Sewage Lift Station – $175,000 (awaiting a detailed quote from the supplier – only verbal costs provided to date)
3) Provide permanent and automatic back-up generators for sewage lift stations - $125,000

5 to 10 Year Plan

4) Replace sewage lagoon liners - $950,000
5) Install flow meters - $50,000

10 to 20 Year Plan

6) Expand the sewage lagoons for increased capacity - $750,000

Similar to the watermain pipeline extensions, sewer piping could also be extended, however, a more detailed review of how westerly properties could be serviced by gravity sanitary sewer pipe is warranted.

9 Summary

In summary, the Village of Canal Flats road network, water system infrastructure and sanitary infrastructure all require upgrades in the near future and within the next 5 to 20 year horizon. The following table summarizes the priority list of infrastructure upgrades and the related estimated construction costs for future budgetary planning.

20 YEAR CAPTIAL PLAN PROJECTION SUMMARY

20 Year Capital Plan Horizon	Road Network	Water System Infrastructure	Sanitary Infrastructure	Stormwater Collection Closed Pipe System
2 to 5 Years	• Beatty Avenue - $60,000 • Shaughnessy Ave –$3,000 • Grainger Road – $240,000 • Burns Avenue – $4,000 • Side Street Work - $70,000 • Hwy Intersection Improvements - $50,000 annually first two years and seek funding thereafter	• Flow meter - $40,000 (likely to be funded by ENWS upgrade) • Turbidity Meter - $20,000 • Electrical System and Well Compound - $70,000 • New Well Compound building Sized for Future Treatment - $80,000 • Reconnect fire hydrants fed from 100mm dia mains to existing 150mm dia mains - $70,000	• Shaughnessy Lift Station upgrade – up to $60,000 (excl removal of confined space) • Main Lift Station Confined Space Elimination – Pumps to Surface - $175,000 (to be confirmed by supplier) • Lift station back up generators - $125,000	• $80,000 – Stormwater Master Plan Document and • $310,000 annual budget
5 to 10 Years	• Side Street Work –$100,000 annually and • $900,000 share/ contribution to partially funding intersection improvements	• Dedicated Pipeline to Reservoir - $150,000 • Water Treatment - $540K to $740,000	• Replace Sewage Lagoon Liners - $950,000 • Install Flow Meters - $50,000 • Blower Replacement - $75,000	• $310,000 annual budget
10 to 20 Years	• Side Street Work –$100,000 annually	• Bighorn Sheep Lane Servicing - $400,000 • Miscellaneous Watermain Looping and Extensions - $1,000,000	• Expand Sewage Lagoons - $750,000	• $310,000 annual budget

Note the following are not included in the summary table on the previous page:

- Community Hall addition, face lift or replacement
- Public Works office space, warm storage of inventory, cold storage, covered vehicle and mechanical equipment storage, enclosed yard area and heated work space (bays)
- Fire Hall planned expansion – additional bays and possible relocation