Our File: 2241-24126-00

TECHNICAL MEMO

To	From
Eddie Kunderman, Operations Manager Alberni-Clayoquot Regional District	Mitchell Hahn, PEng Division Manager-Water and Wastewater Facilities
Re	**Date**
Beaver Creek Water System: Surface Water Treatment Feasibility Assessment – Final Report	July 14, 2025

1. Introduction

Alberni-Clayoquot Regional District (ACRD) retained McElhanney Ltd. (McElhanney) to complete a feasibility study for a dedicated water supply for the Beaver Creek Water System (BCWS). The study consists of three technical memorandums focusing on key areas of the study: surface water, groundwater, and water treatment facilities. This memorandum evaluates the feasibility of water treatment facilities.

2. Project Background

2.1. BEAVER CREEK WATER SYSTEM BACKGROUND

Beaver Creek is an unincorporated community in the Alberni-Clayoquot Regional District on Vancouver Island, BC. The community is listed as Electoral Area E within the ACRD. Historically, the BCWS utilized surface water collected from the Stamp River through an infiltration gallery located on 7692 Sportsman Road. The water was then treated by chlorine gas before distribution. This water source method was abandoned in 2014 due to issues with high turbidity and non-compliance with Island Health treatment objectives. The BCWS distribution pipe network consists of 1960's era Asbestos Cement (AC) and polyvinyl chloride (PVC) pipes. Connected to the distribution system are three reservoirs, with a combined storage volume of 2543 cubic meters.

Since 2014, the BCWS has received treated water from the City of Port Alberni (the City) through a bulk water agreement. Water is transferred to the system by a pump station located on Strick Rd. The City intends to terminate the bulk water agreement and re-negotiate the rate. The BCWS therefore intends to explore alternate groundwater and surface water sources. This investigation was completed in two earlier memorandums and are summarized below. Please refer to McElhanney Technical Memos, Surface Water Feasibility Assessment and Grroundwater Feasibility Assessment, for further information.

2.2. SURFACE WATER SOURCE

Four surface water sources were proposed by McElhanney to serve the BCWS, Sproat Lake/River, Stamp River, Truman Creek, and Beaver Creek. Hydrometric flow data was analysed for each source, providing a summarization of annual water availability. Due to historically low flows at Beaver and Truman Creeks, these two water sources were removed as viable alternatives, leaving Sproat Lake and Stamp River.

2.3. GROUNDWATER SOURCES

Six groundwater aquifers were studied in the Electoral Area E (The Study Area), each of which with varying yield, size and classification. Of the 160 well records in the Study Area, the maximum estimated well yield for a single well was 545 m^3/day. Only two wells reported this yield and are located 7 km apart. Under this maximum flow rate, 7 wells would be required to supply the BCWS. Since the true production is likely lower than this maximum value, a larger number of wells would be needed to reliably supply the BCWS. Further, water wells typically have an operational lifespan of 30-50 years. Only 12 of the total wells have been drilled in the past 20 years. All other records are more than 40 years old. As a result of these considerations, concerns exist related to the technical feasibility of a groundwater source.

2.4. WATER SOURCE EVALUATION

Evaluation of these water sources was completed through an evaluation matrix. Each water source was evaluated on three criteria: technical feasibility, capital cost, and special considerations. The water source was ranked out of ten for these criteria, and a weighting factor was applied to these ratings. The results are included in Table 1 below.

Table 1: Source Water Ratings

Source Water Option	Technical Feasibility (1-10)	Capital Cost (1-10)	Special Considerations (1-10)	Total (%)
Weighting	*30%*	*40%*	*30%*	*100%*
Sproat Lake	8.5	5	4.25	58.25
Stamp River	6	10	3.75	69.25
Groundwater	1	1	6	25

The table indicates the highest rating to be for the Stamp River water source. After completion and review of the first two memorandums, it was decided by the Beaver Creek Water Advisory Committee that the **Stamp River** surface water source would be explored for water treatment. The Stamp River is therefore utilized in this memorandum as the proposed water source for treatment.

3. Water Demands

Water usage data was analysed using information provided by the ACRD in previous annual reports. These annual reports outline water usage on a cubic meter per year basis. Figure 1 below displays a trend in total water usage in the Beaver Creek water service area from 2012 to 2023.

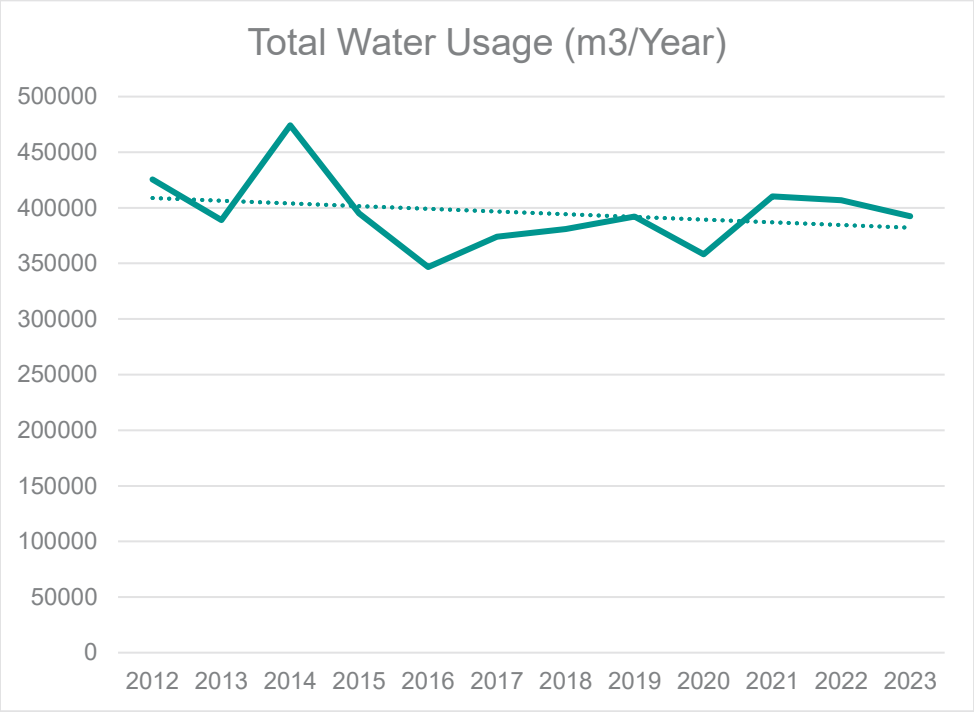


Figure 1: BCWS Total Water Usage 2012-2023

The trendline shows a decrease in total water usage, with an average year-over-year drop percent of -0.132%. A net decrease in water usage is expected due to the decrease in population from 2012 to 2016. This percentage decrease may not be representative of future demand, especially as population in Beaver Creak is increasing, and so the last five years of data were also graphed with a trendline in Figure 2 below.

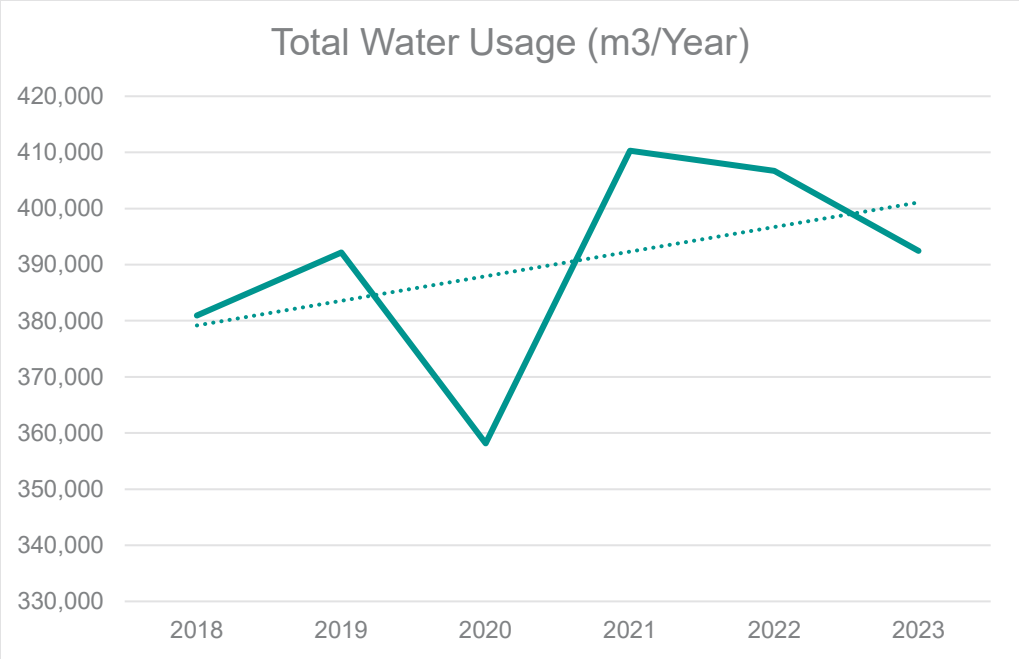


Figure 2: BCWS Annual Water Usage (2018-2023)

More recent water demands for the BCWS area ranges from lows of 500 – 600 cubic meters per day (m^3/day) to highs of 2,000 – 2,500 m^3/day. The average year over year percent increase in water usage in this timeframe was 1.143%. The Beaver Creek Infrastructure Assessment report from Koers in 2017 indicated an increase in the number of connections of 0.54%. This increased number of connections is difficult to translate directly into a population increase or a water usage increase as each connection could be to a variety of customers: single family, multifamily, agricultural, etc.

To conservatively predict future water demands, a 1% yearly increase in water usage was projected to 2044. The result is a predicted average daily flow of 1,322 m^3/day in 2044. A maximum daily demand peaking factor was calculated to be 2.48-2.65 by Koers, therefore, a value of 2.5 was utilized to give a future maximum daily demand of (MDD) **3,305 m^3/day**. This value was used as the design flow for a potential water treatment plant.

The scope of this project does not include detailed demand forecasting, as such there has not been a detailed analysis into full buildout of the system or potential population growth. The area has been subject to many factors affecting population, including industry shifts, housing prices and market trends. Should an alternate future flow value be considered, this memo will be updated to suit.

With the existing total reservoir capacity of 2,453 cubic meters, there exists approximately 24 hours of water supply at maximum daily demand. At future maximum daily demands (3,305 m^3/day), there is approximately 18 hours of storage.

4. Water Treatment Requirements

4.1. APPLICABLE LAWS AND REGULATIONS

The following laws and regulations would apply to a potential water treatment plant for the Beaver Creek Water System.

- The Drinking Water Protection Act & The Drinking Water Protection Regulation: the 'Act' covers all water systems other than single family dwellings and systems excluded through the 'Regulation'. The Act sets out certain requirements for drinking water operators and suppliers to ensure the provision of safe drinking water to their customers[1]. The Act and Regulation give drinking water officers (DWOs) the discretion to address public health risks through treatment requirements.

- Guidelines for Canadian Drinking Water Quality: the 'Guidelines' provide maximum acceptable concentrations and aesthetic objectives for water quality parameters. These values are established by the Provincial-Territorial Committee on Drinking Water. It is the role of the provinces to ensure compliance with these guidelines through enforcement of their respective Acts.

- Drinking Water Officer's Guide - Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies in British Columbia. The 'Objectives' provide a general overview of drinking water treatment objectives for surface water supplies in BC. The Objectives provide goal requirements for system designers and operators for disinfection and filtration. Including the 4-3-2-1 drinking water objective described below.

4.2. REGIONAL HEALTH AUTHORITY

Regional health authority Drinking Water Officers (DWO) are responsible for compliance and enforcement activities under the Drinking Water Protection Act & Drinking Water Protection Regulation. In the case of the BCWS, the regional health authority is Island Health. It is therefore up to the DWO's discretion to determine the requirements of an individual drinking water system. As the DWO rely heavily on the is the Drinking Water Officer's Guide, it good practice to follow these guidelines to be in compliance.

4.3. 4-3-2-1-0 DRINKING WATER OBJECTIVE

The general treatment objectives in the Drinking Water Officer's Guide are the 4-3-2-1-0 objectives, which provide a minimum performance target for water suppliers. These are outlined below.

- 4-log reduction or inactivation of viruses
- 3-log reduction or inactivation of Giardia and Cryptosporidium
- Two forms of treatment for pathogen log reduction
- Less than or equal to one nephelometric turbidity unit (NTU) of turbidity.

[1] Government of British Columbia, 2025

- No detectable E. Coli, fecal coliform and total coliform.

Depending on specific situations, the actual amount of treatment required will depend on the risks identified and may require greater levels of treatment. Given the Stamp River is an unprotected surface water source, it can be expected that the 4-3-2-1-0 objectives must be followed as a minimum.

Regarding 'Two treatment forms of treatment', for surface water filtration followed by disinfection are the two forms of treatment. For filtration exemptions (not considered here) pathogen reduction is met using two types of disinfection. Regardless of the system, chlorination (or chloramination) as secondary disinfection is a requirement for to meet a minimum 0.2 mg/L chlorine (or 1.0 mg/L chloramine) residual at service connections.

5. Source Water Characterization

5.1. STAMP RIVER

The Stamp River is a major watercourse located at the base of the Alberni Valley. The river receives flows from the two dams at the outfall of Great Central Lake, both of which are operated by Catalyst Paper corporation. Additional flows into the river come from upstream lakes and creeks in the Alberni Valley watershed. The Stamp River has significant flows, with a historical minimum of 983,232 m^3/day and historical maximum of 81,561,600 m^3/day. Major socio-economic considerations exist for the river as it contains the largest summer Steelhead Salmon run on Vancouver Island.

The BCWS currently holds two water licenses for withdrawal from the Stamp River. With a combined maximum average day demand of 3,114 m^3 and MDD of 6,228 m^3, these are sufficient to meet the project future MDD. The licenses are summarized in the table below.

Table 2: BCWS water licenses for Stamp River

License No.	Licensed Withdrawal from Stamp River, m^3			
	Average Day	Maximum Day	Yearly	Date
C025763	1,477	2,955	539,269	Aug 11, 1959
C061407	1,637	3,273	597,344	Feb 27, 1985
Total	3,114	6,228	1,136,614	

Prior to purchasing water from the City of Port Alberni, the BCWS drew water from the Stamp River through an infiltration gallery. Collected water was disinfected with chlorine in the pump station, with further residual disinfection provided at each reservoir.

The existing Stamp River intake pumphouse is located at the end of Sportsman Rd on lot number 7689. Although the intake and pumphouse has not been used since 2014, it has been maintained for

emergency use. The intake is located at the confluence of Truman Creek and Stamp River. As described in the surface water memo, large turbidity events are associated with Truman Creek. It was therefore recommended that the Stamp River intake be moved upstream of Truman Creek. A plan drawing by Koers and Associates showing the location of the existing intake is included below.

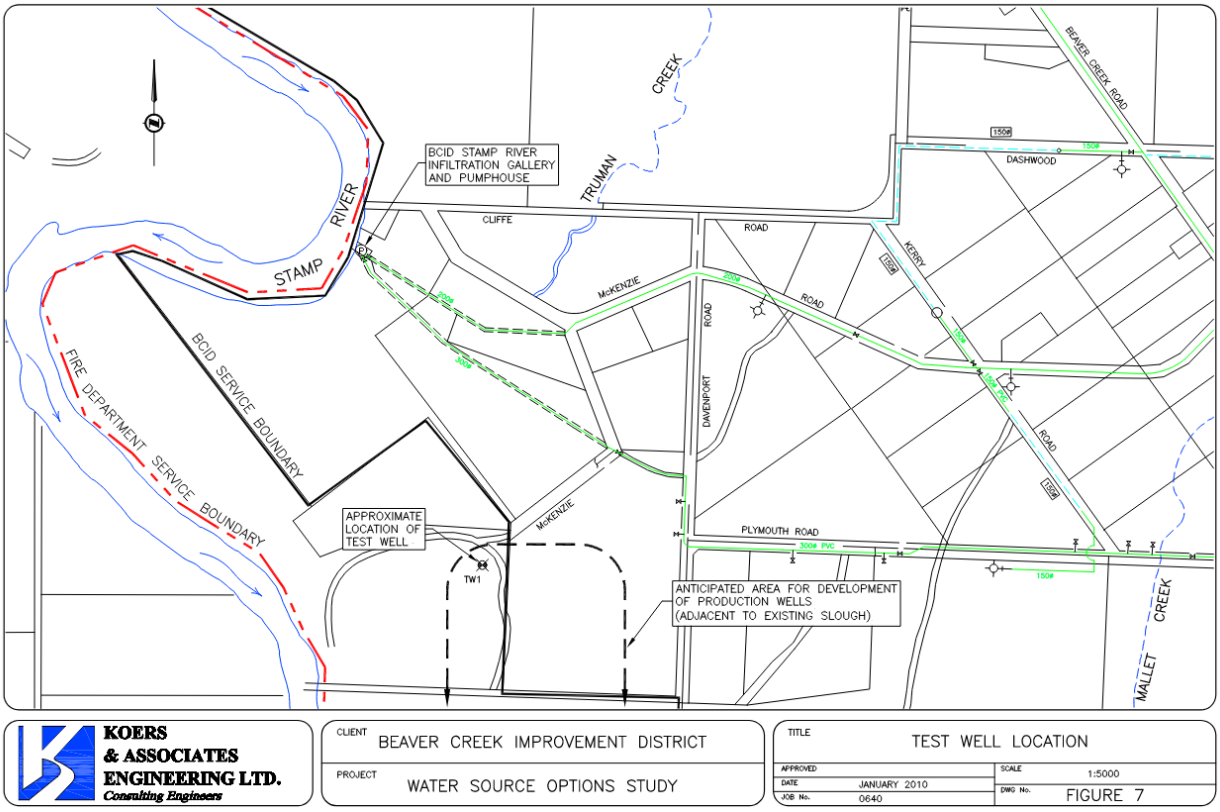
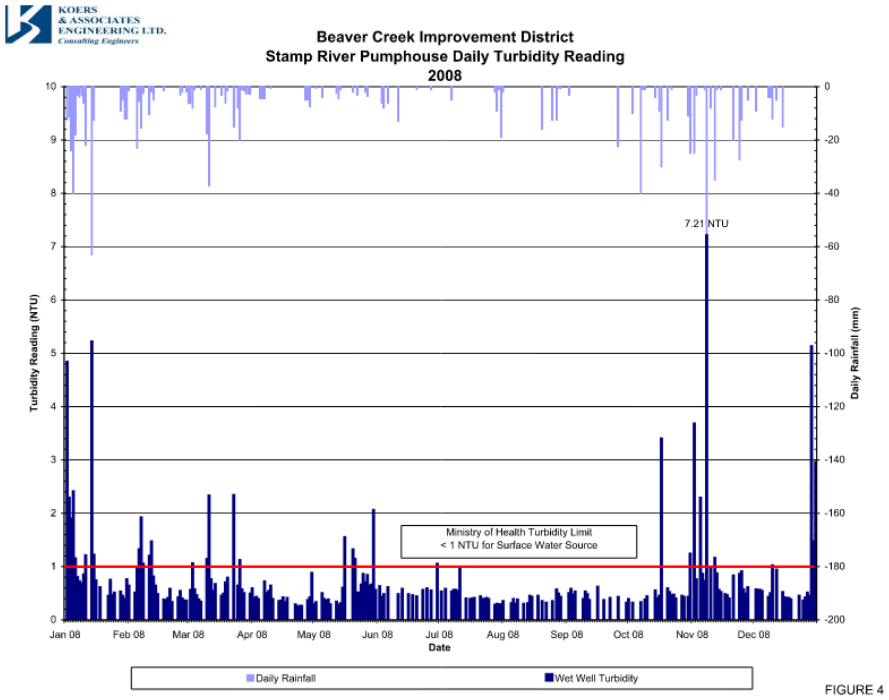


Figure 3: Location of the existing Stamp River intake.

5.2. WATER QUALITY

5.2.1. Turbidity

Historical water quality testing was provided by the ACRD. There are no recent records of full suite drinking water test parameters other than one document from 2010. A preliminary review of the provided water quality results shows exceedances in turbidity with up to 7.21 NTU recorded on a single occasion. Graphs of turbidity readings for 2008 and 2009 from Koers and Associates are shown in Figure 4 below.



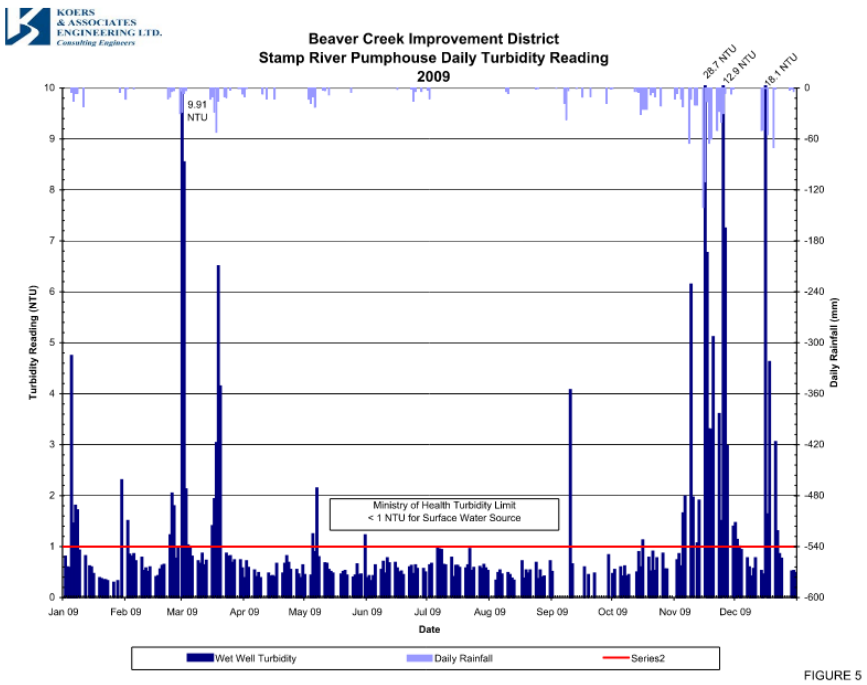


Figure 4: Stamp River pumphouse turbidity readings (2008 & 2009)

In 2008, there were approximately 30 days where the source water in Stamp River exceeded the limit of 1 NTU; these appear to coincide with rain events. The exceedances in 2009 appear to be more drastic, with a maximum turbidity reading of 28.7 NTU. There exists two alternatives for addressing turbidity exceedance, moving the intake upstream of Truman Creek or providing adequate filtration to reduce

turbidity ‘spikes’ in treated water. These two alternatives are discussed further in 5.2.3. Stamp River Intake section below.

5.2.2. Microbiological Parameters

Microbiological parameters were tested in raw water at the Stamp River both above and below the confluence with Truman Creek as part of the Beaver Creek Water System annual report in 2012. The parameters tested were Total Coliforms, Fecal Coliforms, and Escherichia coli (E. Coli). This data is included in Appendix B.

Raw water from all locations shows an exceedance of the maximum allowable concentration (MAC) of zero (0) CFU / 100mL. Any detection of coliforms is a potential indication of fecal matter entering the water supply. The data shows water quality upstream of Truman Creek is significantly better than that downstream of the confluence with Truman Creek, thus indicating that microbiological contamination is entering the Stamp River through Truman Creek. This assumption is bolstered by the data showing higher recordings of coliforms in Truman Creek.

Treated water within the system was also tested for these same parameters. On February 1, 2012, there was a recorded exceedance of 95.9 CFU / 100mL for total coliforms and 4.1 CFU / 100mL for E. Coli. Due to the high value and single event, the reading could have been a false positive. A single exceedance was discovered of total coliforms in 2013 with a reading of 35 CFU / 100mL.

5.2.3.Physical Parameters

Additional raw water quality data was found within the document titled Alberni Valley Drinking Water Reference Guide. The data was collected on August 19, 2010 and is included below.

Appendix D. Raw Water Quality Parameters—Stamp River Intake (Beaver Creek Improvement District)

Raw Water at Stamp River Intake	Date: Aug 19, 2010		
Test	**Results**	**Units**	**Drinking Water Guidelines**
Alkalinity	17	mg/L	
Colour – Apparent	<5	Colour Units	15 AO
Conductivity	39.7	uS	
Hardness (CaCO3)	18	mg/L	80-100
pH	7.6	pH Units	6.5 - 8.5
Total Dissolved Solids	16	mg/L	500 AO
Turbidity	<0.5	NTU's	5 AO
Chloride	<2.0	mg/L	250 AO
Fluoride	<1.0	mg/L	1.5 MAC
Nitrate (N)	<o.1	mg/L	10 MAC
Nitrite (N)	<0.1	mg/L	1 MAC
Sulphate	<2.0	mg/L	500 AO
T- Aluminum	0.021	mg/L	0.1 Operational Std.
T- Antimony	<0.0002	mg/L	0.006 MAC
T- Arsenic	<0.002	mg/L	0.010 MAC
T- Boron	0.009	mg/L	5IMAC
T- Cadmium	<0.00001	mg/L	0.0005 MAC
T-Calcium	6.19	mg/L	
T-Chromium	0.001	mg/L	0.05 MAC
T-Copper	0.004	mg/L	1.0 AO
T-Iron	0.02	mg/L	0.3 AO
T-Lead	0.0002	mg/L	0.010 MAC
T-Lithium	<0.001	mg/L	
T-Magnesium	0.62	mg/L	
T-Manganese	0.0021	mg/L	0.05 AO
T-Mercury	<0.00001	mg/L	1ug/L MAC
AO = Aesthetic Objective; MAC = Max. Allowable Concentration;			
IMAC = Interim Mac; >= Greater than; < = Less than			
Results relate only to samples as submitted.			
Canadian Drinking Water guidelines as listed on Dec 5th, 2005			

Figure 5: Stamp River Raw Water Quality Data

This water data is largely for metals and other physical parameters. None of the results show exceedances of the maximum allowable concentrations (MAC).

5.2.4. Stamp River Intake

It is evident that Truman Creek has a negative effect on the Stamp River water quality, it would therefore be recommended to either relocate the existing intake location to upstream of Truman Creek or apply adequate filtration and disinfection to manage the turbidity ‘spikes’ and any exceedances in microbiological parameters.

It is anticipated that any method of treatment would be capable of treating these two parameters, however excessive loading results in increased costs and maintenance for the treatment system; potentially leading to fouling and reduced water quality. From a treatment perspective, it is preferable to modify the intake location.

From a capital cost perspective, it may be preferred to retain the existing intake location, since the land is already under ownership by the ACRD. To install an intake upstream of Truman Creek, land will likely need to be leased or purchased from the adjacent lot at 7715 Sportsman Rd. The additional capital cost may be worthwhile due to the savings in treatment and maintenance.

Given the reduced risk of poor water quality, the cost estimate will therefore include a relocation of the Stamp River intake. The treatment design should include provisions to treat higher turbidity and coliform exceedances should these occur despite the intake relocation. The associated costs of land acquisition are discussed in Section 7.

6. Proposed Treatment Alternatives

6.1. TREATMENT VENDORS

Four water treatment suppliers were contacted regarding a potential treatment system for the BCWS. Vendors were provided with historical water quality data (Turbidity, coliforms, and physical data from 2010). Initially four treatment alternatives were selected for review:

- Ultrafiltration
- Adsorption clarifier
- Tube settler
- Dissolved air floatation

The DAF and tube settler vendor indicated that the tube settler was the preferential treatment over the DAF, as DAF units have shown a higher cost than the other proposed alternatives while having a larger footprint and requiring additional forms of treatment since they are not recognized as having log reduction credit without subsequent filtration. Given these considerations and the supplier's recommendation to proceed with a tube settler, DAF was removed as an alternative. Unfortunately, this same vendor was unable to provide a quote in the time limits of this report and tube settlers were also dropped but are recommended be reviewed in preliminary design.

6.2. TREATMENT SELECTION

At such a preliminary stage and without recent detailed water quality information, it can be impractical to provide a recommendation on a primary form of treatment. At this stage, it is believed that all the proposed methods of treatment are viable, however each holds it's own advantages. Factors considered for providing a method of treatment include the following:

- Operations and maintenance
- Treatment ancillaries
- Capital cost

.

6.2.1. Operations and Maintenance

Operations and maintenance costs are a significant factor due to the likely desire to maintain and operate the system in-house with typical components available off-the shelf. Beaver Creek is not considered a remote community but also lacks much of the product availability of other urban centers. The recent closure of Highway 4 in 2023 was an indication of the potential risks to infrastructure in the Alberni Valley should critical components be required.

The adsorption clarifier system requires coagulant and polymer addition to effectively clarify and filter to remove particulates. Ultrafiltration benefits from coagulant addition, however it is not considered a requirement. As coagulation may be required based on filtration performance, they are considered equivalent for chemical costs.

Shared costs between each alternative for O&M include power supply and staffing on-call to service the plant any time of day. Both are anticipated to be a significant cost to the District compared to the existing pumphouse and treatment system. Unit rates for O&M are included in the cost estimate section.

6.2.2. Treatment ancillaries

Each treatment alternative is anticipated to require backflushing of the filtration component. Disposal of the filtration effluent is expected to be completed largely on-site through the use of a subsurface dispersal field combined with solids removal when required. The frequency of such removals and servicing the field will depend on fluctuating water quality. Backwashing is required for all treatment types to remove solids, limit filter fouling and to achieve a turbidity reading of less than one NTU. Because all methods require this disposal, it was not considered a deciding factor in selecting a treatment alternative.

Ultraviolet disinfection is often utilized as an effective form of treatment to be included if the primary treatment filtration method is not recognized as being eligible for log-reduction credit. Ultrafiltration is recognized as having log-reduction credits for the removal of Giardia and Cryptosporidium, it would therefore be considered by Island Health meeting filtration providing log reduction credits (one of the forms of treatment).

Vendor 3’s system combines pretreatment in the form of an adsorption clarifier with mixed media filtration within a single tankage. It is not specifically clear as to whether this will qualify for a full 3 log-reduction credit of *cryptosporidium* and *giardia*, it is therefore up to the DWO’s discretion. For this reason, ultraviolet disinfection may be a requirement and is therefore added to the O&M power costs and capital costs.

With the above factors considered, both the ultrafiltration system and the adsorption clarifier filter are acceptable options that will provide adequate treatment for the raw surface water. The final deciding factor is the total capital cost.

6.3. CAPITAL COST

Capital cost estimates are summarized below from each vendor.

Table 3: Process cost estimates

Vendor	Primary Treatment Method	Treatment Capital Cost
Vendor 1	Ultrafiltration	$2,300,000
Vendor 2	Ultrafiltration	$1,985,000
Vendor 3	Adsorption Clarifier	$1,130,000

Each vendor has differing proposals for treatment infrastructure. Therefore, it is not reasonable to compare each quote directly, additional cost considerations must be made and are discussed in the following sections. Vendor 1 provided only a preliminary cost estimate based on anecdotal information without a proposal, whereas Vendor 2 has provided a cost estimate with detailed proposal. For the more detailed cost estimate, the value from Vendor 2 was therefore used. Note these costs due not include for any impacts of recent tariffs between the US and Canada.

6.3.1. Water Treatment Ancillaries

The estimates provided by vendors are not all-encompassing of potential treatment costs, the prices above are simply the quoted values of the filtration components. Each quotation varies in what is included. Therefore, ancillaries may be necessary to comply with provincial guidelines and to provide a complete treatment system. These may include:

- Ultraviolet disinfection: UV disinfection will provide log removal credits for Viruses, Cryptosporidium and Giardia. It is also a requirement to comply with drinking water objectives for two forms of treatment.

- Chlorination: Dosing of sodium hypochlorite prior to distribution is needed to maintain a minimum residual. It can also provide log-removal credits for cryptosporidium, giardia and viruses.

- Building enclosure: Generally, process treatment suppliers do not include a building enclosure in their quotations. A manufactured building to house filtration, chemical storage, and UV disinfection will be required for appropriate protection and temperature regulation. For the purpose of this quote it was assumed a metal engineered building complete with HVAC and electrical was used. A value of $6460 per square meter of floorspace was used based on recent cost estimates. Building sizes vary for each type of treatment process.

- Backwash effluent disposal: Each filtration process consists of a backwashing procedure resulting in significant volumes of concentrated effluent. This water is not regulated as wastewater, however it must be effectively managed to limit contamination to the surrounding environment. A proposed method of discharge is to an engineered subsurface disposal field.

6.3.2. Total Treatment Infrastructure Costs

The following table indicates estimated total capital costs including building construction, electrical upgrades, ancillary treatment equipment, an effluent disposal system, contingency, engineering, inflation and commissioning.

Table 4: Total treatment cost estimates

Vendor	Primary Treatment Method	Total Capital Cost
Vendor 2	Ultrafiltration	$7,455,000
Vendor 3	Adsorption Clarifier	$8,450,000

6.3.3. Treatment Selection

Each of these proposed alternatives are viable for treatment of the raw water. It would be prudent to collect raw water quality samples from various locations in the river throughout the year, both upstream of Truman Creek and at the existing intake location. More detailed and recent water quality data would provide a better understanding of which treatment method would be best suited to the raw water quality.

7. BCWS Infrastructure Requirements

7.1. LAND TENURE REQUIREMENTS

The current raw water intake and pumphouse is located on leased land on 7692 Sportsman Road. Their current tenure is a land area of 15.24 m by 15.24 m.

The largest estimated footprint of the treatment alternatives is 116 m^2 including the new water treatment plant, chemical storage, and pumping infrastructure. Additional land may be required for an access roadway, parking, security, back up power, backwash disposal field, and landscaping

7.1.1. Existing Intake Location

7692 Sportsman Rd property has a total value of $1,210,500 for the 12,125.51 m^2 property as per the BC Assessment. The ACRD has identified that the existing landowner has sought to terminate the lease, it is therefore assumed that expansion of the lease area or partial sale is unlikely, and a full purchase of the lot would be required. An alternate property could be explored to house the treatment plant as indicated below.

7.1.2. Alternate Intake Location

The most likely location for purchase upstream of Truman Creek is the adjacent Alberni Fish and Game Club lands located at 7715 Sportsman Rd. The BC Assessment indicates a land value of $1,773,000 for the 477,464.15 m^2 property. Resulting in $3.71 per square meter of land.

The land at 7715 Sportsman Rd. is designated in the ACRD GIS as crown provincial and largely undeveloped. Therefore, a transfer of ownership could potentially occur through a sponsored Crown grant from the province. Alternatively, the BCWS, through the ACRD could receive a nominal rent tenure where the land would be leased from the province at a reduced rate. A sponsored Crown grant is only possible for local governments and regional districts, such as the ACRD, but likely not the BCWS. However, a nominal rent tenure can be leased to municipalities, regional districts, and community organizations, which could include the BCWS. Whichever avenue is used, this land parcel is likely the most reasonable location for housing the new treatment plant and raw water intake. To consider this potential cost for a land, a surface area of approximately 7000 square meters to house the access road, treatment plant, disposal field and parking lot. The resulting land cost would translate to $25,970. This number cannot be relied upon since ownership of crown land is not possible, it was therefore not included in the cost estimate.

To accommodate the more expensive of the land costs, the full $1,210,500 land parcel at 7692 Sportsman Road was included in the cost estimate. As the proposed treatment does allow for the treatment of water at this existing location, it was felt that this location would still make sense from a feasibility perspective. It is noted that this value came from the BC Assessment database and may not be indicative of the true market value of the property. The source of the assessment data is recent sales of neighbouring properties and regional housing market trends. The true price demanded by the owner is subject to many external factors, potentially increasing the cost of purchase.

7.2. IMPACTS & ADDITIONS TO EXISTING INFRASTRUCTURE

To relocate the Stamp River intake upstream of Truman Creek, notable additions to existing infrastructure would be as follows.

- New infiltration gallery and pumphouse: Relocation of the intake would require a new infiltration gallery or river intake. Historical water level in the river shows less than 0.5 m, thus an infiltration gallery is the best alternative to ensure flows are captured in these low water level scenarios.

- Access road to a proposed treatment plant location on 7715 Sportsman Rd: An access road to a site location adjacent to the Stamp River would be required, likely through the Alberni Fish and Game Club property. Ensuring safe separation distance from the shooting range, the road could be up to 1km in length.

Watermain extension from the proposed treatment plant location to distribution. The existing 200mm distribution connection at Sportsman Rd and 300mm connection at McKenzie Rd. would be utilized with a watermain extension to the treatment plant discharge. If an alternate intake and treatment plant location would be utilized, the plant discharge could follow the existing service connection alignment along Sportsman Rd. to McKenzie Rd, resulting in approximately 1.2km of new 300mm watermain. The following upgrades would likely be required regardless of the intake location, some of these are already discussed in previous sections.

- Booster pumping (post treatment) to supply the distribution network. Understanding that some of the treatment processes create significant pressure losses and potentially a “break” in hydraulic head, booster pumping would be required to pressurize the distribution system.

- Distribution upgrades: It is not in the scope of this study to assess the distribution infrastructure, however it would be prudent for the ACRD and BCWS to assess the existing pipe network and reservoirs. It is understood that some of the infrastructure is original and would require upgrades or replacement.

- New infiltration gallery: it was noted in the 2010 Koers report that the infiltration gallery is over 50 years old at the time of writing and is likely past it’s usable life. It was noted that backflushing was required daily during peak demand and weekly during average demands. Sand was also recorded as entering the water supply system.

- New pumphouse: the 2010 Koers report also noted that the current electrical room and chlorination room floor elevations are within the 200-year flood elevation. It was also noted that the pumphouse is ‘congested’ with most room taken up by pump motors, valves, and piping. Limited space exists for maintenance. Replacement of the pumphouse is anticipated with the relocated intake.

- Land purchase: the existing pumphouse is located within a 15.24 m by 15.24 m statutory right of way (SROW) registered under plan 1786R. The building takes up 6 m by 5 m of the ROW, leaving limited space for expansion. ACRD identified that none of the land parcels are municipally owned. Expansion options are discussed in section 7.1.2.

- Electrical upgrades. The power draw of a new water treatment plant is significant, likely requiring three phase power supply and transmission. Other electrical components considered in this cost include an onsite backup generator, VFDs, SCADA, and mechanical control cabinetry.

It is evident that system upgrades are required regardless of the intake location. Larger infrastructure costs are anticipated for a new river intake structure and watermain extension.

8. 20-year Net Present Value – (Class D Cost Estimate)

The following cost estimate was prepared based on the unit rates in Table 5 below, estimates from suppliers and previous projects.

Table 5: Unit rate estimates

Item	Unit Rate
Coagulant	$0.85 / gram
Replacement Media	$208 / ft^3
Power Consumption	$0.13 / kWhr
Sludge / Screenings Disposal	$125 / tonne
Engineered Building Construction	$6,500 / m^2
Reinforced Concrete	$2,500 / m^3
PVC Pipe Installation	$350 / m

For estimating the net present value of operations and maintenance costs a 4% discount rate was utilized over a 20-year period. The results of this cost estimate are summarized in the table below. It is noted that these costs are all preliminary and would be refined during design stages.

Table 6: Class D Cost Estimate

Item	Ultrafiltration	Adsorption Clarifier
Process Package Quote	$1,985,000	$1,130,000
Land Purchase	$1,210,500	$1,210,500
Civil Site Works	$721,000	$721,000
Ancillaries	$440,000	$582,000
Backwash Effluent Disposal	$220,000	$220,000
Electrical Upgrades	$352,000	$352,000
Building Construction	$1,137,000	$1,129,000
20-year O&M NPV	$6,763,000	$6,668,000
Contractor Markup on Process Equipment (25%)	$1,034,000	$853,000
Engineering (20%)	$827,000	$683,000
Capital Cost Inflation (5%)	$207,000	$171,000
Tendering and Commissioning (1%)	$42,000	$35,000
Contingency (40%)	$1,654,000	$1,365,000
Total (Net Present Value)	**$16,592,500**	**$15,119,500**

For Ultrafiltration, only the price listed from Vendor 2 is shown as this was a number provide in a proposal. The price provided by Vendor 1 was preliminary and given in correspondence rather than within a comprehensive proposal. A budget price was also provided by Nuvonic for an Ultraviolet (UV) filtration unit for the specified flow rate. UV disinfection is required for an adsorption clarifier to comply with 4-3-2-1 treatment guidelines, therefore this cost was included in the ancillaries line item.

While ultrafiltration presents a higher cost than the adsorption clarifier, both in the package quotation and the total cost, the difference in price is still less than the contingency of both projects. These prices are considered ‘Class D’, meaning a variance of +/- 50% is expected. The definition of this level of estimate is included below from EGBC:

Class D estimate (±50%): A preliminary estimate which, due to little or no site information, indicates the approximate magnitude of cost of the proposed project, based on the client's broad requirements. This overall cost estimate may be derived from lump sum or unit costs for a similar project. It may be used in developing long term capital plans and for preliminary discussion of proposed capital projects.

To develop a cost per cubic meter of water use, 20-years of payments and flows were projected to 2044. To convert the present value capital cost to future payments, it has been assumed that the ACRD would apply for a long term loan through the Municipal Finance Authority. The current 20 year loan rate is 4.75% for municipalities. A table is included below showing the average yearly payments based on future water usage. As a conservative estimate, the higher capital cost option of $16,592,500 was utilized.

Table 7: 20-year Cost Per Cubic Meter

Year	Annual Payment (O&M + 20-year capital cost)	Projected Yearly Flow (m^3)	Cost Per Water Usage ($/$m^3$)
2025	($1,303,348.63)	399,414	($3.26)
2026	($1,303,348.63)	403,408	($3.23)
2027	($1,303,348.63)	407,442	($3.20)
2028	($1,303,348.63)	411,517	($3.16)
2029	($1,303,348.63)	415,632	($3.13)
2030	($1,303,348.63)	419,788	($3.10)
2031	($1,303,348.63)	423,986	($3.07)
2032	($1,303,348.63)	428,226	($3.04)
2033	($1,303,348.63)	432,508	($3.01)
2034	($1,303,348.63)	436,833	($2.98)
2035	($1,303,348.63)	441,201	($2.95)
2036	($1,303,348.63)	445,613	($2.92)
2037	($1,303,348.63)	450,070	($2.89)
2038	($1,303,348.63)	454,570	($2.86)
2039	($1,303,348.63)	459,116	($2.84)
2040	($1,303,348.63)	463,707	($2.81)
2041	($1,303,348.63)	468,344	($2.78)
2042	($1,303,348.63)	473,028	($2.75)
2043	($1,303,348.63)	477,758	($2.73)
2044	($1,303,348.63)	482,536	($2.70)

The resulting average cost for water usage is **$2.96 per cubic meter**. This will cover future O&M costs and the present cost of constructing the water treatment plant. This does not account for annual O&M of the current water system infrastructure which was reported as $611,874 in the 2023 BCWS Annual Report. A higher value may be applied by the District to raise funds for future treatment expansion. Additional costs may be required if an increase in demand is not fully realized by 2044. If population growth and water usage remains stagnant, it is recommended to continue to evaluate bulk water purchasing against the 2025 rate of $3.26/$m^3$. Additional costs for distribution upgrades and capital costs may arise, therefore the rates should be evaluated on a yearly basis.

Currently the BCWS purchase water from the City of Port Alberni at ta a rate of $0.50 /m3, as reported in the 2023 report. This currently provides for a significant savings in cost of water to service the Beaver Creek Community.

9. Next Steps

The recommended next steps for the BCWS are as follows:

1. **Evaluation of the proposed Port Alberni Bulk Water Rate**
    - Rate per m^3 vs both the average rate and current rate of financing a new water treatment system.
    - Term of agreement
2. **Choose Option**
    - Continue Bulk Water Agreement at new negotiated rate and term
    - Pursue Design of BCWS Water Treatment Plant
3. **Bulk water agreement (Status Quo)**
    - Remain on bulk water for foreseeable future or until re-evaluation is required/desired again
    - Evaluate if need for emergency connection remains
        - Upgrades/maintenance to maintain this connection
4. **BCWS Water Treatment Plant**

    - Temporary bulk water agreement required
    - Begin intelligence gathering on property acquisition or land tenure options
    - 30% Preliminary design of intake location
        - Permitting requirements with Ministry Water, Land, and Resource Stewardship for either:
            - *Upgrades to existing infiltration gallery*
            - *New intake location*
    - Water quality sampling program at inlet location– capture all seasons
    - 30% Preliminary design of treatment plant
        - Confirm treatment technology
        - Confirm conveyance criteria
        - Confirm building footing print
        - Confirm waste disposal
    - Pursue property acquisition or land tenure
    - Revaluate decision to move to detailed design and construction of BCWS treatment facility or remain on bulk water from Port Alberni.

10. Closing

This memorandum is intended to be considered with the two adjacent memorandums regarding surface water and groundwater feasibility. The analysis concludes that a water treatment plant with the Stamp River as a source is feasible, pending various infrastructure upgrades and movement of the river intake to the lot at 7715 Sportsman Road. Expansion of the existing treatment plant is required to meet current treatment objectives and guidelines.

Preliminary pricing from treatment vendors indicate an average treatment cost of $8,578,000, including treatment ancillaries, building construction, contingency and other required upgrades. Average 20-year operations and maintenance (O&M) estimate shows a cost of $6,716,000 in 2025 dollars. This is in additional to O&M that occurs on the system (ie without a water treatment plant).

Given the preliminary level of this cost estimate, both treatment alternatives, and likely others, are considered viable. Detailed site information and water quality data will further guide a decision on the selected method. Regulatory changes can change instantly, rendering a selected method inviable or out of compliance. As such, the selected treatment method would be re-evaluated and proved out during preliminary design.

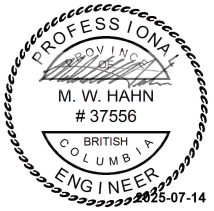
We trust the above final memorandum provides valuable information to the District to decide on a method to proceed. Should any questions arise, do not hesitate to contact the undersigned.

Sincerely,
McElhanney Ltd.

Prepared by:

Jack Percy, EIT
JPercy@mcelhanney.com
778-584-3927

Reviewed by:



Mitchell Hahn, PEng
MHahn@mcelhanney.com
778-584-7003

APPENDIX A

Statement of Limitations

Statement of Limitations

Use of this Report. This report was prepared by McElhanney Ltd. ("**McElhanney**") for the particular site, design objective, development and purpose (the "**Project**") described in this report and for the exclusive use of the client identified in this report (the "**Client**"). The data, interpretations and recommendations pertain to the Project and are not applicable to any other project or site location and this report may not be reproduced, used or relied upon, in whole or in part, by a party other than the Client, without the prior written consent of McElhanney. The Client may provide copies of this report to its affiliates, contractors, subcontractors and regulatory authorities for use in relation to and in connection with the Project provided that any reliance, unauthorized use, and/or decisions made based on the information contained within this report are at the sole risk of such parties. McElhanney will not be responsible for the use of this report on projects other than the Project, where this report or the contents hereof have been modified without McElhanney's consent, to the extent that the content is in the nature of an opinion, and if the report is preliminary or draft. This is a technical report and is not a legal representation or interpretation of laws, rules, regulations, or policies of governmental agencies.

Standard of Care and Disclaimer of Warranties. This report was prepared with the degree of care, skill, and diligence as would reasonably be expected from a qualified member of the same profession, providing a similar report for similar projects, and under similar circumstances, and in accordance with generally accepted engineering and scientific judgments, principles and practices. McElhanney expressly disclaims any and all warranties in connection with this report.

Information from Client and Third Parties. McElhanney has relied in good faith on information provided by the Client and third parties noted in this report and has assumed such information to be accurate, complete, reliable, non-fringing, and fit for the intended purpose without independent verification. McElhanney accepts no responsibility for any deficiency, misstatements or inaccuracy contained in this report as a result of omissions or errors in information provided by third parties or for omissions, misstatements or fraudulent acts of persons interviewed.

Effect of Changes. All evaluations and conclusions stated in this report are based on facts, observations, site-specific details, legislation and regulations as they existed at the time of the report preparation. Some conditions are subject to change over time and the Client recognizes that the passage of time, natural occurrences, and direct or indirect human intervention at or near the site may substantially alter such evaluations and conclusions. Construction activities can significantly alter soil, rock and other geologic conditions on the site. McElhanney should be requested to re-evaluate the conclusions of this report and to provide amendments as required prior to any reliance upon the information presented herein upon any of the following events: a) any changes (or possible changes) as to the site, purpose, or development plans upon which this report was based, b) any changes to applicable laws subsequent to the issuance of the report, c) new information is discovered in the future during site excavations, construction, building demolition or other activities, or d) additional subsurface assessments or testing conducted by others.

Independent Judgments. McElhanney will not be responsible for the independent conclusions, interpretations, interpolations and/or decisions of the Client, or others, who may come into possession of

this report, or any part thereof. This restriction of liability includes decisions made to purchase, finance or sell land or with respect to public offerings for the sale of securities.

Construction Cost Estimates. This construction cost estimate has been prepared using the design and technical information currently available, and without the benefit of Survey, Geotechnical, or Environmental information. Furthermore, McElhanney cannot predict the competitive environment, weather or other unforeseen conditions that will prevail at the time that contractors will prepare their bids. The cost estimate is therefore subject to factors over which McElhanney has no control, and McElhanney does not guarantee or warranty the accuracy of such estimate.

APPENDIX B

Water Quality Data

Water Sample Range Report

Vancouver Island Health Authority
Central Island

Facility Name: BEAVER CREEK IMPROVEMENT DISTRICT
Facility Type: DWT
Date Range: Jan 1 2012 to Dec 4 2012
Date Created: Dec 05 2012

Sampling Site	Date Collected	Total Coliform	E. Coli	Fecal Coliform
, 6287 Springfield Rd-hydrant, Dist. site, Monthly				
	10-Jan-2012	L1	L1	
	13-Feb-2012	L1	L1	
	13-Mar-2012	L1	L1	
	10-Apr-2012	L1	L1	
	14-May-2012	L1	L1	
	26-Jun-2012	L1	L1	
	24-Jul-2012	L1	L1	
	20-Aug-2012	T		
	28-Aug-2012	L1	L1	
	24-Oct-2012	L1	L1	
	19-Nov-2012	L1	L1	
	Total Positive:	**0**	**0**	**0**
5520 Beaver Creek Road, Port Alberni, B.C., Gill School Hydrant, Dist. site, Monthly				
	16-Jan-2012	L1	L1	
	06-Feb-2012	L1	L1	
	05-Mar-2012	L1	L1	
	03-Apr-2012	L1	L1	
	07-May-2012	L1	L1	
	05-Jun-2012	L1	L1	
	16-Jul-2012	L1	L1	
	14-Aug-2012	L1	L1	
	17-Sep-2012	L1	L1	
	20-Nov-2012	L1	L1	
	Total Positive:	**0**	**0**	**0**
6038 Beaver Creek Road, Port Alberni, B.C., Office, Dist. site, Bi-weekly				
	04-Jan-2012	L1	L1	
	09-Jan-2012	L1	L1	
	11-Jan-2012	L1	L1	
	16-Jan-2012	L1	L1	
	24-Jan-2012	L1	L1	
	25-Jan-2012	L1	L1	
	26-Jan-2012	L1	L1	
	27-Jan-2012	L1	L1	
	31-Jan-2012	L1	L1	
	13-Feb-2012	L1	L1	
	21-Feb-2012	L1	L1	
	24-Feb-2012	L1	L1	
	28-Feb-2012	L1	L1	
	28-Feb-2012 9:00:00	L1	L1	

	13-Mar-2012	L1	L1	
	19-Mar-2012	L1	L1	
	20-Mar-2012	L1	L1	
	02-Apr-2012	L1	L1	
	10-Apr-2012	L1	L1	
	23-Apr-2012	L1	L1	
	14-May-2012	L1	L1	
	22-May-2012	L1	L1	
	19-Jun-2012	L1	L1	
	04-Jul-2012	L1	L1	
	24-Jul-2012	L1	L1	
	31-Jul-2012	L1	L1	
	28-Aug-2012	L1	L1	
	05-Sep-2012	L1	L1	
	25-Sep-2012	L1	L1	
	02-Oct-2012	L1	L1	
	24-Oct-2012	L1	L1	
	29-Oct-2012	L1	L1	
	19-Nov-2012	L1	L1	
	27-Nov-2012	L1	L1	
	Total Positive:	**0**	**0**	**0**
Port Alberni, 7296 Dashwood Rd. Standpipe, Dist. site, Monthly				
	30-Jan-2012	L1	L1	
	27-Feb-2012	L1	L1	
	26-Mar-2012	L1	L1	
	30-Apr-2012	L1	L1	
	28-May-2012	L1	L1	
	10-Jun-2012	L1	L1	
	11-Jul-2012	L1	L1	
	12-Sep-2012	L1	L1	
	10-Oct-2012	L1	L1	
	Total Positive:	**0**	**0**	**0**
, North Reservoir, Dist. site, Monthly				
	04-Jan-2012	L1	L1	
	09-Jan-2012	L1	L1	
	11-Jan-2012	L1	L1	
	24-Jan-2012	L1	L1	
	25-Jan-2012	L1	L1	
	26-Jan-2012	L1	L1	
	27-Jan-2012	L1	L1	
	31-Jan-2012	L1	L1	
	01-Feb-2012	L1	L1	
	21-Feb-2012	L1	L1	
	24-Feb-2012	L1	L1	
	28-Feb-2012	L1	L1	
	28-Feb-2012 9:00:00 PM	L1	L1	
	19-Mar-2012	L1	L1	

	20-Mar- 2012	L1	L1	
	28-Mar-2012	L1	L1	
	02-Apr-2012	L1	L1	
	23-Apr-2012	L1	L1	
	22-May-2012	L1	L1	
	19-Jun-2012	L1	L1	
	04-Jul-2012	L1	L1	
	05-Sep-2012	L1	L1	
	02-Oct-2012	L1	L1	
	29-Oct-2012	L1	L1	
	27-Nov-2012	L1	L1	
	Total Positive:	**0**	**0**	**0**
Port Alberni, 6000 Kitsuksis , Dist. site, Weekly				
	04-Jan-2012	L1	L1	
	09-Jan-2012	L1	L1	
	10-Jan-2012	L1	L1	
	11-Jan-2012	L1	L1	
	16-Jan-2012	L1	L1	
	30-Jan-2012	L1	L1	
	31-Jan-2012	L1	L1	
	01-Feb-2012	95.9	4.1	
	06-Feb-2012	L1	L1	
	13-Feb-2012	L1	L1	
	21-Feb-2012	L1	L1	
	27-Feb-2012	L1	L1	
	05-Mar-2012	L1	L1	
	13-Mar-2012	L1	L1	
	19-Mar-2012	L1	L1	
	26-Mar-2012	L1	L1	
	03-Apr-2012	L1	L1	
	10-Apr-2012	L1	L1	
	23-Apr-2012	L1	L1	
	30-Apr-2012	L1	L1	
	07-May-2012	L1	L1	
	14-May-2012	L1	L1	
	22-May-2012	L1	L1	
	28-May-2012	L1	L1	
	05-Jun-2012	L1	L1	
	11-Jun-2012	L1	L1	
	19-Jun-2012	L1	L1	
	26-Jun-2012	L1	L1	
	04-Jul-2012	L1	L1	
	11-Jul-2012	L1	L1	
	16-Jul-2012	L1	L1	
	24-Jul-2012	L1	L1	
	14-Aug-2012	L1	L1	
	28-Aug-2012	L1	L1	
	05-Sep-2012	L1	L1	
	12-Sep-2012	L1	L1	
	17-Sep-2012	L1	L1	
	25-Sep-2012	L1	L1	
	02-Oct-2012	L1	L1	
	24-Oct-2012	L1	L1	
	29-Oct-2012	L1	L1	
	14-Nov-2012	L1	L1	
	19-Nov-2012	L1	L1	
	27-Nov-2012	L1	L1	
	Total Positive:	**1**	**1**	**0**

, 7000 Swanson Rd-Standpipe, Dist. site, Monthly				
	06-Feb-2012	L1	L1	
	05-Mar-2012	L1	L1	
	03-Apr-2012	L1	L1	
	07-May-2012	L1	L1	
	05-Jun-2012	L1	L1	
	16-Jul-2012	L1	L1	
	14-Aug-2012	L1	L1	
	17-Sep-2012	L1	L1	
	Total Positive:	**0**	**0**	**0**
, 6825 Lamarque Road-Standpipe, Dist. site, Monthly				
	30-Jan-2012	L1	L1	
	27-Feb-2012	L1	L1	
	26-Mar-2012	L1	L1	
	30-Apr-2012	L1	L1	
	28-May-2012	L1	L1	
	11-Jun-2012	L1	L1	
	11-Jul-2012	L1	L1	
	07-Aug-2012	L1	L1	
	12-Sep-2012	L1	L1	
	10-Oct-2012	L1	L1	
	Total Positive:	**0**	**0**	**0**
, Kitsuksis Reservoir, Dist. site, Monthly				
	24-Jan-2012	L1	L1	
	26-Jan-2012	L1	L1	
	27-Jan-2012	L1	L1	
	24-Feb-2012	L1	L1	
	28-Feb-2012	L1	L1	
	28-Feb-2012 9:00:00 PM	L1	L1	
	21-Mar-2012	L1	L1	
	28-Mar-2012	L1	L1	
	02-Apr-2012	L1	L1	
	07-Aug-2012	L1	L1	
	21-Aug-2012	L1	L1	
	05-Sep-2012	L1	L1	
	Total Positive:	**0**	**0**	**0**
P.A. Assoc. For Comm.Living, 5535 Maple Rd, 5535 Maple Road/P.A.Assoc.Com, Dist. site, Monthly				
	10-Jan-2012	L1	L1	
	16-Jan-2012	L1	L1	
	25-Jan-2012	L1	L1	
	25-Jan-2012	L1	L1	
	01-Feb-2012	L1	L1	
	21-Feb-2012	L1	L1	
	19-Mar-2012	L1	L1	
	23-Apr-2012	L1	L1	
	22-May-2012	L1	L1	

	19-Jun-2012	L1	L1	
	04-Jul-2012	L1	L1	
	31-Jul-2012	L1	L1	
	05-Sep-2012	L1	L1	
	02-Oct-2012	L1	L1	
	29-Oct-2012	L1	L1	
	Total Positive:	**0**	**0**	**0**
, Pumphouse treated water, Dist. site, Bi-weekly				
	04-Jan-2012	L1	L1	
	09-Jan-2012	L1	L1	
	11-Jan-2012	L1	L1	
	24-Jan-2012	L1	L1	
	26-Jan-2012	L1	L1	
	31-Jan-2012	L1	L1	
	24-Feb-2012	L1	L1	
	28-Feb-2012	L1	L1	
	28-Feb-2012 9:00:00 PM	L1	L1	
	13-Mar-2012	L1	L1	
	20-Mar-2012	L1	L1	
	21-Mar-2012	L1	L1	
	28-Mar-2012	L1	L1	
	02-Apr-2012	L1	L1	
	11-Jun-2012	L1	L1	
	19-Jun-2012	L1	L1	
	04-Jul-2012	L1	L1	
	16-Jul-2012	L1	L1	
	24-Jul-2012	L1	L1	
	14-Aug-2012	L1	L1	
	05-Sep-2012	L1	L1	
	12-Sep-2012	L1	L1	
	17-Sep-2012	L1	L1	
	25-Sep-2012	L1	L1	
	24-Oct-2012	L1	L1	
	29-Oct-2012	L1	L1	
	05-Nov-2012	L1	L1	
	14-Nov-2012	L1	L1	
	19-Nov-2012	L1	L1	
	27-Nov-2012	L1	L1	
	Total Positive:	**0**	**0**	**0**
, 5667 Chapman Road, Dist. site, Monthly				
	30-Jan-2012	L1	L1	
	01-Feb-2012	L1	L1	
	27-Feb-2012	L1	L1	
	26-Mar-2012	L1	L1	
	30-Apr-2012	L1	L1	
	28-May-2012	L1	L1	
	11-Jun-2012	L1	L1	
	11-Jul-2012	L1	L1	
	07-Aug-2012	L1	L1	
	12-Sep-2012	L1	L1	
	10-Oct-2012	L1	L1	
	05-Nov-2012	L1	L1	
	Total Positive:	**0**	**0**	**0**

, 5780 Beaver Creek Road, Dist. site, No Regular Sampling

Port Alberni, Fresh Water, Dist. site, No Regular Sampling

Result Values: **E - estimated** **L - less than** **G - greater than**

Interpreting Sample Reports

In VIHA, the results of drinking water sampling are reported using the following coding system:

L1 Less than 1 (no detectable bacteria) - Meaning: No bacteria present

OG Overgrown - Meaning: Too many background bacteria to give an accurate count

EST Estimated Count

and

A Sample not tested; Too long in transit

C Sample leaked/broken in transit

D Sample not tested; No collection date given

T Sample submitted unsatisfactory. Exceeded 30 hours holding time, please resample.

NS No sample received with requisition

Samples that contain total coliform:	1	0.45% of total
Samples that contain e. coli:	1	0.45% of total
Samples that contain fecal coliform:	0	0.00% of total
Number of positive samples in last 30 days:	0/13	
Total number of samples:	220	

Comments:

Environmental Health Officer
Jan 23 2013

FOR FURTHER INFORMATION PLEASE CALL: Bruvall, Stephanie (250) 731-1315 Port Alberni

Operator

Beaver Creek Improvement District
B 6038 Beaver Creek Road
Port Alberni, BC
V9Y 8X4

(250) 723-9371

Water Sample Range Report

Vancouver Island Health Authority

Central Island

Facility Name: BEAVER CREEK WATER SYSTEM
Facility Type: DWT
Date Range: Jan 1 2012 to Dec 31 2012
Date Created: Jan 23 2013

Sampling Site	Date Collected	Total Coliform	E. Coli	Fecal Coliform
7656 Beaver Creek Road, North Reservoir, Dist. site, Monthly				
7702 Sportsman Road, Pumphouse Treated, Dist. site, Bi-weekly				
	18/12/2012	L1	L1	
	Total Positive:	**0**	**0**	**0**
7702 Sportsman Road, Pumphouse-RAW-Water, Dist. site, Bi-weekly				
	18/12/2012	70	4	
	Total Positive:	**1**	**1**	**0**
6000 Kitsuksis Road, Kitsuksis Road, Dist. site, Weekly				
	05/11/2012	L1	L1	
	18/12/2012	L1	L1	
	Total Positive:	**0**	**0**	**0**
6287 Springfield Road, Springfield Road, Dist. site, Monthly				
	18/12/2012	L1	L1	
	Total Positive:	**0**	**0**	**0**
7271 Thompson Road, Thompson Road, Dist. site, Monthly				
	14/11/2012	L1	L1	
	Total Positive:	**0**	**0**	**0**
7000 Swanson Road, Swanson Road, Dist. site, Monthly				
	14/11/2012	L1	L1	
	11/12/2012	L1	L1	
	Total Positive:	**0**	**0**	**0**

5520 Beaver Creek Road, Gill School Hydrant, Dist. site, Monthly				
	14/11/2012	3	L1	
	11/12/2012	L1	L1	
	Total Positive:	1	0	0
5535 Maple Road, 5535 Maple Road, Dist. site, Monthly				
	27/11/2012	L1	L1	
	Total Positive:	0	0	0
5667 Chapman Road, 5667 Chapman Road, Dist. site, Monthly				
	04/12/2012	L1	L1	
	Total Positive:	0	0	0
6210 Drinkwater Road, 6210 Drinkwater Road, Dist. site, Monthly				
6825 Lamarque Road, 6825 Lamarque Road, Dist. site, Monthly				
	05/11/2012	L1	L1	
	Total Positive:	0	0	0
7296 Dashwood Road, Dashwood Road, Dist. site, Monthly				
	05/11/2012	L1	L1	
	Total Positive:	0	0	0
Shop Building Tap , 6038 Beaver Creek Road, Dist. site, Bi-weekly				
	18/12/2012	L1	L1	
	Total Positive:	0	0	0

Result Values: **E - estimated** **L - less than** **G - greater than**

Interpreting Sample Reports

In VIHA, the results of drinking water sampling are reported using the following coding system:

L1 Less than 1 (no detectable bacteria) - Meaning: No bacteria present

OG Overgrown - Meaning: Too many background bacteria to give an accurate count

EST Estimated Count

and

A Sample not tested; Too long in transit

C Sample leaked/broken in transit

D Sample not tested; No collection date given

T Sample submitted unsatisfactory. Exceeded 30 hours holding time, please resample.

NS No sample received with requisition

Water Sample Range Report

Vancouver Island Health Authority

Central Island

Facility Name: BEAVER CREEK WATER SYSTEM
Facility Type: DWT
Date Range: Jan 1 2013 to Dec 31 2013
Date Created: Feb 21 2014

Sampling Site	Date Collected	Total Coliform	E. Coli	Fecal Coliform
7656 Beaver Creek Road, North Reservoir, Dist. site, Monthly				
	1/2/2013	L1	L1	
	1/29/2013	L1	L1	
	2/26/2013	L1	L1	
	3/26/2013	L1	L1	
	5/1/2013	L1	L1	
	5/28/2013	L1	L1	
	6/25/2013	L1	L1	
	7/23/2013	L1	L1	
	8/20/2013	L1	L1	
	9/26/2013	L1	L1	
	10/8/2013	L1	L1	
	11/5/2013	L1	L1	
	12/3/2013	L1	L1	
	Total Positive:	**0**	**0**	**0**
7702 Sportsman Road, Pumphouse Treated, Dist. site, Bi-weekly				
	1/2/2013	L1	L1	
	1/8/2013	L1	L1	
	1/16/2013	L1	L1	
	1/22/2013	L1	L1	
	1/29/2013	L1	L1	
	2/5/2013	L1	L1	
	2/13/2013	L1	L1	
	2/20/2013	L1	L1	
	2/26/2013	L1	L1	
	3/12/2013	L1	L1	
	3/20/2013	L1	L1	
	3/26/2013	L1	L1	
	5/1/2013	L1	L1	
	Total Positive:	**0**	**0**	**0**
6000 Kitsuksis Road, Kitsuksis Road, Dist. site, Weekly				
	1/2/2013	L1	L1	
	1/8/2013	L1	L1	
	1/16/2013	L1	L1	
	1/22/2013	L1	L1	

	2/5/2013	L1	L1
	2/13/2013	L1	L1
	2/20/2013	L1	L1
	2/26/2013	L1	L1
	3/5/2013	L1	L1
	3/12/2013	L1	L1
	3/20/2013	L1	L1
	3/26/2013	L1	L1
	4/3/2013	L1	L1
	4/9/2013	L1	L1
	4/16/2013	L1	L1
	5/1/2013	L1	L1
	5/8/2013	L1	L1
	5/15/2013	L1	L1
	5/21/2013	L1	L1
	5/28/2013	L1	L1
	6/4/2013	L1	L1
	6/11/2013	L1	L1
	6/18/2013	L1	L1
	6/25/2013	L1	L1
	7/2/2013	L1	L1
	7/9/2013	L1	L1
	7/18/2013	L1	L1
	7/23/2013	L1	L1
	7/30/2013	L1	L1
	8/6/2013	L1	L1
	8/13/2013	L1	L1
	8/20/2013	L1	L1
	8/27/2013	L1	L1
	9/3/2013	L1	L1
	9/10/2013	L1	L1
	9/17/2013	L1	L1
	9/26/2013	L1	L1
	10/1/2013	L1	L1
	10/9/2013	L1	L1
	10/16/2013	L1	L1
	10/22/2013	L1	L1
	10/29/2013	L1	L1
	11/5/2013	L1	L1
	11/12/2013	L1	L1
	11/20/2013	L1	L1
	11/27/2013	L1	L1
	12/3/2013	L1	L1
	12/10/2013	L1	L1
	12/18/2013	L1	L1
	Total Positive:	**0**	**0**	**0**

6287 Springfield Road, Springfield Road, Dist. site, Monthly			
	1/22/2013	L1	L1
	2/20/2013	L1	L1
	3/20/2013	L1	L1
	4/16/2013	L1	L1
	5/21/2013	L1	L1
	6/18/2013	L1	L1
	7/16/2013	L1	L1
	8/13/2013	L1	L1
	9/10/2013	L1	L1
	10/1/2013	L1	L1

	10/29/2013	L1	L1	
	11/27/2013	L1	L1	
	12/17/2013	L1	L1	
	Total Positive:	**0**	**0**	**0**

7271 Thompson Road, Thompson Road, Dist. site, Monthly

	1/16/2013	L1	L1	
	2/13/2013	L1	L1	
	3/12/2013	L1	L1	
	4/9/2013	L1	L1	
	5/15/2013	L1	L1	
	6/11/2013	L1	L1	
	7/9/2013	L1	L1	
	8/6/2013	L1	L1	
	9/3/2013	L1	L1	
	10/22/2013	L1	L1	
	11/20/2013	L1	L1	
	12/17/2013	L1	L1	
	Total Positive:	**0**	**0**	**0**

7000 Swanson Road, Swanson Road, Dist. site, Monthly

	1/16/2013	L1	L1	
	2/13/2013	L1	L1	
	3/12/2013	L1	L1	
	4/9/2013	L1	L1	
	5/15/2013	L1	L1	
	6/11/2013	L1	L1	
	7/9/2013	L1	L1	
	8/6/2013	L1	L1	
	9/3/2013	L1	L1	
	10/22/2013	L1	L1	
	11/20/2013	L1	L1	
	12/17/2013	L1	L1	
	Total Positive:	**0**	**0**	**0**

5520 Beaver Creek Road, Gill School Hydrant, Dist. site, Monthly

	1/16/2013	L1	L1	
	2/13/2013	L1	L1	
	3/12/2013	L1	L1	
	4/9/2013	L1	L1	
	5/15/2013	L1	L1	
	6/11/2013	L1	L1	
	7/9/2013	L1	L1	
	8/6/2013	L1	L1	
	9/3/2013	L1	L1	
	10/22/2013	L1	L1	
	11/20/2013	L1	L1	
	12/17/2013	L1	L1	
	Total Positive:	**0**	**0**	**0**

5535 Maple Road, 5535 Maple Road, Dist. site, Monthly				
	1/2/2013	L1	L1	
	1/29/2013	L1	L1	
	2/26/2013	L1	L1	
	3/26/2013	L1	L1	
	5/28/2013	L1	L1	
	6/25/2013	L1	L1	
	7/23/2013	L1	L1	
	8/20/2013	L1	L1	
	9/26/2013	L1	L1	
	10/8/2013	L1	L1	
	11/5/2013	L1	L1	
	12/3/2013	L1	L1	
	Total Positive:	**0**	**0**	**0**
5667 Chapman Road, 5667 Chapman Road, Dist. site, Monthly				
	1/8/2013	L1	L1	
	2/5/2013	L1	L1	
	3/5/2013	L1	L1	
	4/3/2013	L1	L1	
	5/8/2013	L1	L1	
	6/4/2013	L1	L1	
	7/2/2013	L1	L1	
	7/30/2013	L1	L1	
	8/27/2013	L1	L1	
	9/17/2013	L1	L1	
	10/16/2013	L1	L1	
	11/12/2013	L1	L1	
	12/10/2013	L1	L1	
	Total Positive:	**0**	**0**	**0**
6210 Drinkwater Road, 6210 Drinkwater Road, Dist. site, Monthly				
	1/8/2013	L1	L1	
	2/5/2013	L1	L1	
	3/5/2013	L1	L1	
	4/3/2013	L1	L1	
	5/8/2013	L1	L1	
	6/4/2013	L1	L1	
	7/2/2013	L1	L1	
	7/30/2013	L1	L1	
	8/27/2013	L1	L1	
	9/17/2013	L1	L1	
	10/17/2013	35	L1	
	11/12/2013	L1	L1	
	12/10/2013	L1	L1	
	Total Positive:	**1**	**0**	**0**
6825 Lamarque Road, 6825 Lamarque Road,				

Dist. site, Monthly				
	1/8/2013	L1	L1	
	2/5/2013	L1	L1	
	3/5/2013	L1	L1	
	4/3/2013	L1	L1	
	5/8/2013	L1	L1	
	6/4/2013	L1	L1	
	7/2/2013	L1	L1	
	7/30/2013	L1	L1	
	8/27/2013	L1	L1	
	9/17/2013	L1	L1	
	10/16/2013	L1	L1	
	11/12/2013	L1	L1	
	12/10/2013	L1	L1	
	Total Positive:	**0**	**0**	**0**

7296 Dashwood Road, Dashwood Road, Dist. site, Monthly				
	1/8/2013	L1	L1	
	2/5/2013	L1	L1	
	3/5/2013	L1	L1	
	4/3/2013	L1	L1	
	5/8/2013	L1	L1	
	6/4/2013	L1	L1	
	7/2/2013	L1	L1	
	7/30/2013	L1	L1	
	8/27/2013	L1	L1	
	9/17/2013	L1	L1	
	10/16/2013	L1	L1	
	11/12/2013	L1	L1	
	12/17/2013	L1	L1	
	Total Positive:	**0**	**0**	**0**

Shop Building Tap , 6038 Beaver Creek Road, Dist. site, Bi-weekly				
	1/2/2013	L1	L1	
	1/22/2013	L1	L1	
	1/29/2013	L1	L1	
	2/20/2013	L1	L1	
	2/26/2013	L1	L1	
	3/20/2013	L1	L1	
	3/26/2013	L1	L1	
	4/16/2013	L1	L1	
	5/1/2013	L1	L1	
	5/21/2013	L1	L1	
	5/28/2013	L1	L1	
	6/18/2013	L1	L1	
	6/25/2013	L1	L1	
	7/16/2013	L1	L1	
	7/23/2013	L1	L1	
	8/13/2013	L1	L1	
	8/20/2013	L1	L1	
	9/10/2013	L1	L1	
	9/26/2013	L1	L1	
	10/1/2013	L1	L1	
	10/8/2013	L1	L1	

10/28/2013	L1	L1	
11/5/2013	L1	L1	
11/27/2013	L1	L1	
12/3/2013	L1	L1	
12/10/2013	L1	L1	
Total Positive:	**0**	**0**	**0**

Result Values: **E - estimated** **L - less than** **G - greater than**

Interpreting Sample Reports

In VIHA, the results of drinking water sampling are reported using the following coding system:

L1 Less than 1 (no detectable bacteria) - Meaning: No bacteria present

OG Overgrown - Meaning: Too many background bacteria to give an accurate count

EST Estimated Count

and

A Sample not tested; Too long in transit

C Sample leaked/broken in transit

D Sample not tested; No collection date given

T Sample submitted unsatisfactory. Exceeded 30 hours holding time, please resample.

NS No sample received with requisition

Samples that contain total coliform:	1	0.47% of total
Samples that contain e. coli:	0	0.00% of total
Samples that contain fecal coliform:	0	0.00% of total
Number of positive samples in last 30 days:	0/15	
Total number of samples:	214	

Comments:

Environmental Health Officer
Feb 25 2014

FOR FURTHER INFORMATION PLEASE CALL: Bruvall, Stephanie (250) 731-1315 Port Alberni

Operator

Alberni-Clayoquot Regional District
3008 5th Avenue
Port Alberni, BC
V9Y 2E3

(250) 720-2713

Water Sample Range Report

Vancouver Island Health Authority

Central Island

Facility Name: BEAVER CREEK WATER SYSTEM
Facility Type: DWT
Date Range: Jan 1 2013 to Dec 31 2013
Date Created: Feb 21 2014

Sampling Site	Date Collected	Total Coliform	E. Coli	Fecal Coliform
7702 Sportsman Road, Pumphouse-RAW-surface water, Source site, Bi-weekly	1/2/2013	55.4	5.2	
	1/8/2013	62.0	5.2	
	1/16/2013	39.3	2.0	
	1/22/2013	27.5	6.3	
	1/29/2013	47.2	2.0	
	2/5/2013	EST 210	EST 9	
	2/13/2013	28.8	L1	
	2/20/2013	24.0	1.0	
	2/26/2013	86.0	1.0	
	3/12/2013	EST 120	EST 13	
	3/20/2013	1413.6	77.6	
	3/26/2013	40.4	1.0	
	4/9/2013	79.4	2.0	
	5/1/2013	37.4	L1	
	5/15/2013	EST 62	EST 4	
	5/28/2013	218.7	1.0	
	6/11/2013	EST 220	EST 8	
	6/25/2013	816.4	12.1	
	7/9/2013	1553.1	5.2	
	7/23/2013	1203.3	6.3	
	8/6/2013	1299.7	6.3	
	8/20/2013	770.1	5.2	
	9/3/2013	435.2	6.3	
	9/26/2013	727.0	27.8	
	10/8/2013	13.2	L1	
	10/22/2013	344.8	14.6	
	11/5/2013	155.3	8.5	
	11/20/2013	79.4	1.0	
	12/3/2013	2.0	L1	
	12/17/2013	42.6	2.0	
	Total Positive:	30	26	0

Result Values: **E - estimated** **L - less than** **G - greater than**

Interpreting Sample Reports

In VIHA, the results of drinking water sampling are reported using the following coding system:

L1 Less than 1 (no detectable bacteria) - Meaning: No bacteria present

OG Overgrown - Meaning: Too many background bacteria to give an accurate count

EST Estimated Count

and

A Sample not tested; Too long in transit

C Sample leaked/broken in transit

D Sample not tested; No collection date given

T Sample submitted unsatisfactory. Exceeded 30 hours holding time, please resample.

Samples that contain total coliform:	30	100.00% of total
Samples that contain e. coli:	26	86.67% of total
Samples that contain fecal coliform:	0	0.00% of total
Number of positive samples in last 30 days:	2/2	
Total number of samples:	30	

Comments:

Environmental Health Officer
Feb 25 2014

FOR FURTHER INFORMATION PLEASE CALL: Bruvall, Stephanie (250) 731-1315 Port Alberni

Operator

Alberni-Clayoquot Regional District
3008 5th Avenue
Port Alberni, BC
V9Y 2E3

(250) 720-2713

Appendix D. Raw Water Quality Parameters—Stamp River Intake (Beaver Creek Improvement District)

Raw Water at Stamp River Intake		Date: Aug 19, 2010	
Test	**Results**	**Units**	**Drinking Water Guidelines**
Alkalinity	17	mg/L	
Colour – Apparent	<5	Colour Units	15 AO
Conductivity	39.7	uS	
Hardness (CaCO3)	18	mg/L	80-100
pH	7.6	pH Units	6.5 - 8.5
Total Dissolved Solids	16	mg/L	500 AO
Turbidity	<0.5	NTU's	5 AO
Chloride	<2.0	mg/L	250 AO
Fluoride	<1.0	mg/L	1.5 MAC
Nitrate (N)	<o.1	mg/L	10 MAC
Nitrite (N)	<0.1	mg/L	1 MAC
Sulphate	<2.0	mg/L	500 AO
T- Aluminum	0.021	mg/L	0.1 Operational Std.
T- Antimony	<0.0002	mg/L	0.006 MAC
T- Arsenic	<0.002	mg/L	0.010 MAC
T- Boron	0.009	mg/L	5IMAC
T- Cadmium	<0.00001	mg/L	0.0005 MAC
T-Calcium	6.19	mg/L	
T-Chromium	0.001	mg/L	0.05 MAC
T-Copper	0.004	mg/L	1.0 AO
T-Iron	0.02	mg/L	0.3 AO
T-Lead	0.0002	mg/L	0.010 MAC
T-Lithium	<0.001	mg/L	
T-Magnesium	0.62	mg/L	
T-Manganese	0.0021	mg/L	0.05 AO
T-Mercury	<0.00001	mg/L	1ug/L MAC
AO = Aesthetic Objective; MAC = Max. Allowable Concentration;			
IMAC = Interim Mac; >= Greater than; < = Less than			
Results relate only to samples as submitted.			
Canadian Drinking Water guidelines as listed on Dec 5th, 2005			

North Island Laboratories
• 2755 B Moray Avenue, Courtenay, B.C. V9N 8M9 Tel: (250) 338-7786 Fax: (250) 338-7553

Certificate of Analysis

Report To: Regional District of Alberni & Clayoquot
John Thomas
3008 5th Ave.
Port Alberni, BC V9Y 2E3
V9Y 2E3

Lab Number: 99683
Date Reported: 10 Dec 12
Date Completed: 10 Dec 12
Date Received: 7 Dec 12 10:53

Sampled By:
Sampling Date: 6 Dec 12 0:00

Test	Result	Units	Detection Limit
99683-01 Stamp Above Truman	**Beaver Creek WS**		
Fecal Coliforms (MF)	1	CFU/100ml	1 CFU/100ml
Total Coliforms (MF)	30	CFU/100mL	1 CFU/100mL
E. coli (MF)	5	CFU/100mL	1 CFU/100mL
99683-02 Stamp Below Truman	**Beaver Creek WS**		
Fecal Coliforms (MF)	28	CFU/100ml	1 CFU/100ml
Total Coliforms (MF)	200	CFU/100mL	1 CFU/100mL
E. coli (MF)	20	CFU/100mL	1 CFU/100mL
99683-03 Above Truman Paddock	**Beaver Creek WS**		
Fecal Coliforms (MF)	25	CFU/100ml	1 CFU/100ml
Total Coliforms (MF)	1000	CFU/100mL	1 CFU/100mL
E. coli (MF)	10	CFU/100mL	1 CFU/100mL
99683-04 Below Truman Paddock	**Beaver Creek WS**		
Fecal Coliforms (MF)	33	CFU/100ml	1 CFU/100ml
Total Coliforms (MF)	1300	CFU/100mL	1 CFU/100mL
E. coli (MF)	24	CFU/100mL	1 CFU/100mL