

ALBERNI CLAYOQUOT REGIONAL DISTRICT

BAMFIELD WATER SYSTEM

ANNUAL REPORT
2021

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1.0 Background

Purpose of the Annual Report

This annual report provides an overview of the Alberni-Clayoquot Regional District's (ACRD) Bamfield Water System (BWS). It is the ACRD's responsibility to the community to share this information. This report is for the water consumers to review their individual water system in order to be aware of the service and of the annual activities.

Regulating Authority

The Province of British Columbia's Drinking Water Protection Act and Regulation prescribes the required performance of drinking water suppliers. The Vancouver Island Health Authority (Island Health) is the body that oversees water systems in the ACRD, with the mission to minimize health risks to the public and to assist with providing safe drinking water to communities. As part of these regulations, water systems are required to have operators qualified by the Environmental Operators Certification Program (EOCP) to the same classification level of a system.

Management

The ACRD's Community Services Department is responsible for the overall management of the BWS. The BWS has an advisory committee made up of the Bamfield Electoral Director and volunteer members from the community. This committee provides guidance and advice to the ACRD management regarding infrastructure improvements, bylaws and costs.

Bamfield Water System Overview

The community of Bamfield is a significant part of Electoral Area "A" which has a population of 256 (2021 Census). Bamfield sees a significant influx of people during the summer months that is estimated in the thousands. The majority of the BWS was originally constructed in 1979 and 1980 and water is supplied from Sugsaw Lake which is now treated by a Dissolve Air Flootation (DAF) water treatment plant.

The DAF water treatment plant was commissioned in August 2018 to address the high organics in the source water and related formation of disinfection byproducts (DBP) in the drinking water. Intensive water quality testing has shown the treatment plant is effective at significantly improving the water quality, including colour and taste, and has reduced levels of DBP in the drinking water.

The BWS complexity is partially due to the subsurface water lines crossing the inlets in various locations. These underwater marine water lines are challenging to repair and often under layers of sediment.

The BWS has a Water Treatment 3 Classification and a Level 2 Water Distribution Certification. The daily operation of the distribution and the treatment plant is performed by a contracted operator who is certified by EOCP for these classifications.

The Bamfield Water System includes:

- Water source: Sugsaw Lake
- Water treatment plant: Dissolved Air Flootation (DAF) with UV and Chlorine disinfection
- Two bolted steel reservoirs: 545 m3 capacity
- Number of Services (Customers): 231
- Total Length of mains: 11.4 km
- Water main material: Polyvinyl Chloride (PVC) and Polyethylene (PE)
- Average daily flow: 170 m3

2.0 Goal and Targets

It is our mission to provide potable, cost effective and reliable drinking water through continuous improvements

In order to achieve this mission, measurable targets for potability, cost-effectiveness, and reliability have been set.

Potable Targets:

- 1) No E.coli, no total coliform in any water samples
- 2) Minimum 0.20 mg/L chlorine residual throughout the distribution system
- 3) Less than 1 NTU turbidity in the treated water
- 4) Meet the Drinking Water Quality Guidelines for all parameters (including DBPs)

Regular potability sampling of drinking water is conducted for physical, chemical and biological parameters. This sampling is to ensure that the drinking water meets the Canadian Drinking Water Quality Guidelines and is safe for consumption. Each water system is provided with an Operational Certificate by Island Health that may outline specific requirements such as individual tests and the frequency.

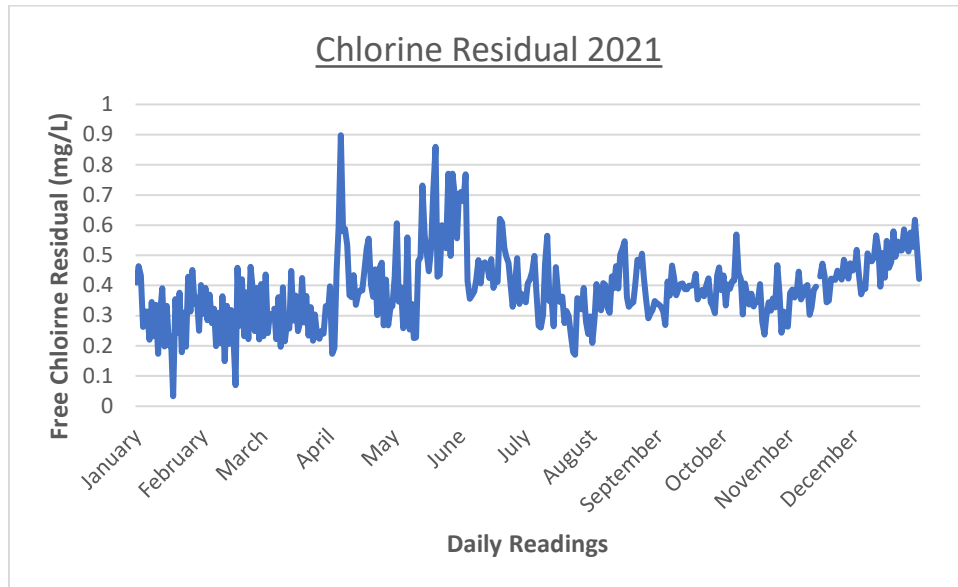
Target 1 – No E.coli and No Total Coliform in any Water Samples

Bacteria testing is performed monthly at multiple locations for Total Coliforms and E.Coli. The locations are spread throughout the distribution system to capture a monthly representation. Island Health's 2021 Water Sample Report shows that all 60 samples taken tested negative for any bacteria.

The Total Coliforms and E.coli organisms are tested as they are good indicator organisms. Indicator organisms are easy and inexpensive to test for, can be correlated with the potential contamination level and are not present in unpolluted waters.

Target 2 - Minimum 0.20 mg/L Chlorine Residual

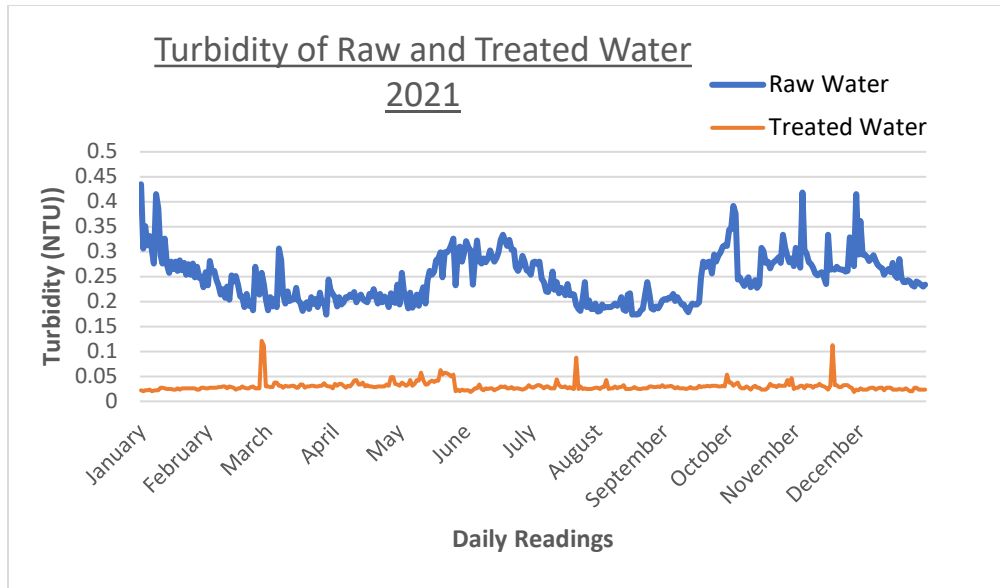
To ensure good water quality throughout the distribution system, water mains are regularly flushed to remove any accumulated silt by creating an increase in velocity to scour the pipes. As water flows within a distribution system, the chlorine is slowly eaten up by organics in the water or any material built up in the pipes. Residual chlorine is an immediate test to measure if the water is safe to drink; although water without a chlorine residual is not necessarily unsafe. Other tests to ensure safety (such as bacterial testing) require 3 to 4 days for results. Low to no chlorine residual in the water system can indicate poor circulation of water and a need for increased flushing.



The graph above shows that the free chlorine level leaving the water treatment plant is usually between 0.2 and 0.8 ppm with some fluctuations above or below. This variation has significantly reduced since the operation of the treatment plant, prior to which levels would range between 0.2 and 3.0 ppm. These values can easily change due to changing water chemistry and chemical pump speed fluctuations. The water system has additional chlorine injection at the reservoirs to ensure the entire water system has adequate disinfection. The water operator conducts daily chlorine checks throughout the system and adjusts the pump speeds if necessary to maintain the minimum 0.20 mg/L chlorine residual throughout the distribution system.

Target 3 - Less than 1 NTU Turbidity in the Treated Water

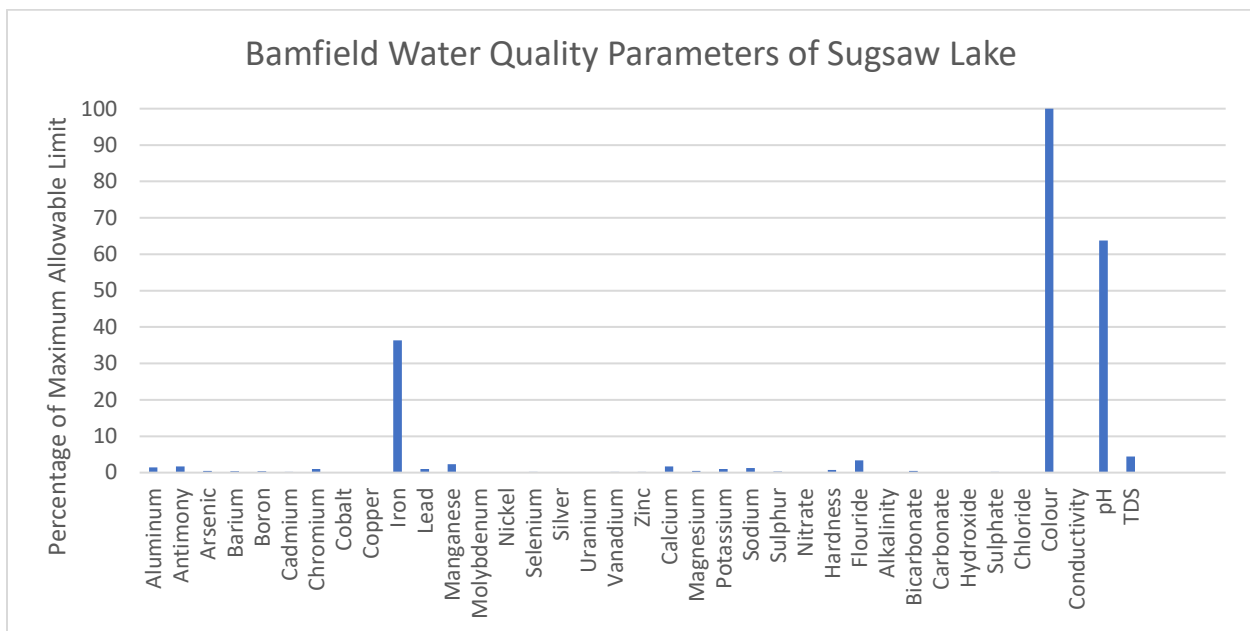
Turbidity is the cloudiness or haziness of a fluid caused by the suspension of individual particles. This parameter is continually monitored as it affects the ability of chlorine to disinfect. The following graph shows that there was high turbidity in the raw water source in January and December due to heavy rains. However, the treated water's turbidity is consistently between 0.03 and 0.04 NTU. This demonstrates that the new treatment plant is very effective.



Typical raw water from Sugsaw Lake has turbidity below 0.3 NTU but during winter rain events turbidity can double or triple. High rainfall events tend to wash in soil particles from the watershed which increases the turbidity. The graph above shows January and December’s high turbidity in the raw water and the effectiveness of the plant to remove the turbidity.

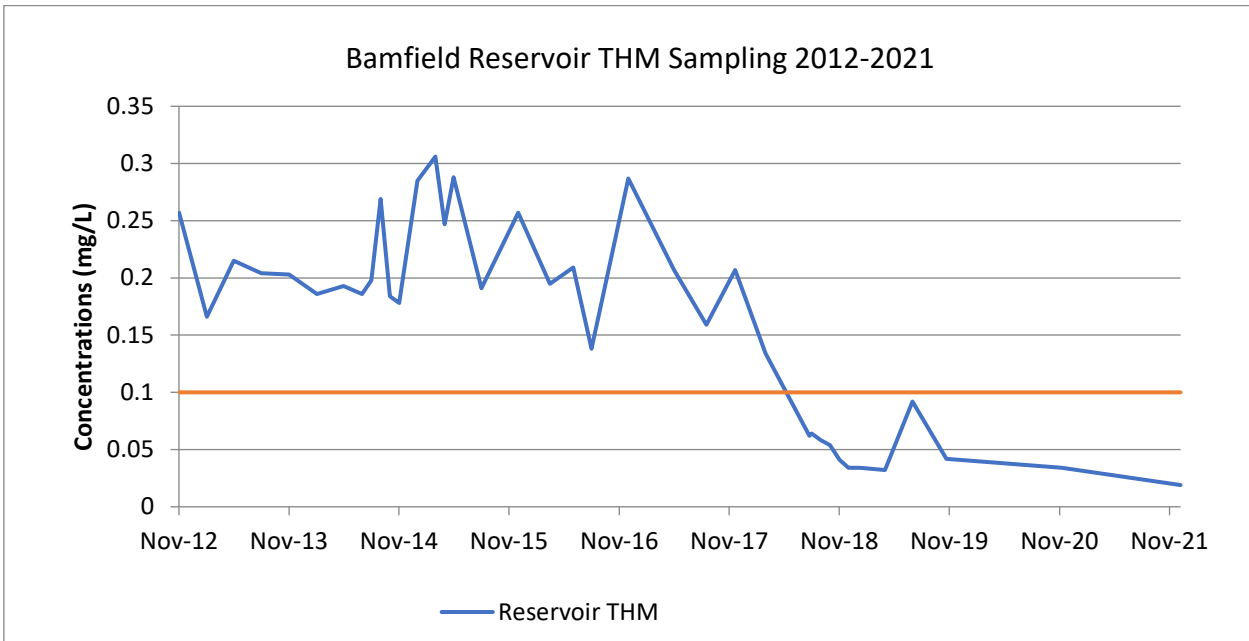
Target 4 - Meet the Drinking Water Quality Guidelines

The ACRD regularly performs tests to ensure that the water is meeting all standards. The water system’s latest complete potability sample is shown in the following Water Quality Parameters graph. Prior to the construction and commissioning of the new treatment plant, water in the system did not meet the drinking water quality guidelines due to the DBP’s.



The above graph shows the untreated water’s results in meeting the Canadian Drinking Water

Standards. The colour is above the acceptable limit in the raw water but after the water treatment plant, the water exceeds the standards. Although colour alone is not harmful, the associated organics in water often causes disinfection byproducts. The plant has been successful in removing the precursors of DBP (colour and organics). The treated water has all DBP's values and colour values well below the guidelines. The graph below illustrates the effectiveness of the treatment plant in the reduction in DBP's.



Cost-Effective Targets:

- 1) Total water demand below 626 m³/day
- 2) Peak Demand Ratio of less than 2:1 PDD: ADD
- 3) O&M cost per customer less than \$1,500

There are many factors that affect how cost effective a system is running. Effective management and planning, good operational practice and changing water demands can all affect system costs.

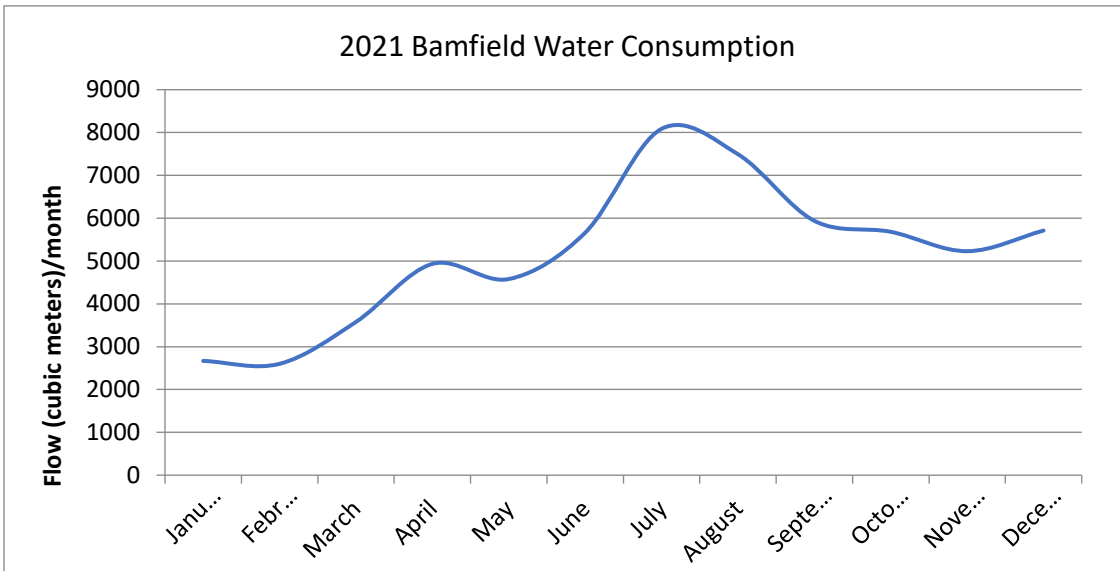
Cost-Effective Target 1 - Total water demand less than 626 m³/day

The new treatment plant has a maximum capacity of providing 626 m³/day. In 2021, the water system provided 62,158 cubic meters of water to the community water system for an average of 170 m³/day demand. In the summer, the peak day demand was 231 m³/day; these are both below the target.

Cost-Effective Target 2 - Peak Demand Ratio of less than 2:1 PDD: ADD

A water system must be designed to provide the peak demand and fire flow. If peak demands are excessively high, then the water pipes are required to be oversized which is expensive and causes operational challenges in keeping water fresh in the lower flow time periods. The target is to have the peak day demand (PDD) less than twice as much as the average day demand (ADD). Peak summer day demand is approximately 231 m³/day compared to average daily demand of approximately 170

m³/day. This is approximately 1.36:1 ratio of PDD to ADD. The 2021 water consumption graph below shows higher values in April due to leaks and repairs to a submerged main with subsequent flushing.



Cost-Effective Target 3 - O&M Cost per Customer less than \$1,500

In 2021, the total operating costs for the Bamfield Water System were \$183,289 excluding contributions to the capital fund and debt repayment. Divided by the 231 services in the system, this results in a cost of \$793 per customer for 2021. This is lower than the cost per customer in 2020 which was \$934. The BWS now has a lower operating cost per customer due to the change in accounting. This change in accounting was to show the actual number of “water services” as opposed to the number of “water connections”. An example of this would be a property that pays for three water services is now being counted as three paying customers instead of one connection. This accounting better reflects the number of customers contributing to the costs of the water system. The number of water services now include all the properties with multiple connections on one property as well as trailer parks, commercial and institutional.

Reliability Targets:

- 1) Unaccounted water loss less than 15%.
- 2) Maximum # of breaks less than 5/year.
- 3) Annual Contribution to capital meets AMP targets of \$905/year

Reliability Target 1 – Unaccounted Water Loss less than 15%.

In 2021, the water system provided 62,158 m³ of water to the community water system. The total water consumed in Bamfield through all water meters for 2021 was 45,662 m³. The difference between two values is called the unaccounted or non-revenue water loss. This loss can be attributed to filter backwash, meter error, water main breaks, flushing, unauthorized consumption and leaks. The unaccounted water loss for 2021 was 16,496 cubic meters which made up 27% of all water produced. The 2020 unaccounted for water loss was at 25% therefore there was a small negative change going in 2021 and getting further from our target of 15%.

Sources of unaccounted water loss for 2021 include several significant large leaks of submarine transmission line as well as back wash water for the treatment plant.

Reliability Target 2 - Maximum # of Breaks less than 5/year.

In 2021 we had a total number of 15 leaks with many of them considered to be large. Many of the large leaks occurred on the submarine crossing to West Bamfield which is the result on fused joint failure on the HDPE pipe. These joints were stressed by an event in 2019 where a boat anchor caught the pipe and pulled it a significant distance from its original alignment. Another major cause of leaks was the freezing weather in mid to late December that caused a number of pipes to burst.

Reliability Target 3 – Annual Contribution to capital meets AMP targets

In the Fall of 2021, an Asset Management Plan was created to guide decision making and facilitate sustainable service delivery. Some of the targets include customer level of service, technical level of service, fire flow requirements, an acceptable level of risk and cost effective allocation of resources. This target will inform us to whether we are collecting enough money to proactively replace failing infrastructure. Failing infrastructure is often indicated by the amount of the non-revenue water that is lost. This amount of water lost can be calculated through loss of potential revenue. Infrastructure replacement costs can be offset through the savings through the reduction in non-revenue water loss.

There were 245 water parcels that contributed \$92,260 in parcel taxes in 2021, which included treatment plant borrowing; in addition, \$178,108 was collected in water fees. This equates to a total contribution of \$270,368, which is well short of the \$474,000 cited by the AMP to cover Operations, Maintenance and Capital costs. Average annual Operation and Maintenance costs total \$153,000, which means ~\$321,000 of the \$474,000 is for capital contributions. Based off of 245 water parcels, this amount would require a contribution of \$1,310 per parcel. This number is up from the 2020 target of \$905 per parcel for capital contributions. It is also likely that the average Operations and Maintenance costs rise in the next few years due to inflation that is being seen across all sectors.

Summary of Target Results for 2021

This past year, most of the targets were met except for the amount of water loss and the number of breaks. With the water treatment plant operating full time, BWS is now exceeding all water quality targets. Bamfield's total water demand for 2021 has seen an increase from 2020's value of 154 m³/day to 170 m³/day in 2021, which is likely due to significant water leaks.

Water leakage was up from 25% in 2020 to 27% in 2021. This is believed to be the result of significant water breaks in the water main feeding west Bamfield. The water loss is still higher than targeted, and projects have been identified for 2022 to help address this issue including better tracking of unaccounted for water and continuing to apply for grant funding to address the marine line that has been experiencing failures.

	Target	2021 BWS
Bacteria Results	0	0
Chlorine Residual	> 0.20 mg/l	> 0.20 mg/l
Turbidity	< 1.0 NTU	< 1.0 NTU
CDWQG	< 100%	100%
Total Demand	< 626 m3/day	170 m3/day
Peak Demand Ratio	< 2	1.36
Cost per customer	< \$1500	\$793
Contribution to Capital	\$1310	\$376
Water Loss	< 15%	27%
Breaks	< 5	15

3.0 Improvement Plan

2021 Projects Completed

Infrastructure Renewal & Long Range Plan

Koers & Associates Engineering provided the “Bamfield Water System Infrastructure Renewal & Long Range Plan” Final Report on May 14, 2021. This plan provides an overview of the aging infrastructure within the Bamfield Water System, and requirements for upgrading the water system to meet minimum fire flow requirements in the system. The plan summarizes the age of the components of the system, with much of the infrastructure being over 40 years old. With this plan a strategy can be developed to facilitate future replacement costs which has been calculated to be over twenty nine million dollars.

Asset Management Plan

The Bamfield Water System Asset Management Plan Version 1.0 was created and presented to the Bamfield Water Advisory Committee on November 23, 2021. The purpose of the AMP is to better guide the Board, management and staff in decision-making, sustainable service delivery, and proactivity versus reactivity. It is also a communication tool for public awareness. The AMP will provide significant value by utilizing existing data to identify areas and projects that require attention in the budgeting and long-term financial planning process. This AMP utilizes data from the Island Health standards, Fire Underwriters Survey requirements, Asset Management Policy, and Asset Management Strategy, and will influence the Long-Term Financial Plan.

Rate & Bylaw Review

On May 20th the Bamfield Water Advisory Committee was presented with a Long-Term Renewal Plan completed by Koers & Associates Engineering. The report provided an overview of the aging infrastructure within the water system. Staff recommended that an update to the Development Cost Charges (DCC) be undertaken at an estimated cost of \$20,000, as the DCC bylaw is outdated and doesn't correctly ensure that additional burden placed on the water system from development is properly funded. An increase in the water fees from \$46 to \$49 per month was recommended. This increase covered CPI increases since the last rate increase and was viewed as a temporary measure ahead of both the Asset Management Plan creation and Long-term Financial plan. Staff also recommended that connection fees be increased from \$1,800 to \$5,000 per new dwelling, to better reflect actual costs

related to new connections. These increases are seen in the updated rates within “Schedule A” of Bylaw F1147-1

West Bamfield Submarine Line Repairs

The West Bamfield submarine transmission line experienced multiple leaks and subsequent repairs in 2021. These large leaks occurred due to the result of cracks occurring where the fused HDPE pipes were originally fused and previous repair clamps leaking. These repairs occurred in April where scuba divers were required to install self-restraining repair couplings. During these repairs boil water advisories were issued and significant water was used to flush water lines.

Upcoming Projects 2022

ICIP Grant Application Submitted for West Bamfield Submarine Line Replacement

An application to Investing in Canada Infrastructure Program (ICIP) will be submitted for the required 100% funding of this water line replacement. This submarine transmission line is the largest of the two lines that provides potable water to West Bamfield. The replacement of this transmission line is required as the line has sustained damage and has experienced multiple leaks and subsequent repairs since 2019. The suspected cause of much of this damage was a boat anchor hooking the line and pulling it out of alignment, stressing the joints. The replacement cost of this West Bamfield Transmission Line has been estimated at \$1,175,238.

DCC Review and Update

Koers Engineering will be performing a Development Cost Charges (DCC) Review in 2022. The Development Cost Charge (DCC) review will include some community engagement and will update the current Bamfield DCC Bylaw and rates. The current DCC bylaw is outdated, and has inadequate fees for new development, with exemptions for development of less than 4 units per property which is the majority of development in the system. The current DCC bylaw was based on a water system plan to meet domestic demands only and excluded fire protection.

Rates and Bylaw review

In the Fall of 2022, the Bamfield Water Advisory Committee will be presented with a Long-Range Financial Plan with options on how to address the current funding gap. In order to meet the Asset Management Plan’s target, funding needs to be increased to continue water line replacement and renewal. In 2021 total parcel taxes were \$92,260 while the contribution to capital was only \$34,570. There are currently 245 parcels that each contribute \$377 per year. The 2021 total water fees were \$178,108 and with the addition of the \$92,260 from taxes the total contributions were \$270,368.

The Asset Management Plan summarises the suggested infrastructure replacement cost and that combined (parcel taxes and water fees) annual contributions need to be \$474,000 to ensure adequate capital reserves are built. The Long-term Financial Plan will highlight options for bridging the current funding gap of \$203,632. This could include both nominal water rate and parcel tax increases. The parcel tax has not been increased since 1988.

Water Loss Investigation

Water loss can come from many sources such as waterline breaks, fire hydrant use, unauthorized water use, flushing and other unaccounted water use. Unaccounted water loss can be a source of lost revenue and cause an increase in operating costs. The cost of developing a leak detection program can potentially be offset with the savings. Water loss can simply be defined as the difference between the metered water at the pump house subtracted by the total household metered water.