

# **ALBERNI CLAYOQUOT REGIONAL DISTRICT**

## **BAMFIELD WATER SYSTEM**

### ANNUAL REPORT 2020

Prepared by the  
Environmental Services Department  
3008 Fifth Avenue, Port Alberni, BC, Canada, V9Y 2E3, Phone 250-720-2700

## Table of Contents

1.0	Background .....	3
	Purpose of the Annual Report .....	3
	Regulating Authority .....	3
	Management.....	3
	Bamfield Water System Overview .....	3
2.0	Goal and Targets .....	4
	Potable Targets: .....	4
	Target 1 – No E.coli and No Total Coliform in any Water Samples.....	4
	Target 2 - Minimum 0.20 mg/L Chlorine Residual .....	5
	Target 3 - Less than 1 NTU Turbidity in the Treated Water .....	5
	Target 4 - Meet the Drinking Water Quality Guidelines .....	6
	Cost-Effective Targets: .....	8
	Cost Effective Target 1 – Total water demand less than 626 m3/day .....	8
	Cost Effective Target 2 - Peak Demand Ratio of less than 2:1 PDD:ADD.....	8
	Cost Effective Target 3 – O&M Cost per Customer less than \$1,500 .....	9
	Reliability Targets:.....	9
	Reliability Target 1 – Unaccounted Water Loss less than 15%.....	9
	Reliability Target 2 - Maximum # of Breaks less than 5/year. ....	9
	Reliability Target 3 - Annual Contribution to Capital meets AMP targets.....	10
	Summary of Target Results for 2020 .....	10
3.0	Improvement Plan .....	10
	2020 Projects Completed.....	10
	2021 Upcoming Projects .....	11

## 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 243 (2016 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
- Current metered service connections: 205 (1 new connection in 2020)
- Total Length of mains: 11.4 km
- Water main material: Polyvinyl Chloride (PVC) and Polyethylene (PE)
- Average daily flow: 154 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.

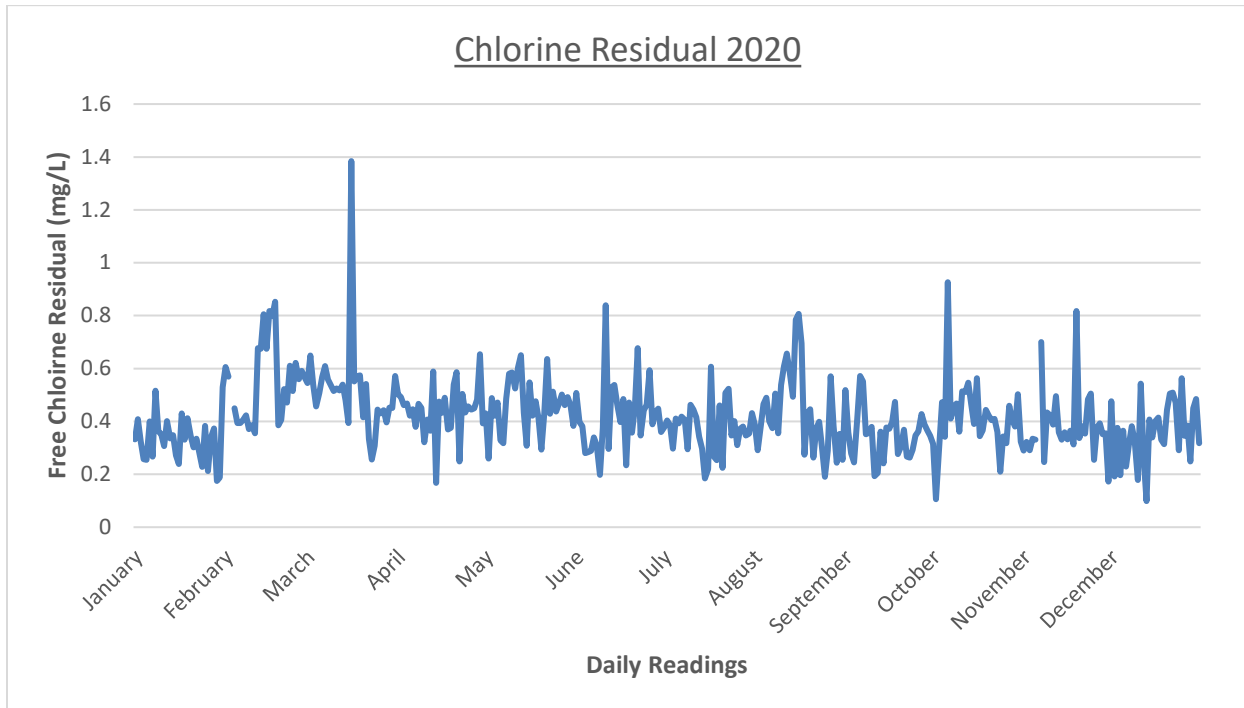
### Target 1 – No E.coli and No Total Coliform in any Water Samples

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 2020 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

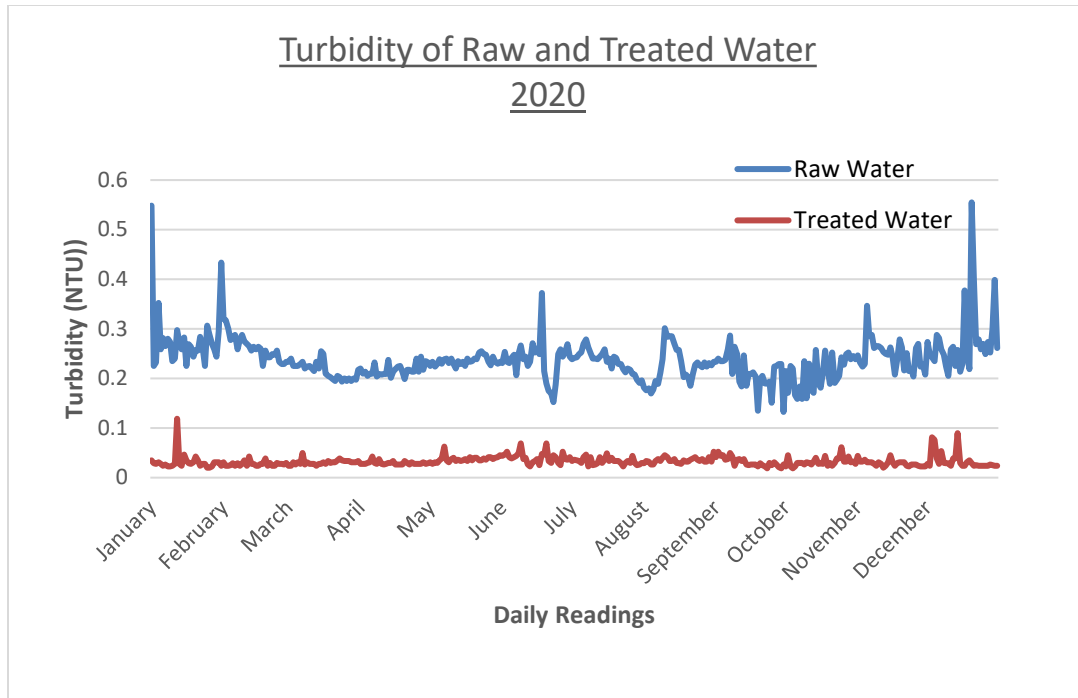
To ensure good water quality throughout the distribution system, water mains are regularly flushed to remove any accumulated silt by creating an increase in velocity to scour the pipes. As water flows within a distribution system, the chlorine is slowly eaten up by organics in the water or any material 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 levels 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

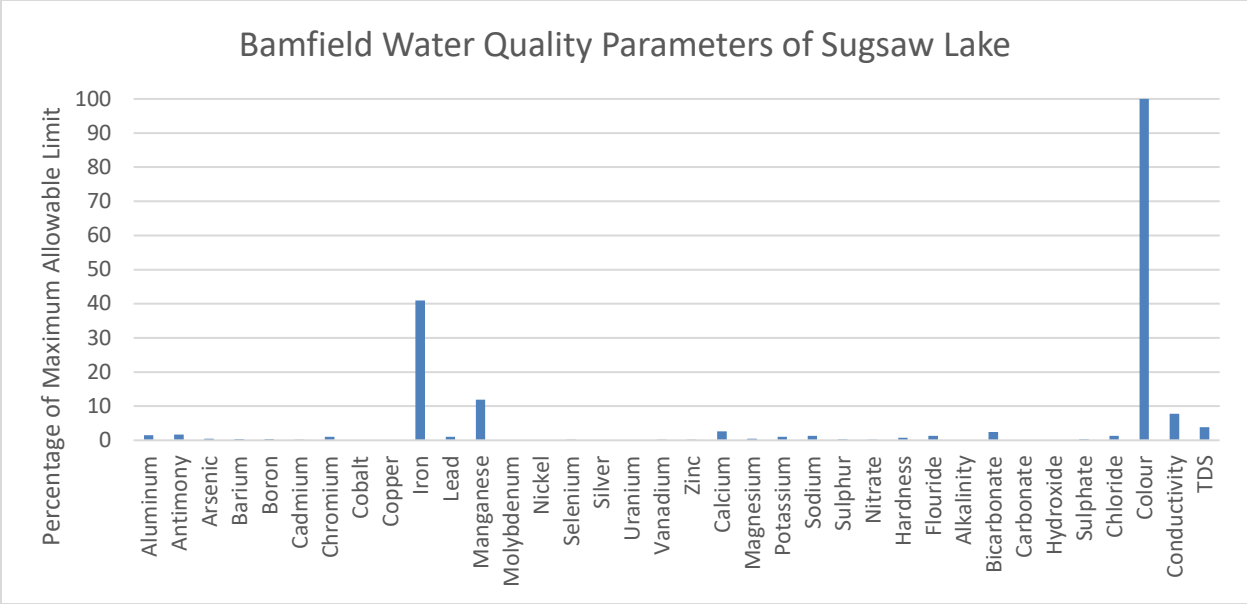
Turbidity is the cloudiness or haziness of a fluid caused by the suspension of individual particles. This parameter is continually monitored as it affects the ability of chlorine to disinfect. The following graph shows that there was high turbidity in the raw water source in January and December due 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.



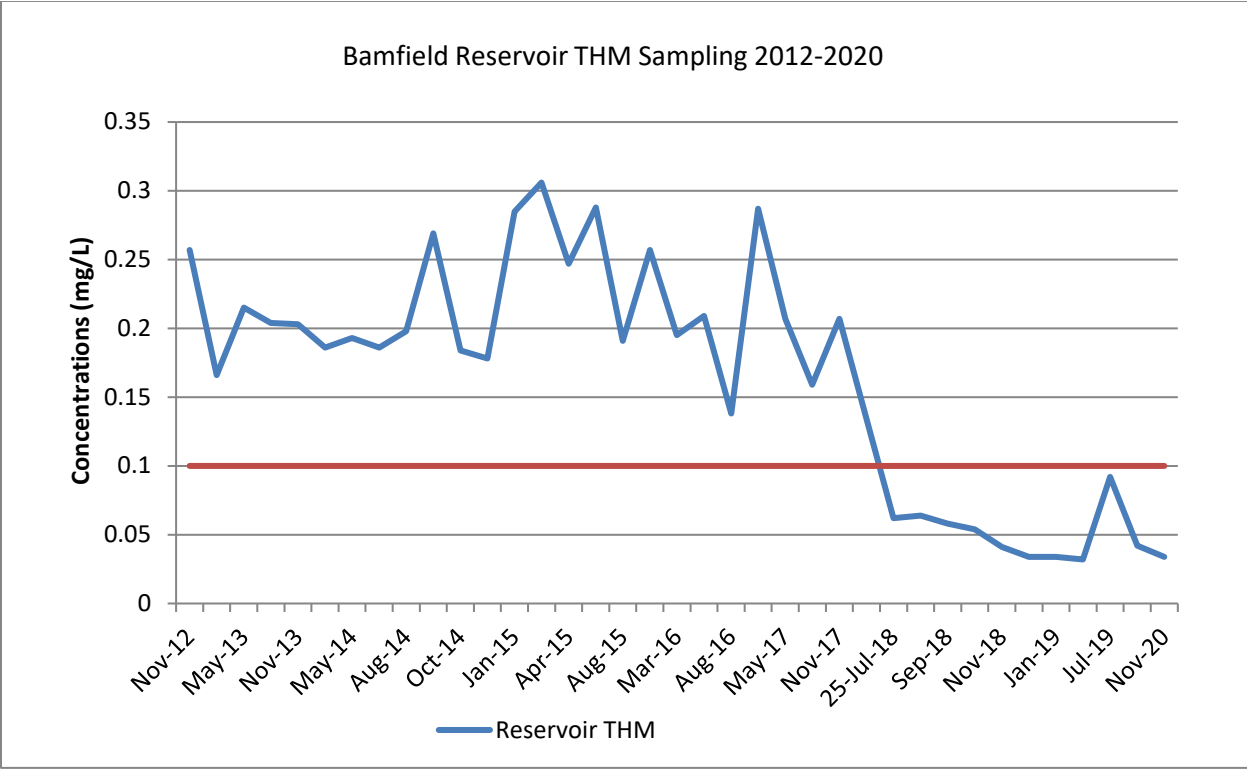
Typical raw water from Sugsaw Lake has turbidity below 0.3 NTU but during winter rain events turbidity can double or triple. High rainfall events tend to wash in soil particles from the watershed which increases the turbidity. The graph above shows January and December's high turbidity in the raw water 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 m<sup>3</sup>/day
- 2) Peak Demand Ratio of less than 2:1 PDD: ADD
- 3) O&M cost per customer less than \$1,500

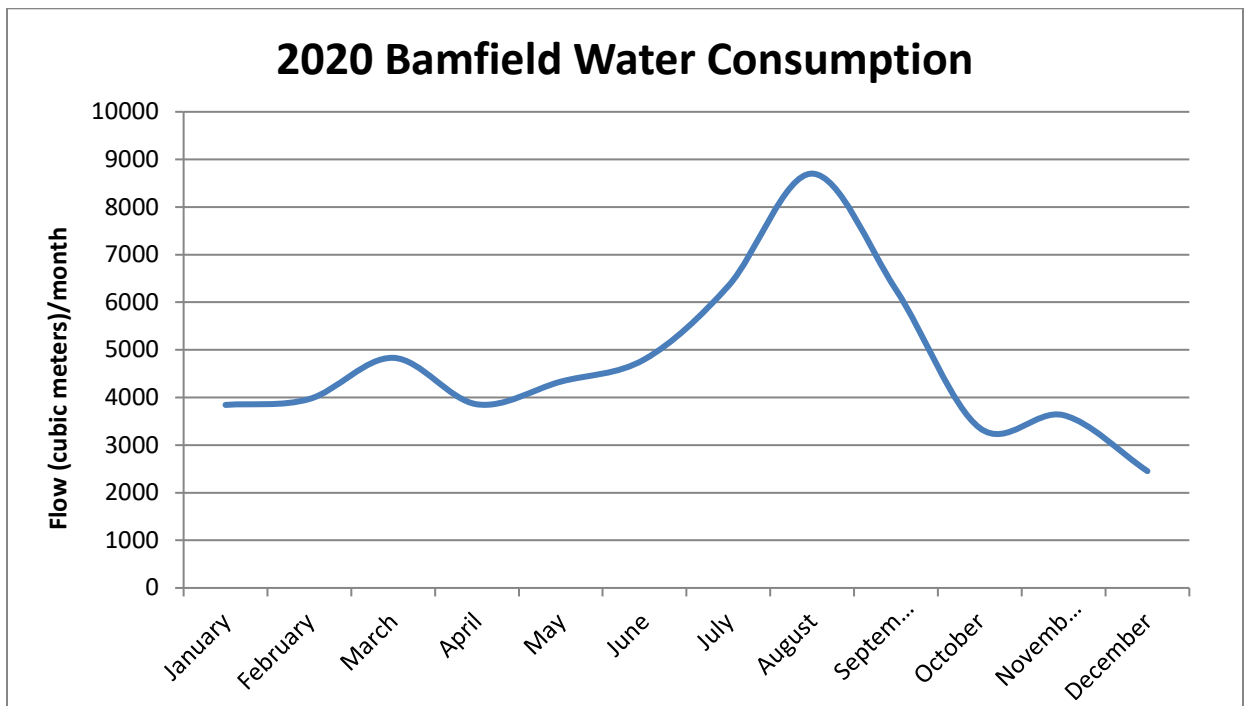
There are many factors that affect how cost effective a system is running. Effective management and planning, good operational practice and changing water demands can all affect system costs.

#### Cost-Effective Target 1 - Total water demand less than 626 m<sup>3</sup>/day

The new treatment plant has a maximum capacity of providing 626 m<sup>3</sup>/day. In 2020, the water system provided 56,385 cubic meters of water to the community water system for an average of 154 m<sup>3</sup>/day demand. In the summer, the peak day demand was 216 m<sup>3</sup>/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 216 m<sup>3</sup>/day compared to average daily demand of approximately 154 m<sup>3</sup>/day. This is approximately 1.40:1 ratio of PDD to ADD. The 2020 water consumption graph below shows higher values in the fall due to large leak events.





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

In 2020, the total operating costs for the Bamfield Water System were \$191,387 excluding contributions to the capital fund and debt repayment. Divided by the 205 services in the system, this results in a cost of \$934 per customer for 2020. This is higher than the cost per customer in 2019 which was \$875. The costs were higher in 2020 as there were significant costs related to emergency repairs of the submarine line which are very expensive.

### 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 2020, the water system provided 56,385 m<sup>3</sup> of water to the community water system. The total water consumed in Bamfield through all water meters for 2020 was 42,239 m<sup>3</sup>. 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 2020 was 14,146 cubic meters which made up 25% of all water produced. The 2019 unaccounted for water loss was at 32% therefore there was a positive change going in 2020 and getting closer to our target.

Sources of unaccounted water loss for 2020 include several significant large leaks of the six-inch underwater main leading to the west side as well as back wash water for the treatment plant.

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

In 2020 we had a total number of 7 leaks with 4 of them considered to be large. Of the 4 large leaks one occurred on Seaboard Road, one on the marine crossing to the north side of Grappler Inlet and 2 on the marine six-inch main crossing to west Bamfield. One of the large leaks that occurred was the result of a previous repair clamp completely being pulled apart. This failure caused the reservoirs to lose half their capacity and the requirement of a Boil Water Advisory. These leaks are thought to be caused originally by a boat anchor pulling the pipe out of place. The marine six-inch main crossing to west Bamfield is in desperate need of replacement.

### Reliability Target 3 – Annual Contribution to capital meets AMP targets

Measurable targets for the current Asset Management program is imperative as it ties in with the Cost-Effective Targets. 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.

In 2020 there were 244 water parcels contributing \$59,563 per year towards capital. This works out to be \$244 per parcel. Based on the estimated current value of assets in the system, the required funding for future renewal the per parcel rate needs to be \$905. This target may need to be updated when the system’s Asset Management Plan is completed in 2021.

### Summary of Target Results for 2020

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 2020 has seen a reduction from 2019’s value of 210 m3/day to 154 m3/day in 2020, which is likely due to the Covid 19 virus with the reduction of seasonal visitors.

Water leakage was down from 33% in 2019 to 25% in 2020. This is believed to be the result of repairing a significant water break in the water main feeding west Bamfield. The water loss is still higher than targeted and projects have been identified for 2021 to help address this issue through better tracking of unaccounted for water and addressing the marine lines that have been experiencing failures.

Based on the new asset management plan Bamfield needs to significantly increase capital funding to meet the target of \$905 per parcel. The cost per customer in 2020 was up to \$934 from 2019’s cost of \$875 due to the additional work related to emergency repairs of the submarine line.

	Target	2020 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	154 m3/day
Peak Demand Ratio	<2	1.40
Cost per customer	\$1500	\$934
Contribution to Capital	\$905	\$244
Water Loss	<15%	25%
Breaks	<5	7

## 3.0 Improvement Plan

### 2020 Projects Completed

Complete Potability Water Testing – This is additional testing above the regular testing of bacteria and online SCADA analysis of the plants water quality. This involves general water quality parameters as well as metals and others.

Disinfection Byproducts Testing Reduction (DBP) – In January we able to reduce our DBP testing program from quarterly to annually. Due to the water treatment plant producing good results Island Health agreed to the reduction and in doing so the water system was able to save a minimum of \$3600.

Water Bylaw Update – The Bamfield water bylaw was updated to provide clearer definitions, improved organization and standardized water bylaw language and fees and provide consistency throughout ACRD water systems.

Decommissioning of the old chlorine building - The old chlorine building was decommissioned and given to the Bamfield Parks Commission for use as a storage facility and utilization of the power at the site. A lease agreement for the land was established with the Bamfield Marine Science Center.

Pumphouse Control – The pumphouse control system was updated to run in a Semi-Automatic mode. This allows the system to run more effectively in certain emergency conditions.

Bamfield Submarine Pipeline Preliminary Assessment – Koers Engineering completed an investigation of the Bamfield submarine pipelines that provided options and cost estimates for replacement or long-term repair. This report provided adequate information to apply for an infrastructure funding Grant to replace this failing infrastructure. A complete underwater video inspection was also completed for both Grappler and West Bamfield Submarine lines.

Improved Back-up Power at the Reservoirs – With the improved communications at the reservoirs, additional back-up power capacity was added to ensure that there would be continuous communications throughout the system. This has drastically improved the reliability of the system.

## Upcoming Projects

West Bamfield Submarine Line Joint Renewal and Protection Measures – This project started in 2020 and followed the completion of the assessment. It involves the underwater replacement of existing repair clamps with Robar couplings at failing joints as well as signage and buoys along the length to reduce chance of further harm to the line from anchors.

Water Rates Assessment – Staff will assess the current water rates and recommend appropriate rates and increases for the next five years.

Bamfield Water System Infrastructure Renewal Plan – This report will complete an inventory of the existing water system, determine what capacity is required to provide potable and fire flow requirements to the community. The report will identify upgrades required for the water system and provide general costs to complete the works.

Asset Management Plan – This plan will build on the Infrastructure plan, assigning condition assessment of the existing infrastructure and estimated useful life remaining for the components of the water system. This will assist in determining the timing of the replacement of specific parts of the system

based on high-risk areas to increase efficiencies of resources and develop a capital funding plan to complete the work.

Development Cost Charge Updates – Following the completion of the infrastructure renewal plan, the Development Cost Charges Bylaw should be renewed and updated to ensure that the projects related to development are receiving adequate funding from development in the community. This process will require public consultation and the adoption of a new bylaw.

Bamfield Submarine Pipeline Pre-design Report – This will conduct a demand analysis and capacity review of the Submarine Pipelines, develop a pipeline replacement strategy and conduct an environmental assessment for the work. This will be required to proceed with replacement work if the grant application is successful.

Grappler Submarine Line Protection Measures – This will install signage and buoys along the length of the pipe to reduce chance of accidental damage of the line from boat activity and anchors.

Water Loss Investigation – Once the final submarine line repair work is completed, staff will be reviewing water use records, meter accuracy, and flushing volumes to get a more accurate estimation of the leakage in the water system. Once this has been determined, leak detection and reduction options will be assessed and a plan to reduce leakage to below 15% will be developed.