

ALBERNI CLAYOQUOT REGIONAL DISTRICT

BAMFIELD WATER SYSTEM

ANNUAL REPORT
2018

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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 our 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 provided 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 Island Health Authority (IHA) 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 our communities. As part of these regulations, water systems are required to have operators qualified by the Environmental Operators Certification (EOCP) program to the same classification level of a system.

Management

The ACRD's Environmental Services Department is responsible for the overall management of the Bamfield Water System. The Bamfield Water System 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. Bamfield's water system is supplied with water from Sugsaw Lake which is now treated by a Dissolve Air Flootation (DAF) water treatment plant.

This past year saw the commissioning of a DAF water treatment plant to remove the natural organic substances out of the water. The DAF creates a large number of small air bubbles to float particles to the surface. A skimmer then directs the particles to waste leaving the cleaned water to pass through a filter to enter the water system. Intensive water quality testing showed the treatment plant is effective at significantly improving the water quality including colour and taste.

The BWS complexity is partially due to the various 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 Bamfield Water System has a classification of 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 Floatation (DAF) with UV and Chlorine disinfection
- Two bolted steel reservoirs: 545 m³ capacity
- Current metered service connections: 203
- Total Length of mains: 11.4 km
- Water main material: Polyvinyl Chloride (PVC) and Polyethylene (PE)
- Average daily flow: 201 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 IH 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 coliforms and fecal coliforms. The locations are spread throughout the distribution system to capture a monthly representation. IH's Water Sample Range Report shows that only one of all 60 samples taken tested positive for bacteria. This one sample was thought to be an error of either the sampling technique or in the lab as the disinfection levels were good and no resampling was required.

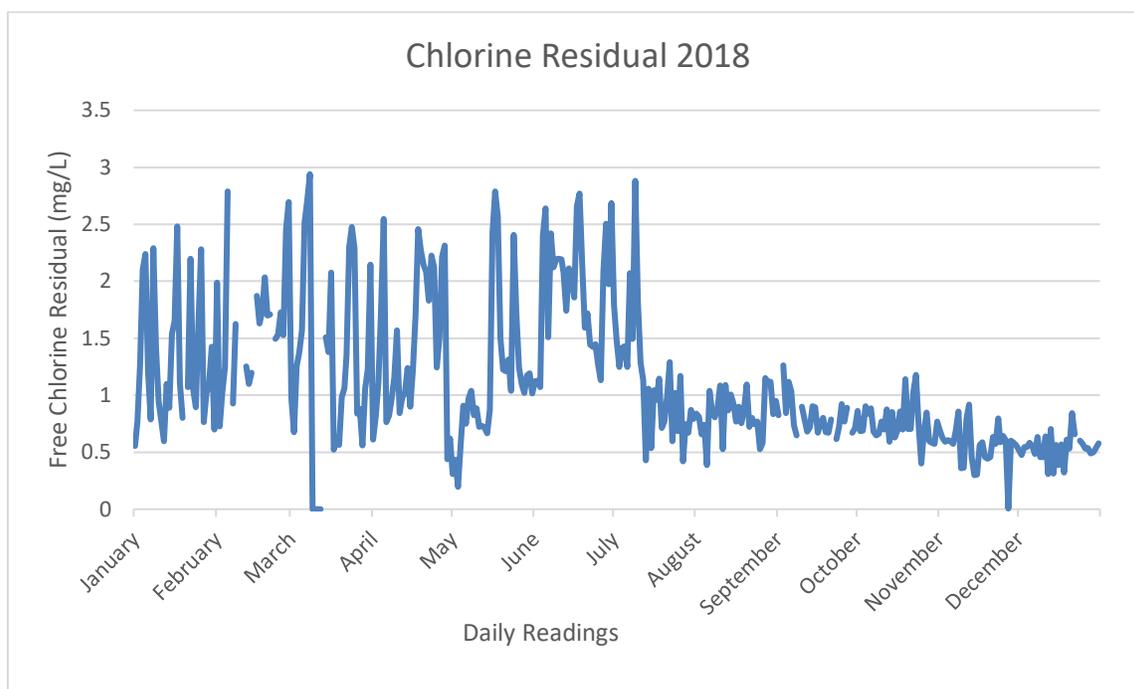
Range Report Information		Water Sample Details	
Date range	Jan 1 2018 to Dec 31 2018	Samples that contain coliform	1 (2% of total)
Total number of samples	60	Samples that contain fecal coliform	0 (0% of total)
		Samples that contain e. coli	0 (0% of total)
		Number of consecutive samples that contain total coliform	0 (0% of total)
		Number of samples that contain total coliform in last 30 days	0 (0% of total)

For more information regarding bacteriological quality guidelines please refer to the [Guidelines for Canadian Drinking Water Quality](#).

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

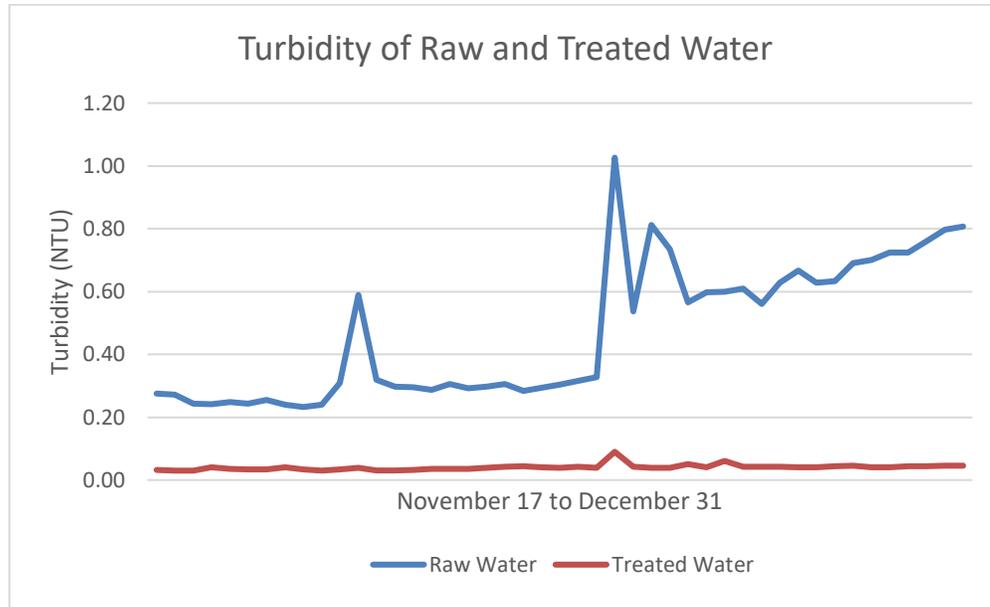
To ensure good water quality throughout the distribution system, water mains are regularly flushed to remove any accumulated silt by creating an increase in velocity to scour the pipes. As water flows within a distribution system, the chlorine is slowly eaten up by organics in the water or any material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



As can be seen on the Chlorine Residual graph above, there was a significant change in the variation of results half way through the year. The first half of the year shows that the water quality changes frequently and that chlorine addition requires frequent changes. The last half of the year shows how the new DAF water treatment plant (startup July 14th) produces a consistent water quality that requires small changes to the chlorine addition.

Target 3 - Less than 1 NTU Turbidity in the water

Turbidity is the cloudiness or haziness of a fluid caused by the suspension of individual particles. This parameter is continually monitored as it effects the ability of chlorine to disinfect. The following graph only shows the turbidity starting in late November and December due to the start of automatic monitoring of the new water treatment plant. The incoming raw water turbidity can be quite high (up to 1 NTU) but the treated water's turbidity is consistently between 0.03 and 0.04 NTU. This demonstrates that the new treatment plant is very effective.

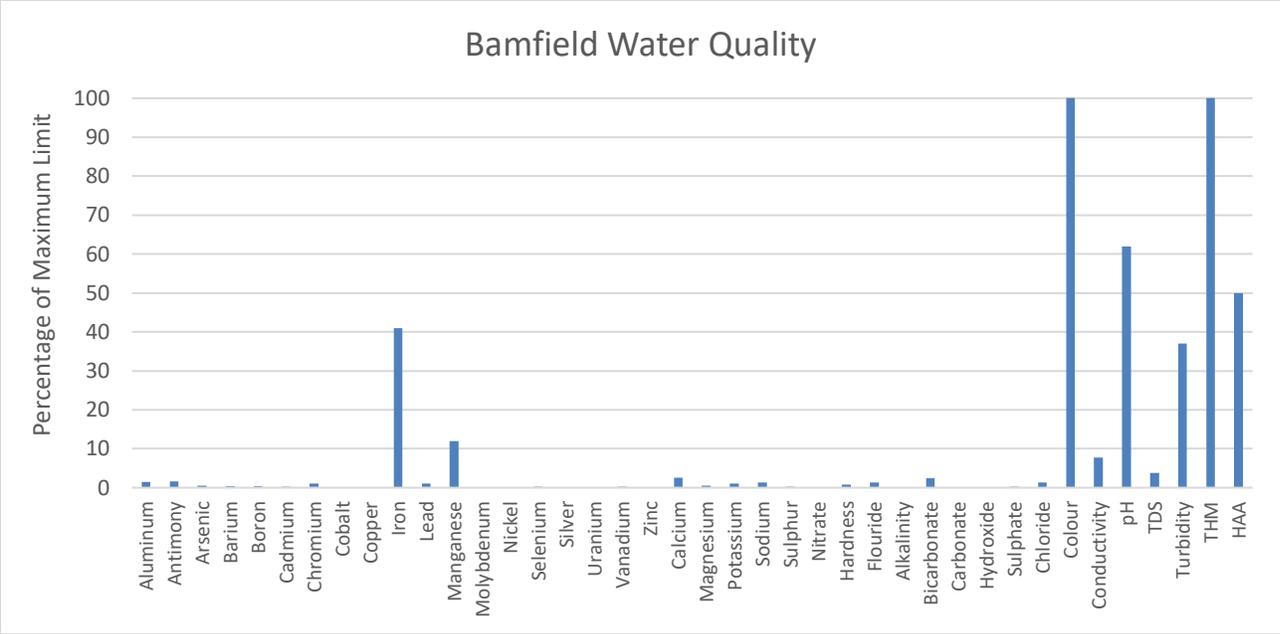


Typical raw water from Sugsaw Lake has turbidity below 0.4 NTU but during winter rain events turbidity can double or triple. High rain fall events tend to wash in soil particles from the water shed which increases the turbidity.

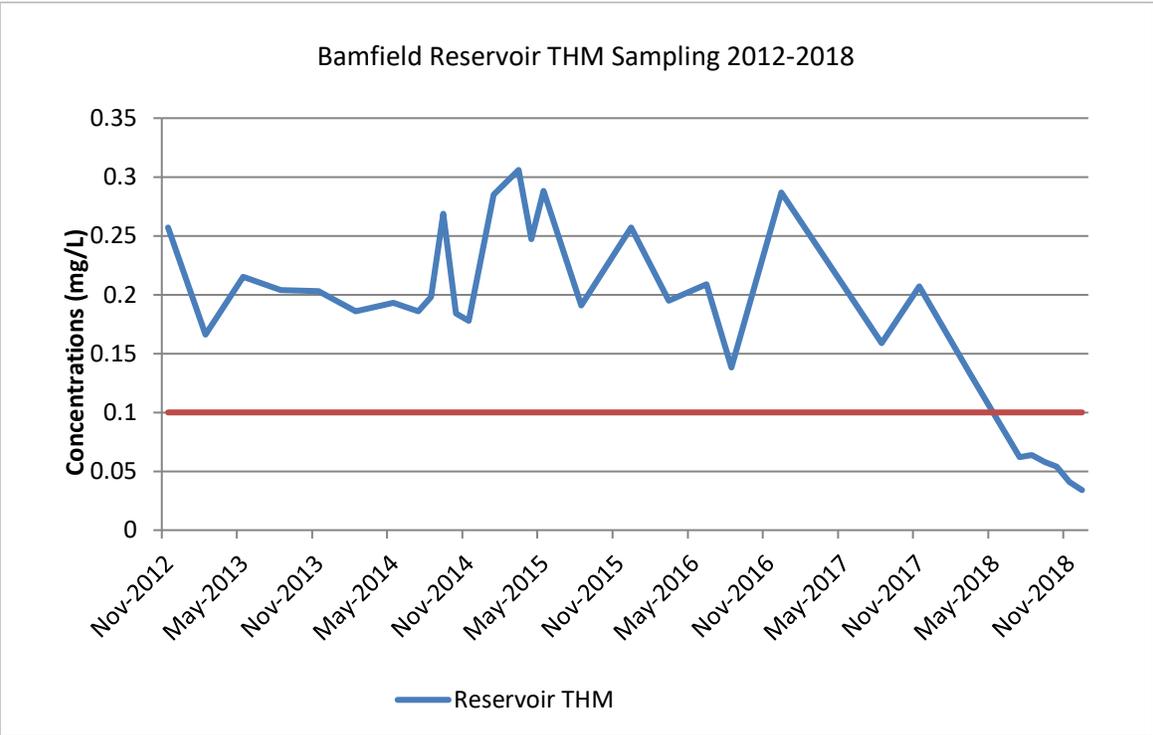
Target 4 - Meet the Drinking Water Quality Guidelines

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. As this testing was completed before the Water Treatment Plant was installed there were DBP and colour values above the standards.

Prior to the construction and commissioning of the new treatment plant, water in the system did not meet the drinking water quality guidelines.



The above graph shows the results in meeting the Canadian Drinking Water Standards. Colour and disinfection byproducts (THM) exceeded the standards. Although colour alone isn't harmful, the associated organics in water often causes disinfection byproducts. The high THM values obtained at this sampling event are not indicative of the entire year but only for this sampling event. The plant was operational in July and has since then been successful in removing the precursors of DBP (colour and organics). All DBP's values and colour values are now well below the guidelines.



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 \$1500

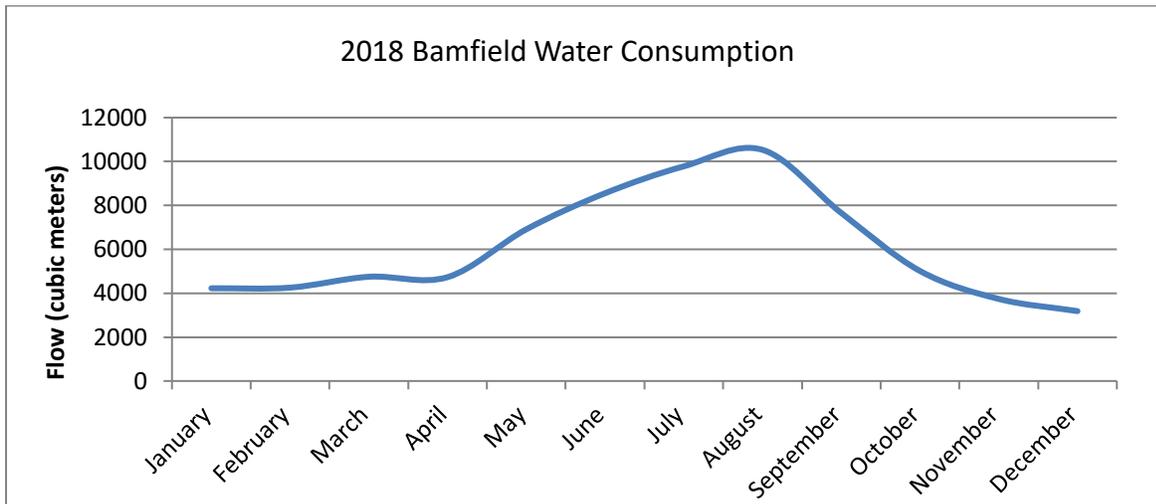
There are many factors that affect how cost effective a system is running. Effective management and planning, bulk water purchase and water demands can all affect system costs.

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 2018, the water system provided 73,413 cubic meters of water to the community water system for an average of 201 m3/day demand. In the summer, the peak day demand was 299 m3/day. These are both below the target.

Cost Effective Target 3 - 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. Our target it to have the peak day demand (PDD) less than twice as much as the average day demand(ADD). Peak summer day demand is approximately 299 m3/day compared to average daily demand of approximately 201 m3/day. This is approximately 1.5:1 ratio of PDD to ADD.



Cost Effective Target 4 – O&M Cost per Customer less than \$1,500

In 2018, the total operating costs for the Bamfield Water System were \$169,907 excluding contributions to the capital fund. This is higher than the total operating cost in 2017 which was \$117,307 due to the addition of the new water treatment plant which came online in August of 2018. Divided by the 203 services in the system, this results in a cost of \$837 per customer for 2018. It is anticipated that the total operating costs for 2019 will be higher as the treatment plant will be in operation for a full year.

Although this is a higher operation cost per customer than other water systems in the ACRD (Beavercreek - \$574, Millstream - \$723), this is the only water system that operates an advanced treatment plant. There are very few comparable water systems, however, the Fulford Water system on Salt Spring Island operated by the Capital Regional District is a very small system that also has a similar DAF treatment plant. For this system, the total operating costs for 2018 (excluding debt repayment and capital) were \$148,564 and they serviced approximately 95 properties. Their cost per customer was \$1,563.

Reliability Targets:

- 1) Unaccounted water loss less than 15%.
- 2) Maximum # of breaks less than 5/year.

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

In 2018, the water system provided 73,413 m³ of water to the community water system. The total water consumed in Bamfield through all water meters for 2018 was 49,047 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 2018 was 24,366 cubic meters which made up 33% of all water produced.

Sources of unaccounted water loss for 2018 include the commissioning of the new water treatment plant, as significant water was used. The backwash cycle of the new water treatment plant uses 5 m³ of finished water per filter cycle. In July 2018 there were approximately 90 backwashes @ 5 m³, totaling 450 m³. For the next year we would anticipate the use of approximately 3,600 m³ for this purpose.

This also means that the 24,366 m³ of the water that was produced generated no revenue. A certain amount of this volume is unavoidable loss including water lost due to main breaks, fire department practices and the flushing program. In order to better determine how much of this volume is unavoidable water loss, the system could begin trying to measure and record the volume of water used in flushing and filter backwash.

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

In 2018, we had one water main breaks and seven service line breaks. Two service lines were broken due to the installation of the fiber optic lines. There was also five leaks due to galvanized fitting failure including a number of leaks on private property. In July a major leak was found in the underwater main leading to West Bamfield that required a scuba diver to repair.

In December, there was seven days without power due to a large storm that downed power lines leading to Bamfield. The emergency generator was used during this time and there were no interruptions to the water supply.

Summary of Target Results for 2018

This past year we have met most of our targets with only a few exceptions. Although we were not meeting our target for DBP in the beginning of the year we now have the water treatment plant operating and are now within the target. We only had one bacteria count out of 60 samples out of 2018 and met our chlorine residual so our one count must have been an error. Bamfield's water demand is meeting our targets even with the increase in population in the summer months. The water loss is higher than preferred and in 2019 we hope to have better tracking of our unaccounted for water.

	Target	2018 BWS
Bacteria Results	0	1
Chlorine Residual	>0.20 mg/l	>0.20 mg/l
Turbidity	< 1.0 NTU	<1.0 NTU
CDWQG	< 100%	50%
Total Demand	< 626 m3/day	299 m3/day
Peak Demand Ratio	<2	1.5
Cost per customer	\$1500	\$837
Water Loss	<15%	33%
Breaks	<5	7

3.0 Improvement Plan

2018 Projects Completed

Water Treatment Plant Construction - Construction of the new Dissolved Air Flootation (DAF) water treatment plant was completed in July of 2018. The plant has been exceeding expectations in performance. Treated water meets the Drinking Water Quality Guidelines and is specifically low in turbidity and colour, reducing the formation of the disinfection byproducts of trihalomethanes (THM's). There have been some small improvements after commissioning the automatic control system (SCADA) and adjusting feed rates and set points. The Vancouver Island Health Authority has removed the Water Advisory as of January 2019. While a pipe fitter was on site working on the new plant additional pipe replacement was performed in the pump house to replace corroded pipes.

Intake Extension Investigation - Sugsaw Lake was being monitored in 2018 for the precursors for disinfection byproducts at multiple depths to determine if there was better water quality at varying depths. This additional monitoring has determined that the lake's water quality is uniform and therefore testing has now stopped.

Reservoir Cleaning - In the fall of 2018, both reservoirs were cleaned of any sediment that could influence water quality results.

Upcoming Projects

Water Emergency Response Plan Update - The review and update of the Water Emergency Response Plan to include all scenarios with the new treatment plant will be completed in 2019. This is a requirement of the Health authority and will help with identifying risks and subsequent plans to enact in an emergency.

Asset Management Plan – Identify all assets along with the estimated useful life remaining, future cost, condition assessments and required contribution. 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.

Water Quality Monitoring - Monitoring of the treated water for disinfection byproducts levels will continue at quarterly intervals as part of a regular monitoring program.

Ocean Transmission Main Vulnerability Assessment – due to the recent failure of the ocean transmission main, an inspection of all transmission mains to determine area of vulnerability and potential costs to reduce risk will be undertaken.

Water Loss Investigation – 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.