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REPORT TO WILDERNESS MOUNTAIN WATER SERVICE COMMISSION
MEETING OF FRIDAY, JULY 31, 2015

SUBJECT **DRAFT STRATEGIC ASSET MANAGEMENT PLAN FOR WILDERNESS MOUNTAIN WATER SYSTEM**

ISSUE

To provide the Wilderness Mountain Water Service Commission (WMWSC) a draft copy of the Strategic Asset Management Plan for the Wilderness Mountain water system for its consideration.

BACKGROUND

At its meeting of March 31, 2015, the Wilderness Mountain Water Service Commission (WMWSC) requested that the Capital Regional District (CRD) staff deliver the draft Strategic Asset Management Plan (SAMP) with proposed future expenditures prior to the 2016 capital and operating budget preparation.

It should be noted that the capital reserve account at the beginning of 2015 was $61,340. Two capital projects have been approved for 2015, those being:

1. Dam Safety Upgrades (Wilfred Reservoir / upper) for $10,000; and
2. SCADA upgrade (Option 2 / March 31, 2015) for $26,250.

In summary, the current capital reserve account balance is $25,570 ($61,340, less $10,000, less $26,250 plus $480 interest). Further, there is an uncommitted amount of $101,196 from the Treatment Plant capital project that was completed in 2013. These two amounts total $126,766.

Draft Strategic Asset Management Plan

The scope of the draft SAMP was to identify issues related to aging infrastructure, changes in legislative obligations, level-of-service expectations, financial issues and water quality aspects of the water service. The WMWSC may desire to pursue other issues and direct the CRD staff to review and report back to the WMWSC on such issues.

In general, the water system performs well, although there is a desire to increase the operating effort related to distribution system flushing and to create fund for small equipment replacement fund. Further, an increase in water quality sampling is proposed.

Operating Budget Implications (annual):

1. Annual distribution system flushing, $5,000 per annum – The distribution system is approximately 3.8 km in length and is not routinely flushed to improve water quality. Therefore, it is proposed to increase the annual operating budget by $5,000 for CRD labour and equipment to create a unidirectional flushing program and implement the program annually.

A $5,000 per annual expenditure would result in an increase in the user charge of $35.71 per SFE and an increase in parcel tax of $32.09 per taxable folio.

2. Small Equipment Replacement, $5,000 per annum – as the existing equipment such as pumps, instruments and filters age, there is often a need to repair or replace small equipment that is in service without having to utilize the capital reserve fund.

   A $5,000 per annual expenditure would result in an increase in the user charge of $35.71 per SFE and an increase in parcel tax of $32.09 per taxable folio.

Water Quality Budget Implications (annual):

1. Increase water quality sampling by $4,150 per annum (to total $8,150) – the water sample plan is proposed to be enhanced to meet the minimum testing requirement and expectations by the Island Health Authority.

   A $4,150 per annual expenditure would result in an increase in the user charge of $29.64 per SFE and an increase in parcel tax of $26.63 per taxable folio.

Capital Budget Implications

The following summarizes the proposed capital expenditures, the estimated cost and proposed year of completion.

1. Dam Safety Upgrades (William Brook Reservoir/lower) $30,000 (2016) – the 2015 five-year capital plan included an expenditure in 2016 for dam safety improvements specifically for the lower dam. Although the CRD staff are pursuing alternatives for ownership of this dam and reservoir, it is prudent to continue to budget and complete the dam safety improvements.

2. SCADA upgrade, Phase 2, $36,250 (2016) – in 2015 the WMWSC approved phase 1 SCADA upgrading and it is propose to complete the balance of the improvements in order for the operators to receive field information from onsite instrumentation and alarms. It was noted at the March 31, 2015 commission meeting, that the SCADA equipment may result in lower operational costs of approximately $2,000 per year ($3,000 savings less SCADA servicing cost estimate of $1,000 per year) associated with performing routine maintenance monitoring and/or call-out for items that could be addressed by accessing information from the water disinfection facility remotely at the Japan Gulch water treatment plant that is operated full time.

3. Undertake improvement to intake pump $2,500 (2016) – the raw water supply pump at Wilfred Reservoir piping is fixed and it is proposed to install pipe fittings to allow the operators to remove and inspect the pump and motor with less difficulty.

4. Chemical Metering Pump $2,000 (2016) – the existing water treatment plant includes a chemical metering pump and these pumps are operated frequently and are critical for chemical dosing and it is proposed to purchase a spare pump and have it on hand should the existing fail.

The proposed capital improvements as noted above total $70,750. Should the WMWSC decide to complete and fund the proposed improvements from the Capital Reserve Account consisting of $126,766 then the balance would be approximately $56,000 and available for future capital expenditures.

Further, the commission should consider maintaining a capital reserve balance using a percentage of the total asset replacement value. Considering that the estimated total replacement value of the water system is in the order of $5,000,000, including dams, water treatment, storage and distribution system and it's favourable condition, a reserve amount in the order of 2 to 5% of the replacement value or $100,000 to $250,000 would be reasonable at this time. However, the CRD Finance Department will review reserve fund balances and types to determine the best strategy in order to sustain the service area. Any major future capital improvements may utilize the reserve amount solely or in combination with an increase in parcel tax and/or supplementary funding opportunities/grants.

ALTERNATIVES

Alternative 1

That the Wilderness Mountain Water Service Commission accept this report and draft SAMP and direct the CRD staff to include the proposed operating and capital expenditures in the draft 2016 budget (five-year budget) for the commission's consideration at the upcoming budget meeting.

Alternative 2

That the Wilderness Mountain Water Service Commission accept this report and draft SAMP and direct the CRD staff to revise the proposed operating and capital expenditures in the draft 2016 budget (five-year budget) for the commissions consideration at the upcoming budget meeting.

IMPLICATIONS

Alternative 1 – By receiving this report and directing the CRD staff to include the proposed operating and capital expenditures in the draft 2016 budget (five-year budget) the CRD staff will prepare the draft 2016 operating and capital budgets based on the identified expenditures for the commission's consideration at the upcoming budget meeting.

Alternative 2 – By receiving this report and directing the CRD staff to revise the proposed operating and capital expenditures in the draft 2016 budget (five-year budget) the CRD staff will prepare the draft 2016 operating and capital budgets based on the revised items for the commission's consideration at the upcoming budget meeting.

CONCLUSION

A draft strategic asset management plan has been prepared for the Wilderness Mountain Service Commission and overall the water system performs well, however, some improvements related to operating and capital are proposed to improve and maintain the water service.

RECOMMENDATION

That the Wilderness Mountain Water Service Commission accept this report and draft SAMP and direct the CRD staff to include the proposed operating and capital expenditures in the draft 2016 budget (five-year budget) for the commission's consideration at the upcoming budget meeting.

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WILDERNESS MOUNTAIN WATER SYSTEM

STRATEGIC ASSET MANAGEMENT PLAN

EAST SOOKE, BC

JUAN DE FUCA ELECTORAL AREA

CAPITAL REGIONAL DISTRICT

Prepared by: Capital Regional District Integrated Water Services
July 2015

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1.0 BACKGROUND

1.1 Introduction

The Capital Regional District (CRD) identified a need to develop a Strategic Asset Management Plan (SAMP) to ensure that the ability of the Wilderness Mountain water system to deliver water is maintained and compliant with regulatory standards. The Capital Budget for the Wilderness Mountain Water Service has included an allowance to conduct an engineering study to determine the quantity, age, condition and approximate life expectancy of watermains and other infrastructure; estimate the cost to renew or replace infrastructure; and develop a long-term financial plan to fund infrastructure renewal or replacement as required to maintain an acceptable level of service and stable annual cost of service.

The Wilderness Mountain water system was first developed in 1983 as a private water utility and ownership was converted in 2008 to the CRD. The CRD completed an operational assessment of the system in early 2009 and began operating it in February 2009. The operational assessment identified a number of deficiencies in the water system. In recent years the CRD has completed routine maintenance and upgrades/repairs to the system, as follows:

- Installed new treatment system and building including: coarse cartridge filtration, UV disinfection and chloramine disinfection
- Upgrades to hydro-pneumatic system at the storage tank site servicing Ambience Place.
- Replaced tank hatches and screens
- Repaired major leak in 150 mm water line near 652 Seascape Place
- Supply and installation of a Supervisory Control and Data Acquisition (SCADA) system.
- Cleared brush from around the reservoirs and pump stations
- Dam safety work

1.2 Regulatory Compliance

The operation and maintenance of a water utility shall be compliant with a number of Provincial and Federal legislation, regulations, guidelines and standards as listed below, but not limited to:

a) Guidelines for Canadian Drinking Water Quality, Canada
b) Drinking Water Protection Act and Regulations, British Columbia
c) British Columbia Groundwater Protection Act and Regulations, B.C.
d) Dam Safety Regulations – Water Act, British Columbia – Water Licenses, and
e) Work Safe BC

The Wilderness Mountain water service has many bylaws related to the service including:

a) Wilderness Mountain Service Establishment Bylaw No.1, 3503
b) Southern Gulf Island and Juan de Fuca Electoral Areas Utilities and Street Lighting Fees and Charges Bylaw No. 1, 3987
c) Water Regulations Bylaw No.1, 1792

Other guidelines and standards to consider when designing or evaluating a water system can include the following:

a) Design Guidelines for Rural Residential Community Water System

b) Master Municipal Construction Document Design (MMCD) Guidelines
c) Fire Underwriters Survey – Water Supply for Public Fire Protection (FUS)

1.3 Level of Service

The level of service that a water system should provide represents a significant factor in determining the required system configuration. The imposition of large utility model systems on smaller utilities can have significant cost implications to the users. The level of service can be generally categorized in a few key areas such as; water system production capacity, water quality, water storage volume, system pressures and fire protection.

The level of service to provide average per capita demands, fire protection and water quality generally have the most impact on the water system configuration and associated capital and operating and maintenance costs. There is a mandatory level of service that must be achieved to adhere to legislation and regulations such as the treatment and quality of water versus an optional level of service such as the level of fire protection and water pressure.

1.4 Study Area

The community of Wilderness Mountain also known as Mount Matheson Estates is a rural residential development located in East Sooke immediately south of Roche Cove Regional Park.

The Wilderness Mountain development is at an elevation between 200 m and 265 m above sea level. The climate is generally cool and dry in the summer with mild winters and an average annual rainfall of 625 mm.

The Wilderness Mountain water service area is made up of 82 parcels encompassing a total area of approximately 124 hectares. Approximately 70 of the 82 parcels are connected to the water system.

2.0 EXISTING WATER SYSTEM

2.1 General

The Wilderness Mountain water system (WMWS) currently draws raw water from the Wilfred Reservoir into the treatment plant. The treated water is discharged directly into the distribution system and fills the two storage tanks during lower demand periods. A hydro-pneumatic system located in a small building next to the storage tanks provides water pressure to residences in a higher zone of the service area (Ambience Place).

2.2 Water Supply

Water Quantity

The Wilfred Reservoir is an artificial man-made lake containing two dams and is at an elevation of approximately 225 m above sea level. The reservoir has an area of approximately 1.1 hectares, a total volume of approximately 57,000 m^3. The available water for use above the intake pipe is estimated at 42,000 m^3. The Wilderness Mountain water system has two water licenses on this source, permitting diversion of approximately 29,000 m^3/year (29 million litres/year).

The water system production is metered at the treatment plant. The total volume metered at the pump house for 2014 was 17,924 m^3. The existing household meters

are non-standard and accuracy is unknown. For these reasons and the fact that the utility does not bill based on consumption, the meters are not regularly read. Therefore, it is not possible to measure the amount of water loss due to leakage, firefighting and flushing.

Water Quality

Wilfred Reservoir has a phosphorous concentration below 10 micrograms per litre classifying this water body as oligotrophic, meaning low biological productivity. In the two years of monitoring by the CRD, there have been some minor algae blooms in the reservoir but no detection of blue green algae or algal toxins.

The CRD has confirmed the boundaries of the watershed catchment area and there are no residential septic tanks or tile fields within the catchment area.

2.3 Treatment

The new treatment plant commissioned in 2012 includes coarse cartridge filtration (25 micron and 5 micron), followed by ultraviolet disinfection, then chloramination with pre-ammonia injection followed by sodium hypochlorite injection.

2.4 Storage Tanks

Currently, the treated water is pumped directly into the distribution system and during low demand to the 136.4 m^3 (30,000 Ig) and 111.4 m^3 (25,000 Ig) storage tanks (total 248 m^3) at an approximate elevation of 285 m. This storage is used for emergency, fire (rural) and balancing storage.

The storage tanks were designed according to the standards of the day and included the sum of the fire flow (based on 400 Igal per minute for two hours or 48,000 igal) plus 25% of the maximum day demand (Bullock Baur Report - February 9th, 1996).

2.5 Distribution Mains

The existing distribution system consists of approximately 3,800 metres of 100 mm and 150 mm diameter PVC water mains that were installed in the 1980s and 1990s. There are about a half dozen "dead end" mains in the water system. Most of these "dead end" mains cannot be looped because they are found at the end of narrow service areas.

Table 1.1 –Summary of Pipe Material

Material	Diameter (mm)	Year Installed	Length (m)
PVC Series 160	100	1981	219
PVC Series 160	150	1981/93/97	3,431
PVC	150	2001	102

The water distribution system includes other miscellaneous appurtenances, including:

- 70 service connections
- 10 fire hydrants
- 6 standpipes
- 21 gate valves

- 1 booster pump station

2.6 Supervisory Control and Data Acquisition – (SCADA)

The Wilderness Mountain water service recently added a partial SCADA system which included the installation of electronics including radio, remote terminal unit (RTU) and transducers/level transmitters to continuously monitor water storage levels, this also indicates the length of pump runs and BC Hydro power status.

2.7 Fire Protection

The Fire Underwriters Survey sets out minimum requirements for a water system to be "recognized" for fire protection purposes. The minimum main size recognized is 150 mm diameter. The minimum fire flow requirement for a rural residential development is 33 l/sec (525 USgpm) for one hour with a minimum residual pressure of 138 kPa (20 psi). This would require a minimum of 120 m^3 to be available at all times from storage for fire protection.

The present system has ten fire hydrants. However, some parts of the system may be undersized to convey sufficient flow (i.e., 33 l/sec) to meet fire flow requirements during normal system operation.

Rural fire departments may typically be outfitted with a bladder and a portable reservoir to use as an on-site storage vessel. The department's tanker truck will fill the bladder from available sources with the pumper truck drawing water from the bladder to fight the fire. The presence of fire hydrants on a system suggests the availability of water to fight a fire and flow testing could be conducted with water flushing activity to gauge the available fire flow if required.

2.8 Water Quality

Water delivered to the Wilderness Mountain water service area is safe to drink, and typically meets the guidelines set out in the Guidelines for Canadian Drinking Water Quality and the requirements of the BC Drinking Water Protection Act and Regulation as administered by the Island Health Authority.

The raw water source for the Wilderness Mountain system does contain E. coli bacteria and total coliforms. The treatment plant has been successful in making the treated water safe to drink. There were no E. Coli bacteria and only three samples with very low concentrations of coliform bacteria (1 – 3 CFU/100ml) detected in the distribution system since 2012.

The turbidity of the raw water is usually below the limit of 1 NTU and only once in 2010 was a low level of Giardia parasites detected in a sample from the raw water. The total organic carbon is typically a moderate 3 – 4 mg/l. The raw water in Wilfred Reservoir does contain elevated concentrations of iron and manganese which, if untreated, could cause exceedance of the aesthetic objectives for these compounds as per Guidelines for Canadian Drinking Water Quality. An undesired water discolouration and possible staining of fixtures and laundry could be consequences of inadequate treatment of these metals.

Levels of disinfection by-products (total trihalomethanes and halocetic acids) were below the limits set out in the Guidelines for Canadian Drinking Water Quality since 2012.

Wilfred Reservoir experiences spring algal blooms (primarily a yellow-brown algal called *Uroglena*) while algal concentrations are typically relatively low. Very low levels of blue-green algaes have been observed over the past years. No water quality complaints were noted during these blooms.

The current Water Sampling Plan consists of a series of samples from the raw water entering the treatment plant at frequencies ranging from weekly to annually and from four distribution system locations at frequencies from bi-weekly to semi-annually. The Water Sampling Plan with its parameter specific sampling schedule was tailored to address system inherent risks.

2.9 Operations

Scheduled disconnections, installations, repairs, capital works are performed by CRD operating staff that are based out of the Integrated Water Services department in View Royal.

Planned water system operating duties include water treatment plant operation, system flushing, reservoir cleaning, hydrant servicing and valve exercising as the operating budget allows. The operators also respond to any customer complaints or water main breaks as required.

Currently, the CRD operating staff is only able to undertake a minimum amount of the maintenance activities due to the availability of budget. The goal would be to achieve best management practices related to maintenance activities which would result in improved longevity of assets, reliability and water quality.

2.10 Dams and Reservoirs

The WMWS has three dams, one at William Brook, the lower reservoir, and two at Wilfred Brook, the upper reservoir. William Brook dam and reservoir was built in 1980 as the sole water source for phase one of the Wilderness Mountain (Mount Matheson Estates) development and it is located on private property (5250 Mount Matheson Road). In 1996, Wilfred Brook reservoir (upper reservoir) located on 706 Cains Way was commissioned and became the primary water source for the WMWS and the lower reservoir was disconnected from the water system.

The WMWS does not require William Brook reservoir as a raw water source as Wilfred Brook reservoir has sufficient capacity for existing and estimated future demand of the existing service area based on historical usage, even though the reservoir would be beneficial if the upper reservoir failed, the raw water from the lower reservoir would have to be treated and conveyed to the distribution system.

William Brook Dam is a concrete arch structure with substantial earth fill on the downstream side. The dam is approximately 51m in length and 8.2m in height at the highest point with a 1m wide concrete dam crest. The dam was originally constructed around 1980 for the Wilderness Mountain (Mount Matheson Estates) development. A concrete spillway is located on the right dam abutment.

Wilfred Dam (South) is a concrete tiered structure. The dam is approximately 20m in length and 4m in height with a 0.5m wide concrete dam crest. The dam has three spillway openings. The wooden boards over the three spillways were replaced in 2014. The dam was originally constructed around 1991 for the expansion of the Wilderness Mountain development.

Wilfred Dam (North) is a concrete tiered structure similar to the south dam. The dam is approximately 13m in length and 5m in height with a 0.5m wide concrete dam crest. The dam has no spillway, but has a 300mm dia. knife valve mounted to a 300mm CSP outlet pipe. The dam was originally constructed around 1991 for the expansion of the Wilderness Mountain development. To date in 2015, stairs have been constructed to improve safety concerns when accessing the dam and four trees were removed from the dam.

3.0 DESIGN CRITERIA

3.1 General

Design criteria used in this study have been taken from CRD Design Standards for the Juan de Fuca water system and from the *Ministry of Water, Land and Air Protection Water Management Branch, Fire Underwriters Survey, MMCD Design Guidelines Ministry of Health, Guidelines for Canadian Drinking Water Quality* in conjunction with the requirements of the Drinking Water Protection Act.

3.2 Water Supply

The Ministry of Environment, Design Guidelines for Rural Residential Community Water Systems indicates the reliable yield of the source should be adequate to supply the design maximum day demand during a moderate drought in the summer. Also, as a rule of thumb, storage reservoirs situated in water courses should have usable storage capacity of at least two years average demand.

It is suggested that historical data be used to develop future demands required for the design of supply, treatment and distribution systems specifically experienced by this community.

3.3 Water Demands

The annual average day demand (ADD) for 2014 was measured at 712 litres per active service connection per day. The measured maximum day demand (MDD) for 2014 was 164 m^3 or 2,375 litres per service connection per day and it occurred in early September.

By comparison, the CRD's design criteria for ADD for the Juan de Fuca water system is 1,744 litres per lot per day and the MDD is 4,360 litres per lot per day. The lower ADD and MDD rates for Wilderness Mountain water system could be a result of the awareness that the community has a limited water source, the rural land use and that the CRD's design criteria is more applicable to new urban development.

The WMWS should consider adoption of a water conservation plan in light of the recent dry weather and concerns of climate change.

3.4 Multiple Barrier Approach/Water Quality

Health Authorities refer to a document published in 2012 when dealing with a water system using surface water as a source: "Drinking Water Treatment Objectives For Surface Water Supplies in B.C.". This document provides the basic, minimum framework for what is considered acceptable water treatment for surface water supply systems in B.C. and it requires such water systems to apply beyond water treatment a *multiple barrier approach* to prevent contamination of the drinking water supplied to customers. The *multiple barrier* concept was outlined in Health Canada's document

"From Source to Tap – The Multi-Barrier Approach to Safe Drinking Water". These 'barriers' for the protection of water quality include:

- **Good Water System Design.** This is the foundation for the protection of water quality and supply. Good system design matches water treatment methods to source water quality and the characteristics of the water supply system, optimizes the efficiency and safety of the water supply infrastructure, and provides for ease of operation, maintenance and monitoring. For the design and construction of the WMWS, current industry standards and best management practices were applied.
- **Protection of Source Water.** Public ownership and the careful stewardship protect the watershed around the source water reservoirs or drainage around groundwater wells. The catchment of the primary water source for the WMWS, Wilfred Reservoir, is subject to covenants that restrict land use to protect the source water quality.
- **Water Treatment.** Provision of treatment processes suitable for the applicable risks to ensure drinking water system meets regulatory requirements. The WMWS incorporates an Island Health approved water treatment system to ensure that safe water is produced and delivered to the customers.
- **Maintenance of the Water System.** A systematic maintenance management program ensures that all equipment is maintained at a high level of serviceability. This includes annual water main flushing, valve exercising, leak detection and the cleaning and disinfection of distribution reservoirs. Certified CRD Operations staff applies best management practices to the operations of the WMWS.
- **Infrastructure Replacement.** Water supply infrastructure is replaced before it reaches the end of its projected lifecycle. The condition of the infrastructure is regularly assessed to determine if the replacement schedule needs to be modified.
- **Staff Certification and Training.** CRD Integrated Water Services requires its operational staff to have the appropriate levels of certification and receive regular training. The water quality testing laboratory is certified by the BC Ministry of Health.
- **Cross Connection Control.** This program works typically with industries, businesses and institutions to install measures to prevent potentially contaminated water from flowing back into the water supply system. Backflow prevention from private residential properties can also be of importance. The WMWS's primary cross connection risk comes from residential sources and risk indicators are not apparent with the system and therefore, back flow prevention is not considered a priority at this time.
- **Water Quality Testing.** The quality of the water is regularly sampled and tested throughout the water supply and distribution system. The results are reported to the health authorities and the public. This audit ensures that the other barriers are operating in a satisfactory manner and identifies any issues that need addressing.

The CRD applies the multi-barrier approach to the Wilderness Mountain water system. While some of the barriers require further consideration and improvement, the general concept of this approach enables the CRD to ensure to the public and to the regulatory authorities that the Wilderness Mountain water system is in a position to provide consistently safe water to its customers.

3.5 Storage

The system was designed according to the standards of the day by Bullock Bauer and reviewed by the Province of B.C., the design criteria included the sum of the fire flow (based on 400 Igal per minute for two hours or 48,000 igal) plus 25% of the maximum day demand (Bullock Bauer Report - February 9th, 1996).

The following design criteria have been used to further assess the storage requirements for the Wilderness Mountain water system:

1) Average Day Demand – CRD's design standard of 545 litre per capita per day and 3.2 people per lot or 1,744 litres per lot per day. 82 lots equates to 143 m^3
2) Maximum Day Demand – CRD's design standards add a peaking factor of 2.5 to generate an MDD of 4,360 litres per lot per day. 82 lots equates to 357 m^3
3) Peak Hour Demand – The peak hour demand has been used to evaluate the supply main. The peak hour demand is achieved from the storage tank draw down and is approximately three times maximum day demand.
4) Fire Flows – The minimum rural residential demand is 33 l/sec for one hour with a minimum residual pressure of 138 kPa (20 psi) in conjunction with the maximum day demand.
5) Distribution System Pressure – The generally acceptable range of pressure for a water distribution system is between 138 kPa (20 psi) and 820 kPa (120 psi).
6) Storage – There are three major components of reservoir storage:
   a) Equalization – This is the volume of water required from storage to provide the difference between instantaneous system demand and maximum day demand system requirements which the pumping and treatment components are sized to provide. This amount is equal to 25% of the maximum day demand – 89 m^3 for Wilderness Mountain.
   b) Fire – This is a volume of water set aside in storage equal to the potential fire demand within the storage tank supply area. The minimum value for a rural residential is 120 m^3. For new storage tanks within Juan de Fuca Water Distribution system the minimum requirement for fire storage is 1,200 m^3, however this is based on a more urban land use criteria, and in this situation would most likely lead to water quality concerns.
   c) Emergency – This is the volume of water held in storage for supply to the water system during extended power outages and is related to typical system demand and duration of outages. The amount is equal to 25% of the equalization and fire demand – 52 m^3 for Wilderness Mountain. The WMWSA currently has SCADA monitoring of the tanks and an auxiliary power(Gen-set) hook up at the treatment plant in the event of a power failure.

Reservoir sizing based on MMCD and rural design guidelines is usually taken as a + b + c. Therefore a total storage of, a + b + c, or 261 m^3 of storage is required. The total existing storage volume is 248 m^3 which is very close to the requirements for equalization, fire (minimum rural requirement) and emergency storage.

3.6 Dams and Reservoirs

In the Province of British Columbia dam structures are regulated under the British Columbia Dam Safety Regulation (Regulation) of the Water Act. The Regulation was passed into law as Regulation 44/2000 under the Water Act effective February 11, 2000, and there were two amendments to the Regulation in 2011.

In accordance with the Regulation, the CRD is obligated to operate the dams in a safe manner. This includes, but is not limited to, completing routine inspections and maintenance tasks, regulatory reporting, preparation and maintenance of Operation, Maintenance and Surveillance manuals, and Emergency Preparedness Procedures manuals, and potentially periodic dam safety reviews/studies based on the consequence of failure rating. Minor maintenance is typically funded by the operating budget and major expenditures are included in the capital budget.

The Regulation rates dams according to the Dam Failure Consequence Classification system based on population, potential loss of life, environmental and cultural values, and infrastructure and economics. All three dams have a failure consequence classification of "Significant". The Province's "Significant" classification notes that temporary population is located in the dam-breach inundation zone. More specifically for WMWS, a dam-breach at one of the Wilfred Brook dams may result in the loss of water supply for the community, damage roads and drainage systems, and residential property.

The CRD has three (3) water licenses on William and Wilfred Brooks reservoirs (C125531, C125686, and C125687). The holder of a water license has obligations and responsibilities associated with dam ownership. The licenses include both William Brook and Wilfred Brook Reservoirs in a common license. If the CRD were to remove or transfer ownership of William Brook Reservoir the water licenses would need to be revised and updated.

The purpose of the CRD's dam safety program is consistent with the legislation. The CRD's dam safety program was primarily established for the water supply dams within the Regional Water Supply Commission's service area for Greater Victoria and more recently, included the local services and the dams operated and maintained by the CRD's Parks and Environmental Sustainability Department. In total, the CRD Integrated Water Services Department is responsible for the safe operation and maintenance of 27 dams and provides support for another eight dams throughout the region.

The Province does not require dam owners to carry out Dam Safety Reviews for dams with "Significant" classification at this time however the following should be adhered to:

Maintenance:

- Brushing along roadways to maintain access; Once or twice a year
- Cleaning of concrete surfaces to provide ease of inspection

Legislated obligations:

- Monthly Dam Inspections; CRD operators conduct monthly dam inspections at William Brook and Wilfred Brook Dams.
- Annual formal dam inspections. Includes report preparation and recommendations to address maintenance and safety concerns. Also includes submitting annual regulatory compliance forms to the Dam Safety Officer.
- Unscheduled dam inspections following unique events such as large rain storms or earthquakes.

4.0 SYSTEM EVALUATION AND IMPROVEMENTS

The following section assesses the existing water system against the design criteria described in the previous sections and identifies what is required to meet the desired design criteria if any shortfalls are present.

4.1 General

The existing water system is approximately 30 years old and the water quality monitoring for the Wilderness Mountain water system indicates that the system continues to produce safe drinking water. Table 4.6.1 summarizes the remaining useful life for each major asset.

However, it is suggested that the WMWS utilize a small equipment replacement fund to be available as existing equipment, such as pumps, instruments and filters age as there is often a need to repair or replace small equipment that is in service without having to utilize the capital reserve fund.

4.2 Water Source

In general, the water source has more than sufficient capacity to meet the maximum day demand in summer months and the current annual water demand of approximately 18,000 m^3. This equates to approximately 1.35 metres of drawdown in the Wilfred Reservoir. The existing water licenses for Wilderness Mountain allow the withdrawal of 29,000 m^3/year, and the estimated volume of water available for use above the pump intake is approximately 42,000 m^3.

The available active storage in the reservoir when it is full would be able to sustain the Wilderness Mountain community for approximately 2 years in a drought situation.

The raw water supply pump at the Wilfred reservoir is fixed and it is proposed to install fittings to allow operators to remove and inspect the pump and motor with less difficulty.

4.3 Disinfection and Treatment

The new treatment process installed in 2012 includes coarse cartridge filtration (25 micron and 5 micron), followed by ultraviolet (UV) disinfection, then chloramination with pre-ammonia injection followed by sodium hypochlorite injection. The system is currently working well

However, additional water treatment beyond the existing two stage disinfection system would be required to deal with the water quality that would deteriorate significantly if there was an extended drought period and inadequate recharge. Considering the significant winter rain that occurs in this area, the chance of an extended drought is considered low.

The quality of the raw water provided by the Wilfred Reservoir currently meets the USEPA and BC Ministry of Health criteria for filtration exclusion. However, regulations or circumstances may change in the future with raw water quality or changes in legislation that could trigger water treatment improvements including filtration.

Phosphorous concentrations in the water source are below 10 micrograms per litre which indicates that this reservoir is less likely to experience a major algae bloom. Every effort should be made to continue to protect the water source from activities within the catchment boundaries that could compromise the water quality.

The existing water treatment plant includes a chemical metering pump and these pumps are critical for chemical dosing. It is desired to purchase a spare pump and have it on have it available should the existing pump fail.

4.4 Water Storage

The Wilderness Mountain water system existing storage capacity for treated water is considered to be very close to the required size to provide emergency, fire (minimum rural) and equalization storage for a rural community based on MMCD and rural design guidelines and the existing storage tanks were sized using an acceptable design criteria of the day, in addition there is currently an auxiliary power generator (gen-set) receptacle at the water treatment plant and SCADA monitoring at the tank site which may reduce the amount of emergency storage required.

4.5 Distribution System

The existing distribution system is less than 30 years old and it currently meets the domestic needs of the community. The existing residential meters are not read or maintained so it is not possible to assess the non-revenue water produced for the system. The water system mains are generally large enough to provide a rural level of fire protection.

The system contains a number of dead-end mains that cannot be interconnected as they service narrow areas that are at the extremities of the system. Flushing these mains during the summer months will be required to ensure the disinfectant residual and to maintain water quality.

4.6 Water Quality Monitoring

CRD staff have developed a tailored Water Sampling Plan for the WMWS to meet the minimum sampling/testing requirements and expectations by the Island Authority for waiving typical standard surface water treatment protocols. However, this Water Sampling Plan exceeds the current water quality monitoring budget approved by the Commission for the 2015 fiscal by $1,500. The additional budget is currently covered from contingency funds.

CRD staff also conducted a water quality risk analysis for future planning which revealed areas of risk associated with the current level of monitoring and testing and therefore proposed a number of revisions to the current Water Sampling Plan:

- Add algae testing to current Chlorophyll-a testing, bi-weekly for January-June and August-October and monthly for July, November and December. This will provide a better understanding of biological cycles in the lake, help identify water quality related trends and enable CRD staff to predict taste and odour events.

- Increase the current annual iron and manganese testing to quarterly. This will provide a better understanding of cyclical iron and/or manganese episodes that can cause staining and discolouration of the drinking water (not a health concern) and will enable CRD staff to predict discolouration events.

- Add an additional sampling station at the north end of Cains Way for regular bacteriological tests. This will provide additional monitoring of relevant bacteriological conditions in a currently unsampled area of the WMWS.

4.7 Supervisory Control and Data Acquisition – (SCADA)

It is proposed to continue with the installation of a full SCADA system which builds upon the recently installed SCADA equipment and would include all data points associated with the water disinfection and operation. This also includes the installation

of transducers to continually monitor storage levels, free and total chlorine analyzers, intrusion alarms, including connection of all other instruments (water meter, turbidity meter, and UV output). This may also result in lower operational costs associated with performing routine, maintenance monitoring and/or call-out for items that could be addressed by accessing information from the water disinfection facility remotely at the Japan Gulch water treatment plant that is operated full-time.

4.8 Dams and Reservoirs

Several deficiencies have been identified during the annual formal dam inspections carried out by CRD personnel. In 2014, the commission requested that CRD staff develop a strategy for proposed dam safety upgrades particularly for the William Brook reservoir (lower reservoir) as identified in the five-year capital plan. The 2015 capital plan includes $10,000 for dam safety improvements at the upper reservoir and further it is proposed to complete dam safety improvements at the lower dam and reservoir in 2016 for $30,000.

The WMWS will continue to incur dam safety maintenance costs as well as downstream liability issues related to the William Brook dam unless the dam is transferred in ownership to another party or the dam is decommissioned.

4.9 Prioritization Summary and Recommended Improvements

The following summarizes the recommended strategy for additional improvements to the WMWS that should be considered for implementation in order to ensure that the capacity of the water system to deliver water is maintained, compliant with regulatory standards and financially sustainable.

Operating

1) Annual distribution system flushing, $5,000 per annum – The distribution system is approximately 3.8 km in length and is not routinely flushed to improve water quality. Therefore, it is proposed to increase the annual operating budget by $5,000 for CRD labour and equipment to create a unidirectional flushing program and implement the program annually.

2) Small Equipment Replacement, $5,000 per annum – as existing equipment, such as pumps, instruments and filters, ages, there is often a need to repair or replace small equipment that is in service without having to utilize the capital reserve fund.

Water Quality

1. Increase water quality sampling by $4,150 per annum (to total $8,150 annually) – the water sample plan is proposed to be enhanced to meet the minimum testing requirement and expectations by the Island Health Authority.

The following provides a summary of the potential increase in operating costs for the operating and water quality items listed above:

Item	Operating Cost
Operating	
1. Annual Flushing	$5,000 (annually)
2. Small Equipment Fund	$5,000 (annually)

Water Quality

1.	Increased Water Testing	$4,150 (annually)
	TOTAL	**$14,150**

Capital

1) Dam Safety Upgrades (William Brook Reservoir/lower) $30,000 (2016) – the 2015 five-year capital plan included an expenditure in 2016 for Dam Safety Improvements. Although the CRD staff are pursuing alternative for ownership of this dam and reservoir, it is prudent to continue to budget for the dam safety improvements.

2) SCADA upgrade, Phase 2 $36,250 (2016) – in 2015 the WMWSC approved phase 1 upgrading and it is propose to complete the balance of the improvements in order for the operators to receive field information from onsite instrumentation and alarms.

3) Undertake improvement to intake pump $2,500 (2016) – the raw water supply pump at Wilfred Reservoir piping is fixed and it is proposed to install fittings to allow the operators to remove and inspect the pump and motor with less difficulty.

4) Chemical Metering Pump $2,000 (2016) – the existing water treatment plant includes a chemical metering pump and these pumps are operated frequently and are critical for chemical dosing and it is proposed to purchase a spare pump and have it on hand should the existing fail.

The following provides a summary of the capital costs for the items listed above:

Item		Capital Cost (year)
1.	Dam Safety Upgrades (William Brook Reservoir/Lower)	$30,000 (2016)
2.	SCADA upgrade, Phase 2	$36,250 (2016)
3.	Undertake improvements to intake pump installation	$2,500 (2016
4.	Chemical Metering Pump	$2,000 (2016)
	TOTAL	**$70,750**

The capital costs are based on estimated costs in 2015 dollars, and includes supply and installation of materials and equipment, engineering, contingency, and indirect costs.

Capital Reserve Account

The replacement cost of the overall WMWS including dams, water treatment plant, booster stations, distribution pipes and appurtenances is estimated to be in the order of 5 million dollars.

Summary of estimated replacement costs:

Dam and Reservoir Infrastructure	$1,000,000
Water Treatment Plant/Supply Works	$1,500,000
Storage Tanks/Booster Station	$1,000,000
Distribution System and Appurtenances	$1,500,000
Total	$5,000,000

The WMWS Committee should consider maintaining a capital reserve balance using a percentage of the total asset replacement value. Considering that the estimated total replacement value of the water system is in the order of $5,000,000 and it's favourable condition, a reserve amount in the order of 2 to 5% of the replacement value or $100,000 to $250,000 would be reasonable at this time. However, the CRD Finance Department will review reserve fund balances and types to determine the best strategy in order to sustain the service area. Any major future capital improvements may utilize the reserve amount solely or in combination with an increase in parcel tax and/or supplementary funding opportunities/grants.

Table 4.6.1 – Prioritization Summary

Asset	Remaining Useful Life (Years)	Importance	Redundancy	Priority (1 is high)
Reservoir	unknown	Needed for service		1
Dams	unknown	Needed for service		1
WTP (2012)	20	Needed for service		1
Pump house(s)	20	Needed for service		2
Booster stations (1)	10	Needed for service		2
Electrical components	10	Needed for control		2
Chlorinator	5	Mandatory		2
UV equipment	5	Mandatory		2
Storage tanks	30	Need for demand		2
Distribution System				
Hydrants (10)	25	Needed for public safety	Other hydrants	4
Air valves (0)	25	Needed for delivery	Other valves, some out of service	4
Standpipes (6)	25	Needed for maintenance		4
Valves (21)	25	Needed for isolation		4
Water Meters (70)	25	Needed for operating information		5
Watermains				
150 mm (PVC)	30	Needed for delivery	No redundancy	3
100 mm (PVC)	30	Needed for delivery	No redundancy	3

5.0 FINANCIAL PLAN

The spreadsheet on the following page illustrates the funding alternatives to implement the capital activities summarized in section 4. The funding alternatives considered include reserve funding and debt funding.

SUMMARY OF WATER SERVICE COMMITTEE BYLAWS

SUMMARY OF BACKGROUND INFORMATION

BATHOMETRIC SURVEY