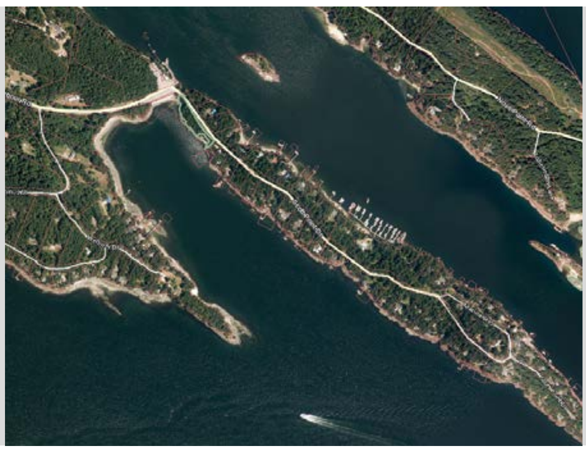
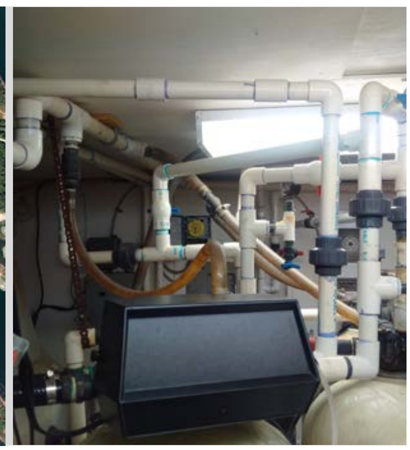
Summary Report for

SCOTT POINT WATERWORKS WATER REPORT

Project number 15-203





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1.0 Introduction

Scott Point Waterworks District (SPWD) has retained MSR Solutions Inc. (MSR) to provide an overview of the water system with respect to short term and long term requirements in support of the notices received from Island Health (VIHA) with respect to water quality, and the Ground Water Protection Officer with the Ministry of Forests, Lands and Natural Resource Operations (FLNRO), with respect to well operations. Concerns have been raised with the salinity in the drinking water, and the formation of trihalomethane and bromate (THMs) disinfection by-products, exceeding Canadian Drinking Water Guidelines.

2.0 Background

Scott Point Waterworks is a small Improvement District serving 61 properties on the long skinny Scott Point peninsula on Salt Spring Island. They are in receipt of requests from VIHA and FLNRO to provide a review of their water system. Based on a request for proposals in early January 2015, MSR was retained to examine water quality and treatment, and Dr. Gilles Wendling of GW Solutions, was retained to examine groundwater issues. The proposal of January 18, 2015, specifies water sampling will be provided from SPWD on historical, as well as current sampling (obtained February 10, 2015), along with a site visit by MSR to review the existing and proposed water works (February 4, 2015). The scope also included a review of information and discussions with Sylvia Barroso, Groundwater Protection Officer, FLNRO.

Based on the available information, MSR prepared this technical memo to determine steps for compliance with VIHA and discussion points for FLNRO, including a conceptual design and costing for compliance for any proposed works. The terms of reporting do not include considerations on replacement of aging infrastructure.

3.0 Site Visit

MSR met with Mr. Richard Ballantyne, Chair of SPWD on February 4, 2014. The purpose of the visit was to familiarize MSR with the current and proposed workings of the water system and to better understand the goals of SPWD in addressing the regulatory concerns. This also included obtaining of additional information to assess the water infrastructure, and meeting with Mr. Ron Stepaniuk, General Manager of North Salt Spring Waterworks. The site visit included a review of each of the three well sites and the reservoir site.

Documentation provided by SPWD from 2006 to 2014 indicated the following averages:

- Annual average consumption at 6,100 m^3 (1,340,000 Igal) or 16,700 L/day (3,700 Igpd)
- Well 3 (Welbury) contributes 30% of the demand, with 35% from each of Well 1 and 4.

4.0 Current Water System

4.1 General

Water is supplied from the following wells

Well	Name	Water Level bgs[1] m (ft)	Pump Level bgs m (ft)	Yield Lpm (Igpm)
1	RO	20.7 – 36.5 (68 – 120)	36.6 (120)	41 (9)
4	RVYC	38.1 – 45.7 (125 – 150)	54.9 (180)	45 (10)
3	Welbury	1.2 – 8.8 (4 – 29)	12.2 (40)	16 (3.5)

[1]bgs – Below Ground Surface

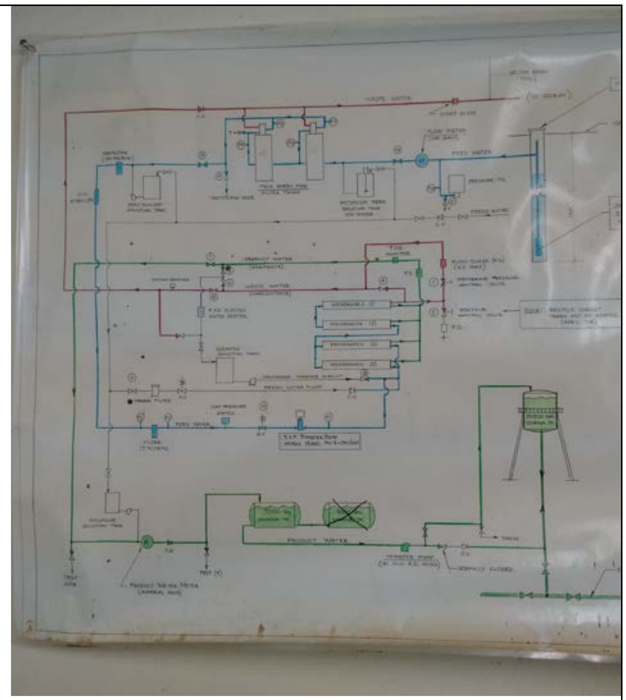
The current water system consists of about 2.5 kilometres of 100 mm diameter asbestos cement (AC) pipe, installed in the late 1960's. Services consist of 19 mm copper pipe with brass corporation and curb stops. SPWD noted that there are no pipe saddles except for a few service lines that have been replaced due to external corrosion. There is a concern with regards to a general problem with external corrosion of service lines. However, an examination by SPWD of two tapped holes replaced with service saddles, have noted the main and the connections to still be in fair to good shape, even if the service lines are not.

Wells 4 (RVYC) and 3 (Welbury) feed directly into the water distribution system after treatment. A 254,000 Litre (56,000 Igal) reservoir is provided for system pressurization and fire storage. Well 1 (RO) discharges to two 22,700 Litre (5,000 gallon) intermediate storage tanks after treatment and before being transferred to the reservoir.


4.2 Water Treatment

4.2.1 Well 1 (RO System)

Water treatment at Well 1 (RO) consists of filtration followed by a commercial grade greensand iron and manganese filter, and UV disinfection before discharging to the reverse osmosis (RO) treatment system, originally installed in 2002. It is not clear if the 8 membrane cartridges of the 3,000 kPa (400 psi) unit have ever been replaced, but they are likely at end of life. Replacement costs are in the area of $600 per membrane (8 required) plus installation and optimization time. It is also noted the recirculation loop to improve removal efficiency was disconnected in 2004.



Regular logs of the operations are maintained and a review of August 2014 data showed the RO system operating on average for 10.5 hours per day at about 13.5 Lpm (3 Igpm) of product water to the system. September data indicated 17.5 hours per day at 10 Lpm (2.2 Igpm), and cleaning of the membranes completed. A review of well pump versus treated water over the period August 1, 2014 to November 14, 2014 indicated on average 67% waste water (3,200 gallons wasted to produce 1,650 gallons product), indicating a very poorly operating treatment system. It was also noted volume to waste was in excess of 50% dating back to January 2005 (60.2% waste). This is potentially due to the recycle flow scour stage being removed in 2004.

A UV disinfection unit is located ahead of the membrane. It is not known if this is provided for destruction of TOC or for bacteriological organisms. Treated water is disinfected with chlorine and discharged to the two smaller storage tanks, before being discharged to the main reservoir on a float operated pump. Remineralization of the RO water is then achieved in the main reservoir from mixing with the other water sources (Well 4 (RVYC)). Backwash water from the operations discharges Welbury Bay by means of a 25 mm pipe. SPWD has letters from both VIHA and the Ministry of Environment, approving the discharge to the surface waters and indicating that RO discharge is not a prescribed activity under the Waste Discharge Regulations (now Environmental Management Act).

As we have not looked at the RO system in detail, or the condition of membranes and design basis, we are concerned on the appropriateness of the design, and condition of the membranes. The high reject rate of >60% of the water, is not expected, or desirable. This could be as a result of poor optimization or wrong selection of equipment and needs be addressed as a critical water concern.

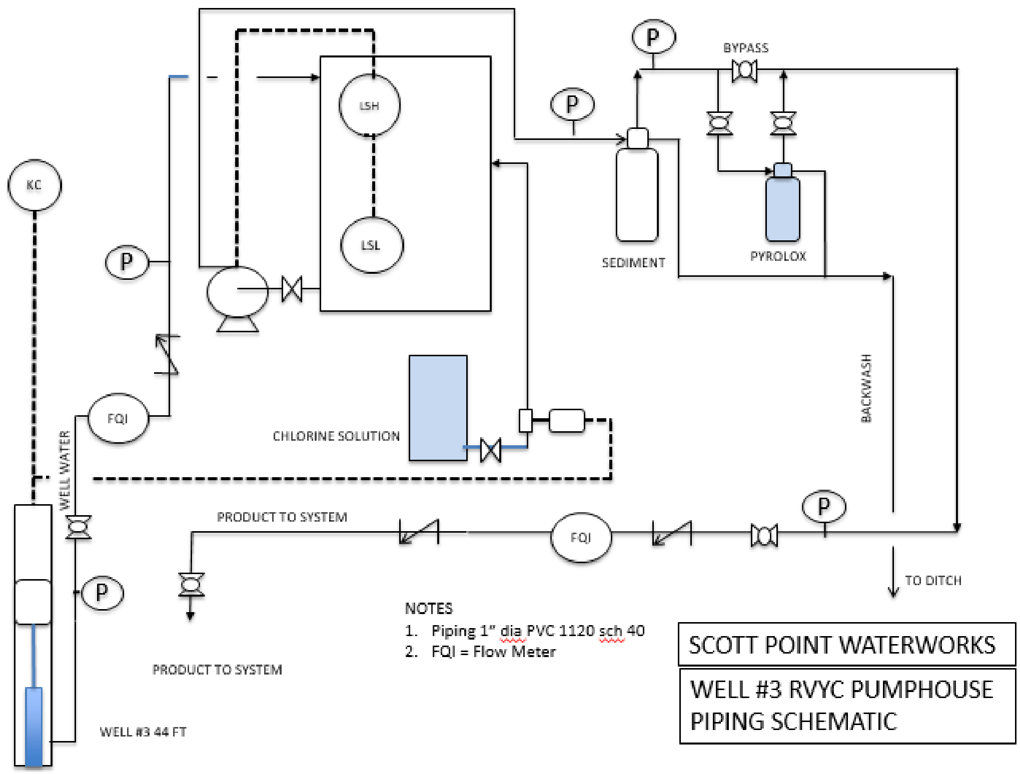
4.2.2 Well 3 (Welbury)

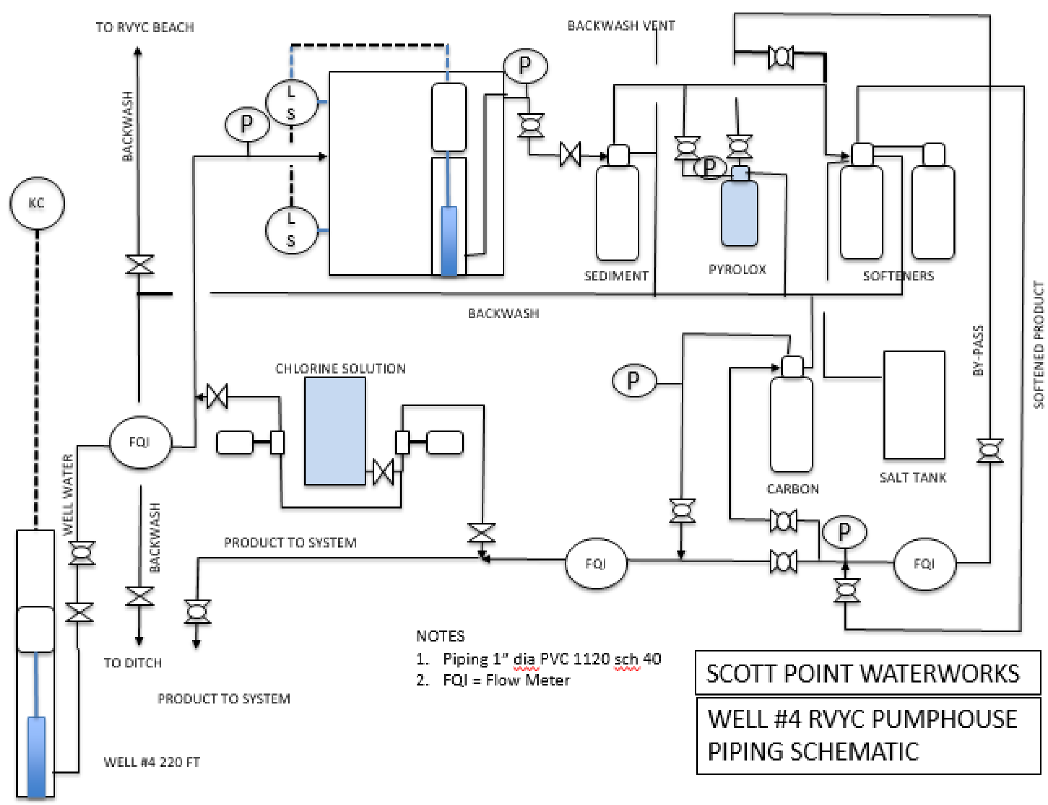
Water treatment at Well 3 consists of filtration and Pyrolux (manganese dioxide) to remove iron and manganese. The backwash system was not reviewed, but the discharge location was noted to be immediately out the back of the well building, which is not in compliance with regulatory requirements and could be impacting the water quality if it is recharging the ground water. The backwash rate was estimated at 4% of the water produced. However, the Pyrolux systems should have a backwash rate in the range of 15% - 25%, suggesting that there is insufficient flushing. Confirmation of backwash rates should be include a visual check on equipment and monitoring of water during a backwash cycle. Iron and sulfate reducing bacteria can be in the well water, further reducing the efficiency of treatment and hence increased backwash rates unless periodic shock chlorination of the wells is implemented (generally alternate years).

4.2.3 Well 4 (RVYC)

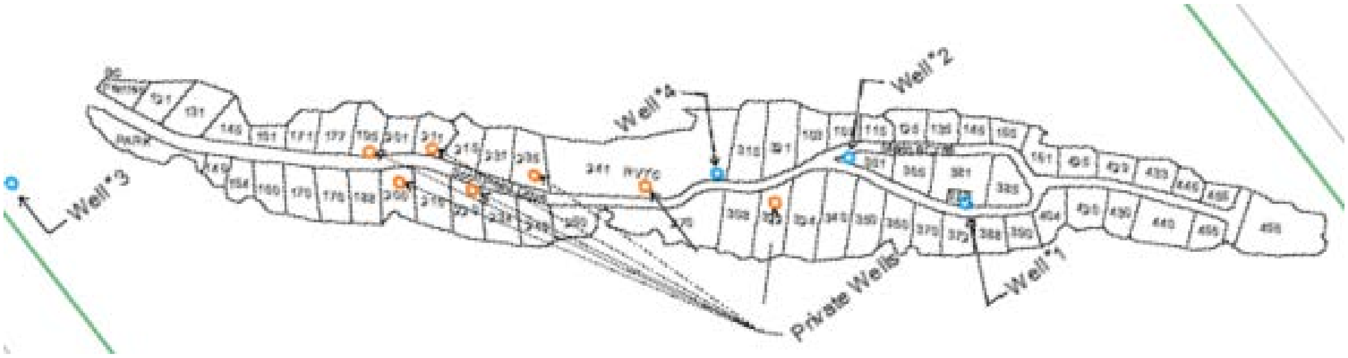
Water treatment at Well 4 consists of sand and carbon filtration, water softening and chlorination. Backwash water is understood to be directed through a drain on the yacht club property. A review of the December 2014 and January 2015 operator reports showed the treatment system operating on average for 4.2 hours per day at about 32 Lpm (7 Igpm). Backwash rates were noted at about 10% of the flow rate.

The process flow diagrams for Well 3 (Welbury) and Well 4 (RVYC) are noted below. Of particular note is the water softening (salt addition) to reduce the hardness of water. This effectively already occurs through mixing of treated water at the reservoir with Well 1 (RO) due to its residual salt content, as well as the remineralisation (addition of calcium and magnesium) of the RO waters from Well 4 (RVYC). Combining of flows directly at the reservoir could substantially improve treatment and effective water quality if provided at a single location.


P
BYPASS
LSH
LSL
KC
SEDIMENT
PYROLOX
FQI
CHLORINE SOLUTION
BACKWASH
WELL WATER
PRODUCT TO SYSTEM
TO DITCH
NOTES
1. Piping 1" dia PVC 1120 sch 40
2. FQI = Flow Meter
PRODUCT TO SYSTEM
WELL #3 44 FT
SCOTT POINT WATERWORKS
WELL #3 RVYC PUMPHOUSE
PIPING SCHEMATIC


TO RVYC BEACH
BACKWASH VENT
BACKWASH
P
L S
KC
SEDIMENT
PYROLOX
SOFTENERS
BACKWASH
CHLORINE SOLUTION
BY-PASS
SOFTENED PRODUCT
CARBON
SALT TANK
FQI
WELL WATER
PRODUCT TO SYSTEM
TO DITCH
NOTES
1. Piping 1" dia PVC 1120 sch 40
2. FQI = Flow Meter
PRODUCT TO SYSTEM
WELL #4 220 FT
SCOTT POINT WATERWORKS
WELL #4 RVYC PUMPHOUSE
PIPING SCHEMATIC

5.0 Source Water Wells



There are a number of private wells on Scott Point in addition to those used by SPWD. Two are known to be used for potable water, with others used for garden irrigation, unknown uses, or inactive. These are generally located between Well 4 and Well 3, with at least 300 metres separation. Wells located towards the end of Scott Point are all noted to be brackish. The FLNRO has noted concerns with the extent of salinity in the wells and the concerns of impacts to fresh ground water supplies. As can be seen with the location, the surface water recharge area is minor beyond Marina Crescent, likely resulting in minimal capacity for fresh water.

5.1 Well 1 (RO System)

Well 1 is located adjacent to the Reservoir at 377 Scott Point Drive. The well is situated at geodetic elevation 23.5 m, with the bottom of the well at -19.2 m. The well pump is situated at about -13 m geodetic. The water level stabilizes at about 2 metres each spring, and is slowly drawn down to near the well pump intake by late August each year. Annual production for this well is about 2,300 m^3 (500,000 gallons).

5.2 Well 2 (Not Used)

Well 2 is located by the intersection of Marina Crescent and Scott Point Drive at 351 Scott Point Drive. The well is no longer used, and SPWD is considering either maintaining the well as a monitoring point for sampling, or permanently sealing it.

5.3 Well 3 (Welbury)

Well 3 is at the intersection of Welbury Drive, and Long Harbour Road, approximately 500 metres from the Long Harbour ferry terminal and Scott Point. The well is situated at elevation 10.7 m, with the bottom of the well at -2.7 m. The well pump is situated at about -1.5 m geodetic. The water level stabilizes at about 5 metres each spring, and is drawn down to around -1.0 m by late August each year. Annual production for this well averages around 1,800 m^3 (396,000 gallons).

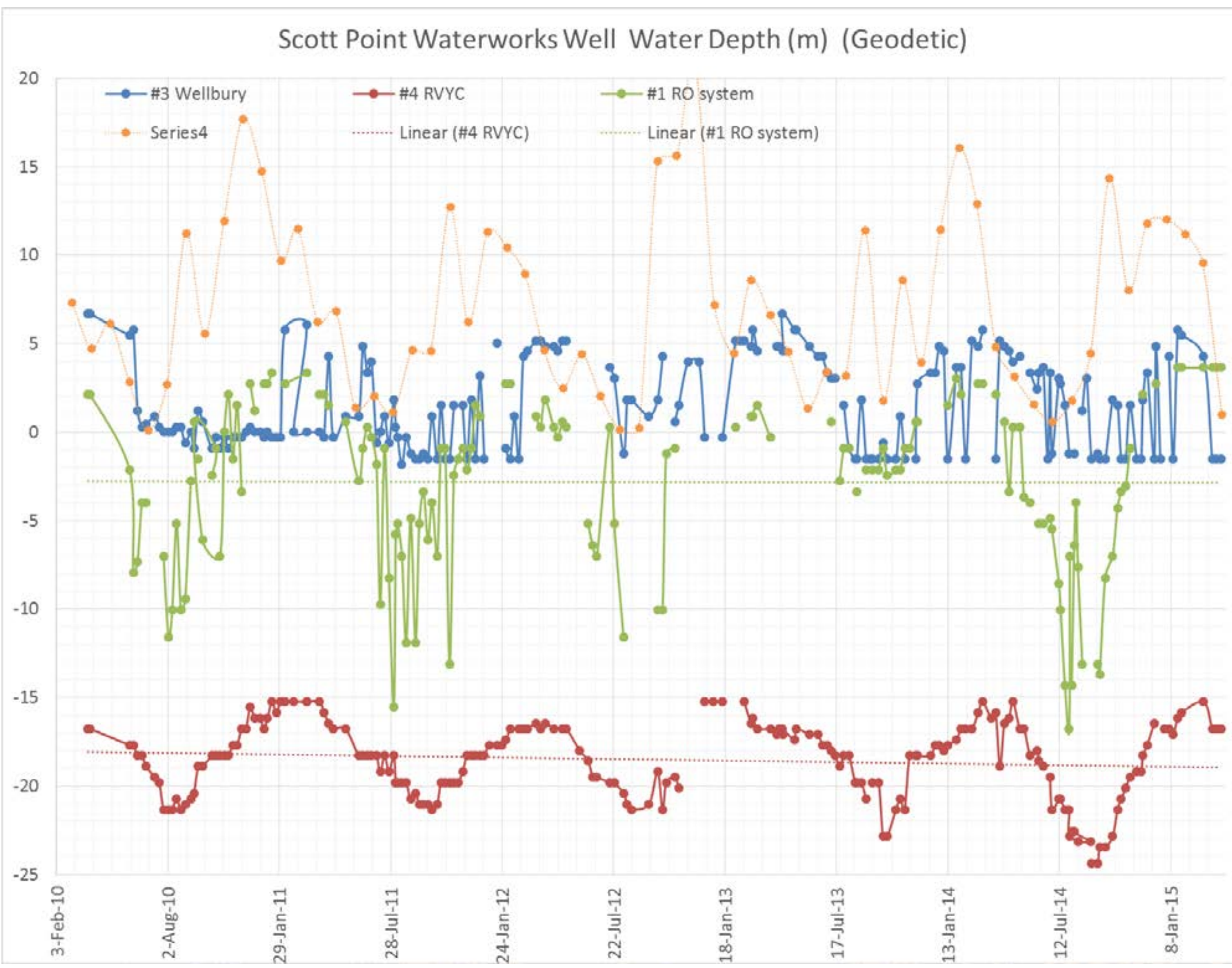
During 2014, there was a greater reliance on this well between January and June, increasing the extracted volume to about 2,000 m^3 (431,000 gallons). Beyond June, concerns with low water levels significantly reduced the withdrawal. This is primarily a factor related to recharge and over pumping, rather than indication of concerns for salt water intrusion.

5.4 Well 4 (RVYC)

Well 4 is located at 309 Scott Point Drive on property of the Royal Vancouver Yacht Club (RVYC). The well is situated at elevation 21.3 m, with the bottom of the well at -48.7 m. The well pump is situated at about -33.5 m geodetic. The water level stabilizes at about -15 metres each spring, and is slowly drawn down to around -25 m by late August each year. Annual production for this well increased between 2013 and 2014 from 1,700 m^3 – 2,400 m^3 (370,000 – 520,000 gallons), as there was a greater demand due to the drier year, as well as an increase in system and residential leaks compared to previous years.

5.5 Water Level Monitoring

Water level monitoring by SPWD over several years is displayed in the following graph.



- Well 1 (RO System) is noted in Green with the pump installed at -13 m.
  - There is a gradual trend line noting an insignificant decrease in the water level over the past 5 years. This is in part to the recharge and resting of the well the past several months, but also an indicator that the extraction and recharge rate is generally sustainable. We are unable to note the difference in recharge being salt water intrusion, or surface water recharge. The system was turned off in November 2014, and generally recharged to the static water level within three months.
- Well 3 (Welbury) is noted in Blue with the pump installed at -1.5 m.
  - The recovery is generally noted to be slow in summer with the water level trending around the bottom of the pump intake.
- Well 4 (RVYC) is noted in Brown with the pump installed at -33 m.
  - There is a gradual trend line noting a decrease in the water level, albeit at a slow gradient.
- The dotted line in Orange represents monthly rainfall in cm
  - The rainfall trends indicate a relative recovery each winter season, but a dry year can impact the total water recovery.

There is a distinct recovery as soon as the wet weather onsets. However over the five years monitored, there is a gradual decrease in the ground water table by end of season (excluding Well 1 (RO)). It was somewhat exacerbated by a particularly dry summer and fall in 2014, as well as the operational issues contributing to over-extraction. Although Well 4 (RVYC) is the deepest of the wells, it has the lower level of salinity to Well 1 (RO), likely due to a larger recharge area. Well 1 (RO) is noted to have a rapid recovery after pumping, suggesting there is a connection with the salt water environment, also as noted by the salinity in the table below, and recent results after several months of inactivity (816 mg/L Na on April 10, 2015).

Elements		Units	CDWQG	RO Well Raw	Well #4 Raw	Wellbury Raw	Well #3 Raw	Well #4 Raw	Well #1 Raw
				28-Nov-12	28-Nov-12	28-Nov-12	11-Aug-14	11-Aug-14	11-Aug-14
Sodium	Na	mg/L	200	1620	77.7	15.2	17.5	81.5	2820

6.0 Water Chemistry

The water chemistry of the raw water prior to treatment, is based on historical and current information as summarized in the following table.

Well	Name	Br (ug/L)	Fe. (0.3)	Mn. (0.05)	TOC	Na (200)	UVT
1	RO	-	0.01-0.8	0.1-2.4	3.2	1500-2800	-
3	Welbury	-	0.5-1.5	0.1-0.4	-	15-20	-
4	RVYC	5.46	0.5-1.5	0.5-0.9	27.5	90-350	-

Bromine commonly exists as salts with sodium, potassium and other cations, and is commonly found in nature along with sodium chloride, owing to their similar physical and chemical properties, but in smaller quantities. Bromide concentrations in seawater are generally in the range of 65 mg/l. Concentrations of bromide in fresh water typically range from trace amounts to about 0.5 mg/l. The presence of Bromine in only Well 4 (RVYC) appears unusual as its presence would have also been expected in Well 1 (RO).

Iron and manganese are dissolved metals which contribute to colour, odour, taste, scaling and staining, increasing the perception to avoid water use. All water samples note concentrations above the aesthetic objectives, prior to treatment.

Total Organic Carbon (TOC) in the wells can be caused by humic layers in the water bearing layers. It is not known if this is derived from undecomposed layers within the sedimentary rock, or via transmittance from fractures in the rock allowing passage of sea water and organics. TOC is not a noted concern by itself, but rather indicates the potential to mix with chlorine to form disinfection byproducts or Trihalomethanes (THMs). The maximum desirable concentration is 4 mg/L prior to treatment. Well 4 (RVYC) is of considerable concern, with Well 1 (RO) of minor concern.

UV transmittance, or UVT was requested in recent sampling, with a low of 86% on Well 4 (RVYC) and about 95% on the other wells. The higher the UVT, usually expressed as a percentage (%), the more energy is transmitted through the water, and therefore the more effective the deactivation of pathogens. UVT is impacted by the quantity of organics, colloidal solids and other material in the water. The less clear the water is, the lower the UVT and the more these water borne materials absorb and scatter the UV light as the water passes by the UV lamp. Since UV disinfects water using a very precise 254 nm wavelength of light, these water borne materials impede the “transmittance” of that light to the water and its microbes, thereby reducing the effective UV dose delivered by the system.

VIHA considers UV disinfection as part of a multibarrier approach to disinfection of surface waters, or those generally under the direct influence (GUDI) of surface waters. There is benefit in the addition of UV at each of the wells as further cautionary disinfection, and the potential to reduce residual chlorine levels.

7.0 Regulatory Baseline Water Demand Versus Actual Demand

7.1 Regulatory Determination

As a base determinant in sizing of infrastructure, we have viewed and compared the existing development at SPWD, against the Design Guidelines for Rural Residential Community Water Systems, 2012 as prepared by the BC government. Sizing of equipment is based on indoor and outdoor use, fire protection and system leakage.

7.1.1 Hypothetical Indoor Water Demand

Hypothetical water demand under regulatory guidelines (CPCN) is typically planned on 3.5 people per single family home, 2.5 people per multi-family home and 4 people for each recreational property. For SPWD, this equates to a design population of 214 people on the 61 lots. Indoor water usage is based on a water use rate of 230 L/capita/day (Lpcd), for an average day demand of 49,220 L/day. Based on the 2011 census, the density is noted at 2.6 people per unit (ppu) on Salt Spring Island. Based on the 61 connections, the contributing population is estimated at about 159 people. Indoor water use is not measured. Overall water use is determined below.

7.1.2 Water Loss Allowance

A water loss allowance is determined based on the American Water Works Association (AWWA) M36 Manual of Practice as follows:

$$Water\ Loss\ (m^3/day) = 5 \times (0.4704 \times L_m + 0.0303 \times N_c + 0.8 \times L_c) \times \left(\frac{P}{49.26}\right)^{1.5}$$

Where:

L_m = mains length (km)
N_c = # of service connections
L_c = total length of service connections (km)
P = average system pressure (meters water column)

Based on the 2.5 km of pipe, 61 service connections and approximately 1.8 km of service connections, operating at an average 35 m (50 psi) water column, the water loss allowance is 13,500 L/day. Records based on individual meter recordings against the meter readings at each of the treatment systems notes that actual water leakage averages 2,500 L/day, excluding any one time system breakages. This would indicate the AC distribution pipe is still in fair condition.

7.1.3 Irrigation Demand

An irrigation demand is based on a number of factors, including evapotranspiration, size of area, soil types and irrigation efficiency

$$IrrigationRate\ (m^3/ha/day) = \left(\frac{Et \times Crop\ Coefficient \times Allowable\ Stress}{Irigation\ Efficiency}\right) \times 10\left(\frac{m^3/ha}{mm}\right)$$

Where:

$Et = Evapotranspiration\ rate\ (mm/day)$
$Crop\ Coefficient = 1\ for\ turf$
$Allowable\ Stress = 0.7\ (Default\ for\ turf\ grass\ in\ B.C.conditions)$
$Irrigation\ Efficiency\ (Percent/100) = See\ below$

Based on a design value of 800 m^2 irrigable area per lot (approximately 20% of a typical 4,000 m^2 (1 acre) lot), and an irrigation demand for the Temperate Zone 2 (5 mm Et rate) of 50 m^3/ha/day, the irrigation demand is estimated at 244 m^3/day.

It is understood that water conservation is practiced in general on Salt Spring Island, and in some cases is fully embraced (Xeriscaping, or no irrigation). Where irrigation water is used, it is most frequently by private wells, rain barrels, or hand watering. A review of records from 2006 to present were compared with July to August consumption records against the January to February records. On average, the difference was 10.3 m^3/day, indicating a very low outdoor use from the water system.

7.1.4 Maximum Day Demand

The theoretical Maximum Day Demand (MDD) is the indoor water usage + water loss allowance + irrigation demand, based on full occupancy and an average household of 3.5 ppu, noting this overstates the current and likely future occupancy at Scott Point. For design purposes, this would equate to a MDD of 49.2 + 13.5 + 244 = 306.7 m^3/day (213 Lpm). The Average Day Demand (ADD) is then determined as half the flow at 153 m^3/day (107 Lpm), and the Peak Hour Demand (PHD) is determined as 613 m^3/day (426 Lpm), or four times the average demand.

7.2 Islands Trust Guidelines

The Salt Spring Island Local Trust Committee bylaw 355 requires 1,600 Lpd (350 Igpd) per lot to support a subdivision application. Based on 61 lots, this would equate to 97.6 m^3/day (21,350 Igpd). This is a strong indicator of low water usage and water conservation practices on the island.

7.3 Measured Water Demand

Scott Point is partially a seasonal operation with most occupancy during July and August. Water records have been maintained annually for many years with a noticeable decrease in water consumption over the past five years. This has also been noted in other jurisdictions within the Capital Regional District (CRD). There was an increase in 2014, due to significant leaks in July and October.

Annual Average Flow rates between 2006 and 2014 are about 14.2 m^3/day (3,100 gpd). Using the May to August values with assumed occupancy in 61 connections, the average flow trends around 21.3 m^3/day. This would suggest the MDD is in the area of 54 m^3/day (37.5 Lpm) , and the PHD is estimated at 216 m^3/day (150 Lpm). On average, summer water consumption is around 350 L/home or about 135 Litres per capita per day (Lpcd) based on the Salt Spring average of 2.6 people per unit (PPU). This is well below both the bylaw 355 and the theoretical demand.

7.4 Fire Flow Demand

The fire flow demand is calculated based on the Fire Underwriters Survey (FUS) – Water Supply for Public Fire Protection – A Guide to Recommended Practice. Minimum FUS requirements are 2,000 Lpm (500 USgpm) for a minimum 1 hour period, and recommended at 3,000 Lpm (750 USgpm) for a 1.25 hour period.

An alternative design calculation is used by the Salt Spring Fire Rescue Shuttle accreditation with the Fire Underwriters Survey. This minimum standard is 3,000 Lpm (750 USgpm) instantaneous flow, and 1,000 Lpm (250 USgpm) sustained flow for 2 hours. The instantaneous flow is obtained from the hydrant adjacent to the reservoir.

7.5 Distribution Storage Reservoirs

Reservoirs are sized to meet balancing storage (25% MDD), fire storage (3,000 Lpm x 1.25 hours) and emergency storage (25% of Balancing and Fire storage). The design fire storage should be (0.25x306.7+ 3x75) x 1.25 = 377 m^3. However, using the above noted shuttle accreditation criteria, the reservoir storage requirement would be no more than 250 m^3 or (0.25x306.7+1x120) x 1.25.

The available storage of 254 m^3 (plus 45 m^3 in the transfer tanks) is is of sufficient size under the shuttle accreditation criteria.

7.6 Summary of Design and Actual Characteristics

A summary of the theoretical design versus the actual conditions as found at the SPWD system are noted as follows:

Description	Theoretical (Regulatory Req'd)	Actual Measured
Per Capita Water Use	230 Lpcd	135 Lpcd (30 Igpd)
Density	3.5 ppu	2.6 ppu
Water Loss	13,500 L/day	2,500 L/day
Irrigation	244 m^3/day	10.3 m^3/day (2,250 Igpd)
Maximum Day Demand	307 m^3/day	54 m^3/day (11,900 Igpd)
Fire Flow Demand	3,000 Lpm	3,000 Lpm (660 Igpm)
Reservoir Storage	250 m^3	254 m^3 (56,000 Igal)
Backwash/Reject Water	1,150 – 1,600 m^3/year	4,650 m^3/year

Based on historical records provided by SPWD, and recognizing the low water use in general on the Gulf Islands, it is acceptable to use the maximum day demands based on actual measurements. Therefore, for demand analysis, a MDD of 54 m^3/day (11,900 Igpd) and average of 21.3 m^3/day (4,700 Igpd) is recommended for use.

8.0 Well Water Demand

8.1 Water Extraction

Well 1 (RO) produced 2,300 m^3 (509,000 gallons) in 2014. However, reject water was noted at 67% of the total water extracted, or 4,600 m^3 to waste. This is an unacceptable water loss and is a result of overdue membrane replacement, and potentially from lack of the recirculation line on the RO system to improve the cleaning scour and efficiency of the fibres.

Well 3 (Welbury) has a water backwash rate of about 4%, which is uncharacteristically low as the use of Pyrolux is noted to have a higher reject water rate at 15-20% than other treatment systems. Based on this estimate and 2014 production of 1,900 m^3 (431,000 gallons), backwash water estimates should be at least 290 m^3, suggesting either incorrect meter recording, or inadequate backwash rates. Typically for a 5 gpm Pyrolux filter, a 25-30 gpm backwash is required to adequately flush the oxidized solids, otherwise the oxidation process will eventually diminish and the filter will stop working. Most filters require a backwash every 2-3 days, but Pyrolux systems require a daily backwash to continue operating effectively.

Well 4 (RVYC) reject water rates were noted during the time period measured at approximately 10% of the production rate, or for 2014 at 240 m^3. The removal of iron and manganese was noted to be generally effective with this treatment system, but no measurement on the amount of chlorine being used was recorded as impacted by the bromate, TOC and iron and manganese levels in the raw water, which could be an additional factor to be considered in treatment needs.

The well water demand is the sum of all water uses including backwash water, and can be affected by the efficiency of any of the treatment processes. Production from the wells varies year to year but in general there is a desire to balance production across each of the wells. However, production does not equate into actual water withdrawal and losses to backwash water, and extraction should be based on the lowest overall impact to the ground water aquifer, and treatment level required. As an example, 100 gallons of potable water from Well 3 (Welbury), requires 105-120 gallons of ground water, whereas, at Well 1 (RO) this would equate currently to about 300 gallons of ground water extraction.

8.2 Chemical Usage

A review of chlorine injection rates for the 2014 year were based on records provided by SPWD. It was noted from records, that a total of 734 cm of dilute chlorine was measured as consumed at well 4 (RVYC), of a 0.6% chlorine solution (700 ml of 9% solution mixed with 10 L water = 0.7 L x 90,000 mg/L / 10.7 L = 5,887 mg/L) and raises the chlorine tank an average of 9.5 cm. This equates to 827 L of dilute chlorine added to the 2,361,500 L of water pumped, or about 2.1 mg/L of chlorine, as an overall average. By comparison, Well 1 (RO) and Well 3 (Welbury), were each injected with over 5 mg/L of chlorine, indicating a higher chlorine dose than ideal and, potentially a factor in the remaining oxidation of metals, and THM formation.

Reject water in Well 1 (RO) is not sustainable, as it equals the entire yearly water demand for Scott Point. A properly operating water treatment system based on RO technology should have between 25-50% reject rates or in the area of 1,200 – 2,300 m^3/year. This would have a significant reduction on the water extraction rates along with electrical and chemical demands on the water system.

9.0 Island Health Drinking Water Requirements

There is no Act or Regulation specifically identifying water quality requirements, other than bacteriological parameters. However under the Drinking Water Protection Act and Regulation, guidelines must be considered, and directives must be followed. Island Health requires all water systems to meet a multi-barrier disinfection process, and meet the Health Canada Drinking Water Quality Guidelines, including for aesthetic objectives. Full scale water quality testing is conducted annually by SPWD, with the most recent sampling on February 10, 2015. Additional sampling was provided dating back to 1973 in the form of a spreadsheet summary of the wells pre and post treatment monitoring.

Treatment is provided by SPWD, and is generally effective in meeting the Guidelines, with a few exceptions. The following reviews raw water issues prior to treatment.

- Iron and manganese are aesthetic objectives, yet the staining and scaling issues are of concern, which can inhibit water use. The current water sample history suggests continuing the requirements for treatment (provided as noted) at each of the wells. Iron ranges between 0.4-1.0 mg/L consistently across all water samples with some higher numbers considered as outliers. The blended concentration is typically around 0.53 mg/L as compared to the maximum aesthetic value allowed at 0.3 mg/L. Manganese ranges from 0.1-2.0 mg/L with a blended concentration of 1.0 mg/L as opposed to the maximum aesthetic value of 0.05 mg/L.
- Bromate and Total Organic Carbon (TOC) were noted in Well 1 (RO) and Well 4 (RVYC) at elevated levels of concern in February testing. April testing did not detect concentrations (albeit colour, Tannins and Lignins, and THM were noted in the samples) With the current treatment systems in operation, the blended sources and production water remove iron and manganese as concerns, but retain the THM risks, as no treatment is provided currently for TOC removal.
- Salinity in the water has always been of concern with water wells on Salt Spring Island. Well 4 (RVYC) exceeds salinity limits most likely only during the summer period when the well is drawing through the lowest ground water levels. Well 1 salinity levels indicate a direct influence from sea water intrusion. The well has always displayed this characteristic, hence the requirement for reverse osmosis (RO) treatment.
- THM's are exceeding the maximum allowable concentrations. A contributing factor is the TOC in Well 4 (RVYC), and the use of chlorine disinfection. As water is direct fed into the distribution system without treatment, there is a high chlorine demand at Well 4 (RVYC) to react with the residual iron, manganese and untreated TOC, also as noted by the Total Chlorine measured at 9 mg/L at Well 4.

A comparison of low water levels and rainfall (August 2014) against recharged and high rainfall levels (December 2012) indicate water quality does not vary significantly at Wells 3 and 4. However at Well 1, high recharge levels indicate a reduction in the iron and manganese concentrations, as well as the level of sodium.

Date	Well	Iron (mg/L)	Manganese (mg/L)	Sodium (mg/L)
28-Nov-12	1	0.221	1.43	1620
	3	0.509	0.091	15.2
	4	0.8	0.721	77.7
11-Aug-14	1	0.474	2.03	2820
	3	0.309	0.096	17.5
	4	0.694	0.714	81.5

10.0 Island Health Drinking Water Requirements

SPWD has been contacted by Island Health and FLNRO Ground Water Protection Branch regarding water quality concerns and issues with sea water intrusion. Letters requesting a review and action plan were submitted to SPWD, and form the basis of the request for engineering and hydrogeological assessments.

10.1 Ministry of Forests, Lands and Natural Resources

The FLNRO contacted SPWD on December 15, 2014 with concerns that Well 1 (RO) and Well 4 (RVYC) were impacted by sea water intrusion, and the potential for Well 3 to come under stress. They indicated Well 1 may have to cease operation unless it can produce potable water at <250 mg/L of Chloride. They have suggested consideration for best management practices including adjusting the pump intake elevation, reduced pumping cycles, and water conservation.

The **Water Act** *Section 78 Well Operation* notes that a person must not operate a well that causes the intrusion of salt water into an aquifer, and a significant adverse impact on the quality of the ground water or the existing uses. A hydrogeological assessment is currently underway, which will best address those issues, and address the capture and recharge area of the well. As the wells in this area have been noted to be brackish, and treatment has always been provided on this well for salt removal; it is feasible that additional monitoring and system treatment improvements will further reduce the impacts of operation, and the ability to continue use of the well without violation of this section.

10.2 Vancouver Island Health Authority

VIHA contacted SPWD on November 24, 2014 with concerns that trihalomethane and bromate levels exceeded the maximum acceptable concentration standard as indicated in the Canadian Drinking Water Quality Guidelines. They have accepted a response from SPWD that a review is under way, but have requested a follow up action plan to mitigate the issues.

11.0 Treatment Considerations

Raw water quality sampling indicates the ongoing need for iron and manganese removal which is provided already at each of the three wells. However improvements to the overall treatment systems to improve operations and efficiencies are as follows.

11.1 Well 1 (RO)

The treatment area is constrained for space and fee movement. It has not been well maintained. Accumulation of rust on equipment, dirt and mould, as well as loose chemical storage indicates a lack of operator time and potentially attention to good operations. Consideration of access and storage provisions, as well as improved working space will be contributing factors to ease of equipment operations.

The UV disinfection system is located ahead of the RO system, and if not supplied for TOC destruction, is more suited for disinfection on the discharge after treatment for any residuals. The provision for a duplicate train should be considered.

As noted, the RO membranes are in need of replacement. SPWD may consider the Hydranautics membranes (available through VanIsle Water), which provide an energy saving polyamide (ESPA2-LD) membrane suitable for replacement units. Pretreatment chemicals and cleaners should be considered from Professional Water Technologies (www.pwtchemicals.com) to augment the effectiveness of the membranes. The recirculation loop is required to improve the scouring flow rate across the membranes. These actions will improve the efficiency of treatment and contribute to reduced wastage rates.

11.2 Well 3 (Welbury)

The treatment works provide only for iron and manganese, which results in a small footprint, and allows for improved operator access and work space at this site. General improvements such as replacement of corroding fittings and replacement of tubing with pipe, might be considered.

The accuracy of the flow meters is suspect and confirmation of backwash rates and durations should be undertaken. The backwash cycle discharge should be relocated away from the building. It should be provided with a septic tank for initial solids settling, and a subsurface distributed discharge.

The chlorine contact time is assumed to be provided by the existing mixing tank, prior to discharge to the distribution main. However, monitoring of chlorine addition over the 2014 year noted an average 5.2 mg/L concentration of chlorine, which is a contributing factor of THM formation. Typical disinfection rates are 2-3 mg/L to maintain a 1 mg/L or less residual. The higher limit is a cost factor, and irritant to end users. Based on design chlorine contact calculations, we recommend installation of a larger tank (about 2,800 L (620 Igal)), and potentially online chlorine monitoring.

11.3 Well 4 (RVYC)

There are improvements to the piping and configurations that could be undertaken as housekeeping and system improvements. The pump and other electrical controls are co-located with water piping of various materials and conditions. This does not meet the electrical code and has the potential for water to damage electrical components.

The carbon filter does not appear to be effective at this time in reduction of organics and bromate, as indicated by the THM formation. It may require additional backwashing, and new media as the last replacement is probably longer than five years ago.

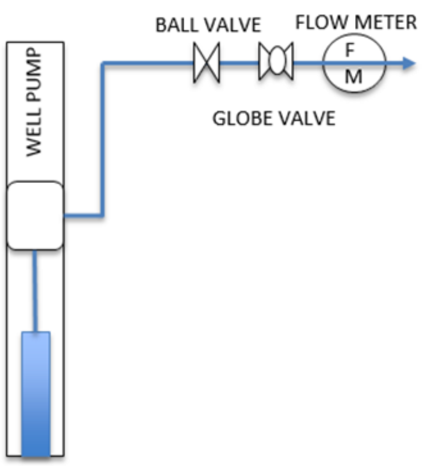
The water analysis indications of Bromate, TOC and Total Dissolved Solids (TDS) suggest additional treatment by means of an RO system would substantially improve the water quality. Independently, or in conjunction with Well 1, RO treatment would be beneficial to water quality, but increase reject water rates and operating costs. Chlorine injection rates over 2014 were about 2 mg/L, which is reasonable. However contact time is in the supply line and consideration should be given to installation of a contact tank to improve mixing.

12.0 Options for Consideration by Scott Point Waterworks

Scott Point Waterworks is faced with a number of issues relating to poor water quality, salt water intrusion potential, insufficient treatment, and aging infrastructure. The implications to budgets and actual costs to residents could place severe strain on SPWD's ability to provide potable water, and meet the requirements of the various regulatory authorities. The following options and implications are possible action items which might be undertaken by SPWD in planning for future works.

- Replace the membranes in Well 1 (RO) system, and consider improvements to the treatment train to reduce the excessive reject rate, which could effectively replace the production from Well 4 (RVYC). This will maintain the status quo of separate treatment systems, and may not provide for additional treatment capacity.
- Subject to water quantity limitations during summer periods, remove Well 4 (RVYC) from production, either permanently, or until an improved treatment system can be provided. The current treatment system is not effective for TOC removal, and is contributing to THM formation. The impact on water availability may require watering restrictions until the impacts are better understood. There are no financial costs to this option, other than increased monitoring. During this time, avoid changes to the Well 1 (RO) system to maintain the available water supply, and allow time to measure changes in water chemistry.
- Assess and reduce the pumping rates in Well 1 (RO) and Well 3 (Welbury) to 15 Lpm and 22.5 Lpm (3.3 and 5 Igpm) respectively through installation of control valves. This will increase pump operation time and shrink the zone of influence around the well extraction areas. The estimated MDD can be provided with the pumps operating at 24 hours, but under most conditions would have an average operation time of 8 hours per day (subject to membrane replacement on Well 1 (RO)).

  Either a gate, or ball valve will provide for coarse flow control, followed by a globe valve for fine flow control by the operator on an as needed based. An inline flow rate meter, as shown will provide for confirmation of flow rates.



Reinstallation of the recirculation pump on the RO system will supplement for any loss of supply flow from the well pump required for membrane scouring. A note on historical operating times does not correlate with the pump hours and flow rate, and will require further review to confirm. Financial costs include installing flow restriction devices, flow meters and totalizers at each well, and recording of information, as well as increased monitoring.

- Consider improvements to the treatment system at Well 4 (RVYC) as the current system does not treat for TOC removal – the precursor for THM formation.
    - An interim low cost solution would be to add UV (185 nm wave length) to the existing treatment works and monitoring for improvements.
    - Install new UV and an RO treatment system to improve water quality, and negate the water softening addition.
    - It may be possible to add activated carbon but due to potential degradation as a result of chlorides in the raw water, can reduce the efficiency.
    - Alternatively connect Well 4 (RVYC) to Well 1 (RO) for a combined treatment center, and negating the need for water softening and salt addition.
        - A 400 m – small diameter poly supply line (shallow bury) would cost in the area of $70,000. This includes costs associated with engineering design and approvals (VIHA), contingency for rock excavation (chipping), asphalt reinstatement, taxes and contingencies, and would allow for a single treatment site.
        - The existing RO treatment, with improvements to the manganese pre-treatment might be suitable, but there would be concerns on the impact of higher usage on the RO plant reliability.
        - A new generation, higher capacity RO system might be required. The financial impacts could range significantly depending on the method of treatment, quality of equipment selected (commercial as opposed to municipal standard), and the type and area of building space provided.
- Install chlorine contact (mixing) tanks at Well 3 (Welbury) and Well 4 (RVYC) to improve chlorine contact time and reduce the amount of chlorine injected into the distribution system. This could include online chlorine monitoring as per the photograph.

- Consider installation of water level monitoring at the reservoir for high usage events and line breaks. When the tank level drops a determined value greater than anticipated, an alarm will signal for operator attention, either through an autodialer or alarm panel.
- Continue use of the data loggers currently installed in four wells measuring depth of water column, and conductivity. This will provide continuous data with respect to establishing recommended pump depths, impacts of salt water intrusion, and substantiation for addressing issues of concern with the regulatory authorities.
- Perform additional water quality monitoring, recording and reporting on changes to the system operations should be considered over the various seasons through 2015. Water quality monitoring completed in April 2015, should be the basis for future monitoring parameters.

13.0 Construction Estimates

The above noted options are subject to consideration by SPWD based on feasibility, as well as anticipated construction costs. The following summarizes potential options, and related costs as noted by the options above.

Scott Point Waterworks Options and Estimated Construction Costs			
Option	**Description**	**Estimate**	
Replace Membranes in Well 1 (RO)			$ 12,000.00
	8 replacement membranes	$ 6,000.00	
	Reconnect recirculation loop	$ 1,500.00	
	General assessment and repairs	$ 1,500.00	
	Engineering and Contingencies	$ 3,000.00	
Install Backwash Tankage at Well 3 (Wellbury)			$ 11,000.00
	2,000 gallon septic tank	$ 5,000.00	
	Seepage pit	$ 3,000.00	
	Engineering and Contingencies	$ 3,000.00	
Improvements Well 4 (RVYC) Treatment			$170,000.00
	UV - TOC removal	$ 5,000.00	
	RO Skid replacement	$60,000.00	
	Mechanical Installation and Parts	$25,000.00	
	Electrical Installation and Parts	$15,000.00	
	Building renovations	$20,000.00	
	Engineering and Contingencies	$45,000.00	
Connect Well 4 (RVYC) to Well 1 (RO)			$350,000.00
	400 m - Shallow Bury 39 mm Poly	$20,000.00	
	Contingency for Rock Excavation	$10,000.00	
	Asphalt and drainage reinstatement	$10,000.00	
	Iron and Manganese Treatment	$25,000.00	
	RO Treatment Skid Replace	$65,000.00	
	UV and Chlorine Disinfection	$15,000.00	
	Monitoring and SCADA controls	$35,000.00	
	Building Addition and Renovations	$25,000.00	
	Mechanical Installation and Parts	$35,000.00	
	Electrical Installation and Parts	$20,000.00	
	Engineering and Contingencies	$90,000.00	
Pumping Rate Modifications at Wells			$ 11,000.00
	Flow meters and valve controls	$ 7,500.00	
	Engineering and Contingencies	$ 3,500.00	
Chlorine Contact Tanks and Monitoring (3 sites)			$ 37,000.00
	1,000 gallon poly tanks	$ 3,000.00	
	Chemtrol Chlorine Controller and Probe	$16,500.00	
	Mechanical Installation and Parts	$ 6,000.00	
	Electrical Installation and Parts	$ 1,500.00	
	Engineering and Contingencies	$10,000.00	
Additional Water Quality Monitoring and Report			$ 20,000.00
	Site Review and Sampling (4 times)	$ 4,000.00	
	Laboratory Fees (4 times)	$10,000.00	
	Reporting	$ 6,000.00	

14.0 Summary and Conclusions

Based on our investigation and review of various documents, we offer the following summary and conclusions.

- Scott Point Waterworks has been requested by Island Health (VIHA) and the Ministry of Forests, Lands and Natural Resources (FLNRO) to respond to concerns related to water quality and impacts to groundwater by THM formation, and potential salt water intrusion.
- The SPWD system serves 61 residential properties on Salt Spring Island through a series of three active wells, each with treatment systems. The treated and disinfected water is fed into the distribution system at Well 3 (Welbury) and Well 4 (RVYC), with Well 1 (RO) discharging to a flow balancing well, which also provides fire protection storage.
- Water usage as measured over several years indicated the per capita water use at about 125 Lpcd (27.5 Igpd/person), half of design standards. Irrigation usage appears to be very minor due to conservation, use of private wells, or reliance on rainwater capture.
- Water losses as a measure of reject water, or backwash water are in the range of expectations at upwards of 10% at Well 4 (RVYC) and slightly lower at Well 3 (Welbury). However, at Well 1 (RO), reject water is 2/3 of all water extracted.
- Iron and manganese in the raw water exceed water quality guidelines aesthetic objectives at each of the wells.
- TOC and Bromate in the raw water periodically exceed recommended concentrations. They contribute to the formation of disinfection byproducts, when mixed with the chlorine disinfectant, if not sufficiently removed.
- Saltwater intrusion somewhat impacts Well 4 (RVYC), and significantly impacts Well 1 (RO), thus requiring the RO treatment system. The Well 1 (RO) location may not impact other wells on Scott Point as it is more than 300 m away from other active potable wells.
- Well 3 (Welbury) is founded in granular soils and could potentially be impacted by salt water intrusion during dry periods if allowed to over pump. It has adequate treatment to meet the water quality and directly feeds residences prior to the storage reservoir. The Pyrolux water treatment system is discharging directly back to the well recharge zone. The backwash flow rate also does not appear to be characteristic of expected higher backwash rates.
- Well 4 (RVYC) is high in metals, organic carbon and bromate. Current treatment is insufficient for TOC removal which contributes to the formation of disinfection byproducts (THMs), when mixed with chlorine as the disinfectant. Treatment improvements such as a UV module for TOC could potentially reduce this at relatively low cost. If this does not prove effective, treatment with RO should be considered.
- Connecting Well 4 (RVYC) and Well 1 (RO) to a single treatment site would facilitate improvements to treatment operations prior to the distribution system. However, costs to connect and for treatment improvements will be high, especially if a new RO plant is required to handle both wells.

- There has been a general decline in ground water levels at Well 4 (RVYC) over the past few years, exacerbated by the dry 2014 year. There is no indication of decline at Well 3 (Welbury) possibly due to effective management of use in summer. Well 1 (RO) has little indication of ground water decline even with the high water reject rate. This would strongly suggest the well is impacted as a salt water intrusion well, and if found to not affect surrounding wells, a potential consistent water source.
- Replacement of the RO membranes in Well 1 (RO) and reconnecting the recirculation loop back into the system, among other system improvements will reduce backwash waste, which may offset losses in water production from a temporary closure of Well 4 (RVYC).
- If Well 1 (RO) is found to have low impact to surrounding wells, it may be sufficient to provide water for domestic needs without Wells 3 and 4, thereby reducing operation and maintenance costs of operating multiple systems. Ongoing RO treatment is still required.

Based on our investigation and review of various documents, we believe there is sufficient water to support the needs of Scott Point Water Works, although it may be through salt water intrusion, particularly at Well 1 (RO). Treatment is currently in need of improvements at all wells due to age and efficiency, and to treat for factors contributing to THM formation. Chlorine disinfection is providing proper disinfection, however poor mixing requires high injection rates to deal with remaining or inadequately treated residuals, and contributes to THM formation.

15.0 Recommendations

We offer the following recommendations to Scott Point Waterworks District for consideration and implementation.

- Receive this report and final for acceptance and consideration or recommendations, and submit copies to VIHA and FLNRO.
- Optimize the performance of treatment systems with the goal of reducing chlorine injection rates at the wells.
- If sufficient water is available during summer, remove Well 4 (RVYC) from service for the 2015 season.
- Replace the RO membranes in Well 1 (RO) and correct the recirculation loop to reduce water reject rates. Estimated costs are $12,000.
- Extend the discharge point on the Well 3 (Welbury) backwash discharge to remove it from the zone of influence on the well, and consider installation of a settling tank for residuals. Estimated costs are $11,000.
- Consider installation of UV treatment at Well 4 (RVYC), if it is required to meet consumption. Estimated costs are $5,000.
- Install flow restriction devices, flow meters and totalizers at Well 1 (RO) and Well 3 (Welbury) to allow for reducing the flow rate, and increasing overall pump time for withdrawals, as well as general maintenance and improvements to the existing treatment

systems for efficiencies. Estimated costs will be about $10,000 including field service time and subsequent monitoring support from MSR.

- Complete the ground water monitoring program for water level and conductivity through 2015 as being implemented by GW Solutions.
- Perform supplemental water quality monitoring for TOC, bromate, metals and TDS at each of the wells until a sufficient and reliable baseline is established to best identify further treatment improvements. Sampling every 6-8 weeks through to December 2015 (minimum 4 sampling periods) is recommended.
- Following the 2015 summer period, and based on implementation of the above; prepare a report on treatment effectiveness, improvements, and the cost and benefits of further treatment options that may be necessary; and which considers the impacts on water supply by relying exclusively on Well 1 (RO) improvements and to post treatment chlorine contact time for reduction in THM formation.

APPENDIX A: WELL LOGS

Report 1 - Detailed Well Record

Well Tag Number: 18517 Owner: SCOTT POINT WATER WORKS Address: SCOTT POINT Area: WELL LOCATION: Land District District Lot: Plan: 17161 Lot: 36 Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: SALTSPRING BCGS Number (NAD 83): Well: 2 Class of Well: Water supply Subclass of Well: Domestic Orientation of Well: Vertical Status of Well: New Well Use: Observation Well Number: Observation Well Status: Construction Method: Diameter: 6.0 inches Casing drive shoe: Well Depth: 140 feet Elevation: 117 feet (ASL) Final Casing Stick Up:	Construction Date: 1964-01-01 00:00:00 Driller: Well Identification Plate Number: 12982 Plate Attached By: PUBLIC HEALTH OFFICER Where Plate Attached: TOP OF WELL CASING PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 20 (Driller's Estimate) Development Method: Pump Test Info Flag: N Artesian Flow: Artesian Pressure (ft): Static Level: 98 feet WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: 1400581 Water Chemistry Info Flag: Y Field Chemistry Info Flag: Site Info (SEAM): Y Water Utility: Water Supply System Name: SCOTT POINT WATER WORKS DISTRICT Water Supply System Well Name: WELL 1 SURFACE SEAL: Flag: N Material:

inches Well Cap Type: Bedrock Depth: 0 feet Lithology Info Flag: N File Info Flag: N Sieve Info Flag: N Screen Info Flag: N Site Info Details: Other Info Flag: Other Info Details:	Method: Depth (ft): Thickness (in): WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:

Screen from	to feet	Type	Slot Size	

Casing from	to feet	Diameter	Material	Drive Shoe

GENERAL REMARKS:
P.L. 110' @ 20 - 25 GPM
DWIMP RECORD INDICATES WELL YIELD 5GPM(IMPERIAL)

LITHOLOGY INFORMATION:

From 0 to 140 Ft. BEDROCK

- Return to Main
- Return to Search Options
- Return to Search Criteria

Report 1 - Detailed Well Record

Well Tag Number: 32555 Owner: SCOTT POINT WATER WORKS Address: SCOTT POINT DR Area: WELL LOCATION: Land District District Lot: Plan: 17161 Lot: 33 Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: SALTSPRING BCGS Number (NAD 83): Well: 6 Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Observation Well Number: Observation Well Status: Construction Method: Diameter: 6.5 inches Casing drive shoe: Well Depth: 115 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: 0 feet	Construction Date: 1975-05-23 00:00:00 Driller: Well Identification Plate Number: Plate Attached By: Where Plate Attached: PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 4 (Driller's Estimate) Development Method: Pump Test Info Flag: Artesian Flow: Artesian Pressure (ft): Static Level: WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: 1400111 Water Chemistry Info Flag: Y Field Chemistry Info Flag: Site Info (SEAM): Y Water Utility: Water Supply System Name: Water Supply System Well Name: SURFACE SEAL: Flag: Material: Method:

Lithology Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Site Info Details: Other Info Flag: Other Info Details:	Depth (ft): Thickness (in): WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:

Screen from	to feet	Type	Slot Size	
Casing from	**to feet**	**Diameter**	**Material**	**Drive Shoe**

GENERAL REMARKS:
EST YIELD: 4 GPM

LITHOLOGY INFORMATION:

From	0 to	45 Ft.	SANDSTONE TRACE OF WATER @ 45'
From	53 to	68 Ft.	BLACK SHALE, SANDSTONE, BLACK SHALE
From	0 to	85 Ft.	SANDSTONE
From	0 to	92 Ft.	BLACK SHALE
From	105 to	110 Ft.	FRACTURE - 4 GPM
From	0 to	114 Ft.	SANDSTONE
From	0 to	115 Ft.	T.D.

- Return to Main
- Return to Search Options
- Return to Search Criteria

Information Disclaimer

Report 1 - Detailed Well Record

Well Tag Number: 33836 Owner: SCOTT POINT WATER WORKS Address: SCOTT POINT ROAD Area: SALTSPRING WELL LOCATION: Land District District Lot: Plan: 17161 Lot: 1 Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: SALTSPRING BCGS Number (NAD 83): Well: 12 Class of Well: Water supply Subclass of Well: Domestic Orientation of Well: Vertical Status of Well: New Well Use: Observation Well Number: Observation Well Status: Construction Method: Diameter: 6.5 inches Casing drive shoe: Well Depth: 245 feet Elevation: 90 feet (ASL) Final Casing Stick Up:	Construction Date: 1975-11-12 00:00:00 Driller: Well Identification Plate Number: 12984 Plate Attached By: PUBLIC HEALTH OFFICER Where Plate Attached: ATTACHED TO WOOD HOUSING (INSIDE) PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 4.5 (Driller's Estimate) Development Method: Pump Test Info Flag: N Artesian Flow: Artesian Pressure (ft): Static Level: WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Water Utility: Water Supply System Name: SCOTT POINT WATER WORKS DISTRICT Water Supply System Well Name: WELL 4 SURFACE SEAL: Flag: N Material:

inches Well Cap Type: Bedrock Depth: 20 feet Lithology Info Flag: N File Info Flag: N Sieve Info Flag: N Screen Info Flag: N Site Info Details: Other Info Flag: Other Info Details:	Method: Depth (ft): Thickness (in): WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:

Screen from	to feet	Type	Slot Size

Casing from	to feet	Diameter	Material	Drive Shoe

GENERAL REMARKS:
EST YIELD: 4.5 GPM
DWIMP RECORD STATES THAT WELL DEPTH IS 220 FEET.

LITHOLOGY INFORMATION:

From	0	to	20	Ft.	RED CLAY
From	20	to	245	Ft.	SANDSTONE
From	0	to	0	Ft.	FRACTURE @ 70' WITH .5 GPM
From	0	to	0	Ft.	FRACTURE @ 177
From	0	to	0	Ft.	FRACTURE @ 203 WITH 3 GPM
From	0	to	0	Ft.	WATER INCREASE TO 4.5 GPM @ 245'
From	0	to	245	Ft.	T.D.

- Return to Main
- Return to Search Options
- Return to Search Criteria

British Columbia

Report 1 - Detailed Well Record

Well Tag Number: 45361 Owner: SCOTT PT WATERWORKS Address: OLD SCOTT RD Area: WELL LOCATION: Land District District Lot: 1 Plan: 1422 Lot: 44 Township: Section: Range: Indian Reserve: Meridian: Block: Quarter: Island: SALTSPRING BCGS Number (NAD 83): Well: 124 Class of Well: Water supply Subclass of Well: Domestic Orientation of Well: Status of Well: New Well Use: Observation Well Number: Observation Well Status: Construction Method: Diameter: 6.0 inches Casing drive shoe: Well Depth: 50 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: feet	Construction Date: 1980-06-19 00:00:00 Driller: Well Identification Plate Number: Plate Attached By: Where Plate Attached: PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 5 (Driller's Estimate) Development Method: Pump Test Info Flag: N Artesian Flow: Artesian Pressure (ft): Static Level: 5 feet WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Water Utility: Water Supply System Name: Water Supply System Well Name: SURFACE SEAL: Flag: N Material: Method:

Lithology Info Flag: N File Info Flag: N Sieve Info Flag: N Screen Info Flag: N Site Info Details: Other Info Flag: Other Info Details:	Depth (ft): Thickness (in): WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:

Screen from	to feet	Type	Slot Size	
Casing from	**to feet**	**Diameter**	**Material**	**Drive Shoe**

GENERAL REMARKS:
5 US GPM

LITHOLOGY INFORMATION:

From	0	to	10	Ft.	BROWN GRAVELLY SOIL
From	10	to	13	Ft.	BLUE TILL
From	13	to	32	Ft.	SOFT BLUE CLAY, OCCAISIONAL STONES.
From	32	to	35	Ft.	SILTY GRAVEL, WATER BEARING
From	35	to	42.5	Ft.	BLUE SILTY GRAVEL
From	42.5	to	44	Ft.	GRAVEL SOME SILT
From	44	to	50	Ft.	SILT, SAND & GRAVEL INTERBEDS
From	50	to	52	Ft.	SHALE

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- Return to Search Options
- Return to Search Criteria

APPENDIX B: WATER QUALITY TEST REPORTS

Client/Code

N. Saltspring Waterworks - M
Ron Stepaniuk, Dist. Manage(A)
761 Upper Ganges Rd.
Salt Spring Island, BC
V8K 1S1

TEL: (250) 537-9902
Group

Date 11Aug14 2:50p No. W115494
Source FWS
Type of Sample water
No. of Samples 6

Comments Arrival temp.: 6.0C
Sampler: Kerry Walker Amended 16Sep14

Samples: Scott Pt - 1) Welbury Well #3 Source WTX: 2CFF8 11Aug14 09:00a 2) Welbury Well #3 Treated WTX: 2CFFC 11Aug14 09:15a

3) Welbury Well #4 Treated WTX: 2D081 11Aug14 10:10a 4) Well #4 Source WTX: 2CFF9 11Aug14 10:25a
5) Well #1 RO Raw WTX: 2CFF7 11Aug14 10:55a 6) Well #1 RO Treated WTX: 2CFFA 11Aug14 11:45a

ELEMENTS		1 SAMPLE	2 SAMPLE	3 SAMPLE	4 SAMPLE	5 SAMPLE	6 SAMPLE	UNITS	Maximum Limits Permissible In Drinking Water*
1) Aluminium	Al	<0.010	<0.010	0.049	<0.010	<0.010	<0.010	mg/L	no limit listed
2) Antimony	Sb	<0.500	<0.500	<0.500	<0.500	1.19	<0.500	ug/L	6.00 ug/L
3) Arsenic	As	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	ug/L	10.0 ug/L
4) Barium	Ba	0.011	0.011	<0.009	0.039	0.245	<0.009	mg/L	1.00 mg/L
5) Beryllium	Be	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	mg/L	no limit listed
6) Boron	B	<0.050	<0.050	<0.050	<0.050	0.378	0.244	mg/L	5.00 mg/L
7) Cadmium	Cd	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	ug/L	5.00 ug/L
8) Calcium	Ca	25.5	22.7	0.846	92.9	1180	3.85	mg/L	200 mg/L
9) Chromium	Cr	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	mg/L	0.050 mg/L
10) Cobalt	Co	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	mg/L	no limit listed
11) Copper	Cu	0.011	0.024	0.013	<0.008	<0.008	<0.008	mg/L	1.00 mg/L
12) Gold	Au	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	mg/L	no limit listed
13) Iron	Fe	0.309	0.011	0.105	0.694	0.474	<0.010	mg/L	0.300 mg/L
14) Lanthanum	La	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	mg/L	no limit listed
15) Lead	Pb	1.19	1.13	<0.500	<0.500	<0.500	<0.500	ug/L	10.0 ug/L
16) Magnesium	Mg	9.14	8.45	0.272	27.4	188	0.715	mg/L	50.0 mg/L
17) Manganese	Mn	0.096	<0.004	0.005	0.714	2.03	0.014	mg/L	0.050 mg/L
18) Mercury	Hg	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	ug/L	1.00 ug/L
19) Molybdenum	Mo	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	mg/L	no limit listed
20) Nickel	Ni	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	mg/L	no limit listed
21) Phosphorus	P	0.038	0.034	<0.010	0.114	<0.010	<0.010	mg/L	no limit listed
22) Potassium	K	1.30	1.23	242	0.960	12.7	1.15	mg/L	no limit listed
23) Scandium	Sc	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	mg/L	no limit listed
24) Selenium	Se	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	ug/L	10.0 ug/L
25) Silicon	Si	7.79	6.85	9.52	9.60	6.71	0.266	mg/L	no limit listed
26) Silver	Ag	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	mg/L	0.050 mg/L
27) Sodium	Na	17.5	17.4	138	81.5	2820	135	mg/L	200 mg/L
28) Strontium	Sr	0.202	0.182	0.009	0.983	17.6	0.048	mg/L	no limit listed
29) Tin	Sn	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	mg/L	no limit listed
30) Titanium	Ti	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	mg/L	no limit listed
31) Tungsten	W	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	mg/L	no limit listed
32) Vanadium	V	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	mg/L	no limit listed
33) Zinc	Zn	0.157	0.153	0.144	0.142	0.146	0.163	mg/L	5.00 mg/L
Hardness (mg/L $CaCO_3$)		101	91.6	3.23	345	3720	12.5	mg/L	75-150 mg/L = moderately hard
pH		6.51	6.55	7.30	7.18	7.23	6.10	units	6.5 to 8.5

* As per Canadian or B.C. Health Act Safe Drinking Water Regulation BC Reg 230/92, & 390 Sch 120, 2001. Task Force of Canadian Council of Resource & Envir. Ministers Guidelines for Canadian Drinking Water Quality, 1996. Ammend. Health Canada (2006).

H. Hartmann

R. Bilodeau
Analytical Chemist

H. Hartmann
Sr.Analytical Chemist

MB LABS LTD.
ANALYTICAL & TESTING SERVICES P.O. BOX 2103, SIDNEY, B.C. V8L 3S6 TEL: (250) 656-1334 FAX: 656-0443

Client/Code

N. Saltspring Waterworks - M
Ron Stepaniuk, Dist. Manage(A)
761 Upper Ganges Rd.
Salt Spring Island, BC
V8K 1S1
TEL: (250) 537-9902
Group

Date 11Aug14 2:50p
Source FWS
Type of Sample water
No. of Samples 6

No. W115494 pg2

Comments Arrival temp.: 6.0C
Sampler: Kerry Walker
Amended 16Sep14

Samples: Scott Pt

SAMPLE	DATE	TIME	$BrHO_3$ (ppb)	Br (ppm)	TDS (mg/L)
Welbury Well #3 Trtd WTX: 2CFFC	11Aug14	09:15a	2.82	0.330	---
Welbury Well #4 Trtd WTX: 2D081	11Aug14	10:10a	3.41	0.545	749
Well #4 Source WTX: 2CFF9	11Aug14	10:25a	---	0.545	644
Well #1 RO Raw WTX: 2CFF7	11Aug14	10:55a	---	9.99	7150
Well #1 RO Treated WTX: 2CFFA	11Aug14	11:45a	ND	0.568	466
Lab Blank			ND	ND	ND
S_o			0.030	3.00	0.700
REF. VALUE			10.0	200	200
STD ± 2SD			10.2 ± 0.850	198 ± 16.1	200 ± 12.4

SD = standard deviation
STD = secondary standard calibrated to primary standard reference material
S_o = standard deviation at zero analyte concentration; method detection limit is generally considered to be 3x S_o value
ND = none detected n/a = not applicable

H. H[signature]

R. Bilodeau
Analytical Chemist

H. Hartmann
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Ron Stepaniuk, Dist. Manage(A)
761 Upper Ganges Rd.
Salt Spring Island, BC
V8K 1S1

TEL: (250) 537-9902
Group

Date 10Feb15 3:18p
No. W118451 pg2
Source FWS
Type of Sample water
No. of Samples 4

Comments Arrival temp.: 7.0C
Sampler: Kerry Walker
Amended 24Feb15

Samples: Scott Pt

SAMPLE	DATE	TIME	Bromate (ug/L)	Cl⁻ (mg/L)	T.O.C. (mg/L)
Well #4 Raw WTX: 2CFF9	10Feb15	09:35a	5.46	9.32	27.5
Well #1 Raw WTX: 2CFF7	10Feb15	09:45a	---	700	3.19
Marina Cres WTX: 2D001	10Feb15	10:25a	---	---	---
Scott Pt Dr WTX: 2D000	10Feb15	10:00a	---	---	---
Lab Blank			ND	ND	ND
S_o			0.100	0.015	0.300
REF. VALUE			1.00	100	10.0
STD ± 2SD			1.05 ± 0.048	105 ± 10.3	9.99 ± 0.771

SD = standard deviation
STD = secondary standard calibrated to primary standard reference material
S_o = standard deviation at zero analyte concentration; method detection limit is generally considered to be 3x S_o value
ND = none detected n/a = not applicable

Samples: 3) Marina Cres 10Feb15 10:25a WTX: 2D001 4) Scott Pt Dr 10Feb15 10:00a WTX: 2D000

TRIHALOMETHANES

COMPOUNDS	3 SAMPLE	4 SAMPLE	UNITS
1) Bromodichloromethane	14.8	17.9	ug/L
2) Bromoform	98.7	151	ug/L
3) Chloroform	1.81	1.40	ug/L
4) Dibromochloromethane	62.8	77.9	ug/L
TOTAL THM'S	178	248	ug/L
SURROGATE RECOVERY			
1) Bromofluorobenzene	91.9	89.9	%
2) Toluene-d8	90.9	96.4	%

ND = not detected ug/L = micrograms per liter < = less than

Comment: maximum allowable concentration of Total Trihalomethanes permitted is 100 ug/L (0.1 mg/L): Guidelines for Canadian Drinking Water Quality, 6th edition, 1996.

R. Bilodeau
Analytical Chemist

H. Hartmann
Sr.Analytical Chemist

MB LABS LTD.

Client/Code

N. Saltspring Waterworks - M
Ron Stepaniuk, Dist. Manage(A)
761 Upper Ganges Rd.
Salt Spring Island, BC
V8K 1S1
TEL: (250) 537-9902
FAX:
group

Date 10Apr15 12:49p No. W119502
Source FWS
Type of Sample water
No. of Samples 8

Comments Arrival temp.: 7.0C
Sampler: Grant Tamboline

	Site Code	Date	Time	CFU/100 ml TC	CFU/100 ml T-NC	CFU/100 ml FC	CFU/100 ml F-NC	CFU/100 mL E.coli
1	Well #1 WTX: 2CFF7	10Apr15	10:20a	0	0	0	0	0
2	Well #4 WTX: 2CFF9	10Apr15	09:45a	0	0	0	0	0
3	Well #3 WTX: 2CFF8	10Apr15	09:15a	0	60	0	0	0
4	Marina Cres WTX: 2D001	10Apr15	10:45a	0	58	0	0	0

	Sample	Date	Time	Sulfur Reducing/ Iron Bacteria *	TPC * (CFU/mL)
1	Well #1 WTX: 2CFF7	10Apr15	10:20a	ND / ND	24.0
2	Well #4 WTX: 2CFF9	10Apr15	09:45a	ND / ND	0
3	Well #3 WTX: 2CFF8	10Apr15	09:15a	ND / ND	86.0

* all counts are colony forming units per milli-litre
TC = total coliform bacteria
FC = fecal coliform bacteria (aka thermotolerant coliforms)
NC = non-coliform bacteria
CFU/100 ml = colony forming units per 100 milli-litres
ND = none detected
TPC = total plate count- spread plate method - 35C/48hr TGEA
FDA/BAM 8th ed, 1995 + Revision A, 1998, May 2009
Note: test may also be refered to as "Standard, Heterotrophic or Aerobic Plate Count" (STP, HTP or APC).
Results may be adversely affected if samples are submitted to the laboratory more than 24 to 30 hours after collection.
E. coli = Escherichia coli, FDA/BAM 8th ed, 1995 + Revision A, 1998
Bergy's Manual of Systematic Bacteriology vol 1, AOAC 1984; J.Clin.Micro., J.Intern.Systm.Bact.

-see following pages for chemistry results-

K. Paneque Martinez
Microbiologist

W. Riggs
Sr. Microbiologist

Client/Code

N. Saltspring Waterworks - M
Ron Stepaniuk, Dist. Manage(A)
761 Upper Ganges Rd.
Salt Spring Island, BC
V8K 1S1

TEL: (250) 537-9902
Group

Date 10Apr15 12:49p

No. W119502 pg2

Source FWS
Type of Sample water
No. of Samples 8

Comments Arrival temp.: 7.0C
Sampler: Grant Tamboline

Samples: 1) Well #1 10Apr15 10:20a WTX: 2CFF7 2) Well #4 10Apr15 09:45a WTX: 2CFF9 3) Well #3 10Apr15 09:15a WTX: 2CFF8

ELEMENTS		1 SAMPLE	2 SAMPLE	3 SAMPLE	UNITS	Maximum Limits Permissible In Drinking Water*
1) Aluminium	Al	<0.010	0.011	0.068	mg/L	no limit listed
2) Antimony	Sb	<0.500	<0.500	<0.500	ug/L	6.00 ug/L
3) Arsenic	As	<0.500	<0.500	<0.500	ug/L	10.0 ug/L
4) Barium	Ba	<0.009	<0.009	<0.009	mg/L	1.00 mg/L
5) Beryllium	Be	<0.003	<0.003	<0.003	mg/L	no limit listed
6) Boron	B	0.433	0.326	0.488	mg/L	5.00 mg/L
7) Cadmium	Cd	<0.100	<0.100	<0.100	ug/L	5.00 ug/L
8) Calcium	Ca	239	106	35.2	mg/L	200 mg/L
9) Chromium	Cr	<0.010	<0.010	<0.010	mg/L	0.050 mg/L
10) Cobalt	Co	0.025	0.021	0.020	mg/L	no limit listed
11) Copper	Cu	<0.008	<0.008	0.009	mg/L	1.00 mg/L
12) Gold	Au	<0.040	<0.040	<0.040	mg/L	no limit listed
13) Iron	Fe	0.204	0.769	1.43	mg/L	0.300 mg/L
14) Lanthanum	La	1.20	0.695	0.603	mg/L	no limit listed
15) Lead	Pb	1.09	<0.500	<0.500	ug/L	10.0 ug/L
16) Magnesium	Mg	54.9	28.2	10.1	mg/L	50.0 mg/L
17) Manganese	Mn	0.851	0.850	0.135	mg/L	0.050 mg/L
18) Mercury	Hg	<0.100	<0.100	<0.100	ug/L	1.00 ug/L
19) Molybdenum	Mo	<0.020	<0.020	<0.020	mg/L	no limit listed
20) Nickel	Ni	<0.050	<0.050	<0.050	mg/L	no limit listed
21) Phosphorus	P	<0.010	<0.010	<0.010	mg/L	no limit listed
22) Potassium	K	7.73	1.08	1.90	mg/L	no limit listed
23) Scandium	Sc	<0.050	<0.050	<0.050	mg/L	no limit listed
24) Selenium	Se	<0.500	<0.500	<0.500	ug/L	10.0 ug/L
25) Silicon	Si	19.1	28.0	25.4	mg/L	no limit listed
26) Silver	Ag	<0.010	<0.010	<0.010	mg/L	0.050 mg/L
27) Sodium	Na	816	94.8	22.0	mg/L	200 mg/L
28) Strontium	Sr	<0.002	1.12	0.269	mg/L	no limit listed
29) Tin	Sn	<0.020	<0.020	<0.020	mg/L	no limit listed
30) Titanium	Ti	<0.010	<0.010	<0.010	mg/L	no limit listed
31) Tungsten	W	<0.050	<0.050	<0.050	mg/L	no limit listed
32) Vanadium	V	<0.010	<0.010	<0.010	mg/L	no limit listed
33) Zinc	Zn	0.157	0.186	0.173	mg/L	5.00 mg/L
Hardness (mg/L $CaCO_3$)		824	382	130	mg/L	>300 mg/L = very hard
pH		6.99	7.03	6.73	units	6.5 to 8.5

* As per Canadian or B.C. Health Act Safe Drinking Water Regulation BC Reg 230/92, & 390 Sch 120, 2001. Task Force of Canadian Council of Resource & Envir. Ministers Guidelines for Canadian Drinking Water Quality, 2014.

H. H

R. Bilodeau
Analytical Chemist

H. Hartmann
Sr.Analytical Chemist

Client/Code

N. Saltspring Waterworks - M
Ron Stepaniuk, Dist. Manage(A)
761 Upper Ganges Rd.
Salt Spring Island, BC
V8K 1S1
TEL: (250) 537-9902
Group

Date 10Apr15 12:49p
Source FWS
Type of Sample water
No. of Samples 8

No. W119502 pg3

Comments Arrival temp.: 7.0C
Sampler: Grant Tamboline

Samples: 4) Marina Cres 10Apr15 10:45a WTX: 2D001   5) Scott Pt Dr 10Apr15 10:45a WTX: 2D000

HALOACETIC ACIDS

COMPOUNDS	4 SAMPLE	5 SAMPLE	UNITS
1) Bromochloro Acetic Acid	<0.100	<0.100	ug/L
2) Dibromo Acetic Acid	<0.100	<0.100	ug/L
3) Dichloro Acetic Acid	1.38	1.16	ug/L
4) Monobromo Acetic Acid	<0.100	<0.100	ug/L
5) Monochloro Acetic Acid	0.800	0.261	ug/L
6) Trichloro Acetic Acid	<0.100	<0.100	ug/L
TOTAL HAA'S	2.20	1.42	ug/L

ND = not detected
ug/L = micrograms per liter
< = less than

Comment: maximum allowable concentration of Haloacetic acids permitted is 60 ug/L (0.060 mg/L); EPA 816-10-010 May 2002.

TRIHALOMETHANES

COMPOUNDS	4 SAMPLE	5 SAMPLE	UNITS
1) Bromodichloromethane	38.9	56.4	ug/L
2) Bromoform	80.9	88.6	ug/L
3) Chloroform	10.7	18.3	ug/L
4) Dibromochloromethane	89.5	113	ug/L
TOTAL THM'S	220	276	ug/L

SURROGATE RECOVERY

1) Bromofluorobenzene	87.5	90.2	%
2) Toluene-d8	93.8	92.2	%

ND = not detected
ug/L = micrograms per liter
< = less than

Comment: maximum allowable concentration of Total Trihalomethanes permitted is 100 ug/L (0.1 mg/L); Guidelines for Canadian Drinking Water Quality, 6th edition, 1996.

R. Bilodeau
Analytical Chemist

H. Hartmann
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Sr.Analytical Chemist

Client/Code

N. Saltspring Waterworks - M
Ron Stepaniuk, Dist. Manage(A)
761 Upper Ganges Rd.
Salt Spring Island, BC
V8K 1S1
TEL: (250) 537-9902
Group

Date 10Apr15 12:49p
Source FWS
Type of Sample water
No. of Samples 8

No. W119502 pg4

Comments Arrival temp.: 7.0C
Sampler: Grant Tamboline

SAMPLE	DATE	TIME	Alkalinity (mg/L)	NH_3-N (ug/L)	Bromate (ug/L)	Cl^- (mg/L)	Colour (TCU)
Well #1 WTX: 2CFF7	10Apr15	10:20a	235	120	---	1583	3.49
Well #4 WTX: 2CFF9	10Apr15	09:45a	245	32.1	---	231	4.80
Well #3 WTX: 2CFF8	10Apr15	09:15a	110	ND	---	14.6	2.27
Marina Cres WTX: 2D001	10Apr15	10:45a	---	---	---	---	---
Scott Pt Dr WTX: 2D000	10Apr15	10:45a	---	---	---	---	---
Well #1 Treated WTX: 2CFFA	10Apr15	10:35a	---	---	14.1	---	---
Well #4 Treated WTX: 2D081	10Apr15	09:25a	---	---	ND	---	---
Well #3 Treated WTX: 2CFFC	10Apr15	09:00a	---	---	ND	---	---
Lab Blank			ND	ND	ND	ND	ND
S_o			0.100	0.254	0.100	0.015	0.300
REF. VALUE			100	20.0	10.0	10.0	5.00
STD ± 2SD			106 ± 8.45	19.9 ± 1.67	10.1 ± 0.063	10.2 ± 0.88	5.06 ± 0.038

SAMPLE	DATE	TIME	E.C. (uS/cm)	CORROSIVITY (Is 20C)	F^- (mg/L)	TKN (mg/L)
Well #1 WTX: 2CFF7	10Apr15	10:20a	4810	0.352	3.53	0.119
Well #4 WTX: 2CFF9	10Apr15	09:45a	1182	0.057	0.287	0.050
Well #3 WTX: 2CFF8	10Apr15	09:15a	323	1.07	ND	0.002
Lab Blank			ND		ND	ND
S_o			0.300		7.00	0.012
REF. VALUE			100		10.0	1.00
STD ± 2SD			106 ± 8.45		10.1 ± 0.063	1.06 ± 0.062

...../5

Client/Code

N. Saltspring Waterworks - M
Ron Stepaniuk, Dist. Manage(A)
761 Upper Ganges Rd.
Salt Spring Island, BC
V8K 1S1
TEL: (250) 537-9902
Group

Date 10Apr15 12:49p
No. W119502 pg5
Source FWS
Type of Sample water
No. of Samples 8

Comments Arrival temp.: 7.0C
Sampler: Grant Tamboline

SAMPLE	DATE	TIME	NO_3-N (ug/L)	NO_2-N (ug/L)	SO_4^{2-} (mg/L)	Sulfide (ug/L)	T.O.C. (mg/L)	T&L (mg/L)
Well #1 WTX: 2CFF7	10Apr15	10:20a	ND	ND	168	ND	ND	0.844
Well #4 WTX: 2CFF9	10Apr15	09:45a	ND	ND	31.7	27.6	ND	1.09
Well #3 WTX: 2CFF8	10Apr15	09:15a	344	7.83	29.0	9.31	ND	0.072
Lab Blank			ND	ND	ND	ND	ND	ND
S_o			0.160	0.300	0.075	0.007	0.300	0.070
REF. VALUE			100	10.0	10.0	50.0	1.00	1.00
STD ± 2SD			103 ± 8.12	10.2 ± 0.76	10.3 ± 0.94	49.0 ± 3.90	1.05 ± 0.057	0.998 ± 0.080

SAMPLE	DATE	TIME	TDS (mg/L)	Turbidity (NTU)	UVT (%)
Well #1 WTX: 2CFF7	10Apr15	10:20a	2790	1.73	94.3
Well #4 WTX: 2CFF9	10Apr15	09:45a	686	0.490	86.2
Well #3 WTX: 2CFF8	10Apr15	09:15a	187	9.69	95.5
Lab Blank			ND	ND	ND
S_o			0.700	0.015	0.005
REF. VALUE			200	5.00	90.0
STD ± 2SD			206 ± 11.8	5.20 ± 0.390	90.8 ± 0.52

SD = standard deviation
STD = secondary standard calibrated to primary standard reference material
S_o = standard deviation at zero analyte concentration; method detection limit is generally considered to be 3x S_o value
ND = none detected n/a = not applicable

R. Bilodeau
Analytical Chemist

H. Hartmann
Sr.Analytical Chemist

Agrichem Analytical

Drinking Water Report

409 Stewart Rd
Salt Spring Island, BC
V8K 1Y6

Phone: 250.538.1712
web: www.agrichem.ca
email: info@agrichem.ca

Leslie Stubbs

235 Scott Pt pumphouse

current treatment
none

sample	90423
date received	03-Mar-15
time/temperature	12:00 12 °C
date of report	11-Mar-15
sampled by	agrichem

	Result	Units	*Potable Water Quality Standards* Health Canada (2008)	Island Trust (2001)
Total Coliforms	**15**	MPN/100ml	0	0
E. coli	**0**	MPN/100ml	0	0
pH	**6.44**		6.5 to 8.5 *	6.5 to 8.5
Conductivity	**456**	uS/cm	no limit set	
Total Dissolved Solids (TDS)	**314**	mg/L	500*	500
Hardness (as CaCO3)	**145**	mg/L	80-100	80-100
Turbidity	**2.62**	NTU	****	1
Fluoride (F)	**< 0.02**	mg/L	1.5 **	1.5
Sodium (Na)	**25**	mg/L	200 ***	200
Potassium (K)	**0.7**	mg/L	no limit set	
Magnesium (Mg)	**12.2**	mg/L	500 *	
Calcium (Ca)	**38**	mg/L	no limit set	
Iron (Fe)	**0.18**	mg/L	0.3 *	0.3
Copper (Cu)	**< 0.01**	mg/L	1 *	
Manganese (Mn)	**0.79**	mg/L	0.05 *	0.05
Zinc (Zn)	**< 0.01**	mg/L	5 *	
Arsenic (As)	**< 1**	ug/l	10**	10
Lead (Pb)	**< 2**	ug/L	10**	

< is " less than "   > is "greater than "

* aesthetic - no health risk
** maximum
*** 20 mg/L for restricted diets

**** surface water or surface influenced groundwater (drilled well) source 1 NTU **
secure groundwater (drilled well) source 5 NTU *
the presence of Total Coliform bacteria indicates surface influenced water source

For the Total Coliforms and E. coli method, 0 is UNDETECTED and is technically < 1 MPN/100ml

This water sample meets the Health Canada Guidelines for Potability for all parameters tested except for Total Coliforms and Turbidity. The following parameters have not met the Aesthetic Objectives: hardness, pH and manganese - these are not Health concerns and may only contribute to an undesirable smell, taste or color or may cause scale buildup on appliances.

metals and minerals are digested as per APHA 3030E2
Aesthetic Objective - values pose no health risk but may affect the taste, color or smell or cause scaling

John Harris BSc

APPENDIX C: WATER TREATMENT LITERATURE

NITTO DENKO

HYDRANAUTICS
www.membranes.com
A Nitto Denko Company

ESPA2-LD

Energy Saving, High Productivity, Low Fouling Polyamide RO Membranes

ESPA2-LD from the LD Technology™ innovative low fouling membranes, offers significant cost savings with lower operating pressure requirements while providing an optimal flow

When high productivity from a membrane element is important, the ESPA family of products is the right choice. ESPA (Energy Saving Polyamide) membranes achieve high flux without compromising on the standard for high rejection. The ESPA2-LD membranes find wide applications in the industry due to the significant cost savings associated with their use.

The ESPA2-LD has a high rejection of silica and boron, and an enhanced tolerance to high pH cleaning. Combining the energy saving properties of the ESPA membranes with the low biological and colloidal fouling properties of the LD Technology™, the ESPA2-LD membranes provide you an optimum performance and greater cost savings!

With a high boron rejection the ESPA2-LD membrane is most suitable for applications such as irrigation where it is critical to maintain a very low level of boron, bottling operations and other light industrial uses.

Key benefits

- **High Permeate Flow - 10,000 gpd (37.9 m^3/d)**
- **Lower operating pressure**
- **Lower energy consumption**
- **High Salt Rejection - 99.6% (99.5% minimum)**
- **Lowest Biological And Colloidal Fouling**
- **Higher rejection for impurities including Silica and Boron**
- **Greater tolerance to high pH cleanings**

Applications:

- Municipal drinking water treatment
- Water treatment for irrigation in agricultural activities
- Drinking water and beverages bottling operations
- Light industrial uses for treating water low in biodegradable organics

Performance:

Permeate Flow	10,000 gpd (37.9 m^3/d)
Salt Rejection	99.6% (99.5 % minimum)

† When tested at standard test conditions with 5.0 ppm Boron in feed solution

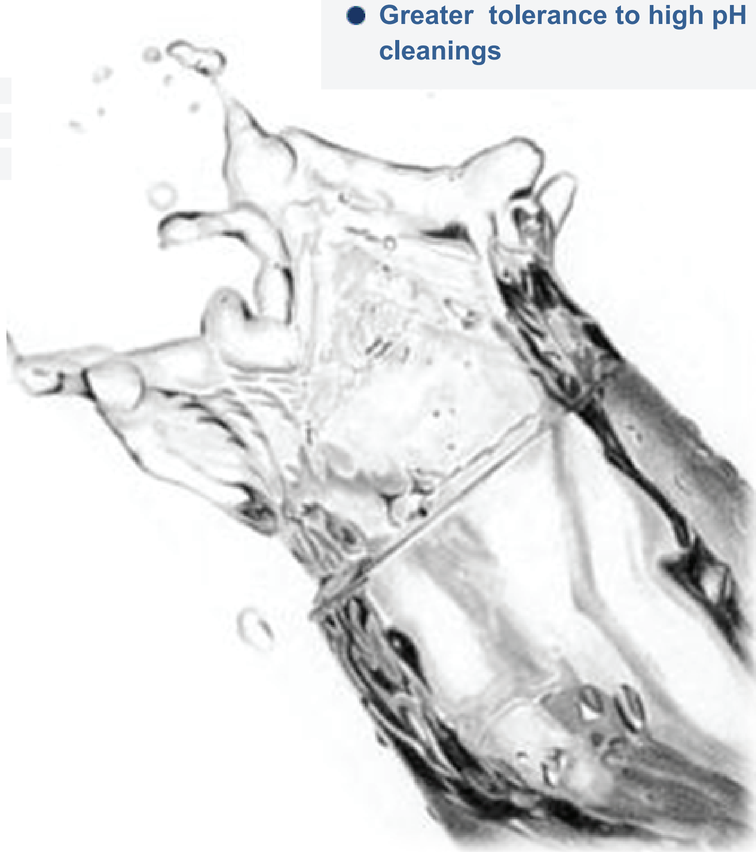
Applications Data:

pH Range, Continuous (Cleaning)	2-11 (1-13)*
Maximum Feedwater SDI (15 min)	5.0
Maximum Feed Flow	75 GPM (17.0 m^3/h)

* The limitations shown here are for general use. For specific projects, operating at more conservative values may ensure the best performance and longest life of the membrane. See Hydranautics Technical Bulletins for more detail on operation limits, cleaning pH, and cleaning temperatures.

Test Conditions:

The stated performance is initial (data taken after 30 minutes of operation), based on the following conditions
1500 PPM NaCl solution
150 psi (1.05 MPa) Applied Pressure
77° F (25° C) Operating Temperature
15% Permeate Recovery
6.5 - 7.0 pH Range



NITTO DENKO

HYDRANAUTICS
www.membranes.com
A Nitto Denko Company

Features:

- Enhanced membrane chemistry for increased chemical resistance
- Innovative spacer design to minimize trapping of small colloidal particles
- HYDRAblock technology providing biostatic properties to minimize proliferation of biological fouling
- Proprietary Vented Seal Carrier to eliminate pressure-shock damage during system startup.

ESPA2-LD, Energy Saving PolyAmide RO Membranes, For Your Water Treatment Needs!

Nitto Denko-Hydranautics is a global leader in research, including reverse osmosis, nanofiltration, ultrafiltration, and microfiltration. Our membrane products (SWC, CPA, ESPA, LFC, ESNA, HYDRAcap, and HYDRAsub) are used extensively in municipal & industrial water and wastewater treatment.

Nitto Denko and Hydranautics have over 40 years experience in the membrane technology arena and are committed to creating innovative membrane technologies which provide clean water to a thirsty world.

Our global membrane division is headquartered in Oceanside, CA, USA. With three state-of-the-art manufacturing sites located in Oceanside - CA - USA, Shiga - Japan and Shanghai – China, Hydranautics has a combined manufacturing area in excess of 131,000 m2 (1,400,000 ft2). Our world-wide sales and customer service offices are located throughout Europe, Asia, the Middle East, North America and South America.

Solutions You Need.

Technologies You Trust!

Hydranautics Corporate Office:

401 Jones Road, Oceanside, CA 92058, USA 1-8000-CPA-PURE Phone: 760-901-2500 Fax: 760-901-2578 Email: info@hydranautics.com

Website: www.membranes.com

Americas Hydranautics	Europe/Africa Hydranautics	Middle East Hydranautics	Indian Subcontinent Hydranautics	S.E. Asia/Australia Nitto Denko	Japan Hydranautics-Nitto Denko Corp.
401 Jones Road Oceanside, CA 92058, USA Tel: +760-901-2500 Tel: 1-800-CPA-PURE Fax: +760-901-2578	Wilhelmina Singel 116, NL 6221 BL Maastricht, The Netherlands Tel: +31-(0) 43-350 3470 Fax: +31-(0)43-350 3489	DAFZ, Building No.6WA, Office No.828, PO Box 29 38 35, Dubai - UAE Tel: +971 4 2146820/1 Fax: +971 4 2146822	407, Palm Springs Center, Link Road, Malad (West), Mumbai 400 064, India Tel:+91-22-40030500 Fax: +91-22-40030496	(Singapore) Pte Ltd 3 Temasek Ave. # 07-01/05 Centennial Towers, Singapore 169074 Tel: +65-6879-3820 Fax: +65-6223-7690	61-7, Azasasadani, Yamadera Kusatsu, Shiga, 525-0042, Japan Tel: +81-77-565-3656 Fax: +81-77-565-3515

01/10/2011

Membrane Element ESPA2-4040

Performance:	Permeate Flow:	1900 gpd (7.2 m^3/d)
	Salt Rejection:	99.6 % (99.4 %minimum)

Type	Configuration:	Spiral Wound
	Membrane Polymer:	Composite Polyamide
	Membrane Active Area:	85 ft^2 (7.9m^2)

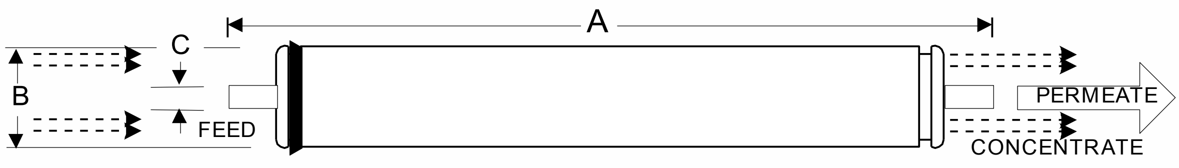
Application Data*	Maximum Applied Pressure:	600 psig (4.16 MPa)
	Maximum Chlorine Concentration:	< 0.1 PPM
	Maximum Operating Temperature:	113 °F (45 °C)
	pH Range, Continuous (Cleaning):	2-10.6 (1-12)*
	Maximum Feedwater Turbidity:	1.0 NTU
	Maximum Feedwater SDI (15 mins):	5.0
	Maximum Feed Flow:	16 GPM (3.6 m^3/h)
	Minimum Ratio of Concentrate to Permeate Flow for any Element:	5:1
	Maximum Pressure Drop for Each Element:	10 psi

* The limitations shown here are for general use. For specific projects, operating at more conservative values may ensure the best performance and longest life of the membrane. See Hydranautics Technical Bulletins for more detail on operation limits, cleaning pH, and cleaning temperatures.

Test Conditions

The stated performance is initial (data taken after 30 minutes of operation), based on the following conditions:

1500 PPM NaCl solution
150 psi (1.05 MPa) Applied Pressure
77 °F (25 °C) Operating Temperature
15% Permeate Recovery
6.5 - 7.0 pH Range
(Data taken after 30 minutes of operation)



A, inches (mm)	B, inches (mm)	C, inches (mm)	Weight, lbs. (kg)
40.0 (1016)	3.95 (100.3)	0.75 (19.1)	8 (3.6)

Core tube extension = 1.05" (26.7 mm)

Notice: Permeate flow for individual elements may vary +25 or - 15 percent. All membrane elements are supplied with a brine seal, interconnector, and o-rings. Elements are enclosed in a sealed polyethylene bag containing less than 1.0% sodium meta-bisulfite solution, and then packaged in a cardboard box. All elements are guaranteed 99.4% minimum rejection.

For information contact:
info@lenntech.com
www.lenntech.com
Tel. +31-15-26.10.900
Fax. +31-15-26.16.289

Solutions you need. Technologies you trust.

Brackish Water Reverse Osmosis Membrane Elements

NITTO DENKO
HYDRANAUTICS
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CPA
High Rejection Membrane

CPA (Composite Polyamide) elements set the standard for RO membrane elements – over 600 million gallons per day of pure water are produced by CPA elements for global municipalities and industries. 4" and 8" configurations available.

Advantages

- 99.7% nominal rejection
- High TOC, silica and hardness rejection

Applications

- Desalting of well waters – municipal drinking water
- Reducing TDS prior to ion exchange
- Boiler make-up water
- Ultrapure water for semi-conductor manufacture

Product Offering*

CPA2, CPA3, CPA5-LD (low colloidal and biological fouling)

ESPA®
Ultra Low Pressure Membrane

ESPA® (Energy Saving Polyamide) elements achieve high flux/lower pressure without compromising standards for high rejection. Since its introduction in the late 1990s, the ESPA® membrane has gained wide acceptance in the water treatment industry due to the significant operational cost savings associated with their use. 4" and 8" configurations available.

Advantages

- Up to 99.6% nominal rejection
- Lower pressure for lower CAPEX/OPEX

Applications

- Municipal potable and wastewater plants
- Bottling operations
- Light industrial

Product Offering*

ESPA1, ESPA2, ESPA2 MAX, ESPAB (high boron rejection), ESPAB MAX, ESPA2-LD (low colloidal and biological fouling), ESPA4

LFC®
Low Fouling Membranes

LFC® (Low Fouling Composite) elements combine neutral surface charge and hydrophilicity, providing significant reduction in fouling rates and increasing membrane efficiency by restoring nominal performance after cleaning.

Advantages

- 99.7% nominal rejection
- Low fouling membrane chemistry reduces or eliminates pre-treatment
- LD technology increases brine spacer thickness for reduced differential pressures
- Lower cleaning frequency and costs

Applications

- Municipal/Industrial surface and wastewaters
- Difficult feedwaters requiring significant pretreatment

Product Offering*

LFC3-LD (Low organic, colloidal and biological fouling)

Seawater
Reverse Osmosis
Membrane Elements

SWC®
Seawater Membranes

SWC® seawater desalination elements offer the highest levels of salt rejection and a consistently pure end product. Membrane formulations are designed to accommodate varying levels of seawater salinities worldwide with reliable field-proven performance. 4” and 8” configurations available.

Advantages

- 99.8% nominal rejection
- Up to 9,900 gpd
- Highest combination flow, rejection and boron rejection (SWC5 Max)
- Up to 440ft2 active membrane area

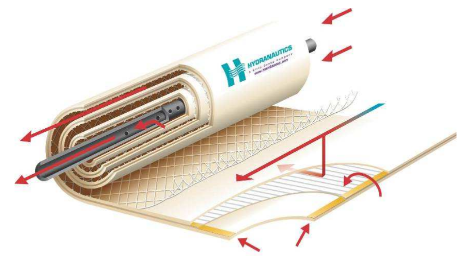
Applications

- Seawater desalting
- Broad offering of membrane formulations designed to accommodate varying levels of seawater salinities worldwide

Product Offering*

SWC4+, SWC4 MAX, SWC4B (high boron rejection), SWC4B MAX, SWC5 (optimal flow and rejection), SWC5 MAX, SWC5-LD (low biological and colloidal fouling), SWC6 (high flow), and SWC6 MAX

Brackish Water
Nanofiltration
Membrane Elements



ESNA®
Energy Saving Nanofiltration Membrane

ESNA® (Energy Saving Nanofiltration) elements provide 50% - 91% salt rejection with ultra-low operating pressures (below 100psi), and are ideal for softening applications and the removal of pesticides, bacteria or viruses. 4” and 8” configurations available.

Advantages

- Up to 91% nominal rejection
- Optimum hardness rejection
- Effectively removes organics
- Ultra-low pressure, energy saving, lower OPEX

Applications

- Municipal water treatment

Product Offering*

ESNA1-LF, ESNA1-LF2, NANO-BW, NANO-SW

Integrated Membrane Solutions® Design

IMSDesign is a powerful software tool for designing an integrated membrane system. IMSDesign is available as a complimentary download at www.membranes.com and a complimentary CD may be requested by sending an e-mail to info@hydranautics.com or calling 800-CPA- PURE.

***Technical Specification Sheets and Application Bulletins are available at www.membranes.com. Installation references available upon request.**

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Toll Free: 1-800-CPA-PURE Phone: 760-901-2500 Fax: 760-901-2578 Web: www.membranes.com

PROFESSIONAL WATER TECHNOLOGIES, Inc.

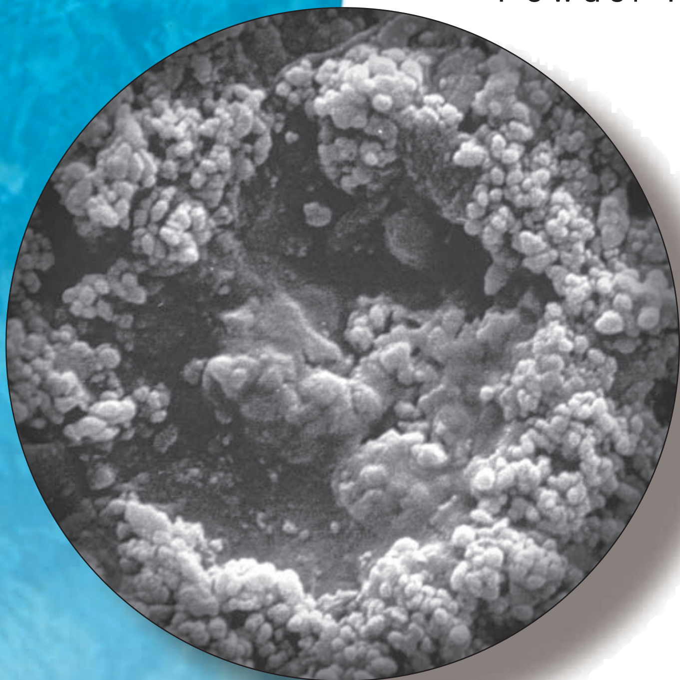
Silica – Colloidal Silica and Reactive Silica
Colloids – Colloidal Silt and Particulate Materials
Organics – Hydrocarbons, Cellulose, Lignins, Dyes, Waxes, Paraffins, Paper Pulp, Heavy Oils, Light Oils
Biological – Aerobic Bacteria, Anaerobic Bacteria, Iron-Related Bacteria, Slime-Related Bacteria, Sulfate-Related Bacteria
Inorganics – Calcium Carbonate, Calcium Sulfate, Calcium Phosphate, Strontium Sulfate, Barium Sulfate, Iron, Aluminum, Metals

THIN-FILM COMPOSITE	CELLULOSE ACETATE	RO PRETREATMENTS	LIQUID	POWDER	PRODUCT DESCRIPTION	SILICA	COLLOIDS	ORGANICS	BIOLOGICAL	INORGANICS
●	●	SpectraGuard	●		High performance antiscalant & stabilizer controls inorganics, metals, colloids. Compatible with all PWT pretreatments.	●	●			●
●	●	Titan ASD 200	●	●	Economical medium performance antiscalant & stabilizer. Compatible with all PWT pretreatments.		●			●
●	●	MetaGuard		●	High performance antiscalant & stabilizer controls inorganics, metals, colloids. Compatible with all PWT pretreatments	●	●			●
●	●	BioGuard ACS	●	●	High performance biological control for online injection or periodic hotshots. Compatible with all PWT pretreatments				●	
●	●	OrganoGuard	●	●	High performance organic control pretreatment for online injection. Compatible with all PWT pretreatments.			●		
		MEMBRANE CLEANERS								
●	●	Lavasol I	●		Highly concentrated membrane cleaner for inorganics. May be mixed with Lavasol V.					●
●		Lavasol II	●		Highly concentrated membrane cleaner for biological growth and colloids. Compatible with TFC type membranes.		●	●	●	
	●	Lavasol III	●		Highly concentrated membrane cleaner for biological growth and colloids. Compatible with CA type membranes.		●	●	●	
●	●	Lavasol IV	●		Highly concentrated membrane cleaner for organics. Compatible with TFC type membranes.			●		
●	●	Lavasol V	●		Highly concentrated membrane cleaner for silica fouling. Compatible with TFC and CA membranes.	●				
●	●	OptiClean A		●	Highly concentrated membrane cleaner for inorganics. May be mixed with OptiClean S. Compatible with CA & TFC.					●
●		OptiClean B		●	Highly concentrated membrane cleaner for biological growth, organics, colloids. Compatible with TFC type membranes.		●	●	●	
	●	OptiClean C		●	Highly concentrated membrane cleaner for biological growth, organics, colloids. Compatible with CA type membranes.		●	●	●	
●	●	OptiClean S		●	Highly concentrated membrane cleaner for silica fouling. Compatible with TFC and CA membranes.	●				

In pretreatment section:
FilteRx 5 series – Filter-aids in organic polymer only formulations. Reduces solid waste in the backwash of media filter systems.
FilteRx 6 series – Filter-aids in blends of organic polymers with ferric sulfate; applied where higher organic content in feed water.
BioGuard Shock – Quick acting, non-oxidizing biocide for intermittent treatment.
BioGuard ISO – Non-oxidizing biocide for continuous injection.

OrganoGuard™

Powder RO Antiscalant/Dispersant



OrganoGuard™ organic pretreatment controls hydrocarbons, cellulosic material, lignins, dyes, waxes, paraffins, oils, and other organics in fluid treatment processes

OrganoGuard is a process aid designed to control organic fouling of membrane separation systems. Utilized at ppm levels, OrganoGuard™ controls organics in process streams containing refined oils, vegetable byproducts from food processes, dyes and chemicals from textile processing, cellulosic and chemical byproducts from paper mills and other organics found in treatment processes.

A preventive maintenance program including OrganoGuard™ reduces cleaning requirements while maintaining optimum operating efficiency of the processing system.

- ***Reduces organic fouling of water treatment & separation systems***
- ***Reduces system cleaning requirements improving system operation efficiency***
- ***Compatible with most other pretreatment process and chemicals***

- Hydrocarbons
- Cellulosic Material
- Lignins
- Dyes
- Waxes
- Paraffins
- Paper Pulp
- Heavy Crude Oils
- Light Machine Oils

OrganoGuard™ utilizes a unique proprietary polymeric system to stabilize and separate hydrophobic and weakly hydrophilic organics by use of a unique surface active chemical physics process. Hydrophobic organics are separated and stabilized reducing maintenance requirements of the membranes. Weakly hydrophilic organics are also stabilized as water soluble molecular complexes which minimizes fouling of membranes.

OrganoGuard™ is stable in the presence of both cationic and anionic polymers so it may be safely used in conjunction with most other pretreatments.

OrganoGuard™ complies with ANSI/NSF Standard 60 requirements and may be used on potable water systems.

PROFESSIONAL WATER TECHNOLOGIES, Inc.

High-Performance Reverse Osmosis Chemicals

For more information, contact us today:

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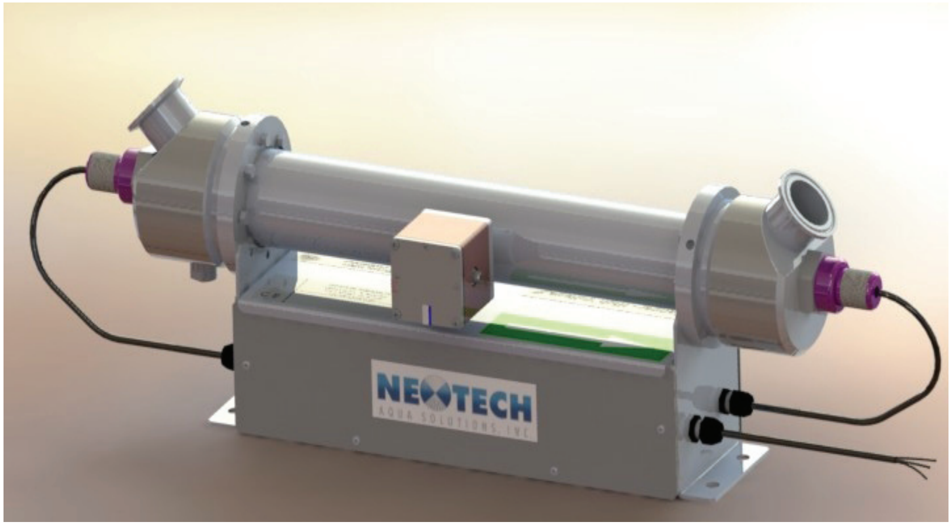
NEOTECH™
AQUA SOLUTIONS
The World's Most Advanced UV Technology™

NeoTech T222™

TOC Reduction

• Pharmaceutical • Microelectronics



The NeoTech T222™ is specially designed to remove TOCs in high-purity water treatment applications.

This high-efficiency UV system utilizes NeoTech Aqua's patented ReFleX™ chamber technology, reflecting over 99% of the 254nm UV generated. Further, its unique design maximizes the exposure of TOCs to the 185nm wavelength UV light that the unit generates. It is the highest efficiency, smallest footprint, and lowest operating cost UV system in the water treatment industry.

With only a single twenty-two inch lamp, the T222™ provides users the most convenient and lowest cost service schedule of any low pressure UV system.

PRODUCT BENEFITS

- Single lamp efficiency processes up to 10 gallons per minute
- 75% smaller footprint compared to standard UV systems
- May be mounted vertically or horizontally, vertical mount recommended for best results
- Up to four units may be controlled with a single micro-control box
- Built for 120V or 230V single phase power providing for maximum flexibility
- No flow, no problem – guaranteed 60 minutes
- Water contact finish – Ra-15
- Controller – Remote
- Alarms, Remote Control, 4-20 mA output
- Real time dosimetry, 100% dosage assurance – with constant flow
- UV monitor is NIST traceable
- Sanitization in place – hot water or steam
- No-tool lamp change
- NSF Standard 50 certified
- Warranty one year parts and labor

SPECIFICATIONS

Flow Rate - gpm (m^3/hr.) - TOC Reduction	10 (2.3)
Number of High Output Amalgam Lamps	1
Lamp Life - Hours*	9000
Operating Power - watts	98
Operating Pressure - psi (bar)	150 (13)
Operating Temperature - ºF (ºC)	36 - 104 (2 - 40)
Pressure Drop - psi (bar)	0.1 (0.01)
Dry Weight - pounds (kg)	29.8 (13.5)
Dimensions (L x H x D) - inches	24.0 x 6.2 x 8.2
Dimensions (L x H x D) - millimeters	609 x 158 x 208
Sanitary Fittings - Standard[+]	1.5 in.

** Lamp life is based on a maximum of one on/off cycle per day and room temperature water.*

[+] All units include sanitary tri-clamp fittings for improved reliability, sanitation, and ease of installation. Alternative connections are available upon request.

MAXIMUM UV PENETRATION

The NeoTech T222™ provides users an unparalleled level of engineering sophistication by maximizing the penetration of 185nm UV light in a unique annular design. This technical advantage also reduces the number of lamps and power requirements by up to 90% compared to standard UV systems.

MINIMAL MAINTENANCE AND SERVICE

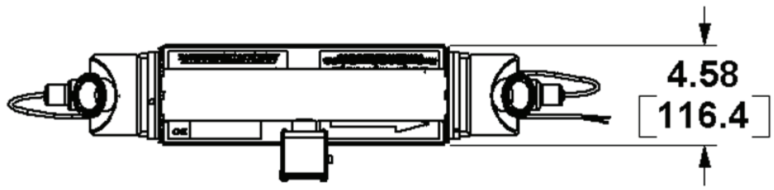
The service and maintenance requirements for the NeoTech T222™ are limited to three basic requirements:

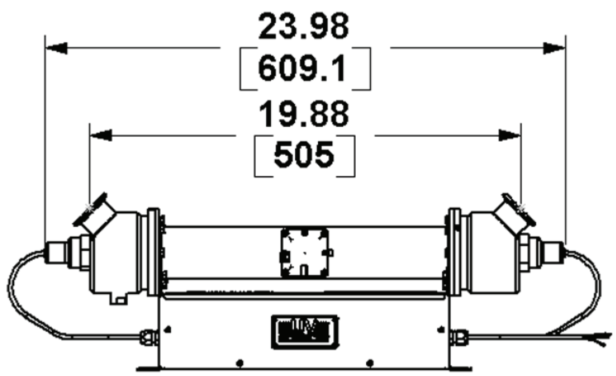
- Lamp Replacement: No Tools Required
- UV Monitor: May be changed with a single screwdriver while the system is operating
- Cleaning: May be cleaned as needed in a CIP loop or manually brushed.

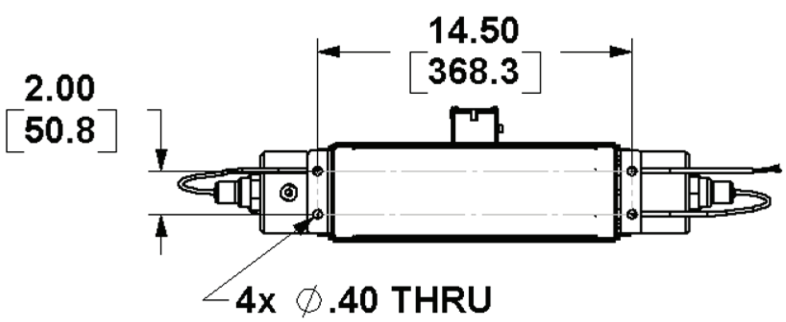
UNPARALELLED EFFICIENCY

The NeoTech T222™ boasts the smallest footprint in its class. With as few as one-tenth as many bulbs compared to standard UV systems, it has the lowest operating cost and maintenance schedule in the field.

5893 Oberlin Drive, Suite 104, San Diego, California 92121
Toll-Free 888.718.5040, ph: 858.571.6590, fx: 858.571.6596, Web: neotechaqua.com, info@neotechaqua.com



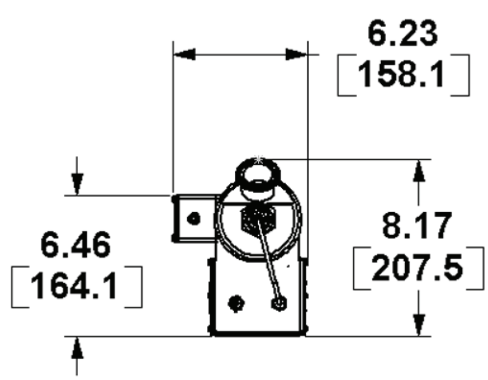




OPTIONS AND SPARES

Description	Part Number
Light Trap Kit*	UVLTK-2
Cleaning Kit	CK-2-1
Amalgam Lamp Kit	LK-22
Lamp Sleeve Kit	QSK-22
UV Monitor Calibration	UVIM-CAL
Ballast Kit, 120V	BK-120
Ballast Kit, 230V	BK-230

** Reflected UV light may be harmful to nonmetallic surfaces, such as PPL, PVC, and other plastics. If such materials are utilized in the water treatment system, a light trap is recommended.*



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