

# **Appendix 3 – Water Treatment & Water Distribution Operation & Maintenance Supplemental Information**

## **1.0 INTRODUCTION**

This Operation & Maintenance Manual (OMM) was developed to meet requirements set by Vancouver Coast Health (VCH) and by the Sunshine Coast Regional District (SCRD). It aims to describe the Eastbourne Water System (EWS) which is a water treatment and water distribution system servicing the community of Eastbourne on Keats Island, BC.

This OMM includes the following:

- Description of all components of EWS
- Description of system operator's duties and responsibilities
- Description of operational and maintenance procedures
- An outline of safety features on system and concerns
- An outline of forthcoming improvements to the system
- EWS contact list

## **1.1 How to Use this Operation & Maintenance Manual**

- a) The operator of this system will review the OMM with any members of staff who will be expected to fulfill the duties and responsibilities outlined within.
- b) The OMM will be use in the training of new operators, also as a reference and resource for any existing operator.
- c) Regular updates will be made to ensure the OMM remains current in regards to the system, as well as in regards to requirements outlined in the operator's Permit to Operate, as issued annually by Vancouver Coastal Health.

- d) Copies of the OMM are available in the following locations:
- the EWS Treatment Plant
  - the Offices of the SCRD's Infrastructure Services

## 1.2 Integration with Other Plans

a) Vancouver Coastal Health Permit to Operate

The VCH Permit to Operate is issued annually to the operator of EWS. The Permit outlines conditions to which the operator must abide, and includes a report on the previous year's operation of the system. The OMM is designed to reflect conditions outlined in the current Permit to Operate. The EWS Permit to Operate is available in the following locations:

- posted in the EWS Treatment Plant
- the Offices of the SCRD's Infrastructure Services
- Appendix A of the OMM

b) EWS Emergency Response Plan

An Emergency Response Plan (ERP) was developed for EWS in 2010 by the engineering firm of Dayton and Knight. The ERP outlines possible emergency situations that, should they occur, would affect normal operation of the water system. The ERP recommends what actions should be taken in the event of any such emergency. The ERP is an invaluable resource in the operation of EWS and the operator should be familiar with its location and contents. The ERP should be updated annually. Copies of the ERP can be found in the following locations:

- the EWS Treatment Plant
- the Offices of the SCRD's Infrastructure Services

c) Sunshine Coast Emergency Response and Recovery Plan

The Emergency Response and Recovery Plan (ERRP) describes the roles and responsibilities of the departments and personnel for the entire SCRD during major emergencies or disasters. The ERRP provides a framework to guide the SCRD's efforts to respond to and recover from major emergencies or disasters. In the event of major emergency or disaster, the ERRP will govern. Any operator of EWS should be familiar with the contents and location of the ERRP.

Copies of the ERRP can be found in the following locations:

- the offices of the SCRD Emergency Program Coordinator
- on the SCRD website

For more information on the ERRP or on the Sunshine Coast Emergency Program, visit [www.scrd.ca/emergency-program](http://www.scrd.ca/emergency-program).

d) Cross Connection Control Bylaw

The primary objective of Cross Connection Control is to safeguard drinking water within the municipal water system from possible contamination and from subsequent health risks created from backflow. Where potential sources of contamination pose a risk, physical separation or backflow prevention devices/assemblies are required to prevent the return of non-potable water to the potable water distribution system.

Refer to the SCRD Cross Connection Control Bylaw or Tab 16 of the ERP for more details.

e) SCRD Drought Management Plan

The purpose of the Drought Management Plan is primarily to manage the demand for drinking water during the summer months. EWS experiences fairly severe water shortages every year during the summer months. The system has as such been designed and is operated in anticipation of such shortages. This OMM describes practices for the prevention and management of water shortages in sections 2.1 and 3.6. For more information on what to do in the event of severe drought, refer to ERP section 1.4 and tab 4.

## **2.0 EASTBOURNE WATER SYSTEM**

The Eastbourne Water Treatment & Water Distribution System is located in the community of Eastbourne on Keats Island and is operated under the purview of the SCR.D. The system is classified as an EOCP Water Treatment Level 2 and Water Distribution Level 1 system. EWS provides continuous potable water to approximately 160 homes and cottages.

### **2.1 General Characteristics**

EWS can be considered in four parts.

- 1) The collection part of the system consists of three shallow wells with pumps and a drilled well with pump. From the wells, water is transported into three 2500 US Gal. raw water tanks. (Note: Water from the drilled well is pre-treated with filtration and arsenic removal before mixing in the raw water tanks).
- 2) Water is carried on demand through the EWS Treatment Plant. Demand is set by a level switch in tank four of the treated water reservoir. Treatment consists of filtration, UV disinfection and chlorination. Following treatment water is held in reserve using seven 2100 US Gal. treated water tanks.
- 3) Water is gravity fed into the distribution system, passing through the main distribution meter. The distribution system is a mix of 50mm and 38mm polyethylene pipe (the majority of which is buried, though some, older sections of the system remain above ground). There are five sections of the distribution system, four of which are metered (refer to fig. 1 below).
- 4) All services connected to the distribution system are for single household, residential users. Each service is metered and fitted with a flow restrictor (of between 1.0 and .50 GPM). Each user is encouraged to maintain an individual storage tank on their property so that during summer months water can be rationed into the distribution system.

### **3.0 OPERATOR DUTIES**

The operator of EWS has the primary duty of providing a continuous supply of safe, potable water to the residents of the Eastbourne Community. Additionally, there are requirements for the operation of the system which are laid out by various parties. The duties outlined in this OMM aim to meet all the requirements of:

- the Drinking Water Protection Act and Regulation
- the Vancouver Coastal Health Permit to Operate
- the SCR D Infrastructure Services Department
- the Eastbourne Community
- the Eastbourne Water System

#### **3.1 Drinking Water Protection Act and Regulation**

The Drinking Water Protection Act outlines requirements for water suppliers to ensure that water supplied is potable and meets any additional requirements established by the Drinking Water Protection Regulation or by the system's Permit to Operate which is issued by the local Drinking Water Officer. In summary, the Act:

- requires that operators of a water system must operate the system in compliance with the Act through a Permit to Operate which may contain its own specific conditions
- requires minimum treatment standards, monitoring, testing, and specific water quality standards
- requires water suppliers to have microbiological samples analyzed by a laboratory approved by the Provincial Health Offices
- establishes standards for public notification of any water quality problems
- requires that operators of any system serving more than 500 individuals be certified through the Environmental Operators Certification Program
- requires a water system to have an up to date Emergency Response Plan

The Drinking Water Protection Regulation sets out specific standards for the potability of water, the frequency of monitoring and the responsibility of public notification, among other things.

Both the Act and Regulation are publically available and can be accessed through the BC Ministry of Health website: [www.gov.bc.ca/health](http://www.gov.bc.ca/health).

### **3.2 Vancouver Coastal Health Permit to Operate**

The EWS Permit to Operate is posted in the Eastbourne Treatment Plant. This document, renewed annually, lays out specific requirements that must be met by the operator in the operation of the system throughout a given year.

### **3.3 SCRD Infrastructure Services Department**

The Eastbourne Water system is operated under the purview of the SCRD's Infrastructure Services Department, under the supervision of the Utility Services Manager. The operator reports to the Utilities Services Manager with the results of bi-weekly bacteriological samples, quarterly DWSub samples, in the case of any issues arising in the operation of the system, and annually with a year end report. Inspections of the water system are periodically carried by the SCRD.

### **3.4 Eastbourne Community**

The operator's chief responsibility with regards to the Eastbourne Community is to provide a continuous supply of water which meets the standards for potability as laid out by the Drinking Water Protection Act and Regulation. It is also worth noting that in the case of EWS, as the system is so drastically affected by seasonal fluctuations in both supply of and demand for water, the operator has a responsibility to anticipate annual water shortages, and to manage the system in such a way as to minimize the chance of interruption to service.

The operator also has a responsibility to communicate with the Eastbourne Community. As required by the Drinking Water Protection Act, the operator must give public notice in case of any water

quality problems. They must also complete and make public an annual report on the water system within six months of the end of the year. Finally, it is in the best interest of the operator to maintain communications with the Community on the subjects of water supply, usage, wastage and shortages.

### **3.5 Eastbourne Water System**

The operator's duties with regard to the EWS include, but are not limited to the following:

- monitoring and maintenance of all components of the system
- monitoring of treatment processes, e.g. upkeep of filtration, chlorination and UV systems
- management of water supply with regards to seasonal fluctuations

### **3.6 General Practices**

What follows is an outline of the general practises involved in the operation of the EWS:

#### a) Quick Read

- perform 4 to 5 times per week, or daily in the summer season
- compare distribution meter with treatment meter
- record level in both raw water and treated reservoir tanks
- rotate treated reservoir tanks (i.e. those with outgoing valves open are closed, those with closed are opened)
- activate treatment manually, verify working of the UV and chlorination systems
- record flow rate through the treatment train
- check level of chlorine solution tank, record setting on chlorinator
- measure chlorine residuals of treated waters enroute to reservoir and to distribution
- record all data on the quick read sheet and input to the computer spreadsheet

(Note: Refer to Appendix B for copy of the Quick Read Sheet)

#### b) Medium Read

- perform 2 to 3 times per week in the summer season

- perform all the same procedures as in a quick read
- read all meters
- record data on the quick read sheet and on a full read sheet and input to the computer spreadsheet

(Note: Refer to Appendix B for copy of the Full Read Sheet)

c) Full Read

- perform 2 to 3 times per week year round
- perform all the same procedures as in a quick read
- read all meters
- measure water levels in the Gordon, East and Collector Wells
- measure chlorine residuals at extremities of the East, West, Village and Dock sections of the distribution system
- record pressure differentials between filters in the treatment plant
- record all data on the quick read sheet and on a full read sheet and input to the computer spreadsheet

d) Record Keeping

Within the Eastbourne Treatment Plant there are several overlapping methods of keeping records:

- a Log Book records the date, the initials of the Operator, the duties performed that day (i.e. quick read, full read, samples), as well as any special notes regarding the system on a given day
- a Quick Read Sheet contains all data recorded during a quick read of the water system, each column on the sheet represents one reading (for copy of the Quick Read Sheet see Appendix B)
- a Full Read Sheet contains all data recorded during a full or medium read of the water system, each sheet represents one reading (for copy of the Full Read Sheet see Appendix B)



- the Computer Spreadsheet contains all data recorded during a quick or medium or full read of the system, it also maintains an historical record of all data taken in the operation of EWS; the Spreadsheet has been designed by the operator and is subject to change, it performs a wide variety of functions:

- historical data is used to illustrate flow rates through the distribution system, is invaluable in the processes of monitoring and of catching leaks
- historical data is used to track well production and past rates of well recovery
- measurements of water levels in the wells are translated into percentages full
- illustrates trends in stored water through well, raw tanks and treated tanks
- calculates differentials in pressure between filters, helps the operator recognize when filters cartridges ought to be replaced
- tracks the age of the UV bulb
- tracks the rate of treatment to the level in the chlorine solution tank

e) Monitoring/Sampling

- Chlorine Residuals

- monitoring the chlorine in treated water to ensure demand from raw water has been met without residual exceeded limits set for potable drinking water
- chlorine residuals of treated water both enroute to and out of the treated reservoir are taken 5 to 6 times per week within the treatment plant
- chlorine residuals are taken at the extremities of the distribution system 2 to 3 times per week

- Bacteriological Samples

- minimum frequency for bacteriological sampling is set in the VCH Permit to Operate as semi-monthly from 5 sites in the distribution system
- general practice is to sample bi-weekly from 5 sites in the distribution system (from sample ports at the extremities of East, West, Village and Dock lines as well as from the Distribution tap in the Treatment Plant) and from the 4 wells

(Note: Refer to Appendix C for copy of Bacteriological Sample cover sheets)

- Quarterly SUB Samples
  - Drinking Water SUB packages are put together by the SCRCD and are delivered to the operator some time around the middle of every quarter
  - packages received by the operator will include sample bottles and a requisition form outlining what is required
  - sampling requirements differ per quarter, but generally there are samples taken for trihalomethanes and heavy metals
  - packages also will include prepaid courier papers, so that when sampling is complete, the operator has only to deliver samples to the courier's office who will have them delivered to an approved lab
  
- Arsenic Samples
  - samples must be taken on a regular basis of water passing through the Drilled Well Arsenic Removal system to ensure that the system is performing and to gauge when the ion exchange medium within the system ought to be changed
  - samples must taken of water pre-lead, post-lead/pre-lag, and post-lag (where lead and lag are the first and second tanks respectively)

f) Distribution System Audits

The operator should periodically perform audits on the distribution system. There are a variety of problems that can be caught and corrected in an audit. What follows is an outline of the steps taken in an audit and details about what the operator should be watching for:

- a print out should be made with details of all service connections, including the property owners' names, addresses, a previous meter reading, a record of any issues discovered in previous audits and space to make note of any issues discovered this time around (Note: Refer to Appendix D for a sample audit print out)
- each section of the distribution system should be audited separately
- the operator should visit every service in a given section, should open the incoming ball valve to the service assembly and should slightly open the blow coming out of the Y

strainer in the assembly – here the operator is verifying that water reaches the service and passes through the assembly and that the meter is sensitive

- at each service the operator should take a meter reading and should make a note of any malfunction in the assembly, and of other issue regarding the individual service
- while progressing through a section of the distribution system, the operator should be leaving individual services shut off following inspection, then coming to the end of a given section, should make a five minute timed trial at the main line meter corresponding to that section – here the operator is verifying that the meter should not move when all services in that section are shut off
- to further test the veracity of the meter, the operator might isolate individual sections of the distribution system (i.e. to check the East Meter, all other sections of the distribution system should be shut off), in this way individual meters can be tested against the main Distribution Meter

g) Communications

The operator has the duty of communicating any issue with water quality to SCRD. As the owners of EWS, the SCRD is responsible for communicating with members of the Eastbourne Community. Any issues, including but not limited to water quality issues, that arise in the operation of EWS should be communicated by the operator to the SCRD. Operators and the SCRD communicate on an as-need basis.

The SCRD is also responsible for filing an annual report on the operation of the system with Vancouver Coastal Health. This annual report must be made publicly available.

h) Drought Conditions

As stated above, the Eastbourne Water System faces annual periods where summer drought conditions prevent water supply from meeting total demand. It is the duty of

the operator in such time to carefully manage the system to make the most of what supply is available. The current approach to addressing drought conditions is as follows:

- In periods when the wells cannot produce enough water to keep the reservoir tanks full, the operator begins each week day by opening the reservoir tanks to community, releasing whatever water has been able to store over night.
- Making calculations based on known distribution meter flows, the operator can estimate at what time the reservoir tanks will have emptied into the distribution system and can return at that time to close the tanks for the day.
- Tank number four, which contains a float switch to trigger the treatment of raw water, should at all times remain open to the distribution system.
- The operator can also manipulate the reservoir tanks in an effort to 'bank' some portion of water every weekday in preparation for weekends when there are typically more people using the system. Typically, when the wells are at their least productive, the operator is able to bank between 800 and 1200 gal. per weekday. During weekends, all tanks remain open to all parts of the distribution system.
- The operator of the system must make themselves available in some way to the members of the Eastbourne community, so that in the case where an individual household, or a localized group of households may be having issues accessing water during summer drought conditions, the operator may be easily contacted, and such issues can be resolved.

## 4.0 MAINTENANCE

This section of the OMM will describe in detail how to perform many of the common tasks associated with the fulfilment of the operator duties outlined above.

### 4.1 Within the Treatment Plant

#### a) Change Cartridge Filters

- Shut off treatment at electrical breaker
- Isolate filter banks with shutoffs before and after
- Open drain to isolated portion (press red button on top of filter cartridge to break vacuum)
- Using fitted wrench tool (looks like a hollow paddle), dethread desired filter cartridge
- Select new filter
- Keep used filter, throw away previously used one
- Reinstall cartridge with new filter
- Open incoming water and keeping drain open to bleed out any air, restart treatment at the electrical breaker
- Open outgoing water and close drain

#### b) Change UV Bulbs

- Shut off treatment at electrical breaker
- Unplug UV unit
- Allow bulb to cool for 5 mins.
- Remove bulb and replace
- Restart treatment at electrical breaker, run treatment to fill UV chamber
- Plug in UV unit and allow ICE controller to go through startup procedure and self-diagnosis

c) Refill Chlorinator

- Chlorine solution tank needs to be refilled when level reaches below 80 litres
- Chart on the wall indicates ratios of Cl<sub>2</sub> & water to be added based on level remaining in the tank (e.g. 80 litres remaining, add 55 litres water, 2.04 litres Cl<sub>2</sub>)
- While treatment is running, open valve above to allow water into tank
- Open the top of the tank and while tank fills with water, add amount of Cl<sub>2</sub>
- Once tank has filled, close valve
- At the treatment sample port in sink, measure Cl<sub>2</sub> residual to ensure potency of the new solution

d) Adjust Chlorinator Pump

- While treatment is running, loosen lock screw to the right of the dial, turn dial to desired setting, re-tighten screw
- At the treatment sample port in sink, measure Cl<sub>2</sub> residual to ensure appropriateness of the new setting

e) Backwash Arsenic Removal Tanks

- Backwash arsenic medium with chlorinated water – run treatment and set up a jumper hose from hose bib on the treatment train (located on outlet pipe where treated water leaves the building) to hose bib on the drilled well line (located above drilled well meter)
- Adjust red-handled valve before arsenic tanks so that water bypasses 3.0 GPM flow restrictor
- Backwash tanks in sequence – isolate 1<sup>st</sup> (lead) tank with post-lead drain open, set handle at the top of the tank to ‘backwash’ setting, water will spew out the side, backwash until water runs clear, move handle to ‘rapid rinse’ setting, allow a few minutes for medium in tank to settle, open valves and set handle back to default service position
- There is a length of hose in the treatment plant that can be fitted over the outlet at the side of the tank to direct the backwashed down to a drain located in the floor.
- Repeat all of previous step for tank 2 (lag)

- When finished, adjust red handled valve back to default 3.0 GPM restrictor
- Disconnect jumper hose

f) Change Arsenic Removal Medium

- Shut off drilled well breaker
- Isolate desired tank with shut off valves
- Disconnect union fitting leading into the back of the tank
- Remove plumbing body that is threaded into the top of the tank
- Using vacuum, empty the tank of old medium
- Dispose of old medium \*
- Fill tank with new medium
- Reinstall plumbing body and union fitting
- Open isolation valves
- Before running drilled well, set up jumper hose from treatment train and follow steps for backwashing arsenic medium

\* Note: Used medium is not currently being accepted at the Sechelt Landfill. Old medium is being temporarily stored in drums at the EWS Treatment Plant until a suitable facility can be found that will accept it. As of December 2016, an attempt is being made by the operator to locate a suitable disposal facility.

g) General Maintenance

- Treatment plant should be kept tidy – on a regular basis garbage taken out, floors swept, general clean-up

## 4.2 Waterline Maintenance

In operating EWS it is important for the operator to take a proactive approach to catching and repairing leaks. Even a small leak in the distribution system can be a significant issue in times of

summer shortages. There are several methods the operator employs in trying to catch and correct leaks:

- a) Regular audits of the distribution system (procedure outlined in OMM Section 3.5)
- b) Regular attentive readings of the spreadsheet – flows through different parts of the distribution system can be monitored, compared against historical data, and abnormalities should be investigated
- c) When a leak is detected, shutoffs along the distribution system can be used to isolate different sections of the water line and to narrow the field of investigation – the operator should determine the size and approximate location of the leak and then should develop a plan to have it excavated and repaired
- d) Some of the older distribution lines being above ground, leaks can be easy to locate and easy to repair

### **4.3 General Maintenance**

- a) Regular auditing of the distribution system will reveal issues that will need to be resolved (e.g. cracked flow restrictors, malfunctioning check valves, clogged meters)
- b) Access to individual services should be maintained, grasses and brambles cut back, services boxes dug out where run offs have buried them
- c) The treatment plant and well property should be regularly mowed as should brambles at the Gordon Well be cut back to maintain access

## **5.0 SAFETY**

Safety is a paramount concern in the operation of the Eastbourne Water System. Safety refers to the well-being of the operator, of any staff or other workers engaged in the operation of the system, as well as the members of the community of Eastbourne. Any work performed on the system must be done in accordance with BC's Occupational Health and Safety Regulations. These OHS Regulations contain legal requirements that must be met by all workplaces under the jurisdiction of WorkSafeBC. The OHS Regulations can be found online at [www.worksafebc.com](http://www.worksafebc.com).

### **5.1 Safety Equipment**



a) Eye Wash Station

Inside the Eastbourne Treatment Plant there is an emergency eye wash station. It is a wall-mounted unit with a tank full of disinfected water, with two arms in front that can be pulled down. The arms have perforated rubber ends which, when pulled down, let out a sprinkling of water from the tank that can be used in case of need to rinse a person's eyes and face. There is a user manual in a plastic bag affixed to the top of the eye wash tank, in which are described the procedures for general maintenance of the unit. The eye wash station must be regularly inspected to insure cleanliness, proper water temperature, and usability. Water should be changed every six months at which time a commercially available stabilizer is added to the liquid. There is an inspection sign-off sheet affixed to the wall beside the station.

b) Defibrillator

A Medtronic Lifepak defibrillator, available for Eastbourne community use, can be found in the Eastbourne Treatment Plant. The defibrillator is accessed through a panel in the outside wall of the Treatment Plant. The panel is locked, but a key is contained in a lock-box beside the panel. The code for the lock-box is 9111. The defibrillator must be inspected periodically to ensure battery life and general functionality. Within the defibrillator's case there is an inspection sign-off sheet.

c) First Aid Kit

A well stocked first aid kit is to be maintained at all times in the Eastbourne Treatment Plant. It is available to anyone who has access to the plant.

## 5.2 Keats Island Fire Emergency Group

The community of Eastbourne is home to an independent volunteer fire and emergency group. KIFEG, keeps well stocked, regularly serviced and inspected fire and emergency response equipment.

There are two locations where such equipment is kept. The first is a mobile unit parked on Meek Rd. The second location is a shed at the corner of Esplanade Rd. and Oak Ave. Both locations are clearly labelled with the KIFEG acronym. Within both locations can be found equipment for fighting fires and for other emergencies – fire-hoses, pumps, axes, shovels, first aid materials. KIFEG also maintains several 2500 US Gal. water storage tanks located throughout the community. Each tank has a blow off fitted with a fire-hose connection and can be used in the case of fighting fire. Although KIFEG equipment is in no way tied to the Eastbourne Water System, any operator of the system should be aware of this asset to the community.

### **5.3 Emergency Response Plan**

An ERP was prepared for EWS in 2010 by the engineering firm of Dayton and Knight. The ERP outlines possible emergency situations that, should they occur, would affect normal operation of the water system. The ERP recommends what actions should be taken in the event of any such emergency. The ERP is an invaluable resource in the operation of EWS and the operator should be familiar with its location and contents. The ERP should be updated annually. Copies of the ERP can be found in the following locations:

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