

## VILLAGE POINT WATER SYSTEM FEASIBILITY STUDY

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### **EXECUTIVE SUMMARY**

The Village Point Improvement District (VPID) owns and operates a water system and sewer utility located on Mayne Island.

The VPID requested the Capital Regional District (CRD) undertake two engineering feasibility studies one for the water system and one for the wastewater system. The CRD would identify necessary system improvements, capital costs for upgrade of works and operating costs for CRD operation of the facilities. The studies provide an overview of the present condition and operation of each system, deficiencies with each system, the degree of upgrading deemed necessary to allow the CRD staff to recommend to the CRD Board takeover of the two systems and the associated costs associated with the works. On completion of the works, property owners and residents of the improvement district service area would have sufficient information to determine by voting, whether they would wish to have the CRD initiate conversion of the improvement district to two new CRD services. If the VPID elected not to become a service of the CRD, the documents provide a blueprint for the improvement district to use to guide the upgrading of their systems.

The CRD applied for, and received, two infrastructure planning grants from the province to assist with funding these studies.

The improvement district is somewhat unique in that it provides two distinct services, water and wastewater, to two different user groups. In order to become a CRD local service the improvement district would have to be split into the two distinct service areas, with local services being created for both water and sewer purposes. This study will consider the water system only.

### **Water System**

#### ***Source***

The VPID has a limited supply of water from three of the twelve groundwater wells that were originally developed for the utility. The remaining nine groundwater wells have been isolated from the system, as they have apparently demonstrated problems with either the quality or quantity of water they can produce. The Ministry of Environment has reviewed data from all of the Village Point wells in the last year and has identified a work program for the Utility to implement to ensure each well is upgraded to an acceptable standard and or to ensure unused wells are abandoned properly. The well production and quality issues are common with groundwater wells in the vicinity of the water district.

Wells #15, #9 and #14 are presently pumped at approximately 12, 18 and 2 Imperial gallons per minute (lgpm) respectively, as required to meet system demand throughout the year. Well #15 is the primary source. Well #9 will be activated during high demand conditions or when Well #15 exhibits declining water quality. Well #14 has very limited capacity, in the order of 4,000 Imperial gallons per day (lgpd) in the spring reducing to 1,300 lgpd in the summer. There is inadequate storage in the well system to avoid excessive drawdown during peak day events.

All three sources have associated water quality issues. Well #15 has high levels of manganese, periodic bacterial contamination from e-coli and seasonal saline intrusion. As with many wells in the area, low levels of arsenic have also been identified with periodic levels in excess of Canadian Drinking Water Quality Guidelines (CDWQG). Wells #9 and #14 have elevated iron, manganese and calcium levels.

### ***Treatment***

Treatment is limited to filtration by a manganese greensand filter with secondary disinfection by sodium hypochlorite, for water supplied by Wells #9 and #14 and simple chlorination of water from Well #15. There is no facility implemented at this time for further treatment of backwash water prior to discharge. Water, after treatment from the greensand plant is stored in one of the five steel storage tanks that have a combined volume of 77,000 Imperial gallons (lg). Due to the condition of these tanks, only two are presently in service with a combined capacity of 35,000 lg. Well #15 pumps to one of the 10,000 lg tanks as well as directly to the system. There are two properties serviced off the supply main from Well #15 that have no treatment other than disinfection which is likely insufficient for adequate user protection.

### ***Distribution and Storage***

The system balances off the storage tanks that have a top water level of 97.5 m (320') providing system pressures between 35 and 120 psi at property lines. The Improvement District has 277 potential connections and 218 existing connections of which approximately 74 are considered full time residents. The water usage varies throughout the year between 8,000 lgpd in winter up to 30,000 lgpd under maximum day conditions. The present system is able to provide maximum day conditions but requires both Wells #15 and #9 to be on line.

The distribution system consists of a network of 150 mm (6") and 100 mm (4") cast iron (CI) pipes, with some 50 mm (2") PVC pipes on short cul-de-sacs. There are 18 fire hydrants, four standpipes, several pigging stations and multiple valves on the system. There are also six metering stations located within the system to assist in leak detection. There are meters at each of the three wells and one that paces the chlorinator at the greensand filter plant. There is no metering, nor double check valves on the individual domestic services.

With the exception of the operation of Well #15, which is controlled by the level in the storage tanks via cable and the chlorinator, which is paced off the meter, all other components have to be manually operated or monitored. There are no alarm points in the system to interrupt a process or summon assistance should a system malfunction or failure occur.

### ***Concerns***

There are significant concerns with respect to the quality of water provided to customers, and the available volume necessary to meet long term requirements of the service area both of which need to be addressed. Two customers on the system are serviced before adequate water treatment.

The quantity of water available from the three well sources is considered inadequate at the present consumption rates for the Improvement District to be able to supply the full development of 277 parcels. It is expected that additional sources of water will need to be developed in combination with a reduction in system usage and losses to meet future needs of the service area. A water conservation strategy addressing the installation of individual household meters, assessment of water supplied from storage and from individual meters to confirm rates of consumption and leakage, and a program to promote homeowner awareness of the need to conserve water is necessary. To further curb usage a variable consumption fee system should be implemented.

The water quality issues related to bacteria, turbidity, iron, manganese, calcium and arsenic need to be addressed. If operated by the CRD, the utility would require a new treatment facility capable of providing treated water meeting the CDWQGs. The new facility would likely include additional filtration for turbidity reduction, metals and arsenic removal, primary disinfection by ultra-violet (UV) disinfection system and secondary disinfection by chlorination using the existing

chemical injection system. The treatment and disposal of filter backwash water in an environmentally acceptable manner is a recent requirement that will impact on the costs and complexity of the treatment process. Standby power, remote monitoring of the system and in line monitoring for disinfection residual would also be necessary.

To address shortage of water supply in high demand situations with the low yield wells, the existing storage tanks would be converted for use as raw water storage. Two additional tanks would be added providing approximately 50,000 lg capacity for treated water storage. To facilitate this conversion of the reservoir system, a new pump station would be required to transfer the raw water through the treatment process and into the new treated water storage tanks.

The two customers on the supply line from Well #15 should either be removed from the system or need to be provided with an adequate supply of quality water to CDWQG's. This requires removal of undesirable components in the source water as well as provision of disinfection to the treated water, a "Point of Use" treatment unit on each property at a designated drinking water supply, with the remainder of the household system on raw water may be an option.

The system has been generally well maintained, with prudent spending, but is now at an age that all assets require a plan for upgrade and replacement. Valving, hydrants and standpipes need evaluation with a strategy to replace or overhaul, piping requires a thorough swabbing and evaluation and storage vessels and treatment and pumping works need to be identified for replacement at the end of their design life. The swabbing of mains is a priority issue in order to avoid conditions supporting the regrowth of bacteria.

There was concern that the cast iron (CI) pipeline may have been compromised by the calcium content of the groundwater, which could have resulted in internal corrosion with significant reduction in line capacity and deterioration in water quality. A section of the CI pipe was removed for evaluation and found to be in acceptable condition, which hopefully is representative of the system's overall condition. This information will be better defined in the asset plan.

### ***Improvements and Costs***

The capital improvements required to bring the water system facilities up to a standard where CRD could be assured it would have sufficient water volume to service all properties, where water quality provided to users would consistently meet the CDWQGs and where the system could be operated cost effectively, would include the following:

- develop additional water supply sources as necessary, evaluate, optimize current groundwater supplies and those not currently in use, decommission wells not planned for use today or in future
- develop a water treatment strategy to provide appropriate treatment of all groundwater and to provide for responsible discharge of waste products
- revise, expand reservoir capacity to provide storage for raw and treated water to optimize the available supply
- ensure all properties receive appropriate levels of treatment regardless of location
- provide continuous in line monitoring equipment to ensure disinfection residual and continued operation of all facilities
- provide remote SCADA monitoring for major components throughout system
- install individual household service metering and backflow protection
- develop an asset evaluation and replacement program

The estimated cost to complete the upgrade works noted above is \$1,085,000. CRD costs to set up and administer the capital works program would increase the cost by \$50,000 to \$1,135,000.

Closer costing of these works is difficult at this time owing to widely variable costs experienced in the industry for acquisition of equipment and materials and especially on Mayne Island due to lack of available labour and the associated construction cost increases to bring labour from off island.

### ***Senior Government Assistance***

There are no provincial/federal grant programs currently available to assist in the funding of such works at the time of this report. However, if such funds were made available in a new grant program, where the program had similar eligibility criteria to previous projects and if the CRD was successful in obtaining assistance, the funding of the project from senior government might approach 2/3 of the eligible capital cost or about \$723,500 of the \$1,085,000 estimated cost for upgrade works. The in-house cost for CRD to administer work done by consultants and contractors has not been considered eligible in the past; the cost of this process is estimated at \$50,000.

### ***Borrowing for Capital Improvements***

The estimated capital cost to the community, if federal/provincial funding were obtained, would be \$361,500, plus the \$50,000 administration cost for a total of \$411,500. The CRD would borrow funds for the project over a fifteen year term and would typically requisition the annual borrowing costs by way of a tax per parcel. Calculated in this manner, each parcel would pay an annual tax of \$163 based on 277 parcels for the 15 year term, with a grant, or \$449 if no grant were available.

### ***Operating Costs***

CRD operating costs include all costs to operate, maintain and administer the water system. The annual costs are inclusive of insurance, allowances for operator time, allowances for maintenance, calibration and repair of mechanical, electrical and controls systems, water sampling and testing costs, administrative costs, electrical and utility costs, technical support costs, the cost of chemicals, miscellaneous parts and consumables, and an allowance for replacement costs and emergency repairs. Waste disposal collected from the filter backwash system has been considered a new cost for an installation of this complexity, increasing the costs of operations by \$15,000.

The annual operating cost, based on the above is estimated at \$105,000. Expressed as an annual user fee, the cost to a water user would be \$482, based on 218 serviced parcels in 2008.

### ***Total Costs***

The combined debt servicing and operating cost for a serviced parcel within the water system would amount to \$645/annum, assuming works are completed as described and a federal/provincial grant is obtained in the amount of \$723,500. If no grants were available, the cost would rise to \$931/annum.

### ***Conversion Approval Process***

If the VPID wished to proceed to convert to a new CRD service, there are several steps to the process. The process is complicated by the current improvement district having responsibility for both a sewer and a water system. As the provision for funding annual debt for improvements normally falls to property owners who are able to benefit from the service provided, and as the sewer collection system only services a small portion of the total water customers, it will be necessary to parse the current improvement district into two new services, each with distinct service area boundaries. After defining the new benefiting area for the sewer system, the CRD would need to obtain the assent of the electors or property owners within the boundaries of the

new sewer area and of those within the current water service area by way of a Petition or a Referendum. The questions to be voted on would in general terms be:

For those electors in the current water area:

1. Subject to the CRD establishing a new Village Point sewer service, are you in favour of the CRD establishing a new water service to take over the assets of the Village Point water system, make improvements to the system and operate the upgraded system as a new CRD Village Point water service? and;
2. Do you approve the CRD to borrow the necessary capital funds to facilitate the upgrade of the water system?

For those electors in the new sewer area:

1. Subject to the CRD establishing a new Village Point water service, are you in favour of the CRD establishing a new sewer service to take over the assets of the sewer system, make improvements to the system and operate the upgraded system as a new CRD Village Point sewer service? and;
2. Do you approve the CRD to borrow the necessary capital funds to facilitate the upgrade of the sewer system?

As noted, for CRD to request the province to dissolve the improvement district and transfer the assets of the district to the CRD electors in both the water and sewer areas would need to support the establishment of the service for their respective area.

CRD staff have presented this information to residents of the improvement district. Although this information was well received, it was evident that the costs of sewer upgrade, which is much more significant and which benefits fewer individuals, creates a significant impediment to conversion of the improvement district to a new service of the CRD. The improvement district has authorized CRD staff to expend further funds to better evaluate the sewer costs and options.

## **CHAPTER 1 – INTRODUCTION**

### **1.1 General**

The Capital Regional District (CRD) was approached by Trustees of the Village Point Improvement District (VPID) to undertake an engineering study into the condition and operation of their water and sewer systems. The trustees also wanted to know the annual costs that would be associated with the CRD upgrading and operating the two systems as local services of the CRD. In order to achieve this the VPID would need to be separated into the Village Point Water Improvement District (VPWID) and the Village Point Sewer Improvement District (VPSID) since they are not providing coverage to the same areas. This report considers the requirements for establishment of the VPWID.

The VPID requested the CRD to apply to the Ministry of Community Services for an infrastructure planning grant to assist in funding the study. The ministry subsequently approved funding in accordance with their criteria which provides 100% of the first \$5,000 of the study and 50% of the next \$10,000. The VPID is responsible for all other costs, including 50% of the \$10,000 and all other costs if the study exceeds \$15,000. The study cost was estimated at \$15,000 with the ministry responsible for \$10,000 and VPID funding the remaining \$5,000.

### **1.2 Scope**

Prior to the CRD establishing a new water local service, a study is undertaken to identify the condition of the system, its performance, deficiencies and present mode of operation. The scope of the study is to:

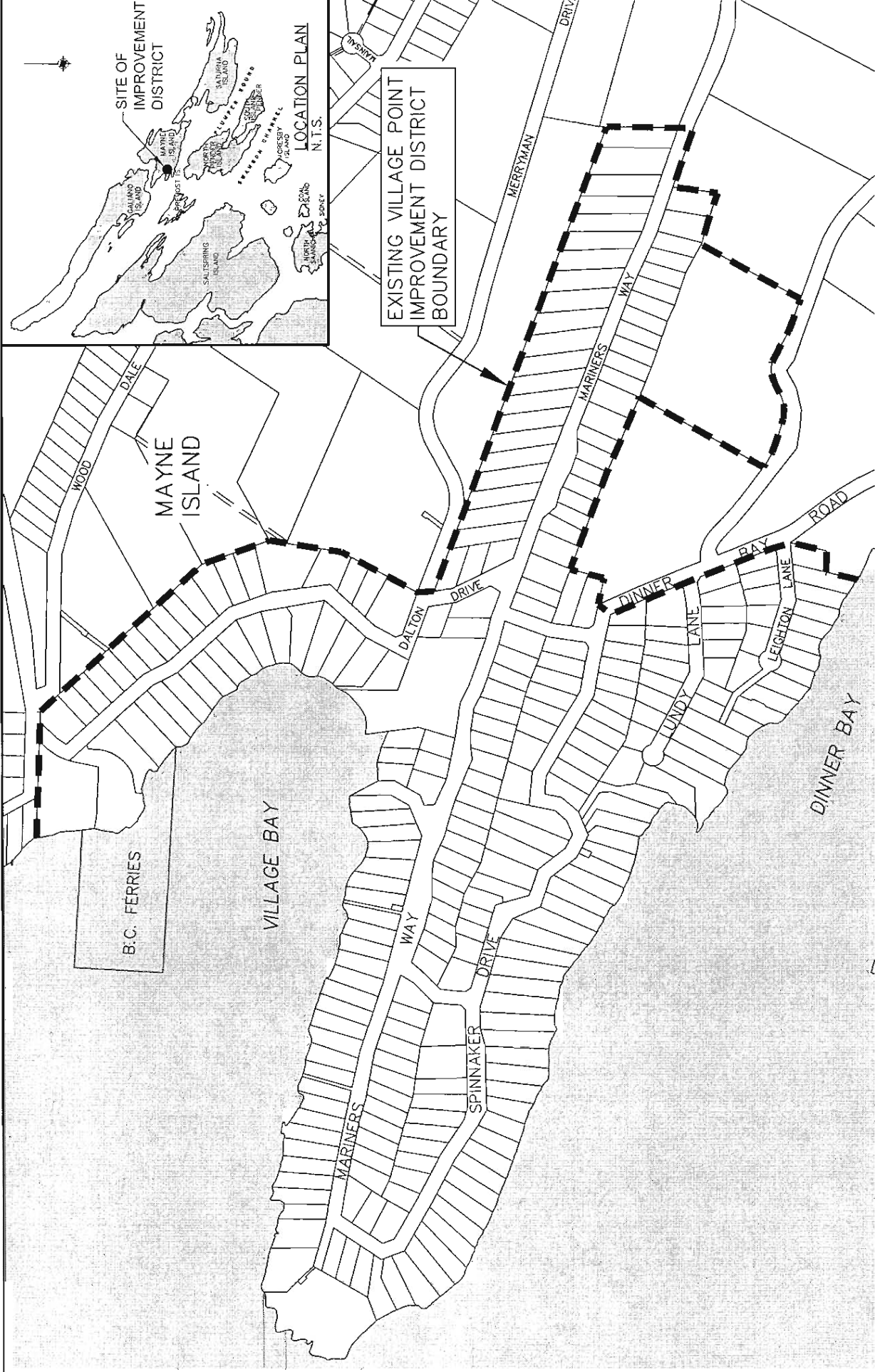
- review the system design and performance;
- evaluate the condition of the existing system;
- assess the quality and quantity of the water available from existing groundwater sources;
- consider options to develop new sources, if present sources are inadequate in either quality or quantity;
- estimate the capital cost to make the improvements necessary for the VPWID to become a CRD local service;
- calculate the annual costs for residents of the VPID for capital improvements necessary should the CRD takeover; and
- estimate the annual operation and maintenance costs for CRD to operate the upgraded system.

Once the study is completed, the residents of the VPID may decide to be polled to determine if they wish to create a new water local service under the CRD and to have the CRD complete the upgrades proposed within the study. However, the residents may also decide to receive the report for information only and may use it in future years as a guide when budgeting for potential improvements to their water system. The improvement district also owns and operates a rudimentary sewer collection and disposal system for a very few properties. The cost of the upgrade of the sewer system is expected to be significant and may well be a determining factor in whether the improvement district agrees to convert to two CRD services.

### **1.3 Study Area**

Village Point is a rural-residential community situated adjacent to the BC Ferries terminal on Mayne Island, approximately 50 kilometres northeast of Victoria (see Figure 1).

The climate is cool Mediterranean, with generally dry summers and mild winters with annual precipitation of 650 mm (26"). The subdivision has 277 parcels, 218 of which are connected to the water system, of these 74 are considered full-time residents.



The community is centered on Mariners Way, Spinnaker Drive, Dalton Way and Dinner Bay Road; 96 of the properties are waterfront. The properties extend from approximately 90 m elevation down to waterfront.

The VPID was incorporated by Letters Patent issued by Cabinet Order on March 1, 1979; it is responsible for the operation of a water system and a sewer system. The VPID is unique in that it provides two distinct services, water supply and distribution, as well as wastewater collection and treatment to two distinctly different user groups within its boundaries. For the purpose of this study, the properties serviced by the water system, VPWID, define the extent of the proposed local service area.

## CHAPTER 2 – EXISTING WATER SYSTEM

### 2.1 General

The VPID has a limited supply of water from three of the twelve wells that were originally developed for the community in the 1970's. Water from the wells is chlorinated and pumped to multiple storage reservoirs at a common site where treatment using a manganese greensand filter can be achieved along with secondary disinfection by chlorination.

### 2.2 Groundwater

In the early 1970's several rock wells were drilled for the community (see Figure 2). Of the twelve drilled, only three are presently in use, while the remainder have been either not put into production or their use terminated due to either quality or quantity issues. The three in use are Wells #9, #14 and #15; Well #15 is the primary source, with a reported capacity of 10-12 imperial gallons per minute (lgpm). Well #9 is activated during high demand conditions or when Well #15 has water quality issues. Well #9 has a reported capacity of 18-20 lgpm, however, in August/September 2006 this had reduced to 9 lgpm. Well #14 has very limited capacity, only capable of  $\pm 4,000$  imperial gallons per day (lgpd) in the spring and reducing to 1,300 lgpd by late summer.

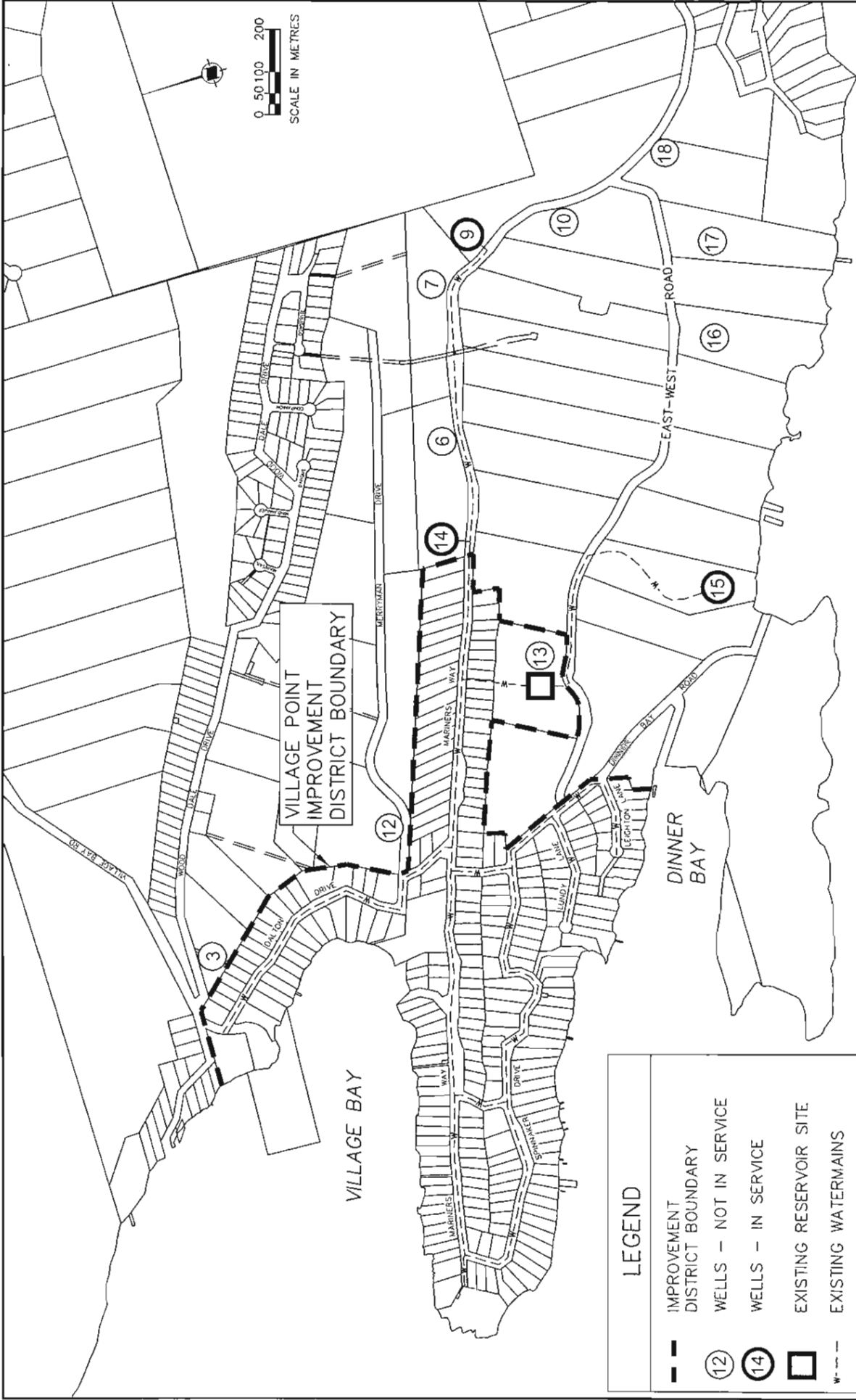
All three sources have associated water quality issues. Well #15 has elevated manganese, periodic bacterial contamination (e-coli), seasonal saline intrusion and periodic levels of arsenic that exceed Canadian Drinking Water Quality Guidelines (CDWQG). Wells #9 and #14 both have elevated iron, manganese and calcium levels. All three sources are metered at well head and have liquid chlorine injected upon discharge. Well #15 operates on a wired relay to the water level in the storage tanks, with preset start and stop levels. Well #9 has a manually set timer that can be initiated when required. Well #14 is manually operated as required.

The remaining nine groundwater wells have been isolated from the system due to quality and/or quantity issues. The Ministry of Environment completed a review of these wells in 2006 and identified a work program for the utility to implement to ensure each well is upgraded to an acceptable standard and/or to ensure unused wells are abandoned to code.

Mayne Island is served entirely by groundwater. Rock wells may be influenced by drawdown by other well use. Those in proximity to the Village Point wells demonstrate common water quality issues. The opportunity to locate a new production well without water quality issues is unlikely.

### 2.3 Distribution System

The supply and distribution system consists of approximately 7,000 m of 150 mm, 100 mm, 75 mm and 50 mm cast iron (CI) and PVC pipes. The supply lines from groundwater sources and the 50 mm mains are PVC. The 150 mm and 100 mm distribution system is mostly CI. Well #15 pumps directly into the system, with only chlorination at the well head, there are two properties adjacent to the well that receive water that has not been adequately disinfected. Wells #9 and #14, if required, pump chlorinated water through a manganese greensand filter to the existing storage facilities and from there water is piped to the distribution system. System valving is typically at intersections, however, the condition of the valving is of concern, with some valves reportedly stuck shut and others not fully closing when operated. There are 18 fire hydrants, four standpipes, several pigging stations and multiple valves throughout the system. The utility has installed six metering stations within the distribution system to assist in leak detection; however, there are no individual meters nor double check valve assemblies on the domestic services. All system operation is manual, with the exception of Well #15 which is controlled via cable to the level in the storage tanks and the secondary disinfection system that is paced off the system meter at the manganese greensand filter building. System usage is 15,000 lgpd on average throughout the year, with winter rates down to 8,000 lgpd and summer rates up to 30,000 lgpd. As part of the study a section of the CI main was removed for inspection, due to concerns over its potential condition. The section



LEGEND	
---	IMPROVEMENT DISTRICT BOUNDARY
⊖	WELLS - NOT IN SERVICE
⊕	WELLS - IN SERVICE
□	EXISTING RESERVOIR SITE
- - -	EXISTING WATERMAINS

**CRD** CAPITAL REGIONAL DISTRICT  
Environmental Services

**VILLAGE POINT WATER IMPROVEMENT DISTRICT, MAYNE ISLAND**  
**EXISTING WELLS (2007)**

removed was in good condition, which resulted in the assumption that all the CI would be in similar shape.

#### 2.4 Reservoir Storage

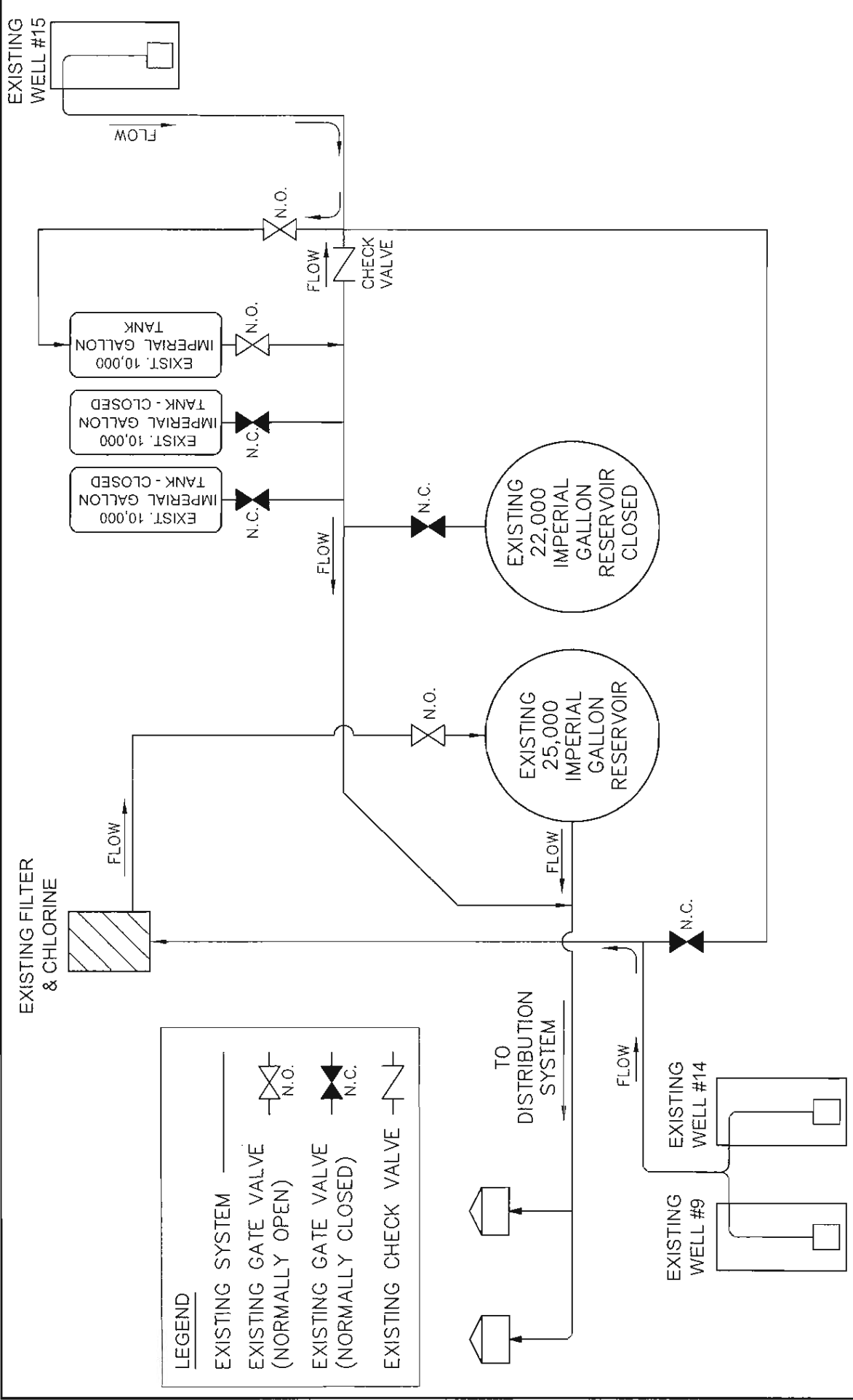
The VPID has five steel tanks at a common site off East-West Road. There are three at 10,000 lg, one at 22,000 lg and one at 25,000 lg. Two of the 10,000 lg tanks need re-coating as does the 22,000 lg tank. All three are out of service at present, leaving one 10,000 lg and the 25,000 lg tank in service. Although of different size, they have been plumbed to have a common top water level (TWL) of 97.5 m (320'), which would provide system pressures of between 35-120 psi within the distribution system. Figure 3 shows the existing reservoir arrangement. Well #15 is connected via cable to the water level in the tanks and operates automatically to refill as necessary. Well #9 and #14 are manually set to pump if/when required.

#### 2.5 Water Treatment

The existing sources have manganese, iron, calcium, saline intrusion, arsenic and occasional bacterial contamination (e-coli). The existing treatment is chlorination for primary and secondary disinfection with a manganese greensand filter being used to deal with the iron and manganese concerns associated with Wells #9 and #14. Well #15 can be directed through the filter but presently isn't. Water that passes through filtration is subsequently re-chlorinated and discharged into the 25,000 lg tank from where it flows into the distribution system. The unfiltered water from Well #15 is pumped into one of the 10,000 lg tanks from where it discharges into the system in a common main with the 25,000 lg tank. There are periodic issues with turbidity within the distribution system. Regrowth of bacteria in the mains is anticipated but not documented.

#### 2.6 Fire Protection

The existing system has 18 fire hydrants and four standpipes installed upon the 150 mm and 100 mm CI mains and 50 mm PVC mains. The system has potential to provide limited fire protection from the 35,000 lg storage tanks; the limit would be due to the minimal recharge potential of the wells compared to the potential available for the fire protection through the 150 mm and 100 mm mains.



**LEGEND**

EXISTING SYSTEM	
EXISTING GATE VALVE (NORMALLY OPEN)	
EXISTING GATE VALVE (NORMALLY CLOSED)	
EXISTING CHECK VALVE	

## CHAPTER 3 – SYSTEM ISSUES

### 3.1 General

The CRD, in the operation of a public water supply, strives to provide water to its customers in adequate quantity and with quality meeting or exceeding the CDWQGs. Operationally, the water system must address safety concerns for employees and be cost effective to operate. The evaluation of the water infrastructure within the Village Point system was made with these objectives in mind. The CRD assumes that the water and sewer components are now separate and will be considering the water service area only within this report.

The VPWID has a limited supply of groundwater of a quality that requires treatment beyond simple disinfection. There is substantial storage potential at the reservoir site, however, several of the tanks will need to be evaluated by a structural engineer and if acceptable will need reconditioning and recoating before they could be put back into service. The distribution system has a suitably sized network of 150 mm, 100 mm and 50 mm pipework, however, the condition of valving and fittings within the system is a concern.

The system is presently well operated within its limited financial structure. The monitoring and record keeping in the utility are excellent.

The major areas of concern the CRD has with respect to the VPWID would be as follows:

- The three existing groundwater sources have limited production and are not expected to be adequate to accommodate future growth, development of an alternate supply may be challenging.
- The water quality and its variable nature at all three existing wells, and likely others, with the manganese, iron, calcium, bacterial (e-coli), arsenic and salinity issues will require a comprehensive treatment strategy.
- The existing water treatment process equipment has limited potential for expansion. The utility should consider at this time recharging the existing manganese greensand filter or changing out the media to enhance existing treatment.
- The structural condition of the multiple storage tanks and the potential costs to recondition or replace them.
- The condition of hydrants, standpipes and valving within the distribution system.
- The two properties adjacent to Well #15 that are serviced by the utility receive water directly from Well #15 with limited disinfection residual.
- There is no individual metering of household services and there is no backflow protection on these services.
- There is no automatic system monitoring to alert operators in case of equipment malfunction, such as well pump failure, reservoir drawdown or chlorinator failure resulting in no disinfection.
- Turbidity within the distribution system.

These issues will be addressed in Chapter 4.

### 3.2 Design Criteria

Theoretical design criteria typically used by CRD are taken from Ministry of Water, Land and Air Protection (MWLAP), Islands Trust, Fire Underwriters Survey and CDWQG.

The following design criteria have been used to evaluate the recommended capacity of the various components for the Village Point water system:

- 1) **Maximum Day Demand**  
The maximum day value of 500 imperial gallons per connection per day (lgpconpd) has been used to size well pumping requirements, supply line to the reservoir, water treatment and reservoir storage components of the water system.

Maximum day values in 2006 were approximately 30,000 lgpd which would be equivalent to +/- 200 lgpconpd, far less than the design value.

- 2) **Peak Hour Demand**  
The peak hour demand has been used to evaluate the pipeline capacity. The peak hour demand is achieved from reservoir storage draw down and is approximately three times the maximum day value. This demand typically occurs between 8-10 a.m. and 5-8 p.m.

- 3) **Annual Average Demand**  
The annual average rate is used to determine the volume of water required as a supply source; typically, it is obtained by dividing the maximum day value by 1.5.

- 4) **Fire Flows**  
The Fire Underwriters Survey of the Insurer's Advisory Organization (IAO) has established specific requirements for a water system to meet to be recognized and graded for fire protection purposes. The rating of the IAO is provided to insurance companies as a means to assess risk in setting of insurance rates. One of the main interests of the IAO in rating a system is the ability to maintain a minimum fire flow over a specific period of time for various types and uses of buildings. The minimum rural residential demand is 440 lgpm for one hour with a minimum residual pressure of 20 psi, when provided in conjunction with maximum day demand.

- 5) **Distribution System Pressure**  
The range of system pressures should be between 35 and 120 psi under all normal supply conditions. The exception would be under fire flow conditions where a minimum 20 psi residual pressure to the property line would be acceptable.

The system pressure is achieved by utilizing the supply head, by pumping, or by elevated storage reservoirs. The present system pressure is from the balancing reservoirs, which should provide between 30-120 psi at the serviced property lines.

- 6) **Reservoir Storage**  
There are three major components of reservoir storage:
  - a) **Peak hour balancing** – this is the volume of water required to provide the difference between instantaneous demand and maximum day system requirements which are used to design pump and treatment components. This amount is equal to one quarter of maximum day demand.
  - b) **Fire protection** – this is a volume of water available from storage equal to the potential fire demand within the reservoir supply area. The minimum recognized volume is either 220 lgpm for two hours or 440 lgpm for one hour duration (26,400 lg).
  - c) **Emergency storage** – this is the volume of water held for supply of the utility during extended power outages and is related to typical system demand and duration of outages. If fire protection is also provided, additional emergency storage is not often considered in the reservoir volume calculation.

Reservoir sizing is usually taken as the worst of a+b or a+c.

- 7) Summary of Future Requirements
- a) Maximum Day Flow Rate - 500 lgpconpd
  - b) Peak Hour Flow Rate - 3 times maximum day flow rate
  - c) Annual Average Flow Rate - maximum day/1.5 = 333 lgpconpd
  - d) Fire Protection - 440 lgp for 1 hour = 26,400 lg
  - e) System Operating Pressure at Property - 35-120 psi
  - f) Reservoir Storage - balancing + fire protection  
=  $\frac{500 \times 277}{4} + 26,400 = 61,025$
  - g) Population Development (2007) - 218 lots serviced, 277 potential,  
74 full-time residents

**Note:** The utility is metered at the wells and treatment plant only; there are no individual household meters. In 2006, the maximum day metered use was approximately 30,000 lg which would indicate that maximum day demand was significantly lower than the 500 lgpconpd design value, however, corresponding storage reservoir levels were not taken into account in this evaluation. Typically, water systems based upon groundwater sources use significantly less than the 500 lgpconpd value, however, if this figure is used, the utility would require groundwater sources in excess of 96 lgp, compared to the present day 20-35 lgp +/- potential.

### 3.3 Water Quantity

The availability of groundwater on the Gulf Islands is a concern. The three existing wells used by the utility have in general provided an adequate supply to meet existing demand, however, they will need to be augmented for future development to occur within the existing subdivision. The design flow rates are considered high compared to recorded rates. Typically groundwater systems report less unit consumption than do systems relying on a surface water source owing to perceived availability. The accurate measurement of well production, individual use, water into and out of storage is essential to maximize the capacity of these limited sources. Through timely metering, a comparison between production and individual use can be made, such that system losses due to leakage can be minimized. This will also lead to a better understanding of usage trends and will enable the VPWID to plan for future resource development or the implementation of water use restrictions for excessive use. Mayne Island has implemented a rainwater collection scheme and encourages homeowners to collect their own water for outside uses such as gardening; with a little planning and adequate storage containment, the 650 mm annual precipitation can be collected off roof runoff for use in the garden at times of the year when precipitation is at a minimum.

### 3.4 Water Quality

Historical water quality data for the three source wells was supplied by M.B. Labs at the request of the VPID. In addition, periodic distribution system sampling was included. These tests included metals (ICP) bacteria, THM's and algae; they are included in Appendix A. concerns include manganese, iron and pH levels as well as arsenic and lead. Calcium buildup in discharge pipework at Wells #9 and #14 has resulted in reduced pumping potential of these sources. Some turbidity issues have been reported in the distribution system.

### 3.5 Waste Product Disposal

Treatment and disposal of filter backwash water in a manner sensitive to the receiving environment has become a focus for the water industry in BC. It has been common practice in the past to discharge the backwash water to a drainage course or to a surface water supply. Where conventional wastewater collection and treatment systems are in place, the byproduct may be routed to such a system. While Village Point may have such a system in place to receive the waste, the water plant is remote from the sewer collection system making the interconnection a costly endeavor. More likely the water will likely need to be collected and transported to a facility off Mayne Island.

## CHAPTER 4 – SYSTEM IMPROVEMENTS

### 4.1 General

The system is approximately 35-40 years old, supplied from three of 12 existing wells; the wells have limited capacity and periodically exhibit elevated iron, manganese and arsenic levels as well as salinity and bacteria (e-coli). Raw water is chlorinated and some of the flow is filtered, but not all. There are five storage tanks, three of which are out of service, needing to be structurally evaluated and if acceptable then recoated, prior to being brought back on line. The water is distributed to the customer through 150 mm, 100 mm and 50 mm mains. The system is not considered to have sufficient treatment to ensure water quality consistently meets CDWQG.

For the CRD to take over the infrastructure of the VPWID to form a new CRD water service, a commitment would be required from the residents of VPWID to fund various system improvements.

The improvements considered necessary to ensure the supply of an adequate volume of potable water to CDWQG for the community include the following:

- Provide adequate treatment to all existing sources to ensure compliance with CDWQG.
- Provide for adequate disposal of residuals from the new water treatment process.
- Provide and monitor primary and secondary disinfection of the treated water such that a measurable residual is maintained.
- Provide alternate "Point of Use" treatment for the two properties adjacent to Well #15, or remove them from the system.
- Provide new metering at each source, meter flow into and out of system storage and install individual household meters along with double check valving at the meter setters.
- Modify and augment storage for raw and treated water at the existing reservoir site to ensure adequate storage for low flow periods, and enhanced treatment and disinfection of final water.
- Perform maintenance on valving, hydrants and standpipes within the system. Swab the watermain system on completion of the system upgrade to avoid bacterial regrowth.
- Provide control and monitoring equipment at each well site, reservoir and treatment facilities and provide for remote monitoring of the system through the CRD's SCADA system.
- Complete necessary works to the nine original wells such that they are in compliance with provincial requirements for groundwater protection. Evaluate each well to identify production and water quality to determine whether they can be utilized in future to augment supply for the utility.

### 4.2 Source Treatment

Well #15 is the main supply to the system and is rated at 10-12 l/gpm. It is backed up by Well #9 which is rated at 18-20 l/gpm, but has been more recently recorded in September 2006 to produce 9 l/gpm. Well #14 is the third on-line source with very limited potential equivalent to 1-3 l/gpm. These give a potential of between 20-35 l/gpm which would be insufficient to meet design criteria for the development, so consideration should be given to develop alternate sources of water. The present sources have periodically elevated levels of manganese, iron, arsenic and calcium which are considered as a problem, as is saline intrusion if Well #15 is drawn down too far. Well #15 has also reported periodic bacteria contamination (e-coli). Storage in the wells is not presently adequate to meet peak demand on the system

resulting in well shutdown. It is suggested that for the immediate future a change in system operating philosophy would be appropriate with the existing storage facilities converted to raw water storage allowing well abstraction from all three sources on a continual but reduced production basis. This change would require provision of new treated storage capacity of 50,000 lg but should result in improvement in overall water production from the existing sources which under present operations can be overtaxed during periods of high system usage. The change in operating philosophy would avoid well shut down due to over demand and allow the raw water storage to augment supply to meet the peak demand.

Raw water treatment should be sized for +/- 40 lgpm and could be phased in with two 20 lgpm units in parallel. The existing single green sand filter as a minimum should have new media supplied as the original media is likely not doing an effective job. The filter vessel itself would appear suitable for continued use in conjunction with a new second unit. The removal of manganese, iron and arsenic could be achieved through appropriate filtration, with manganese greensand filtration or an adsorption filtration system as options. Either system would require a small pumped system to transfer the raw water through the treatment process to the treated storage tanks; oxidation of the trace metals may be required to enhance removal. The continued use of green sand should be evaluated from an environmental perspective. Backwash water from the plant may require further treatment prior to discharge or disposal owing to the presence of arsenic and other contaminants in the backwash supply. An option could be to consider one of the adsorption technologies which might be more cost effective option in the long term.

Additional benefit may be achieved through further carbon filtration if taste and odour issues persist; however, this can be added at a later time and is presently not considered as necessary.

This phased approach would allow the community to improve its present situation with respect to quantity and the associated drop in quality at times of high system demand. It would also provide the community with time to evaluate system demand and determine if they were actual demand or losses through the proposed metering works, and enable data to be gathered on other wells in the area before establishing alternate sources of water if required.

#### **4.3 Disinfection**

Disinfection is the destruction or inactivation of pathogenic and non-pathogenic microorganisms existing in the source water to an acceptable level, as determined by the Ministry of Health Services.

There are two types of disinfection, primary, which ensures inactivation of pathogenic organisms prior to the first customer and secondary, which ensures continuation of the disinfection process by maintaining a measurable residual concentration of disinfectant throughout the distribution system.

Chlorine, or one of its related compounds, has historically been the most commonly used primary disinfection agent to control microbial contaminants in drinking water. Others include ozone and ultraviolet light (UV). Secondary disinfection cannot be achieved through ozone or UV as both have short life spans; although good as primary disinfection mediums, they do not provide a residual that can be measured in the distribution system.

Concerns regarding potential health hazards from disinfection by-products (DBP's) has led to limits upon DBP's such as Trihalomethanes (THM's) and halo acetic acids (HAA's). THM's and HAA's result from the reaction between a halogen (chlorine) and precursor (organic or inorganic matter by-product).

It is recommended that UV be used as a primary disinfectant after the filtration process and that chlorination be employed as the secondary disinfectant along with monitoring devices and alarms to ensure the process is working.

#### 4.4 Treatment to Two Properties Adjacent to Well #15

There are two properties connected to the raw water line from Well #15 to the existing system storage tanks. When Well #15 is pumping, chlorine is added at the well head to provide disinfection of the source, however, these two properties are too close to the well for adequate disinfection to have taken place. If the well pump is not running, the properties draw from the water line that is balanced off the 10,000 lg storage tank, this has chlorinated water in it, which by then may or may not have achieved adequate disinfection. This is not a satisfactory situation. These two properties should either be removed off the system, or be provided with "Point of Use" treatment equipment, which is typically located upon a portion of the household system. The potable portion such as a tap used for drinking water and cooking would have the device installed, whereas outside use and the remainder of the individual system would have untreated water.

Construction of a separate main from the treated water storage to these two properties would require approximately 500 m of main and is not considered a financially viable option.

#### 4.5 System Metering

The ability to accurately record water production and usage is essential to be able to operate and maintain a water system with limited capacity to its fullest potential. Metering of the sources, as well as, into and out of the storage facilities is a start, but to complete the picture, individual household meters are essential. With individual household meters in place and a regular data gathering procedure, tracking of water use along with system losses can be closely determined resulting in a more efficiently operated and maintained system. The benefit of this program is a more cost effective program of water source development and treatment avoiding the need to increase production to account for system losses.

#### 4.6 System Storage

The existing system storage consists of five steel tanks with a total capacity of 77,000 lg, however, presently three of these tanks are not in service due to their condition including that of their internal coating. The remaining two in use provide 35,000 lg capacity.

It is proposed to complete a structural review of all five tanks, to recoat as necessary and if suitable use all five as a raw water storage facility. This will optimize the capacity of the existing wells by reducing peak demand on these resources by utilizing the raw water storage as a buffer against high system demand. Pumping the sources at a slower rate over a longer period of time is generally a better way to operate a well, as the drawdown is not as severe. However, it requires that high system demand be made up from storage.

Treated water storage would be provided through a new 50,000 lg storage tank that will receive treated water pumped from raw water storage through the treatment process, before distribution to the consumer. There would need to be some on site pipework done to permit the tanks to be reconfigured to this method of operation of the system.

#### 4.7 Asset Management

The Village Point water system was installed in the 1970's. In recent years data collection and system maintenance appear to be well above average for this kind of system considering the financial restraints typically encountered by Improvement Districts. However, all water system components have a working life and will need a program to ensure each meets its service life and maintains the necessary performance through its life.

If the CRD were to take over the system, a cataloguing of all system components would be undertaken. Mechanical components such as hydrants, standpipes, valves and pumps would be evaluated, service

life determined, and a strategy implemented to replace or repair, as necessary. The costs included in this report are to evaluate the condition of the various components rather than to replace these components. Those costs would, as necessary, be budgeted for in subsequent years.

Unidirectional swabbing of the mains in the system, which is the hydraulic pushing of a series of synthetic bullet shaped sponges with plastic heads, through the pipe to clean out the debris that adheres to the side walls of the water pipe over time, is also considered necessary. The swabbing program should reduce periodic issues with turbidity and coloured water on Spinnaker Drive which have been identified and will reduce the opportunity for bacterial regrowth in the system. Swabbing is recommended as opposed to flushing as it uses less volume of water to achieve better results.

#### **4.8 Supervisor Control and Data Acquisition (SCADA) and System Monitoring**

The existing control system is a hardwired system connecting Well #15 to the storage reservoirs which automatically starts and stops the well pump when levels in storage reach preset levels. The meters at the three wells and at the filter building are the only existing on line monitoring equipment; they are manually read.

If the CRD were to take over the system, instrumentation to monitor and/or control operation of the system would be required at all three wells, at the storage tanks and at the filtration/treatment building to ensure adequate treatment and operational parameters were being met in compliance with CDWQG's. This information would also be remote monitored and archived by the CRD SCADA system on the Saanich Peninsula. The most critical processes on the system would be alarmed and monitored on a continuous basis such that if certain criteria were not met the process could be shut down and the operator could be alerted to the condition. The method of communication from the island to the Saanich Peninsula would be radio.

#### **4.9 Groundwater Protection Regulations**

The province undertook a field inspection of the unused wells owned by VPID in June 2006; the purpose of the inspection was to assess the compliance of these wells with standards in the BC Water Act, Groundwater Protection Regulation (GWPR). Many of these standards relate to wells constructed or altered after November 1, 2005. The purpose of the regulations are to safeguard the groundwater sources from potential contamination caused by improperly constructed, sealed or capped wells that could act as a conduit for contamination of that resource. The regulations also provide for cataloguing of the resource. The wells were all in compliance with the GWPR, except Well #12, which had a compromised casing that had artesian flow coming from it. The other wells were in compliance but it was recommended that their present caps be replaced with lockable watertight models and that casings be extended a minimum of 30 cm above local grade, if they were not already.

The province suggested that VPID may wish to provide periodic monitoring of the various well sites, as such information could prove valuable if any of these sources should be needed for further development. It is recommended that this monitoring be undertaken.

4.10 Summary of Improvement Costs

The costs associated with the aforementioned system improvements required for the CRD to take over and operate the system would be as follows, based upon 2007 dollars:

<b>System Improvement</b>	<b>Cost</b>
Treatment	\$140,000
Disinfection, Primary and Secondary	50,000
Point of Use Treatment	20,000
System Metering	340,000
Reservoir Storage and Site Pipework	305,000
Asset Program Development	70,000
SCADA, Monitoring and Alarms	160,000
<b>Total</b>	<b>\$1,085,000</b>

The provincial and federal government have in the past provided grants to assist with capital expenditures for water and sewer projects to municipal and regional levels of government, Improvement Districts are not eligible for these grants. The grants, if available, have covered up to 2/3 of eligible costs, eligibility has been mainly related to water quality and conservation issues and is not available for expansion of an undersized system, also in the past the program has not considered in house CRD costs as eligible. If the CRD were to administer these works to be done by consultants and contractors, the estimated additional administrative cost would be \$50,000.

The overall cost of the project if the VPWID decided to become a CRD local water service would be \$1,135,000 of which 2/3 funding may be available for costs outside of the \$50,000 CRD administrative costs if grants were made available. The costs to the utility could vary between \$1,135,000 and \$411,500 dependent upon level of grant, if any. At present there are no grants available for these works.

4.11 Operation and Maintenance Costs

If the residents decide to become a local service of the CRD, an elected committee of the residents would work with CRD staff on issues related to the utility. One of those issues is the development of an annual budget for operation and maintenance (O&M) of the water system. The annual O&M budget has been developed from a format used at other CRD Gulf Island water utilities. The O&M costs estimated for the first year of operation (2008) of the water system at Village Point by the CRD amount to \$105,000. A breakdown of these costs is as follows:

a)	Insurance	\$2,000
b)	Water Testing - based upon four THM's at two locations, 12 bacterial at four locations and two ICP's at storage tank	3,000
c)	System Maintenance - operate/fix valves, pumps, hydrants, chlorination system	16,000
d)	Rental - specific equipment/machinery	1,000
e)	Staffing - operational, technical, part-time operator 20 hours/week	50,000
f)	Electricity - pump, chlorinator, monitors	3,000
g)	Supplies - office, lights, tools	1,000
h)	Administration - financial, committee, secretarial, meetings	8,000
i)	Chemicals	2,000
j)	Miscellaneous - system permit, telephone, mail, travel, advertising, printing, courier, meetings	4,000
k)	Residuals disposal	15,000
<b>TOTAL</b>		<b>\$105,000</b>

Funds that are unexpended or over expended at year end are rolled over either as a surplus or as a deficit to the following year's budget.

Based upon the 218 properties connected, the annual O&M cost would be \$482, per serviced property. The O&M costs are usually allocated as a user fee, so that properties within the service area that are not provided with the service do not pay until they are provided with the service. In the case of the capital expenses, all lots within the service area pay the annual fee, whether they are serviced or not.

**CHAPTER 5 – FINANCIAL ANALYSIS**

5.1 General

The financial analysis is provided for the benefit of residents of the VPID to assist them in making a decision whether or not to carry out the proposed works in concert with the formation of a new water service under the CRD. The analysis assumes that the capital improvements required would be financed through the CRD over a 15-year borrowing period. The borrowing would be through the Municipal Finance Authority (MFA). The rate shown is thought to represent what would be available through the MFA in the year 2007/2008.

5.2 Estimated Capital Debt and Annual Repayment

The estimated capital debt to be financed would be \$1,135,000 or possibly \$411,500 if government grants of up to 2/3 of eligible components were available for health and conservation aspects of the project.

The annual repayment charge is calculated based upon a 6% interest rate, with a debt repayment term of 15 years.

Annual repayment upon \$1,135,000 <sup>(1)</sup>	\$124,216
Annual repayment upon \$411,500 <sup>(2)</sup>	\$45,035
Annual capital repayment <sup>(1)</sup> (parcel tax)	\$449
Annual capital repayment <sup>(2)</sup> (parcel tax)	\$163

<sup>(1)</sup> no grants available

<sup>(2)</sup> grants of 2/3 of eligible components available

5.3 Estimated Operating, Maintenance and Project Costs

The estimated annual O&M costs	\$105,000
Total annual capital, O&M costs with no grants	\$229,216
Total annual capital, O&M costs with grants	\$150,035

5.4 Cost Recovery

The capital debt repayment and annual operating and maintenance costs can be recovered from the ratepayers in a variety of methods. A parcel tax is uniform tax to each parcel of land in the service area, whether or not connected to the water system. A user charge is a fixed charge allocated to only those users who are physically connected to the water system. A variable user charge can be implemented based on actual metered use. Costs can also be recovered through a frontage tax or based on the property assessment, although a frontage tax is more difficult to apply in rural areas where property frontages may vary widely from resident to resident.

5.5 Annual Charges

For purposes of this report, the fees to be recovered are assumed to be recovered using a combined parcel tax, for recovery of the capital improvements and a fixed user fee, for recovery of the annual operating and maintenance costs.

The estimated annual cost per parcel for capital improvements based on 277 lots in the system would be \$449 without grants or \$163 if grants were provided for eligible components to assist with the capital projects.

The estimated annual cost per user for O&M costs is based upon the 218 serviced parcels and would be \$482. The combined annual cost of parcel tax and user fee would be \$931 without grants or \$645 if grants were provided for the health and conservation related items.

#### 5.6 Project Implementation

The assent of the residents of the VPWID is required before the CRD Board can establish a new water local service to take over the ownership and operation of the Improvement District. The CRD Board could be requested to host a referendum on the issue, or the Improvement District could conduct a petition on its own behalf to obtain the necessary approval.

## CHAPTER 6 – CONCLUSIONS

### 6.1 Conclusions

The following conclusions are made:

- a) VPWID consists of 277 lots, 218 of which are connected to the water system, with 74 full-time residents.
- b) The source of water is from three wells drilled in the 1970's: Well #15 is the main source, rated at 10-12 lgpm; Well #9 is the back-up, rated at 18-20 lgpm, but most recently reported at 9 lgpm; and Well #14 can only operate in the 1-3 lgpm range. There are additional wells which have been abandoned by or not used by the Improvement District at present.
- c) The three available sources have periodic issues with manganese, iron, calcium, arsenic, salinity and bacteria. Wells in the general proximity of the water district have also a demonstrated problem with arsenic and other minerals.
- d) There are periodic distribution system issues with bacteria and turbidity. There are expected to be non coliform regrowth problems.
- e) There are two properties adjacent to Well #15, that are serviced off the raw water line, which periodically receive water that may not have been adequately disinfected.
- f) The existing treatment includes disinfection with chlorine as well as filtration of water from wells #9 and #14 through a manganese greensand filter. Well #15 feeds directly into the system with only chlorination at source. Backwash water treatment may be a requirement.
- g) There are five steel storage tanks at a common site with a combined capacity of 77,000 lg, however, three are out of service leaving the capacity available at 35,000 lg.
- h) The system is metered at each well head and also after filtration at discharge to the distribution system. There is no individual metering in place, nor remote monitoring of operating condition..
- i) The system is well operated, within a limited financial structure. Maintenance of the valves, hydrants and mechanical components has been limited due to financial constraints.
- j) Average system usage is 15,000 lgpd rising to 30,000 lgpd in the summer, with winter rates down to 8,000 lgpd.
- k) If CRD were to convert the Improvement District to a service of the CRD it would require considerable capital upgrade works to be funded. These works would optimize the existing groundwater sources, provide additional storage for treated water, provide water treatment for removal of arsenic and manganese and reduction of turbidity, would resolve a local treatment issue for two properties, would provide universal metering of all properties and would implement an asset management and remote monitoring system.
- l) Capital upgrades necessary if the VPWID decide to become a CRD local water service would cost \$1,135,000, which would be equivalent to an annual cost over 15 years of \$449 per parcel or \$163 if grants were obtained from a senior government infrastructure program.
- m) Annual O&M costs for the utility have been estimated at \$105,000 for 2008 which is equivalent to \$482 per user for the 218 connected services.

**APPENDIX A**

**VILLAGE POINT WATER QUALITY DATA**

**November 2004**

**January 2005**

**March 2005**

**June 2005**

**October 2005**

**December 2005**

**March 2006**

**April 2006**

**June 2006**

**November 2006**

**Various ICP, THM's, Bacteria**

Village Pt Improvm't Dist  
Box 3  
Mayne Island, BC  
VON 2J0

03Nov04 8:52a W61384  
Well  
water  
4

TEL: (250) 539-2202  
FAX: (250) 539-2202

Arrival temp.: 8.0C

Samples: 1) Well 9 02NOV04 04:35p 2) W14 02NOV04 04:35p  
3) Well 15 02NOV04 03:15p

ELEMENTS		1 SAMPLE	2 SAMPLE	3 SAMPLE	UNITS	Maximum Limits Permissible In Drinking Water*
1) Aluminium	Al	0.090	<0.065	0.104	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	16.3	ug/L	25.0 ug/L
4) Barium	Ba	<0.009	0.011	<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	0.172	0.178	0.453	mg/L	5.00 mg/L
7) Cadmium	Cd	0.169	0.104	0.122	ug/L	5.00 ug/L
8) Calcium	Ca	43.4	11.6	12.7	mg/L	200 mg/L
9) Chromium	Cr	<0.010	<0.010	<0.010	mg/L	0.050 mg/L
10) Cobalt	Co	<0.020	<0.020	<0.020	mg/L	no limit listed
11) Copper	Cu	<0.008	0.009	<0.008	mg/L	1.00 mg/L
12) Gold	Au	<0.040	<0.040	<0.040	mg/L	no limit listed
13) Iron	Fe	0.076	3.83	0.042	mg/L	0.300 mg/L
14) Lanthanum	La	<0.020	<0.020	<0.020	mg/L	no limit listed
15) Lead	Pb	<0.500	0.990	3.60	ug/L	10.0 ug/L
16) Magnesium	Mg	10.6	3.23	3.49	mg/L	50.0 mg/L
17) Manganese	Mn	0.088	0.014	0.033	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	<0.065	<0.065	<0.065	mg/L	no limit listed
22) Potassium	K	1.44	1.01	2.00	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	50.0 ug/L
25) Silicon	Si	9.37	8.00	7.92	mg/L	no limit listed
26) Silver	Ag	<0.010	<0.010	<0.010	mg/L	0.050 mg/L
27) Sodium	Na	16.3	10.6	153	mg/L	200 mg/L
28) Strontium	Sr	0.194	0.065	0.141	mg/L	no limit listed
29) Tin	Sn	<0.020	<0.020	<0.020	mg/L	no limit listed
30) Titanium	Ti	<0.010	0.011	<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	0.031	0.037	0.024	mg/L	5.00 mg/L
Hardness (mg/L CaCO3)		152	42.3	46.0	mg/L	0-75 mg/L = soft
pH		6.92	5.94	7.88	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 the Canadian Council of Resource and  
Environment Ministers - Guidelines for Canadian Drinking Water Quality, 1996.

R. Bilodeau  
Analytical Chemist

H. Hartmann  
Sr. Analytical Chemist

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Village Pt Improvm't Dist  
Box 3  
Mayne Island, BC  
VON 2J0

03Nov04 8:52a  
Well  
water  
4

W61384 pg2

TEL: (250) 539-2202  
FAX: (250) 539-2202

Arrival temp.: 8.0C

Samples: 1) Well 9 02NOV04 04:35p 2) W14 02NOV04 04:35p  
3) Well 15 02NOV04 03:15p

Comments:

Iron: high amounts of Iron can cause staining of laundry, porcelain and plumbing fixtures; can produce an undesirable taste. Essential for health.  
Manganese: not considered to be toxic; high amounts of Manganese can cause staining of laundry, porcelain and plumbing fixtures; may produce an undesirable taste.  
pH: extremes in pH can lead to corrosion (too low) or incrustation (too high) of pipes & plumbing fixtures. Water with low pH allows metals to dissolve into water; water with high pH reduces disinfection efficacy, increases THM & scale formations.

\_\_\_\_\_  
R. Bilodeau  
Analytical Chemist

\_\_\_\_\_  
H. Hartmann  
Sr. Analytical Chemist

M.B. LABS LTD  
T: 656-1334 P: 656-0443 E: mblabs@pacificcoast.net W: www.mblabs.com

Village Pt Improvm't Dist  
Box 3  
Mayne Island, BC  
VON 2J0

03Nov04 8:52a  
Well  
water  
4

W61384 pg3

TEL: (250) 539-2202  
FAX: (250) 539-2202

Arrival temp.: 8.0C

SAMPLE	DATE	TIME	TIM (ppb)
Mariners	03NOV04	07:00a	33.6
Lab Blank			ND
So			0.030
REF. VALUE			10.0
STD ñ 2SD			9.84 ñ 1.12

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

#### TRihalOMETHANES

SAMPLE	DATE	TIME	CHCl3 ug/L	CHBr3 ug/L	BrCl2CH ug/L	ClBr2CH ug/L
Mariners	03NOV04	07:00a	12.6	2.38	10.2	8.43
Lab Blank			<0.10	<0.10	<0.10	<0.10

#### Reference Standard % Recovery

CHCl3	Chloroform	98
CHBr3	Bromoform	99
BrCl2CH	Bromodichloromethane	100
ClBr2CH	Chlorodibromomethane	98

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.

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

P. Jakubowski  
Organic Chemist

H. Hartmann  
Sr. Analytical Chemist

M.B. LABS LTD  
Fax: 656-0443

□

Village Pt Improvm't Dist  
Box 3  
Mayne Island, BC  
V0N 2J0

04Jan05 2:30p W62045  
FWS  
water  
1

TEL: (250) 539-2202  
FAX: (250) 539-2202

Arrival temp.: 10.0C

Sample: Spinnaker 226 03Jan05

ELEMENTS	SAMPLE	UNITS	Maximum Limits Permissible In Drinking Water*	
1) Aluminium	Al	0.088	mg/L	no limit listed
2) Antimony	Sb	<0.500	ug/L	6.00 ug/L
3) Arsenic	As	<0.500	ug/L	25.0 ug/L
4) Barium	Ba	0.011	mg/L	1.00 mg/L
5) Beryllium	Be	<0.003	mg/L	no limit listed
6) Boron	B	0.358	mg/L	5.00 mg/L
7) Cadmium	Cd	<0.100	ug/L	5.00 ug/L
8) Calcium	Ca	24.5	mg/L	200 mg/L
9) Chromium	Cr	<0.010	mg/L	0.050 mg/L
10) Cobalt	Co	<0.020	mg/L	no limit listed
11) Copper	Cu	0.032	mg/L	1.00 mg/L
12) Gold	Au	<0.040	mg/L	no limit listed
13) Iron	Fe	1.02	mg/L	0.300 mg/L
14) Lanthanum	La	<0.020	mg/L	no limit listed
15) Lead	Pb	1.78	ug/L	10.0 ug/L
16) Magnesium	Mg	6.61	mg/L	50.0 mg/L
17) Manganese	Mn	0.788	mg/L	0.050 mg/L
18) Molybdenum	Mo	<0.020	mg/L	no limit listed
19) Nickel	Ni	<0.050	mg/L	no limit listed
20) Phosphorus	P	0.073	mg/L	no limit listed
21) Potassium	K	0.830	mg/L	no limit listed
22) Scandium	Sc	<0.050	mg/L	no limit listed
23) Silicon	Si	7.25	mg/L	no limit listed
24) Silver	Ag	<0.010	mg/L	0.050 mg/L
25) Sodium	Na	48.0	mg/L	200 mg/L
26) Strontium	Sr	0.127	mg/L	no limit listed
27) Titanium	Ti	<0.010	mg/L	no limit listed
28) Tungsten	W	<0.050	mg/L	no limit listed
29) Vanadium	V	<0.010	mg/L	no limit listed
30) Zinc	Zn	0.043	mg/L	5.00 mg/L
Hardness (mg/L CaCO3)		88.4	mg/L	75-150 mg/L = moderately hard
pH		7.83	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 the Canadian Council of Resource and Environment Ministers - Guidelines for Canadian Drinking Water Quality, 1996.

Comments:

Iron: high amounts of Iron can cause staining of laundry, porcelain and plumbing fixtures; can produce an undesirable taste. Essential for health.  
Manganese: not considered to be toxic; high amounts of Manganese can cause staining of laundry, porcelain and plumbing fixtures; may produce an undesirable taste.

R. Bilodeau  
Analytical Chemist

H. Hartmann  
Sr. Analytical Chemist

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Village Pt Improvm't Dist  
Box 3  
Mayne Island, BC  
V0N 2J0

18Jan05 12:24p  
FWS  
water  
1

W62156

TEL: (250) 539-2202  
FAX: (250) 539-2202

Arrival temp.: 14.0C

Sample		lactose fermentors	Coliforms		Yeast/Fungi	TPC*
			Total	Fecal		
223 Spinnaker	18Jan05	ND	ND	ND	ND / ND	0.80

\* all counts are colony forming units per milli-litre

ND = none detected

TPC = total plate count- spread plate method - 35C/48hr TGEA  
FDA/BAM 8th ed, 1995 + Revision A, 1998

Comments:

For Interpretation of Results:

Total or Fecal Coliforms present greater than 0 CFU/100mL (0 CFU/mL):  
IF Coliform numbers exceed safe limits for drinking water-  
water is not suitable for drinking without treatment.

Total Non-coliform bacteria (=Lactose Fermentors) equal to or greater than  
200 CFU/100mL (2.0 CFU/mL):  
IF the number of organisms present exceed recommended guidelines for  
drinking water; treatment is strongly recommended.

Total Plate Count bacteria are -

- A) greater than 100 CFU/mL:  
IF high numbers of microbial organisms indicate that this water supply  
should be monitored on a seasonal basis.
- B) greater than 500 CFU/mL:  
IF the number of organisms present exceed recommended guidelines for  
drinking water; treatment is strongly recommended.

\_\_\_\_\_  
T. Winchester  
Microbiologist

\_\_\_\_\_  
W. Riggs  
Sr. Microbiologist

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□

Village Pt Improvm't Dist  
 Box 3  
 Mayne Island, BC  
 V0N 2J0

30Mar05 10:53a W63015  
 FWS  
 water  
 4

TEL: (250) 539-2202 Arrival temp.: 15.0C  
 FAX: (250) 539-2202

Samples: 1) East Mariners 29MAR05 05:40p 2) Well 9 29MAR05 05:10p  
 3) Well 14 29MAR05 05:20p 4) Well 15 29MAR05 04:15p

ELEMENTS		1 SAMPLE	2 SAMPLE	3 SAMPLE	4 SAMPLE	UNITS	Maximum Limits In Drinking Water*
1) Aluminium	Al	<0.065	<0.065	<0.065	<0.065	mg/L	no limit listed
2) Antimony	Sb	<0.500	<0.500	<0.500	<0.500	ug/L	6.00 ug/L
3) Arsenic	As	4.49	<0.500	<0.500	2.57	ug/L	25.0 ug/L
4) Barium	Ba	<0.009	<0.009	<0.009	<0.009	mg/L	1.00 mg/L
5) Beryllium	Be	<0.003	<0.003	<0.003	<0.003	mg/L	no limit listed
6) Boron	B	0.213	0.112	0.117	0.214	mg/L	5.00 mg/L
7) Cadmium	Cd	<0.100	<0.100	<0.100	<0.100	ug/L	5.00 ug/L
8) Calcium	Ca	27.0	38.0	10.6	23.8	mg/L	200 mg/L
9) Chromium	Cr	<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	mg/L	no limit listed
11) Copper	Cu	0.019	<0.008	0.014	0.014	mg/L	1.00 mg/L
12) Gold	Au	<0.040	<0.040	<0.040	<0.040	mg/L	no limit listed
13) Iron	Fe	0.020	<0.010	3.49	0.111	mg/L	0.300 mg/L
14) Lanthanum	La	<0.020	<0.020	<0.020	<0.020	mg/L	no limit listed
15) Lead	Pb	1.08	<0.500	<0.500	6.61	ug/L	10.0 ug/L
16) Magnesium	Mg	7.57	10.5	3.22	7.16	mg/L	50.0 mg/L
17) Manganese	Mn	<0.004	0.113	<0.004	<0.004	mg/L	0.050 mg/L
18) Molybdenum	Mo	<0.020	<0.020	<0.020	<0.020	mg/L	no limit listed
19) Nickel	Ni	<0.050	<0.050	<0.050	<0.050	mg/L	no limit listed
20) Phosphorus	P	0.257	<0.065	0.211	<0.065	mg/L	no limit listed
21) Potassium	K	1.25	1.08	1.02	1.22	mg/L	no limit listed
22) Scandium	Sc	<0.050	<0.050	<0.050	<0.050	mg/L	no limit listed
23) Silicon	Si	7.83	8.01	6.62	9.09	mg/L	no limit listed
24) Silver	Ag	<0.010	<0.010	<0.010	<0.010	mg/L	0.050 mg/L
25) Sodium	Na	41.5	12.8	6.92	39.5	mg/L	200 mg/L
26) Strontium	Sr	0.138	0.171	0.057	0.131	mg/L	no limit listed
27) Titanium	Ti	<0.010	<0.010	<0.010	<0.010	mg/L	no limit listed
28) Tungsten	W	<0.050	0.103	<0.050	<0.050	mg/L	no limit listed
29) Vanadium	V	<0.010	<0.010	<0.010	<0.010	mg/L	no limit listed
30) Zinc	Zn	0.194	0.173	0.231	0.231	mg/L	5.00 mg/L
Hardness (mg/L CaCO3)		98.5	138	39.7	88.9	mg/L	75-150 mg/L=mod.hard
pH		7.02	6.75	5.81	6.69	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 the Canadian Council of Resource and  
 Environment Ministers - Guidelines for Canadian Drinking Water Quality, 1996.

R. Bilodeau  
 Analytical Chemist

H. Hartmann  
 Sr. Analytical Chemist

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Village Pt Improvm't Dist  
Box 3  
Mayne Island, BC  
V0N 2J0

30Mar05 10:53a  
FWS  
water  
4

W63015 pg2

TEL: (250) 539-2202  
FAX: (250) 539-2202

Arrival temp.: 15.0C

Samples: 1) East Mariners 29MAR05 05:40p 2) Well 9 29MAR05 05:10p  
3) Well 14 29MAR05 05:20p 4) Well 15 29MAR05 04:15p

Comments:

Iron: high amounts of Iron can cause staining of laundry, porcelain and plumbing fixtures; can produce an undesirable taste. Essential for health.  
Manganese: not considered to be toxic; high amounts of Manganese can cause staining of laundry, porcelain and plumbing fixtures; may produce an undesirable taste.  
pH: extremes in pH can lead to corrosion (too low) or incrustation (too high) of pipes & plumbing fixtures. Water with low pH allows metals to dissolve into water; water with high pH reduces disinfection efficacy, increases THM & scale formations.

\_\_\_\_\_  
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Analytical Chemist

\_\_\_\_\_  
H. Hartmann  
Sr. Analytical Chemist

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Village Pt Improvm't Dist  
Box 3  
Mayne Island, BC  
VON 2J0

30Mar05 10:53a  
FWS  
water  
4

W63015 pg3

TEL: (250) 539-2202  
FAX: (250) 539-2202

Arrival temp.: 15.0C

SAMPLE	DATE	TIME	THM (ppb)
East Mariners	29MAR05	05:40p	30.4
Lab Blank			ND
So			0.030
REF. VALUE			50.0
STD ñ 2SD			50.7 ñ 4.86

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

#### TRIHALOMETHANES

SAMPLE	DATE	TIME	CHCl3 ug/L	CHBr3 ug/L	BrCl2CH ug/L	ClBr2CH ug/L
East Mariners	29MAR05	05:40p	14.8	ND	9.91	5.68
Lab Blank			<0.10	<0.10	<0.10	<0.10

Reference Standard	% Recovery
CHCl3 Chloroform	89
CHBr3 Bromoform	99
BrCl2CH Bromodichloromethane	100
ClBr2CH Chlorodibromomethane	103

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.

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

\_\_\_\_\_  
P. Jakubowski  
Organic Chemist

\_\_\_\_\_  
H. Hartmann  
Sr. Analytical Chemist

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□

Village Pt. Improvm't Dist  
Box 3  
Mayne Island, BC  
V0N 2J0

08Jun05 8:46a W63939

FWS  
water  
1

TEL: (250) 539-2202  
FAX: (250) 539-2202

Arrival temp.: 6.0C

Sulfur			T.As	Pb	Hg	
(mg/L)	SAMPLE	DATE	TIME	(ug/L)	(ug/L)	(ug/L)
12.4	Mariners	08Jun05		3.11	ND	ND
ND	Lab Blank			ND	ND	ND
0.030	So			0.030	0.150	0.150
10.0	REF. VALUE			10.0	16.0	5.00
9.82	STD $\bar{n}$ 2SD			9.92 $\bar{n}$ 0.785	15.6 $\bar{n}$ 1.25	5.08 $\bar{n}$ 0.525

SD = standard deviation

STD = secondary standard calibrated to primary standard reference material

So = standard deviation at zero analyte concentration; method detection limit  
is generally considered to be 3x So value

ND = none detected n/a = not applicable

\_\_\_\_\_  
R. Bilodeau  
Analytical Chemist

\_\_\_\_\_  
H. Hartmann  
Sr. Analytical Chemist

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□

Village Pt. Improvm't Dist  
Box 3  
Mayne Island, BC  
V0N 2J0

09Jun05 12:38p  
FWS  
water  
2

W63978

TEL: (250) 539-2202  
FAX: (250) 539-2202

Arrival temp.: 15.0C

Site Code	Date	Time	CFU/100 ml		CFU/100 ml	
			TC	NC	FC	NC
Tank 5	09Jun05	10:15a	0	0	0	0

TC = total coliform bacteria  
FC = fecal coliform bacteria  
NC = non-coliform bacteria

Results may be adversely affected if samples are submitted to the laboratory more than 24 to 30 hours after collection.

- see following page for algal results -

\_\_\_\_\_  
T. Winchester  
Microbiologist

\_\_\_\_\_  
W. Riggs  
Sr. Microbiologist

M.B. LABS LTD  
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Village Pt Improvm't Dist  
Box 3  
Mayne Island, BC  
V0N 2J0

09Jun05 12:38p  
FWS  
water  
2

W63978 pg2

TEL: (250) 539-2202  
FAX: (250) 539-2202

Arrival temp.: 15.0C

ALGAE

Sample	TOTAL Cells/100cc	per_100cc	Organisms_Identified	Comments
Well 9 09Jun05 10:30a	x 10	x 10	-	-

BA - bacterium	D - diatom	Z - protozoan
BG - bluegreen/Cyanophyte	DI - Dinoflagellate	ZF - zooflagellate
CH - green/Cholorphyte	EU - Euglenophyte	ZP - zooplankton
CL - protozoan ciliate	O - other	
CR - Cryptophyte	R - red/Rhodophyte	
CY - yellow/Chrysophyte		

K. Hooper  
Phycologist

W. Riggs  
Sr. Microbiologist

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Village Pt Improvm't Dist  
Box 3  
Mayne Island, BC  
V0N 2J0

09Jun05 12:38p  
FWS  
water  
2

W63978 pg2

TEL: (250) 539-2202  
FAX: (250) 539-2202

Arrival temp.: 15.0C

ALGAE

Sample	TOTAL Cells/100cc	per_100cc	Organisms_Identified	Comments
Well 9 09Jun05 10:30a	0	0	no algae/protozoa found	n/a
BA - bacterium		D - diatom	Z - protozoan	
BG - bluegreen/Cyanophyte		DI - Dinoflagellate	ZF - zooflagellate	
CH - green/Cholorphyte		EU - Euglenophyte	ZP - zooplankton	
CL - protozoan ciliate		O - other		
CR - Cryptophyte		R - red/Rhodophyte		
CY - yellow/Chrysophyte				

\_\_\_\_\_  
K. Hooper  
Phycologist

\_\_\_\_\_  
W. Riggs  
Sr. Microbiologist

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□

Village Pt Improvm't Dist  
 Box 3  
 Mayne Island, BC  
 V0N 2J0

07Oct05 9:15a  
 FWS  
 water  
 3

W65630

TEL: (250) 539-2202  
 FAX: (250) 539-2202

Arrival temp.: 7.0C

Samples: 1) Well #9 06Oct05 17:45p  
 2) Well #14 06Oct05 17:05p  
 3) Well #15 06Oct05 17:20p

ELEMENTS		1 SAMPLE	2 SAMPLE	3 SAMPLE	UNITS	Maximum Limits Permissible In Drinking Water*
1) Aluminium	Al	0.242	0.209	0.160	mg/L	no limit listed
2) Antimony	Sb	<0.500	<0.500	0.988	ug/L	6.00 ug/L
3) Arsenic	As	1.41	3.63	14.3	ug/L	25.0 ug/L
4) Barium	Ba	<0.009	0.010	0.024	mg/L	1.00 mg/L
5) Beryllium	Be	<0.003	0.003	<0.003	mg/L	no limit listed
6) Boron	B	0.292	0.232	0.472	mg/L	5.00 mg/L
7) Cadmium	Cd	<0.100	0.251	<0.100	ug/L	5.00 ug/L
8) Calcium	Ca	46.1	42.2	7.73	mg/L	200 mg/L
9) Chromium	Cr	0.010	<0.010	0.028	mg/L	0.050 mg/L
10) Cobalt	Co	<0.020	<0.020	<0.020	mg/L	no limit listed
11) Copper	Cu	<0.008	0.009	<0.008	mg/L	1.00 mg/L
12) Gold	Au	<0.040	<0.040	<0.040	mg/L	no limit listed
13) Iron	Fe	0.708	2.85	0.137	mg/L	0.300 mg/L
14) Lanthanum	La	<0.020	<0.020	<0.020	mg/L	no limit listed
15) Lead	Pb	<0.500	0.829	5.85	ug/L	10.0 ug/L
16) Magnesium	Mg	13.7	12.5	2.65	mg/L	50.0 mg/L
17) Manganese	Mn	0.153	0.058	1.08	mg/L	0.050 mg/L
18) Molybdenum	Mo	<0.020	<0.020	<0.020	mg/L	no limit listed
19) Nickel	Ni	0.095	<0.050	<0.050	mg/L	no limit listed
20) Phosphorus	P	0.074	0.119	0.142	mg/L	no limit listed
21) Potassium	K	0.500	0.340	0.680	mg/L	no limit listed
22) Scandium	Sc	<0.050	<0.050	<0.050	mg/L	no limit listed
23) Silicon	Si	9.02	8.13	7.20	mg/L	no limit listed
24) Silver	Ag	<0.010	<0.010	<0.010	mg/L	0.050 mg/L
25) Sodium	Na	1.19	<0.050	94.3	mg/L	200 mg/L
26) Strontium	Sr	0.221	0.205	0.081	mg/L	no limit listed
27) Titanium	Ti	<0.010	<0.010	<0.010	mg/L	no limit listed
28) Tungsten	W	<0.050	<0.050	<0.050	mg/L	no limit listed
29) Vanadium	V	<0.010	<0.010	<0.010	mg/L	no limit listed
30) Zinc	Zn	0.053	0.037	0.045	mg/L	5.00 mg/L
Hardness (mg/L CaCO3)		172	157	30.2	mg/L	150-300 mg/L = hard
pH		7.09	7.08	8.36	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 the Canadian Council of Resource and Environment Ministers - Guidelines for Canadian Drinking Water Quality, 1996.

R. Bilodeau  
 Analytical Chemist

H. Hartmann  
 Sr. Analytical Chemist

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Village Pt Improvm't Dist  
Box 3  
Mayne Island, BC  
V0N 2J0

07Oct05 9:15a  
FWS  
water  
3

W65630 pg2

TEL: (250) 539-2202  
FAX: (250) 539-2202

Arrival temp.: 7.0C

Samples: 1) Well #9 06Oct05 17:45p  
2) Well #14 06Oct05 17:05p  
3) Well #15 06Oct05 17:20p

Comments:

Iron: high amounts of Iron can cause staining of laundry, porcelain and plumbing fixtures; can produce an undesirable taste. Essential for health.

Manganese: not considered to be toxic; high amounts of Manganese can cause staining of laundry, porcelain and plumbing fixtures; may produce an undesirable taste.

\_\_\_\_\_  
R. Bilodeau  
Analytical Chemist

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H. Hartmann  
Sr. Analytical Chemist

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□

Village Pt Improvm't Dist  
Box 3  
Mayne Island, BC  
V0N 2J0

12Dec05 1:45p  
FWS  
water  
1

W66442

TEL: (250) 539-2202  
FAX: (250) 539-2202

Arrival temp.: 3.0C

Sample: Tanks 11Dec05 16:00p

ELEMENTS	SAMPLE	UNITS	Maximum Limits Permissible In Drinking Water*
1) Aluminium	Al 0.128	mg/L	no limit listed
2) Antimony	Sb <0.500	ug/L	6.00 ug/L
3) Arsenic	As 3.61	ug/L	25.0 ug/L
4) Barium	Ba <0.009	mg/L	1.00 mg/L
5) Beryllium	Be <0.003	mg/L	no limit listed
6) Boron	B 0.471	mg/L	5.00 mg/L
7) Cadmium	Cd 1.20	ug/L	5.00 ug/L
8) Calcium	Ca 38.3	mg/L	200 mg/L
9) Chromium	Cr 0.037	mg/L	0.050 mg/L
10) Cobalt	Co <0.020	mg/L	no limit listed
11) Copper	Cu 0.029	mg/L	1.00 mg/L
12) Gold	Au <0.040	mg/L	no limit listed
13) Iron	Fe 2.22	mg/L	0.300 mg/L
14) Lanthanum	La <0.020	mg/L	no limit listed
15) Lead	Pb 1.19	ug/L	10.0 ug/L
16) Magnesium	Mg 10.6	mg/L	50.0 mg/L
17) Manganese	Mn 0.005	mg/L	0.050 mg/L
18) Molybdenum	Mo 0.038	mg/L	no limit listed
19) Nickel	Ni 0.051	mg/L	no limit listed
20) Phosphorus	P <0.065	mg/L	no limit listed
21) Potassium	K 0.290	mg/L	no limit listed
22) Scandium	Sc <0.050	mg/L	no limit listed
23) Silicon	Si 10.2	mg/L	no limit listed
24) Silver	Ag <0.010	mg/L	0.050 mg/L
25) Sodium	Na 36.8	mg/L	200 mg/L
26) Strontium	Sr 0.186	mg/L	no limit listed
27) Titanium	Ti 0.013	mg/L	no limit listed
28) Tungsten	W <0.050	mg/L	no limit listed
29) Vanadium	V 0.011	mg/L	no limit listed
30) Zinc	Zn 0.059	mg/L	5.00 mg/L
Hardness (mg/L CaCO3)	152	mg/L	150-300 mg/L = hard
pH	7.26	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 the Canadian Council of Resource and Environment Ministers - Guidelines for Canadian Drinking Water Quality, 1996.

Comments:

Iron: high amounts of Iron can cause staining of laundry, porcelain and plumbing fixtures; can produce an undesirable taste. Essential for health.

R. Bilodeau  
Analytical Chemist

H. Hartmann  
Sr. Analytical Chemist

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□

Village Pt Improvm't Dist  
 Box 3  
 Mayne Island, BC  
 V0N 2J0

30Mar06 2:58p W67797  
 FWS  
 water  
 4

TEL: (250) 539-2202 Arrival temp.: 8.0C  
 FAX: (250) 539-2202

Samples: 1) Dalton Dr 29Mar06 03:00p 2) Well 9 28Mar06 05:55p  
 3) Well 14 29Mar06 02:10p 4) Well 15 28Mar06 05:20p

ELEMENTS		1	2	3	4	UNITS	Maximum Limits In Drinking Water*
		SAMPLE	SAMPLE	SAMPLE	SAMPLE		
1) Aluminium	Al	0.182	<0.065	0.376	0.540	mg/L	no limit listed
2) Antimony	Sb	<0.500	<0.500	<0.500	<0.500	ug/L	6.00 ug/L
3) Arsenic	As	2.00	<0.500	<0.500	1.13	ug/L	25.0 ug/L
4) Barium	Ba	<0.009	<0.009	0.051	0.024	mg/L	1.00 mg/L
5) Beryllium	Be	<0.003	<0.003	<0.003	0.003	mg/L	no limit listed
6) Boron	B	0.120	<0.050	0.612	0.763	mg/L	5.00 mg/L
7) Cadmium	Cd	<0.100	<0.100	<0.100	<0.100	ug/L	5.00 ug/L
8) Calcium	Ca	26.3	18.4	42.6	51.6	mg/L	200 mg/L
9) Chromium	Cr	<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	mg/L	no limit listed
11) Copper	Cu	0.097	<0.008	0.009	<0.008	mg/L	1.00 mg/L
12) Gold	Au	<0.040	<0.040	<0.040	<0.040	mg/L	no limit listed
13) Iron	Fe	0.012	0.024	3.80	0.190	mg/L	0.300 mg/L
14) Lanthanum	La	<0.020	<0.020	<0.020	<0.020	mg/L	no limit listed
15) Lead	Pb	2.68	2.09	<0.500	2.14	ug/L	10.0 ug/L
16) Magnesium	Mg	8.28	4.62	11.6	15.1	mg/L	50.0 mg/L
17) Manganese	Mn	<0.004	0.103	0.137	0.102	mg/L	0.050 mg/L
18) Mercury	Hg	<0.100	<0.100	<0.100	<0.100	ug/L	1.00 ug/L
19) Molybdenum	Mo	<0.020	<0.020	0.036	<0.020	mg/L	no limit listed
20) Nickel	Ni	<0.050	<0.050	<0.050	<0.050	mg/L	no limit listed
21) Phosphorus	P	0.278	<0.065	<0.065	0.301	mg/L	no limit listed
22) Potassium	K	1.23	1.23	1.16	1.17	mg/L	no limit listed
23) Scandium	Sc	<0.050	<0.050	<0.050	<0.050	mg/L	no limit listed
24) Selenium	Se	<0.500	<0.500	<0.500	<0.500	ug/L	10.0 ug/L
25) Silicon	Si	40.3	20.8	104	114	mg/L	no limit listed
26) Silver	Ag	<0.010	<0.010	<0.010	<0.010	mg/L	0.050 mg/L
27) Sodium	Na	40.0	12.0	9.67	29.5	mg/L	200 mg/L
28) Strontium	Sr	0.119	0.344	0.242	0.278	mg/L	no limit listed
29) Tin	Sn	0.363	0.429	1.32	0.433	mg/L	no limit listed
30) Titanium	Ti	0.025	0.013	0.022	0.016	mg/L	no limit listed
31) Tungsten	W	<0.050	<0.050	<0.050	<0.050	mg/L	no limit listed
32) Vanadium	V	<0.010	<0.010	<0.010	<0.010	mg/L	no limit listed
33) Zinc	Zn	0.112	0.029	0.059	0.064	mg/L	5.00 mg/L
Hardness (mg/L CaCO3)		99.9	64.9	154	191	mg/L	75-150 mg/L = mod. hard
pH		7.40	6.86	6.21	6.86	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 the Canadian Council of Resource and Environment Ministers - Guidelines for Canadian Drinking Water Quality, 1996.

R. Bilodeau  
 Analytical Chemist

H. Hartmann  
 Sr. Analytical Chemist

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Village Pt Improvm't Dist  
Box 3  
Mayne Island, BC  
V0N 2J0

30Mar06 2:58p  
FWS  
water  
4

W67797 pg2

TEL: (250) 539-2202  
FAX: (250) 539-2202

Arrival temp.: 8.0C

Samples: 1) Dalton Dr 29Mar06 03:00p 2) Well 9 28Mar06 05:55p  
3) Well 14 29Mar06 02:10p 4) Well 15 28Mar06 05:20p

Comments:

Iron: high amounts of Iron can cause staining of laundry, porcelain and plumbing fixtures; can produce an undesirable taste. Essential for health.

Manganese: not considered to be toxic; high amounts of Manganese can cause staining of laundry, porcelain and plumbing fixtures; may produce an undesirable taste.

pH: extremes in pH can lead to corrosion (too low) or incrustation (too high) of pipes & plumbing fixtures. Water with low pH allows metals to dissolve into water; water with high pH reduces disinfection efficacy, increases THM & scale formations.

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Analytical Chemist

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H. Hartmann  
Sr. Analytical Chemist

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Village Pt Improvm't Dist  
Box 3  
Mayne Island, BC  
V0N 2J0

07Apr06 12:25p  
FWS  
water  
1

W67904

TEL: (250) 539-2202  
FAX: (250) 539-2202

Arrival temp.: 18.0C  
Delivered: Mike Bullis

Sample: Distribution System

TRIHALOMETHANES

SAMPLE	DATE	TIME	CHCl3 ug/L	CHBr3 ug/L	BrCl2CH ug/L	ClBr2CH ug/L
Mariners	06Apr06	05:20p	4.23	3.78	3.89	<0.10
Lab Blank			<0.10	<0.10	<0.10	<0.10

Reference Standard                      % Recovery

CHCl3	Chloroform	104
CHBr3	Bromoform	103
BrCl2CH	Bromodichloromethane	96
ClBr2CH	Chlorodibromomethane	101

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.

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

\_\_\_\_\_  
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Analytical Chemist

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H. Hartmann  
Sr. Analytical Chemist

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□

Village Pt Improvm't Dist  
Box 3  
Mayne Island, BC  
V0N 2J0

15Jun06 5:00p W68909

FWS  
water  
1

TEL: (250) 539-2202  
FAX: (250) 539-2202

Arrival temp.: 17.0C  
cc: M.Mckinley 544-2425

Site Code	Date	Time	CFU/100 ml		CFU/100 ml		CFU/100 mL
			TC	NC	FC	NC	E.coli+
320 East West Rd	14Jun06	06:00p	0	0	0	0	0

TC = total coliform bacteria  
FC = fecal coliform bacteria  
NC = non-coliform bacteria

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  
Bergey's Manual of Systematic Bacteriology vol 1, AOAC 1984; J.Clin.Micro.,  
J.Intern.Systm.Bact.

\_\_\_\_\_  
T. Winchester  
Microbiologist

\_\_\_\_\_  
W. Riggs  
Sr. Microbiologist

M.B. LABS LTD  
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□

Village Pt Improvm't Dist  
Box 3  
Mayne Island, BC  
VON 2J0

24Jun06 2:45p  
Well  
water  
1

W69021

TEL: (250) 539-2202  
FAX: (250) 539-2202

Arrival temp.: 15.0C

Site Code	Date	Time	CFU/100 ml		CFU/100 ml		CFU/100 mL E.coli*
			TC	NC	FC	NC	
Well #15	21Jun06	03:00p	0	0	0	0	0

TC = total coliform bacteria  
FC = fecal coliform bacteria  
NC = non-coliform bacteria

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  
Bergey's Manual of Systematic Bacteriology vol 1, AOAC 1984; J.Clin.Micro.,  
J.Intern.Systm.Bact.

T. Winchester  
Microbiologist

W. Riggs  
Sr. Microbiologist

SAMPLE	DATE	TIME	UVT (%)
Well #15	21Jun06	03:00p	91.6
Lab Blank			ND
So			0.005
REF. VALUE			90.0
STD $\bar{n}$ 2SD			88.9 $\bar{n}$ 2.46

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

R. Bilodeau  
Analytical Chemist

H. Hartmann  
Sr. Analytical Chemist

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□

Village Pt Improvm't Dist  
 Box 3  
 Mayne Island, BC  
 V0N 2J0

14Nov06 12:12p  
 FWS  
 water  
 5

W71240

TEL: (250) 539-2202  
 FAX: (250) 539-2202

Arrival temp.: 4.0C

Samples: 11Nov06 1) Well 9 03:30p 2) Well 14 04:00p 3) Well 15 02:50p 4) 257 Leighton 02:30p

ELEMENTS		1	2	3	4	UNITS	Maximum Limits In Drinking Water*
		SAMPLE	SAMPLE	SAMPLE	SAMPLE		
1) Aluminium	Al	0.270	0.206	0.410	0.290	mg/L	no limit listed
2) Antimony	Sb	<0.500	<0.500	<0.500	<0.500	ug/L	6.00 ug/L
3) Arsenic	As	<0.500	<0.500	4.40	1.36	ug/L	10.0 ug/L
4) Barium	Ba	<0.009	0.011	0.032	0.012	mg/L	1.00 mg/L
5) Beryllium	Be	<0.003	<0.003	<0.003	<0.003	mg/L	no limit listed
6) Boron	B	0.217	0.203	0.245	0.243	mg/L	5.00 mg/L
7) Cadmium	Cd	<0.100	<0.100	<0.100	<0.100	ug/L	5.00 ug/L
8) Calcium	Ca	35.5	13.0	36.3	36.1	mg/L	200 mg/L
9) Chromium	Cr	<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	mg/L	no limit listed
11) Copper	Cu	<0.008	0.013	0.012	0.030	mg/L	1.00 mg/L
12) Gold	Au	<0.040	<0.040	<0.040	<0.040	mg/L	no limit listed
13) Iron	Fe	0.024	19.6	0.251	0.447	mg/L	0.300 mg/L
14) Lanthanum	La	<0.020	<0.020	<0.020	<0.020	mg/L	no limit listed
15) Lead	Pb	<0.500	0.759	2.80	<0.500	ug/L	10.0 ug/L
16) Magnesium	Mg	7.15	3.56	10.7	9.05	mg/L	50.0 mg/L
17) Manganese	Mn	0.106	0.511	1.82	0.094	mg/L	0.050 mg/L
18) Mercury	Hg	0.401	0.223	0.196	0.249	ug/L	1.00 ug/L
19) Molybdenum	Mo	<0.020	<0.020	<0.020	<0.020	mg/L	no limit listed
20) Nickel	Ni	<0.050	<0.050	<0.050	<0.050	mg/L	no limit listed
21) Phosphorus	P	<0.065	<0.065	<0.065	<0.065	mg/L	no limit listed
22) Potassium	K	0.851	0.770	0.976	0.987	mg/L	no limit listed
23) Scandium	Sc	<0.050	<0.050	<0.050	<0.050	mg/L	no limit listed
24) Selenium	Se	<0.500	<0.500	<0.500	<0.500	ug/L	10.0 ug/L
25) Silicon	Si	7.23	4.31	9.20	8.10	mg/L	no limit listed
26) Silver	Ag	<0.010	<0.010	<0.010	<0.010	mg/L	0.050 mg/L
27) Sodium	Na	16.8	10.9	41.5	24.9	mg/L	200 mg/L
28) Strontium	Sr	0.113	0.084	0.199	0.225	mg/L	no limit listed
29) Tin	Sn	0.029	4.23	0.202	0.149	mg/L	no limit listed
30) Titanium	Ti	<0.010	<0.010	<0.010	<0.010	mg/L	no limit listed
31) Tungsten	W	<0.050	<0.050	<0.050	<0.050	mg/L	no limit listed
32) Vanadium	V	<0.010	<0.010	<0.010	<0.010	mg/L	no limit listed
33) Zinc	Zn	0.012	0.007	0.012	0.041	mg/L	5.00 mg/L
Hardness (mg/L CaCO3)		118	47.1	135	127	mg/L	0 -75 mg/L = soft
pH		8.12	7.01	8.05	7.90	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).

R. Bilodeau  
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H. Hartmann  
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Village Pt Improvm't Dist  
Box 3  
Mayne Island, BC  
VON 2J0

14Nov06 12:12p  
FWS  
water  
5

W71240 pg2

TEL: (250) 539-2202  
FAX: (250) 539-2202

Arrival temp.: 4.0C

TRIHALOMETHANES

SAMPLE	DATE	TIME	CHCl3 ug/L	CHBr3 ug/L	BrCl2CH ug/L	ClBr2CH ug/L
5 178 Mariners	1Nov06	08:30a	47.5	<0.10	8.00	<0.10
Lab Blank			<0.10	<0.10	<0.10	<0.10

Reference Standard                      % Recovery

CHCl3	Chloroform	98
CHBr3	Bromoform	93
BrCl2CH	Bromodichloromethane	103
ClBr2CH	Chlorodibromomethane	93

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.

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

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