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REPORT TO MAGIC LAKE ESTATES WASTEWATER COMMITTEE
MEETING OF TUESDAY, AUGUST 12, 2014

SUBJECT **MAGIC LAKE ESTATES WASTEWATER SYSTEM INFRASTRUCTURE REPLACEMENT**

ISSUE

A comprehensive short- and long-term plan is required to provide a fiscally responsible approach to replacement of existing infrastructure as many of the major facilities and the collection system of the Magic Lake Estates (MLE) wastewater system are at or near end of life.

BACKGROUND

The existing sewage collection systems and the Schooner and Canon Wastewater Treatment Plants (WWTP) were built in the early 1970s. Schooner was expanded in 1981 and secondary treatment was added in 1999. Canon has not been upgraded since installation.

The Chart Drive Septic system was built in the mid-1960s and has recently failed. There are two viable options to replace the existing system: new pump station and raised sand bed septic field or new pump station and forcemain to the collection system for treatment at the Schooner WWTP. Based on further field investigation, using a drilling machine to determine the elevation of rock along the forcemain route, rock quantities were significantly less than expected. The revised cost estimate for the pump station/forcemain and estimated cost the pump station/ raised sand bed septic field option are the same order of magnitude. A breakdown of the cost of each option is included in Appendix A. Therefore, as the pump station/forcemain option was the consultant's preferred option and the slightly lower long-term operation and maintenance costs, the recommended option is to replace Chart Drive Septic System with a new pump station and forcemain to the collection system, treated at Schooner WWTP for an estimated cost of $750,000. As well, there is potential connect up to 30 new customers within the existing service area along the route of the forcemain.

In addition to the work described above, the Capital Regional District (CRD) commissioned a study in 2012, by Stantec Consulting and the results are contained in the *Magic Lake Estates Sewerage System - Asset Condition Evaluation and Engineering Study*, see Appendix B. The work generally included the replacement of the Schooner WWTP, replacement of the Chart Drive and Cannon treatment systems each with a pump station and forcemain, upgrade to the Schooner Lift Station due to age and the required increase in capacity, upgrades to the 5 other lift stations and addressing the I & I issue, both by study and by targeting a section of sewer along Buck Lake and Privateers. A complete list of the work required for the Magic Lake Estates sewerage system is included in Appendix C with updated estimates. The original estimates by Stantec did not include engineering, administration and operations staff time. Therefore, it is necessary to update the original estimates to 2015 dollars using 4% compounded yearly, apply a 30% contingency and then add engineering, administration and operations staff time.

ALTERNATIVES

1. That the Magic Lake Estates Wastewater Committee approve:

   a. proceeding with a public referendum to seek approval by assent of the electors to secure a loan authorization bylaw of $6,814,000 for: the replacement of the Chart Drive Septic Field System with a new pump station, forcemain and related works; Phase 1 of the I & I Program including hydraulic model analysis; provide one new clarifier and aeration tank at Schooner WWTP, upgrade 325m of pipe along Buck Lake, upgrade 112m of pipe on Privateers Road, upgrade Schooner Lift Station and replace Cannon WWTP with Pump Station and approximately 600m forcemain and related works.
   b. funding the Public Engagement strategy in the amount of $3,500 from capital reserves.
   c. funding the Referendum process in the amount of $10,000 from capital reserves.

   The breakdown of the budget for Alternative 1 is:

• Replace Chart Drive Septic System	$750,000
• Phase 1 - I & I Program including hydraulic model analysis	$217,000
• Provide one Clarifier and Aeration Tank at Schooner WWTP	$2,056,000
• Upgrade 325m of pipe along Buck Lake	$387,000
• Upgrade 112m of pipe on Privateers Road	$133,000
• Upgrade Schooner Lift Station	$557,000
• Replace Cannon WWTP with Pump Station/Forcemain	$2,714,000
Total	$6,814,000

2. That the Magic Lake Estates Wastewater Committee approve:

   a. proceeding with a public referendum to seek approval by assent of the electors to secure a loan authorization bylaw of $12,462,000 for: the replacement of the Chart Drive Septic Field System with a new pump station, forcemain and related works; Phase 1 of the I & I Program including hydraulic model analysis; upgrade 325m of pipe along Buck Lake, upgrade 112m of pipe on Privateers Road, Schooner Lift Station and replace Cannon WWTP with Pump Station and approximately 600m forcemain and related works; and a new Schooner WWTP and complete upgrades to the 5 other pump stations.
   b. funding the Public Engagement strategy in the amount of $3,500 from capital reserves.
   c. funding the Referendum process in the amount of $10,000 from capital reserves.

   The breakdown of the budget for Alternative 2 is:

• Replace Chart Drive Septic System	$750,000
• Phase 1 - I & I Program including hydraulic model analysis	$217,000
• Upgrade 325m of pipe along Buck Lake	$387,000
• Upgrade 112m of pipe on Privateers Road	$133,000
• Upgrade Schooner Lift Station	$557,000
• Replace Cannon WWTP with Pump Station/Forcemain	$2,714,000
• 3 years of Annual Pipe Replacement Program	$512,000
• New Schooner WWTP	$6,189,000
• Upgrade 5 Lift Stations	$1,003,000
Total	$12,462,000

3. That the Magic Lake Estates Wastewater Committee approve:

   a. proceeding with a public referendum to seek approval by assent of the electors to secure a loan authorization bylaw of $1,507,000 for the replacement of the Chart Drive Septic Field System with a new pump station, forcemain and related works, Phase 1 of the I & I Program including hydraulic analysis, ultrasonic testing of clarifiers, upgrade 325m of pipe along Buck Lake and upgrade 112m of pipe on Privateers Road.
   b. funding the Public Engagement strategy in the amount of $3,500 from capital reserves.
   c. funding the Referendum process in the amount of $10,000 from capital reserves.

   The breakdown of the budget for Alternative 3 is:

• Replace Chart Drive Septic System	$750,000
• Phase 1 - I & I Program including hydraulic model analysis	$217,000
• Ultrasonic Testing of the Clarifier	$20,000
• Upgrade 325m of pipe along Buck Lake	$387,000
• Upgrade 112m of pipe on Privateers Road	$133,000
Total	$1,507,000

4. That the Magic Lake Estates Wastewater Committee not approve the proposed infrastructure improvements and fund work on an emergency basis.

IMPLICATIONS

Alternative 1 – The Chart Drive Septic system is at its end of life, recently resulting in a notice from Island Health Authority and requires replacement. Given the peak capacity issue at Schooner WWTP, the I & I program along with hydraulic analysis is required to identify and prioritize the sources and a planned cost effective approach for repairs, realizing a reduction in the peak flow wet weather at Schooner WWTP to extend its usable life. As well, addition of a larger aeration/clarifier tank will provide interim relief for the issue. The sewer along Buck Lake is constantly the cause of back-ups in the system and requires replacement with a larger pipe. The sewer on Privateers Road does not maintain proper slope and is undersized. It requires frequent costly maintenance and requires replacement. A new Cannon Pump Station and forcemain will eliminate non-compliance issues at the undersized WWTP, which is at end of life. Schooner Lift Station needs to be upgraded or replaced to handle the increased flow from Cannon.

Based on a total of 714 taxable folios within the MLE sewer system, the impact on the taxpayer using a 15 year MFA loan at 5% is:

Term of Loan	Average User Charge	Existing Parcel Tax	Additional Parcel Tax	Total
15 year	$272	$415	$954	$1,641

The decommissioning of the Cannon WWTP and replacement with a pump station should lower operating and maintenance costs. The actual O&M cost will be assessed once the upgrades are completed and we have had a chance to assess their performance.

Should the Committee approve this Alternative, the CRD staff will also review any grants and funding opportunities (such as Gas Tax Funding – Community Works Fund, etc.) in order to reduce the overall borrowing required for the project.

Alternative 2 – This Alternative included the items from Alternative 1 and a new Schooner WWTP, upgrades to 5 other pump stations and a start on the pipe replacement program. It is proposed that the user charge be increased gradually to provide monies for continuing the pipe replacement program beyond 5 years.

Based on a total of 714 taxable folios within the MLE sewer system, the impact on the taxpayer using a 15 year MFA loan at 5% is:

Term of Loan	Average User Charge	Existing Parcel Tax	Additional Parcel Tax	Total
15 year	$272	$415	$1,744	$2,431

Upgrade or replacement of the Schooner WWTP and decommissioning of the Cannon WWTP and replacement with a pump station should result in lower operating and maintenance costs, as well as dealing with a compliance issue. The actual O&M cost will be assessed once the upgrades are completed and we have had a chance to assess their performance.

Should the Committee approve this Alternative, CRD staff will also review any grants and funding opportunities (such as Gas Tax Funding – Community Works Fund, etc.) in order to reduce the overall borrowing required for the project.

Alternative 3 – The Chart Drive Septic system is at its end of life, recently resulting in a notice from Island Health Authority and requires replacement. Given the peak capacity issue at Schooner WWTP and Cannon, the I & I program along with hydraulic analysis is required to identify and prioritize the sources and a planned cost effective approach for repairs, realizing a reduction in the peak flow wet weather at Cannon and Schooner to extend the usable life of the existing WWTP. Ultrasonic testing of the metal walls of the clarifier will determine the expected life of the unit. The sewer along Buck Lake is constantly causing back-ups in the system and requires replacement with a larger pipe. The sewer on Privateers Road does not maintain proper slope and is undersized. It requires frequent costly maintenance and requires replacement. If this alternative is selected, recognize the other infrastructure must be replaced or upgraded within the next 2-3 years as per the 2012 Stantec report.

Based on a total of 714 taxable folios within the MLE sewer system, the impact of borrowing on the taxpayer using a 15 year Municipal Finance Authority loan at 5% is:

Term of Loan	Average User Charge	Existing Parcel Tax	Additional Parcel Tax	Total
15 year	$272	$415	$211	$898

The proposed work in this Alternative should result in lower operating and maintenance (O&M) costs by reducing emergency call outs and cleaning frequency. The actual O&M cost will be assessed once the upgrades are completed and staff have had a chance to assess their performance.

Should the Committee approve this Alternative, CRD staff will also review any grants and funding opportunities (such as Gas Tax Funding – Community Works Fund, etc.) in order to reduce the overall borrowing required for the project.

Alternative 4 – If the Committee decides not to approve the proposed Capital Works program, the infrastructure will fail, causing non-compliant issues and a requirement to resolve MOE Out of Compliance orders under the Municipal Wastewater Regulations. Over the past few years and as we go forward, emergency repair costs, as well as Operation and Maintenance costs will increase as the infrastructure fails. Replacement of equipment under emergency conditions is not the most cost effective approach and may require staff overtime if after hours or in the evenings. As well, failure of certain components will require a treatment bypass and a requirement to register an illegal discharge with the MOE and potentially environmental consequences as untreated sewage is discharged to the local environment. Depending on the seriousness of the infraction, there could be fines from the Ministry of Environment under the Municipal Wastewater Regulation for these illegal discharges. Emergency equipment replacement can cost considerably more than planned replacement.

Funding Approval Options

There are currently insufficient funds in the Capital Reserve ($200,222 as of July 31, 2014) to fund this proposed work; therefore it is recommended to fund the project through a new loan requiring a new loan authorization bylaw. There are two options for approval of a loan authorization bylaw under the Local Government Act to undertake this project:

1. Alternative Approval Process
2. Referendum Process

Each of the options has its own merits and is outlined for the Committee's consideration.

Alternative Approval Process (AAP)

Local/regional governments can use the Alternative Approval Process under Part 2, Section 801.3 of the *Local Government Act* to obtain participating area approval of a loan authorization bylaw. It is most commonly used in relation to long-term borrowing bylaws as it is a less expensive option than using a referendum. If more than 10% of the affected electors sign a counter-petition opposing the bylaw, a referendum must be held if the Committee still wishes to adopt it.

Based on the above tentative schedule the AAP would take approximately 6 months, and would cost approximately $5,000.

Referendum Process

The referendum process is typically used to seek approval by assent of the electors, under Part 2 of Section 801.2 of the *Local Government Act,* where for a participating area, a majority of the valid votes are counted in favour of the bylaw to fund a project. Typically, a referendum question is developed and then reviewed by the Inspector of Municipalities at the Province, requesting the electors to approve the borrowing of a specified amount of funds for the project.

Based on the above tentative schedule, the referendum would take approximately 7 months, and would cost approximately $10,000.

Implications of an Unsuccessful AAP or Referendum

If the above-noted processes are unsuccessful, the CRD Board shall be requested to authorize borrowing for the work based the level of risk/liability due to non-compliance when failure occurs and an illegal discharge occurs.

Public Engagement

Due to the financial impact of the alternatives on the taxpayers, there is a need for public engagement to inform the stakeholders of the issues, alternatives, impacts and timeline for the process. The exact form and extent of this process will need to be developed once the Committee decides on the preferred alternative.

We recommend using the Public Participation Spectrum developed by the International Association for Public Participation (IAP2) as a model for developing our public engagement strategy. The spectrum outlines varying levels of public participation: inform, consult, involve, collaborate and empower. Even though the taxpayers are empowered by default through the referendum process, at this point in the public engagement process, we advise focusing on informing and consulting with the public to provide them with information needed to assist them in making an informed decision. During the process, a method of obtaining public feedback is important in order to determine the community understanding of the project and gauge their support.

CONCLUSION

The MLE wastewater systems were originally built in the 1970s and are in need a replacement or upgrades to avoid steadily increasing O&M and emergency repair costs, as well as potential non-compliance issues. While the cost of the proposed capital works are significant, a reactive approach will result in higher long-term costs to the customers, potential for significant environmental impacts and Out of Compliance issues.

RECOMMENDATION

That the Magic Lake Estates Wastewater Committee approve:

a. proceeding with a public referendum to seek approval by assent of the electors to secure a loan authorization bylaw of $6,814,000 for: the replacement of the Chart Drive Septic Field System with a new pump station, forcemain and related works; Phase 1 of the I & I Program including hydraulic model analysis; provide one new clarifier and aeration tank at Schooner WWTP, upgrade 325m of pipe along Buck Lake, upgrade 112m of pipe on Privateers Road, upgrade Schooner Lift Station and replace Cannon WWTP with Pump Station and approximately 600m forcemain and related works.
b. funding the Public Engagement strategy in the amount of $3,500 from capital reserves.
c. funding the Referendum process in the amount of $10,000 from capital reserves.

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Attachments: 4

Appendix A - Chart Drive Replacement Cost of Each Option
Appendix B - Magic Lake Estates Sewerage System - Asset Condition Evaluation and Engineering Study, Stantec Consulting, 2012
Appendix C - Capital Replacement Requirements – Stantec Estimates Updated to 2015 Dollars
Appendix D - Proposed Public Engagement Strategy

APPENDIX A

COST ESTIMATES

Replacement with Raised Sand Bed Septic Field		
Description	**Percentage**	**Cost**
Construction (As per report)		375,000
Contingency	30%	112,500
Sub-Total A		487,500
Engineering (CRD)	10%	48,750
Consultant Services	18%	87,750
Hydrogeology	5%	24,375
Operations Staff	10%	48,750
Administration	5%	24,375
Sub-Total B		234,000
	Total A + B	**703,560**
	TOTAL	**$721,500**

New Pump Station and Force Main		
Description	**Percentage**	**Cost**
Force Main Construction		375,000
Pump Station		71,000
Subtotal		446,000
Contingency	30%	134,000
Sub-Total A		580,000
Engineering	18%	104,000
Operations Staff	5%	29,000
Administration	5%	29,000
Sub-Total B		162,000
	Total A + B	**742,000**
	TOTAL	**$742,000**

APPENDIX B

Magic Lake Estates
Sewerage System

Asset Condition Evaluation and
Engineering Study

FINAL REPORT

Stantec

January 9, 2012

Executive Summary

Magic Lake Estate (MLE) consists of three separate sewage systems owned and operated by the Capital Regional District (CRD) Sewerage Local Services. These sewage systems flows are treated by the Schooner and Cannon extended aeration (EA) treatment plants and the Chart Drive septic and disposal field. The two treatment plants were constructed in, or around, 1971 and the Chart Drive septic field was built in the mid 1960's. The Magic Lakes sewage collection system was initially constructed in the early 1970's and underwent some expansion in 1981 around Magic Lake, Buccaneer Road, Privateer Road, Rum Road, and Schooner Way. It consists of approximately 16 km of gravity fed AC (installed in the 1970's) and PVC pipe (installed in 1981) of sizes ranging from 150 to 250mm, and approximately 1 km of PVC forcemain (75mm).

The Schooner wastewater treatment plant is an extended aeration plant with a capacity of 270 m^3/day. Initially it operated with chlorine disinfection as a last treatment step prior to discharge to the ocean outfall, but this was discontinued in the early 1980's. It was upgraded in 1999 with the addition of a second clarifier, headworks (bar screen and grinder), UV disinfection, and sludge holding tanks. At the same time the process was modified to operate in a step feed mode during wet weather months which increased the capacity to 710 m^3/day. Currently, there are approximately 529 lots connected to this treatment plant with 63 vacant additional lots capable of connection.

The Cannon wastewater treatment plant is a packaged extended aeration plant with a capacity of approximately 65 m^3/day. This plant has not seen any upgrades since its construction in 1971. The plant consists of an aeration tank and clarifier and has no headworks or disinfection prior to discharge to the ocean outfall. The maximum day allowable discharge permitted is 68.2 m^3/day. There are currently approximately 100 lots connected to this treatment plant with 4 additional lots capable of connection.

The Chart Drive septic field consists of a septic tank and pumps which direct flows to two distribution fields. The total design volume for this field is 14.3 m3/day. This system serves 18 lots, with no future lots for connection.

This study included a condition assessment of the existing system with recommendations for repairs and replacement over a 20 year period for the collection system, lift stations and treatment facilities. Modeling was not performed on the collection system, but capacities of critical areas identified by the CRD staff were reviewed, as well as those where topography and pipe sizing warranted review.

System Condition

a) Collection System

The existing maximum day flow is typically 4.0 times the average annual flow on both the Schooner system and Cannon system. However, in December 2010, these ratios were as high as 4.51 for Schooner and 5.44 for Cannon. The maximum day flow always occurs during a storm event in the winter months. This ratio of 4.0 times maximum day to annual average is considered atypical and excessive. Approximately 7.6km of asbestos cement (AC) pipe installed in 1971 are still in use in this system. The estimated service life (ESL) for gravity AC pipe can be as high as 100 years, although this can be reduced significantly by wastewater characteristics, ground water influence, soil characteristics and installation. A more conservative 60 year ESL has been used for this study.

In the absence of closed circuit television (CCTV) inspections, it is not possible to provide a condition assessment for the sanitary sewers and to determine the source of inflow and infiltration. It is recommended to undertake an inspection program which would include CCTV inspections, manhole inspection, flow monitoring as well as smoke testing to verify if surface water and groundwater are directed to the sanitary sewer. A manhole assessment was carried out in the late 1990's; however, the report is old and new inspections are necessary. It should be noted that smoke testing was carried out in 2005 with only minimal cross connection discovered which indicates the need for more thorough CCTV type inspection to be carried out for discovery of other sources of inflow and infiltration (I&I).

By today's standards, there are approximately 4.2km of pipe (3.5km of AC) that are smaller than the recommended minimum pipe size of 200mm. These pipes should be replaced within 20 years, at the end of the ESL although the need for replacement is not immediate. In addition, there is approximately 325m of 150mm AC pipe that borders Buck Lake that has a low slope (less than 0.6%) and in some cases a negative slope. This section has backed up on numerous occasions. Replacement of this section of the pipe with a larger diameter pipe is not expected to resolve the issue long term, due to the very shallow slope this pipe must run at, and it is recommended to install a low pressure (LP) system (including pumps at each residence) to serve this portion of the system. There was also an approximately 112m section of low slope (less than 0.4%), high volume pipe along Privateers road which should be replaced with 200mm pipe. Collection system upgrade costs (2011$) over the next 5 years can be summarized as follows:

• CCTV, smoke test, and manhole inspection	$ 140,000
• Low Pressure System	$1,400,000
• Replacement of 112m pipe on Privateer Rd	$ 70,000
Total Cost (5 years)	**$1,610,000**
• Replacement of 3.5km of AC pipe (20 years)	$1,800,000

b) Lift Stations

Six lift stations were inspected and have been identified by the streets on which they are located: Schooner, Buccaneers, Masthead, Capstan, Galleon, and Cutlass. All of the lift stations ultimately pump to the Schooner WWTP with the exception of the Cutlass lift station which presently pumps to the Cannon WWTP.

The lift stations were installed in the early 1980's with the exception of Galleon which is from the original 1970's system. The lift stations were found to be in various stages of needing repair. The process piping of a lift station has a typical lifespan of 25 year; therefore, all (with the exception of Cutlass's process piping, which was recently upgraded to stainless steel) are corroded and reaching the end of their serviceable life. It is therefore recommended to replace all the process piping within the lift stations (except Cutlass). In addition, a major deficiency noted was the outdated electrical system and the lack of a SCADA system at all lift station sites (exception is Galleon which has a SCADA pack). Although rectifying these deficiencies will be expensive, it is a move that the CRD should strongly consider to maximize the efficiency of the Magic Lake System.

The estimated cost for recommended upgrades over the next **5 years** is summarized below. Longer term repairs (including electrical and SCADA) are noted in the report and not included in the summary below. Note the higher cost of Schooner is due to all identified deficiencies being addressed at once to be able to handle future flows from the Cannon treatment plant.

• Schooner LS	$271,000
• Capstan LS	$ 85,000
• Cutlass LS	$ 60,000
• Buccaneer LS	$ 83,000
• Masthead LS	$ 83,000
• Galleon LS	$ 83,000
Total Cost (5 years)	**$665,000**

c) Treatment Facilities

Chart Drive

The Chart Drive septic field is currently experiencing breakthroughs under its current hydraulic loading. An assessment by Thurber Engineering in June 2011, in conjunction with Giles Environmental, indicated that the drainage field is grossly undersized by today's standards. A hydrogeological analysis of the site was not performed to determine its capacity. Even with an upgrade, the existing site would only be able to accommodate a design meeting 50% of the infiltration surface as required by today's standards. No alternative site was identified in the Thurber report and although that does not mean that an alternative is not available, based on topography and soil conditions, it is highly unlikely that a suitable sized vacant parcel with desirable percolation rate could be found in this area.

Two options have been identified to address these deficiencies. Option 1 is to provide a packaged treatment system and upgrade the existing distribution field. This option is only feasible if hydrogeological conditions are favorable. A budget price was given in the Thurber report and is listed below. Option 2 is to install a small pump station and pump the flow from these 18 lots via a new forcemain to the existing gravity system on Schooner Way at Privateers. Flows would then be treated by the Schooner plant. Although more expensive, diverting the flows to Schooner eliminates the possibility of future field failures. Depending on who owns the land the septic field currently resides on, this land could be potentially remediated and sold to offset a portion of the costs for Option 2. The estimated cost for these options are (taxes not included):

- **Option 1 (upgrade field) $400,000**
- **Option 2 (pump to Schooner) $730,000**

Cannon WWTP

The Cannon Crescent treatment plant is over 40 years old and regularly exceeds the permitted discharge of 68 m^3/day. Considering the typical lifespan of a packaged EA plant is 20-25 years, the plant has performed well; however, some of the systems components are now heavily corroded and operating inefficiently. The property where the packaged plant sits on is very small, and steep, and would not accommodate an equalization tank of a size to address the flows in excess of the discharge permit for this plant. Insufficient space is available to install an adjacent packaged plant while keeping the existing system operational at this site. It is therefore recommended that this plant be decommissioned and have the flows diverted to the upgraded or new Schooner WWTP. The trigger for undertaking this work would be the remaining life span on the existing metal tanks at the plant. It is recommended that ultrasonic testing and a fitness for service evaluation be carried out on the clarifier and aeration tank. **The estimated cost for this test/evaluation is $10,000.**

Diverting the Cannon plant flows will add approximately 25% more annual average flow to the Schooner plant. A new lift station would have to be constructed to pump flows to the tie into the gravity sewer on Pirates Road. **A budgetary cost for a new lift station located in the road ROW and 610m of forcemain is $1,130,000 + taxes.**

Schooner WWTP

The aeration tank and clarifier#1 for this plant are over 40 years old. Mechanical components on this clarifier are beyond their lifespan, are corroded and require replacement. Although the winter operating mode of the plant has been modified to a step fed to increase the capacity of the plant to deal with high wet weather flows, the plant does not have the ability to address flows in excess of its discharge permit. A surface water monitoring program for fecal coliforms must take place for 2 consecutive years each time the discharge in any year exceeds the permitted discharge of $640m^3$/day. Even though the results of these tests have shown that the surface waters meet the criteria of <200cfu/ml of fecal coliform due to the effectiveness of the plants treatment and UV disinfection, the testing program continues to be required when the permit is exceeded.

The plant requires both an ability to address flows in excess of its discharge permit, and replacement of clarifier#1. This becomes even more relevant as flows from Cannon and possibly Chart Drive are diverted to Schooner. Two options to address this are summarized below; however, Option 1 is only feasible if the aerations tank has a sufficient lifespan (greater than 15 years). **The cost to perform this preliminary ultrasonic testing and fitness for service evaluation is estimated at $14,000.**

OPTION 1 (new clarifier and equalization tank)

Provided the metal aeration tanks have a RSL of at least 15 years, this option consists of installing a new clarifier#1 and an equalization tank. This option extends the life of the existing plant and allows further time for funding a new treatment plant in 15-20 years. This option should be carried out within 5 years (with designs ready in case of premature failure of the Cannon plant). **The estimated cost for Option 1 is $1,540,000 +taxes.** This amount does not include the sum of $730,000 + taxes to connect the Chart Drive catchment area to the Schooner Way plant.

OPTION 2 (new treatment plant)

If the ultrasonic testing indicates that the aeration tanks remaining life is less than 15 years, it is recommended to forgo the replacement of Clarifier#1, and instead to build a new sequencing batch reactor (SBR) plant adjacent to the existing plant. The new SBR plant would have a capacity of 536 m^3/day maximum month flow and be able to handle max day flows in excess of peaks over 1200 m^3/day. This would allow the plant to take all flows from the Magic Lake Sewage System including the flow from Cannon Crescent and Chart Drive catchment areas. The plants equalization tank would also allow for a controlled discharge to the outfall meeting thereby meeting the discharge permit and eliminating the need to up size the outfall. **The estimated cost for a treatment plant Option 2 is $3,010,000 + taxes.** This amount does not include the sum of $1,130,000 + taxes to connect the Cannon Crescent catchment area to the Schooner plant or the sum of $730,000 + taxes to connect the Chart Drive catchment area to the Schooner Way plant.

The CRD has indicated that a $0.5M Building Canada Fund was approved for the upgrade of the Schooner wastewater treatment plant to handle the increased flows from the new water treatment plant servicing Magic Lake Estates. This funding is required to be used by March 14th, 2014. Therefore it is may be beneficial to put the $0.5M toward the Schooner plant upgrades or apply for a scope change for the funding to address more immediate concerns such as the Chart Drive system. The amount of funding is insufficient to address some of the major concerns, but possible projects could include the following:

1. Undertake ultrasonic evaluations of tanks at Schooner and if sufficient aeration tank service life remains, proceed with new Clarifier #1 at Schooner Treatment Plant and rebuild of Blower#2. Budget Price: $345,000+HST. The design of an aeration tank, and associated modifications to the intake system could also be done at this point to have a shelf ready project when funding becomes available. The estimated cost for design is $75,000.

2. Assessment of sewer collection (CCTV, smoke test, manhole assessment) and replacement and/or upgrade of some areas of damaged, leaking, or substandard piping. The assessment of the entire system has a budget price of $140,000+HST with the remaining $360,000 replacing up to 700m of pipe.

3. Replacement of Chart Drive Septic system (Option #1). A revised scope for the funding agreement may be required for this option. Budget price: $400,000 +HST.

4. Upgrades to Schooner and Galleon lift stations. Budget Price $490,000+HST.

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1.0 Introduction

The Magic Lakes sewage collection and treatment system was initially constructed in the early 1970's and underwent some expansion in 1981 around Magic Lake, Buccaneer Road, Privateer Road, Rum Road, and Schooner Way. It consists of approximately 16 km of gravity AC mains (installed in the 1970's) and PVC pipe (installed in 1981) of sizes ranging from 150 to 250mm, and approximately 1 km of PVC forcemain (75mm). Magic Lake Estate (MLE) consists of three separate sewage systems owned and operated by the CRD Sewerage Local Services. The three systems are as follows:

- Schooner Way WWTP (Formerly Buck Lake WWTP) – operating under Municipal Sewerage Regulation (MSR) RE:01693. Discharging disinfected secondary treated effluent into Swanson Channel via a 198m long outfall.
- Cannon Cresent WWTP – operating under Ministry of Environment Waste Management Permit PE: 00220. Discharging non-disinfected secondary treated effluent into Swanson Channel via a 204m long outfall.
- Chart Drive septic system and disposal field

The CRD 2010 Annual Report on Operations indicates that the Magic Lake Sewer System services 714 properties. The system presently serves approximately 647 single-family residential connections. The boundaries of the MLE sewerage system has some vacant parcels remaining for development with the potential to connect approximately 67 additional properties currently vacant or connected to individual septic fields. The connections are distributed to the three discrete collection systems as follows:

Table 1.1 – Collection System Connections

System	Current Connections	Potential Future Connections
Schooner	529	63
Cannon	100	4
Chart Drive	18	0

Both the Schooner and Cannon WWTP were constructed in 1971. The Schooner extended aeration plant received major upgrades in 1998, 1999 and 2005, while the Cannon extended aeration packaged plant has not been upgraded since it was constructed. The Schooner plant consists of headworks, aeration tank, two clarifiers, RAS pumps, UV disinfection, and three sludge holding tanks. The Cannon plant consists of an aeration tank and clarifier, with no sludge holding capacity. The Chart Drive septic field installed in 1971 services 18 lots. The effluent is distributed to the two disposal fields by a distribution box and perforated pipe with holes spaced every 1.5m.

2.0 Condition Assessment

2.1 WASTEWATER TREATMENT PLANTS

2.1.1 Schooner Way Wastewater Treatment Plant

The original plant, installed in the early 1970's was a packaged extended aeration system consisting of one aeration tank, one clarifier and a chlorine contact tank. The effluent is discharged into Swanson Channel through a polyethylene outfall pipe extending 10 m below low tide level.

In the early 1980's the use of chlorine was discontinued. In 1996, it was found that the treatment plant capacity was largely limited by the clarifier size resulting in permit violations due to solids carryover. In 1998, a second clarifier was installed doubling the clarifier capacity and the effluent quality improved. However, as a result of large wet weather flow during the winter months, effluent quality during the high flow period continued to exceed the permit. Excessive flow into the aeration tank was causing solids washout. To resolve this problem the plant operation was converted to operate in step feed mode during the six month period from November to April. A flow division chamber was added such that the sewage could be introduced at three locations (at head, midpoint and near tail) along the long and narrow aeration tank. During the summer months, the plant reverts to normal mode where all the sewage is introduced to hyead of the plant.

In 1999, a study conducted by Seaconsult Marine Research indicated that the existing outfall could not provide sufficient dilution under the Municipal Sewage Regulation and UV disinfection was recommended.

The plant upgrade carried out in 1999 included the following components:

1. New inlet structure with a grinder and a flow distribution chamber for step feed. A manually cleaned screen is provided in a bypass channel to the grinder.
2. Conversion of the aeration tank to step feed including piping, baffles and additional aeration air diffusers.

3. Replace air lift pumps used for return activated sludge (RAS) and waste activated sludge (WAS) with submersible pumps. New RAS and WAS piping and a new sludge holding tank were installed.

4. The blower was fitted with a variable frequency drives

5. Ultraviolet disinfection was added.

The Schooner Way wastewater treatment plant was inspected on June 23, 2011 with CRD staff. The condition of the facility is described in Table 2.1

Table 2.1 – Schooner Way Wastewater Treatment Plant Condition Assessment

Unit Process	Description	History / Age	Condition / Remarks
Headworks	• Grinder ("Muffin Monster"), flow division chamber and bypass with manually cleaned screen	• Headworks installed in 1999	• No grit removal and no screens to remove rags • Headworks in good condition
Aeration tank	• Partially buried steel tank, 6.3 mm thick • Tank is 19.2 m long, 3 m high and 3 m wide. • Tank installed on a 200 mm concrete slab • Metal walkway with grating and railing	• Tank installed in 1971 • In 1999, the inlet to the tank was modified to allow influent to enter at the head, middle and tail end of the aeration tank.	• No visible rust on exposed portion of tank, grating and railing • Ultrasonic thickness measurements needed to confirm tank condition
Clarifier # 1	• Circular steel tank with conical bottom section • 3 m dia and 4.75 m high • Capable of handling 173m^3/day flow in extended aeration mode and up to 355m^3/day in step mode.	• Installed in 1971 when the plant was constructed	• Clarifier was emptied in 2008 for an inspection and extensive corrosion was noted. • Effluent weir trough is not level and cannot be adjusted • Rising bulking sludge accumulated under effluent trough • New clarifier mechanical equipment required (if tank has suitable service life) or replace clarifier.
Clarifier # 2	• Assumed to be similar to clarifier # 1 but drawings not available	• Installed in 1998	• Good condition
RAS pumps (2)	• Only one of two RAS pumps and its return line	• New RAS system installed in 1999 when	• RAS pumps plugs up with debris

	is metered. This can result in the sludge blanket level and RAS concentrations not being maintained at optimal levels (ie wasted energy or weir overflow)	system converted to step feed	• RAS is chlorinated to prevent growth of filamentous algae
WAS system	• Automated valves installed on one of the two RAS lines	• New WAS system installed in 1999	• Add WAS capability on second RAS line
Blower	• 15 HP 1785 rpm Baldor EM2513T motor , 230/460V/3/60hz, 254 T frame, with 1.15 PF	• Installed in 1999 • 1 blower rebuilt three years ago. • VFD controlled	• 2nd blower should be rebuilt soon.
UV	• Trojan	• Installed in 1999	• Some recorded fouling with algae
Sludge Tanks (3)	• Tanks 1 & 2 - 25 m3 capacity (5,000 US gal) used for decant • Tank # 3 - 3,000 UG gal used for thickened sludge storage	• Tank # 1 installed in 1999 • Tank # 2 installed in 2005 • Tank # 3 installed in • Tanks are high density Poly.	• No issues
Instrumentation	• Two dissolved oxygen probe	• Approximately 2 years old	

Table 2.1A indicates the Estimated Service Life (ESL) and Remaining Service Life (RSL) for use in capital asset reporting.

Table 2.1A – Service Life - Schooner

Element	Year Installed	ESL	RSL
Grinder Pump	1999	20	7
Aeration Tank	1971	50	9
Diffuser	1971	25	-16
Clarifier #1 Mechanical	1971	25	-16
Clarifier # 1 Tank	1971	50	9
Clarifier #2 Mechanical	1998	25	11

Clarifier #1 Tank	1998	50	36
RAS Pumps	1999	20	7
Blower	1999	25	12
UV	1999	20	7
Sludge Tank#1	1999	20	7
Sludge Tank#2	2005	20	13
Sludge Tank#3	1999	20	7

2.1.2 Cannon Crescent Wastewater Treatment Plant

The Cannon Crescent plant is a packaged extended aeration plant built in 1971. The Cannon treatment plant was inspected on June 23, 2011 with CRD staff. The condition of the facility is described in Table 2.2.

Table 2.2 – Cannon Crescent Wastewater Treatment Plant Condition Assessment

Unit Process	Description	History / Age	Condition / Remarks
Aeration Tank (1)	• Above ground steel tank • Coarse bubble diffusers • Air lift pumps for return activated sludge from clarifier	• Plant has never been upgraded since constructed in 1971	• No visible rust on exposed portion of tank, grating and railing • Ultrasonic thickness measurements needed to confirm tank condition • Air headers corroded • Limited RAS capacity because of air lift pumps • Coarse bubble diffuser is not very efficient
Clarifier (1)	• Above ground steel tank	• Installed 1971	• Staff has reported that clarifier is corroded • Ultrasonic thickness measurements needed to confirm tank condition
Blowers (2)	• 7.5 HP, 1760 RPM • 208 Volt (single phase power supply at plant)	• Installed 1971	• No issues with blowers reported
No disinfection			
No sludge holding tank			• Solids accumulate in the clarifier and are pumped out at regular interval

Table 2.2A indicates the Estimated Service Life (ESL) and Remaining Service Life (RSL) for use in capital asset reporting.

Table 2.2A – Service Life - Schooner			
Element	**Year Installed**	**ESL**	**RSL**
Aeration Tank	1971	50	9
Diffuser	1971	25	-16
Clarifier #1 Mechanical	1971	25	-16
Clarifier # 1 Tank	1971	50	9
Blower	1971	25	-16

2.1.3 Chart Drive Septic System

Built in the mid 1960's (designed 1962), the Chart Drive septic system consists of a septic tank and pump located near the road. The septic effluent is pumped to two distribution fields located at a higher elevation. The total design volume for this field is 14.3 m3/day.

On June 23, 2011 a visual inspection of the Chart Drive septic tank installation near the road was carried out. The field area could not be further evaluated by visual inspection due to excessive vegetation. The installation includes a septic tank followed by a pumping chamber. The septic effluent is pumped to the disposal fields using a 2 HP pump. The operator indicated that the septic tank area is flooded in the spring. The flooding appears to be due to a combination of surface runoff and effluent breakout from the disposal fields above.

In 2009 a preliminary assessment of the disposal field was carried by Giles Environmental Engineering and is summarized as follows:

- The distribution of effluent in the disposal field is by a distribution box and perforated pipes. The distribution box is most likely uneven, causing effluent to flow into only a few of the trenches.
- The non-perforated and perforated pipes in the disposal field are made of "No-corrode", a coal tar impregnated wood fibre sewer pipe. This type of pipe deforms and loses its circular cross-section, allowing infiltration and root intrusion. It is quite possible that the pipe in the disposal field has failed causing concentrated organic and hydraulic loading.
- Assuming that the soil fill is a sandy loam, the disposal field probably has about 10 to 15% of the trench bottom infiltrative surface required by today's standards. If we were to rebuild the disposal field for pressure distribution and 90 cm wide trenches, the 500 m length shown on the drawings would provide about 50% of the trench bottom infiltrative area required by today's standards.

2.2 PUMPING STATIONS

Six lift stations currently service the Magic Lakes Sewage System and are identified by the streets they are located: Schooner, Buccaneer, Masthead, Capstan, Galleon, and Cutlass. All of the lift stations ultimately pump to the Schooner WWTP with the exception of the Cutlass lift station which can pump to either WWTP, but presently pumps to the Cannon WWTP. On June 24, 2011, members of the Stantec team met with CRD staff on-site to review the existing lift stations. The lift stations were inspected from the surface.

The pump stations in place today were generally installed in the early 1980's with the exception of Galleon which is from the original 1970's system. The process piping of a lift station has a typical lifespan of 25 year; therefore, all (with the exception of Cutlass's process piping, which was recently upgraded to stainless steel) are corroded and reaching the end of their serviceable life. It is therefore recommended to replace all the process piping within the lift stations (except Cutlass). Although the original piping within the stations was galvanized steel, it is recommended that the replacement piping be stainless steel, Type 304L. Stainless steel is a more robust material than galvanized and provides more protection versus corrosion and a longer lifespan. The wet wells of the pump stations are typically coated steel (except Galleon which is concrete) and should have a number of years of serviceable life remaining, as they typically have a 50 year lifespan. It is therefore recommended to keep the existing chambers (and continue maintaining the protective coating). Sections 2.2.1 to 2.2.6 below provide a detailed breakdown of the inspections and list further deficiencies.

A major deficiency noted at the site visit is the outdated electrical system and the lack of a SCADA system at all lift station sites (exception is Galleon has a SCADA pack monitoring pump start/stops and wet well levels). Although rectifying these deficiencies will be expensive, it is a move that the CRD should strongly consider to maximize the efficiency of the Magic Lake Sewer System.

2.2.1 Schooner LS

Table 2.2 – Schooner Lift Station Condition Assessment

Element	Description	Condition	Remarks
Pumps	Duplex 15hp (230V, 3-phase, 60amp each.	Poor	Pumps grinding
Process Piping	200Ø Galvanized	Corroded piping with couplings rusted	Internal valving undesirable
Lift Out Rails	Galvanized	Corroded	Rail connections to lift station wet well heavily corroded.
Float Hanger	Steel	Corroded but operational	Replacement not yet required
Access	Galvanized ladder	Ladder top cross member	Ladder located in center of

		corroded.	wet well and dangerous to access
Wet Well	Coated steel approx. 2.0m diameter	Wet well recently re-coated	Continue existing maintenance plan including coatings etc.
Kiosk	Separate compartments for hydro / electrical and controls	Kiosk and components operational. Blower operational. Exterior re-coating required	High alarm dial out not checked but confirmed operational by maintenance.

Notes:

- Back-up power required due to size of lift station and susceptibility of overflow during power outages. Suggest the installation of a manual disconnect for a mobile gen set.
- Pumps noisy and grinding – pump replacement likely required
- Pumps air lock when lift station is fully pumped out; operators identified that the pump #1 does not operate for up to 2 days after air lock. This signifies a high point somewhere in the forcemain and an air valve is required.
- Significant hammer on pumps when shut off, check valve possibly not operating.
- Isolation valves require confined space entry into lift station for shut off.
- Condition of existing piping poor and replacement required in short term (5 years); in addition existing outlet piping buried in excess of 2.0m
- Wash down hose bib installed (with backflow preventer).

2.2.2 Capstan LS

Table 2.3 – Capstan Lift Station

Element	Description	Condition	Remarks
Pumps	Duplex 5hp, 230V, single phase, 2 pole 15 amp each pump.	Good	Pumps in good working condition
Process Piping	75Ø Galvanized	Minor pipe corrosion with cast couplings / valves rusted	Internal valving undesirable.
Lift Out Rails	Galvanized	Lift out rails have minor pipe corrosion	Rail connections to lift station wet well heavily corroded.
Float Hanger	Does not exist		Floats hung off ladder cross member.
Access	Galvanized ladder	Ladder top cross member corroded and appears to	Ladder located in center of wet well and dangerous to

		require replacement.	access
Wet Well	Coated steel approx. 1.6m diameter	Wet well recently re-coated	Continue existing maintenance plan including coatings etc.
Kiosk	Separate compartments for hydro / electrical and controls	Kiosk and components operational. Blower operational. Exterior re-coating required	High alarm dial out not checked but confirmed operational by maintenance.

Notes:

- Wet well lid heavily corroded and requires replacement.
- Back-up power likely not required due to low demand of lift station. Daily monitoring recommended during power outages.
- Wash down hose bib installed (with backflow preventer).

2.2.3 Buccaneer LS

Table 2.4 – Buccaneer Lift Station

Element	Description	Condition	Remarks
Pumps	Duplex 5hp, 230V, single phase, 2 pole 15 amp each pump.	Good	Pumps in good working condition
Process Piping	75Ø Galvanized	Minor pipe corrosion with cast couplings / valves rusted	Internal valving undesirable and not easily accessible.
Lift Out Rails	Galvanized	Lift out rails have minor pipe corrosion	Rail connections to lift station wet well heavily corroded.
Float Hanger	Does not exist		Floats hung off ladder cross member.
Access	Galvanized ladder	Ladder top cross member corroded and appears to require replacement.	Ladder located in center of wet well and dangerous to access
Wet Well	Coated steel approx. 1.6m diameter	Wet well required re-coating.	Continue existing maintenance plan including coatings etc.
Kiosk	Separate compartments for hydro / electrical and controls	Kiosk and components operational. Blower operational. Exterior re-coating required.	High alarm dial out not checked but confirmed operational by maintenance.

Notes:

- Wet well lid beginning to corrode and replacement likely required in next few years.

- No overflow exists; however, manual transfer switch and genset connection is available. Monitoring of levels will be required during power outages and pump out as necessary with mobile gen-set.

- Wash down hose bib installed (with backflow preventer).

2.2.4 Masthead LS

Table 2.5 – Masthead Lift Station

Element	Description	Condition	Remarks
Pumps	Duplex 5hp, 230V, 3 phase, 2 pole 15 amp each pump.	Good	Pumps in good working condition
Process Piping	75Ø Galvanized	Minor pipe corrosion with cast couplings / valves rusted	Internal valving undesirable and not easily accessible.
Lift Out Rails	Galvanized	Lift out rails have minor pipe corrosion	Rail connections to lift station wet well heavily corroded.
Float Hanger	Does not exist		Floats hung off ladder cross member.
Access	Galvanized ladder	Ladder top cross member corroded and appears to require replacement.	Ladder located in center of wet well and dangerous to access
Wet Well	Coated steel approx. 1.6m diameter	Wet well required re-coating.	Continue existing maintenance plan including coatings etc.
Kiosk	Separate compartments for hydro / electrical and controls	Kiosk and components operational. Blower operational. Exterior re-coating required.	High alarm dial out not checked but confirmed operational by maintenance.

Notes:

- Overflows into adjacent creek and operations indicate the lift station has historically overflowed. Recommend installation of a manual transfer switch and gen-set connection. Monitor wet well levels daily during prolonged power outages.

- Wash down hose bib installed (with backflow preventer).

2.2.5 Galleon LS

Table 2.6 – Galleon Lift Station			
Element	**Description**	**Condition**	**Remarks**
Pumps	Duplex 5hp, 230V, single phase, 2 pole 20 amp each pump.	Good	Pumps in good working condition
Process Piping	75Ø Galvanized to PVC outlet.	Minor pipe corrosion with cast couplings / valves rusted. Orientation oddly installed.	Internal valving undesirable and not easily accessible.
Lift Out Rails	Galvanized	Lift out rails have minor pipe corrosion	Rail connections to lift station wet well heavily corroded.
Float Hanger	Long cantilever	Minor corrosion, not very stable	Reinforcement required
Pressure Transducer	DeZURIK	Good condition	
Access	Rebar ladder fastened into wet well side wall	Ladder is obstructed by outlet piping mid-way down lift station	If outlet piping is adjusted ladder obstruction will be corrected.
Wet Well	Concrete square wet well	Wet well appears is adequate condition. Power washing and concrete conditioning may be required.	
Control Kiosk	Contains starter, relays, scada pack, sub panel, heater, pressure transducer.	Kiosk and components operational. No blower installed and required.	SCADA pack confirmed operational by maintenance staff.
Electrical Kiosk	Pole mounted meter, manual disconnect, genset connection.	Weathered but functional	

Notes:

- Lift station is situated beside Buck Lake (Magic Lake Estates water source) and considered high risk if overflowed. Lift station is equipped with the appropriate redundant level sensing, Mobile genset back-up power connections, and alarm software.
- No wash down hose bib noted.

2.2.6 Cutlass Court LS

Table 2.7 – Cutlass Lift Station

Element	Description	Condition	Remarks
Pumps	Duplex 5hp, 230V, 3-phase, 2-pole 20 amp each, VFD	Good with new VFD units installed.	Pumps in good working condition. No apparent defects when pumps operated
Process Piping	75Ø Stainless steel	Excellent – New piping	Internal valving stainless and accessible.
Lift Out Rails	Stainless steel	Excellent – New rails	
Float Hanger	Stainless steel	Excellent – New hanger	
Access	No ladder		Access to bottom of lift station not typically required as all valving accessible from surface.
Wet Well	Coated steel approx. 1.6m diameter	Wet well recently re-coated	Continue existing maintenance plan including coatings etc.
Kiosk	Separate compartments for hydro / electrical and controls	Kiosk and components operational. Blower operational. Kiosk in acceptable condition.	High alarm dial out not check but confirmed operational by maintenance.

Notes:

- Air valve missing on top of outlet piping after ball valves. Check valve shuttered when pumps shut off during pump operation check, likely due to missing air valve.
- Recent overflow chamber constructed beside lift station and in use but appeared not to completely fill. Lift station overflow located beside forcemain discharge but gravity overflow outlet could not be located.
- Recent overflow chamber upgrades indicate storage and pump out time problems. Installation of a manual transfer switch and gen-set connection recommended for pump out during power outages.
- Wash down hose bib installed (with backflow preventer).

2.3 COLLECTION SYSTEM

2.3.1 Current Status

Wastewater collection systems generally can experience failures through three mechanisms; hydraulic capacity, hydraulic restrictions, and structural failure. Hydraulic capacity failures are due to the pipe not having adequate capacity for the flow conditions. Our review of hydraulic capacity included looking at (or recommending further investigation where not visible) potential for excessive I&I, pipe deformation, and/or inadequate slope. Hydraulic restrictions failures can be caused by grease build up, rags and accumulation of sediment. Our review looked for areas of low slopes where inadequate scouring may lead to these build up conditions. Structural failure occurs due to defects in pipe wall, pipe support (surrounding soil), off-set joints, internal or external corrosion, cracked manhole frames and pipe deflections. Our review was limited in the detection of this type of failure to visible above ground defects and requires a more comprehensive approach than practical in this assessment.

On June 23, 2011, members of the Stantec team met with CRD staff on-site to review the existing Magic Lakes Local Service Area collection system. The review consisted of a cursory inspection of some of the manholes on the system, as well as reviewing areas which appeared to be experiencing high inflow and infiltration (I&I) rates, and where sewer lines where installed in areas conflicting with structures. No assessment of the forcemains was carried out and the operator did not indicate any issues with any of the forcemain system other than those items associated with Section 2.3 Lift Stations. The existing collection system consists of both gravity and forcemain sewers and pipe material is both asbestos cement (AC) and poly-vinyl chloride (PVC) for the gravity system and PVC for the forcemain. The AC was installed 40 years ago, and the PVC 30 years ago during a major expansion in 1981.

Condition assessments for underground infrastructure are difficult to perform without video inspecting each pipe within the gravity system, and the CRD should give consideration into carrying out such an investigation to verify the condition of the system. This will allow for the detection of pipe defects which indicate the likelihood of pipe failure, as well as aid in evaluating the system's performance. Budget costs for CCTV inspection and smoke testing are provide for in Section 5.1. Forcemains require the use of acoustic, electrical/electromagnetic or innovative technologies such as ground penetrating radar or infrared thermographs to provide detection of defects (pipe wall thickness, leakage and pipe support). Inspection of forcemains typically requires pipelines to be taken out of service and requires by-pass pumping.

The cursory manhole inspection revealed that the manholes seemed to be in fair to good condition, with no visible signs of root invasion, sediment build-up or, corrosion or inflow and infiltration. It was noted by CRD staff that a manhole survey was performed earlier in the decade; however, this report was unable to be found for inclusion into this report. Between 2004 and 2006 approximately 30 manholes underwent repairs/upgrades typically consisting of new lids, frame and covers as well as grout repairs and additional ring height added. As only 5%

of manholes were checked and there is an apparent high amount of I&I from existing flow data, it is recommended that the CRD carries out a manhole condition survey be undertaken in conjunction with the CCTV pipe inspection. Costs for carrying out a manhole condition survey are provided for in Section 5.1.

The operator identified the 150mm AC sewer pipe servicing the lots adjacent to Buck Lake along Galleon Way as an area of concern as it has backed up on numerous occasions (hydraulic failure). This approximately 410m section of pipe includes 14 manholes runs at a shallow grade inside a 7 to 10m easement along the shore of Buck Lake. Design drawings indicate the design grade to be 0.6% which is just above the typical minimum grade of 0.5%, and it has been indicated by the CRD that some areas are at a negative grade. The last 85m of this pipe section was upgraded in 1992 (including 3 manholes) to 200mm diameter SDR35 PVC pipe; however, it runs at a slope of 0.44%. Sediment build up in shallow sloped pipe often lead to restrictions in the flows and contribute to system back up scenarios. It is inherently difficult during construction to maintain such shallow slopes and often peaks and valleys occur which exasperate sediment deposits. The operator noted that the pipes require frequent jet flushing. Flows from approximately 75 lots enter into this section of pipe from Galleon via a 10% slope via two upstream pump stations (Galleon and Masthead). These peak flows from the pump stations could compound the backing up of this section of pipe especially if the hydraulic capacity is already reduced due to hydraulic restrictions. Additional flows from approximately 15 lots enter at approximately ¾ the length of this section of pipe at a slope of 7%, and flows from an additional 65 lots enter the manhole at the end of this section of pipe at a 23% slope.

It was also observed that a 150mm AC sewer main runs underneath the garage and a manhole is situated under the garages concrete slab at 3703 Compass Crescent. In addition a 150mm AC sewer main runs under a solarium at Lot 152 on Spyglass Hill. It is recommended that these mains be relocated to avoid issues which may arise in the event of pipe failures in these areas, which could result in more extensive property damage due to the proximity to structures. Property owners should be made aware of the existing situation, the easements, any existing approvals to build over the easements and any rights the CRD may have for accessing the main for maintenance or replacement. Relocations could prove difficult as these mains traverse through backyards of these properties, unfavorable topography and the properties are bound on one side by Buck Lake. A more detailed investigation of the site is required to determine a feasible relocation of the alignment.

Flow data collected from 2005-2010 at the Schooner treatment plant shows that monthly flows almost double during the winter months (from November to February) indicating that the system is experiencing either high inflow or infiltration to the system. The Cannon treatment plant has also experienced doubling of wet weather flows in 2006, 2007 and 2009. Without a video inspection of the affected areas, it is difficult to pinpoint a reason for this, but there could be a number of reasons for it. One could be that the pipe intersects an underground spring or an area of high groundwater table. This could result in a hydrostatic pressure on the sewer pipe and manhole rubber gaskets in excess of the allowable water pressure of 1.2 metres during seasonal variations in ground water tables. The pipe and the porous gravel backfill can often act like a French drain and water can flow along its alignment due to the high porosity of the backfill and enter the system at the manholes or at pipe joints, especially in pipes where slopes are exceeding 10%. Other major sources of I&I can be broken pipes, cracks, leaks from manhole frames and covers and off-set joints. The age of the AC pipes and potential for exterior corrosions or softening from acidic soils can also cause both deformation and/or breakage of pipes. CCTV inspection along with a manhole condition survey would provide further information into the cause of the I&I and again is strongly recommended.

Table 2.8 below gives a breakdown of the pipe material and sizes, and number of manholes and lift stations within the three wastewater treatment systems on Pender Island (Schooner WWTP, Cannon WWTP, and Chart Drive Drain Fields). The information for this table was drawn from CRD supplied drawings of the original Magic Lake (Buck Lake) system installed in the late 1960's and early 1970's, and the 1981 expansion. It should be noted that as detailed drawings for the Chart Drive area were unavailable, the sizes and materials for the Chart Drive system were assumed to be the same material (asbestos cement) and size (150mm) as the collectors used in the original Magic Lake System as it was carried out in the same time frame.

Table 2.8 – Existing Collection System

Local Service Water System	Lift Stations	75mm	150mm	200mm	250mm	Manholes	Year Built
MLE (Cannon)	1	510 PVC (FM)	1,410 AC + 480 PVC	0	0	35	AC – 1971 PVC - 1981
MLE (Schooner)	5	605 PVC (FM)	5,830 AC +4,160 PVC	2,220 PVC	1,230 PVC	270	AC – 1971 PVC - 1981
MLE (Chart Drive)	0	0	*350 AC	0	0	11	1971

*Assumed size and material

2.3.2 Immediate Deficiencies

- CCTV and smoke test required on gravity system.
- Complete manhole condition survey required.
- 3703 Compass Crescent - Significant contributing area 150mm gravity main (and manhole) travels under existing garage and concrete slab.
- Spyglass Road – 150mm gravity main travels under existing solarium.

- Galleon Way – Gravity main installed along the lake front of the cabins. The 150mm gravity main is installed at 0.6% and known to back up. Overflow float exists with dial out.
- Substandard pipe sizing – Most of the system pipes are 150mm diameter. Current practice is for sanitary sewers to be 200mm diameter minimum, except for the upper portions (approximately 350m) of a non-extendable system, where 150mm is generally acceptable. Based on these minimum criteria, approximately 4.2 km of 150mm PVC and AC are undersized pipe on the system. As the main concern is the age of the AC pipe (40 years) and expected lifespan (60 years), the AC pipe should be focused on over the next 20 years. Therefore approximately 3.5 km of AC pipe to be replaced with 200mm PVC.

3.0 Review of Wastewater Quality and Flow Data

3.1 SCHOONER WAY WWTP

3.1.1 Sewage Flow

Table 3.1 provides a summary of the annual average, maximum monthly and maximum daily flows for the last five years. The maximum day permitted flow (MSR RE:01693) is 640 m^3/day. Plant influent design criteria were as listed as 200 mg/L BOD and TSS, with effluent <45 mg/L BOD and TSS. The annual average daily flow measured at the Schooner WWTP have maintained at fairly stable rates of approximately 200m^3/day (+/- 6%) since 2006 (with exception of the low flows in 2008), as have the monthly maximum.

In four of the last five years, the maximum day flow has been over 3.5 times the annual average. As the maximum day flow is a function of weather dependent inflow and infiltration, this indicates that there is extensive I&I in the collection system flowing to the Schooner WWTP.

There are currently approximately 529 residential SFE's connected to the sewage system serviced by the Schooner WWTP. Assuming three persons per SFE, the total equivalent population connected to the sewage system is 1587 persons. The 2010 annual average flow per SFE is 382 L/day while the 2010 maximum month and the maximum day flows per SFE are 637 L/day and 1,724 L/day respectively.

Table 3.1 – Summary of Flows at Schooner WWTP					
Year	**Annual Average (m^3/day)**	**Maximum Month (m^3/day)**	**Ratio – Max Month: Annual Ave**	**Maximum Day (m^3/day)**	**Ratio – Max Day: Annual Ave**
Permit				***640***	
2006	214	374	1.75	851	3.98
2007	217	347	1.60	884	4.07
2008	183	264	1.44	448	2.45
2009	197	345	1.75	698	3.54
2010	202	337	1.69	912	4.51
Proposed Peaking Factors			1.75		4.0

Table 3.1 indicates that each year, except 2008 had at least one occurrence of MDD exceeding the permitted flow of 640m3/day. In 2006 there were three occurrences of the MDD exceeding 640 m3/day in November, in 2007 there was one occurrence in December and one in January, in 2009 there was one occurrence in November and in 2010 there was one occurrence in December. A typical ratio of maximum month to annual average is 1.3, therefore the values of 1.75 seen at the Magic Lakes sewerage system are considered to be excessive. It appears that these high flows are event driven, and that inflow through manhole lids, or cross connections with roof leaders and possibly basement sump pumps could be contributing factors to these high flows. Infiltration from seasonally high groundwater table is probably a significant factor as well. The very high ratio of maximum day to annual average indicated here is generally considered unacceptable and reinforces the need for CCTV and smoke testing of the system.

3.1.2 Wastewater Characteristics

Raw wastewater sampling is carried out once a month and TSS, pH, TBOD, ammonia and fecal coliform counts are taken. The annual influent average TSS and TBOD concentrations are summarized in Table 3.2. As indicated in Table 3.2, the strength of the wastewater is remaining relatively stable over time and this is consistent with the relative stable annual flows shown in Table 3.1.

Table 3.2 – Schooner WWTP Raw Wastewater Characteristics Annual Average		
Year	**TSS (mg/L)**	**TBOD (mg/L)**
2006	226	215
2007	144	157
2008	241	259
2009	222	232
2010	173	180
Plant Design Value	***200***	***200***
5-year Average	***201***	***209***

It should be noted that the above values are based on grab samples taken once a month. Sewage treatment facilities are typically designed on the basis of the organic loading during the maximum month. In the case of Magic Lake Estate, the maximum organic loading will occur in the summer months when the serviced population is highest. Sewage strength in the summer months would be higher because of lower inflow and infiltration in conjunction with increased seasonal population Table 3.3 below summarizes the average summer month (June to September) loading values as well as gives the average dry weather flow (ADWF)

Table 3.3 – Schooner WWTP Raw Wastewater Characteristics Average Summer Month (June to September)			
Year	**TSS (mg/L)**	**TBOD (mg/L)**	**ADWF (m3/day)**
2006	244	240	154
2007	135	122	166
2008	256	301	154
2009	281	254	151
2010	186	189	164
5- year average	***220***	***221***	***158***
Plant Design Value	***200***	***200***	-
Proposed Revised	***225***	***225***	-

As indicated above, the Schooner wastewater treatment plant was designed on the basis of average TSS and TBOD concentrations of 200 mg/L. This corresponds to what the plant is currently experiencing on a yearly basis, which is slightly more diluted than its summer month averages of 225 mg/L. As TSS and TBOD loadings are population dependent, it is not expected that the sewage strength would change unless there is a significant reduction in inflow and infiltration. However, should the flows (or partial flows) from Cannon Drive WWTP, or the Chart Drive area serviced by the drainage field be diverted to the Schooner WWTP, the TSS and

TBOD values could change depending on the I&I in these catchment areas. In evaluating the capacity of the plant in conjunction with future growth (and/or sewage flow diversion), it is proposed to use higher concentrations of 225mg/L for TSS and TBOD.

3.1.3 Treated Effluent Quality

The Schooner wastewater treatment plant is regulated under MSR Registration RE-01693, issued November 15th 2000, with the requirements outlined in Table 3.4 below:

Table 3.4 – Schooner WWTP Effluent Criteria

Parameter	**Effluent Criteria**
Maximum Daily Flow	640 m3/d
Maximum cBOD	45 mg/L
Maximum TSS	45 mg/L
Maximum Fecal Coliform	200 CFU/100 mL
Toxicity Test	Pass the Rainbow trout 96 hr effluent toxicity test

In 2001 a surface water fecal coliform monitoring program was put into place for the Schooner plant, as a result of outfall performance investigations which indicated a surface plume could arise under certain conditions. The monitoring program was intended to last only one year unless certain triggers were met which would require the program to be reinitiated for 2 consecutive years. These triggers were as follows:

- UV disinfection unit is no longer functioning;
- The maximum day discharge exceeds 640m^3/day
- The disinfected effluent consistently has a fecal coliform concentration greater than 200 cfu/100ml. Consistently, in this case, is defined as exceeding 200 cfu/100ml over two consecutive sampling periods or three of the twelve total sampling events in a year.

Table 3.5 summarizes the triggers of the past six years.

Table 3.5 –Triggers Initiating Surface Water Monitoring Program (2005-2010)

Year	Flow Trigger	Effluent Trigger	UV Trigger
2005	-	-	-
2006	X	X	-
2007	X	X	-
2008	-	-	-
2009	X	-	-
2010	X	X	-

The results of the surface water fecal coliform samples collected in the receiving water since the addition of UV disinfection in February 2000 were all less than 200 CFU/100ml (BC primary contact recreational guideline) indicating a very low risk factor for humans.

Starting in the fall of 2011, the existing sampling program will be discontinued. In its place a new 5 in 30 surface water sampling program will be initiated. This will require 5 samples to be taken within 30 days at times when treatment plant issues are most likely to occur (ie during heavy rains in winter months). This new program is to provide for a more direct comparison to the BC MOE Water Quality Guidelines.

The treated effluent quality is summarized in Table 3.6 below. The plant has met the registration requirements for carbonaceous biological oxygen demand (cBOD) for the last four years. The effluent parameter listed is the disinfected effluent.

Table 3.6 – Summary of Effluent Quality Schooner WWTP

Year	TSS (mg/L)		cBOD (mg/L)		Disinfected Effluent Fecal Coliform (CFU/100 mL)		Ammonia (mgN/L)	
	Mean	Max	Mean	Max	Mean	Max	Mean	Max
Permit		***45***		***45***		***200***[(1)]		***n.a.***
2006	60	621	20	179	230	590,000 2nd highest 820	2.09	14.4
2007	15	41	5	7	99	11,000	0.63	5.37
2008	11	22	4	6	27	6,800	0.21	0.48
2009	9	27	5	10	13	>200	0.4	3.2
2010	14	104	5	27	261	2,100	0.41	2.45

(1) Consistently exceeding 200 cfu/100ml is a trigger for surface water monitoring to be put into effect for 2 consecutive years (see consistently definition above)

The permitted TSS limit was exceeded in 2006 and 2010. In November 2006, effluent sampling occurred during a plant upset that caused a short period of bulking sludge and associated extreme levels of TSS and fecal coliform and should not be considered a representative sample. The next highest TSS value in 2006 was 21 mg/L and 21 mg/L for cBOD, and in 2010 the next highest TSS value was 10 mg/L.

Toxicity Testing

As noted in the Gulf Islands and Port Renfrew Wastewater and Marine Environment Program 2010 Annual Report, the undiluted effluent sample from July 22, 2010 passed the toxicity test with 100% survival, indicating that the effluent was not acutely toxic to the juvenile Rainbow trout.

3.2 CANNON DRIVE WWTP

3.2.1 Sewage Flow

Table 3.7 provides a summary of the annual average, maximum monthly and maximum daily flows for the last five years. The maximum day permitted flow (PE:0220) is 68.2 m^3/day. The annual average daily flow measured at the Cannon WWTP have maintained fairly stable rates of approximately 47m^3/day since 2006, as have the monthly maximum, with the exception of 2008 with was approximately 20% lower. This is similar to the slightly lower flow rates seen at the Schooner WWTP.

With the exception of 2007 and 2010, the maximum day flow has been over 2.5 times the annual average. In 2007 and 2010 the maximum day was 4 times and 5.4 times the annual average respectively. As the maximum day flow is a function of weather dependent inflow and infiltration, this indicates that there is significant I&I and or cross connections in the collection system flowing to the Cannon WWTP.

A review of the lot plans indicate that there are approximately 100 residential SFE's connected to the sewage system connected to the Cannon WWTP. Assuming three persons per SFE, the total equivalent population connected to the sewage system is 300 persons. The 2010 annual average flow per SFE is 520 L/day while the 2010 maximum month and the maximum day flows per SFE are 760 L/day and 2,830 L/day respectively.

Table 3.7 – Summary of Flows at Cannon WWTP

Year	Annual Average (m^3/day)	Maximum Month (m^3/day)	Ratio – Max Month :Annual Ave	Maximum Day (m^3/day)	Ratio – Max Day: Annual Ave
Permit				***68***	
2006	47	75	1.60	133	2.83
2007	48	77	1.60	195	4.06
2008	39	51	1.31	106	2.72
2009	48	85	1.77	136	2.83
2010	52	76	1.46	283	5.44
Proposed Peaking Factors			1.70		4.0

Table 3.7 indicates that each year, there was several occurrences of MDD exceeding the permitted flow of 68.2 m^3/day. In 2006 the MDD flow exceeded the permitted flow 15% of the time, in 2007 the permitted flow was exceeded 12% of the time, in 2008 it was only exceeded 2% of the time, in 2009 permitted flows were exceeded 13% of the time, and in 2010 11% of the flows exceed the permitted value of 68.2 m^3/day. A typical ratio of maximum month to annual average is 1.3, therefore the values seen at the Magic Lakes sewerage system would be considered excessive. Although the system underwent an inflow reduction program between

APPENDIX C

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MAGIC LAKE ESTATES

CAPITAL REPLACEM

Description	Details	Funding Source	Year Required	Cost - Stantec Rpt 2011
COLLECTION S				
I & I Program Phase 1	Inflow / Infiltration program includes CCTV. flow monitoring, smoke testing and field inspection of manholes .	Captial	2013-2018	140,000
Buck Lake Replacement	Using pipe bursting to upgrade the existing pipe	Capital	2013-2018	250,000
Buck Lake Low Pressure System	Replace existing 325m - 150mm AC pipe with Low Pressure System with a pump for each unit.	Capital	2013-2018	900,000
Privateers Rd	Replace existing 112m of 150mm AC pipe with 200mm PVC pipe.	Captial	2013-2018	70,000
Annual Pipe Replacement Program	Replace 3.5 km of AC pipe over the next 19 years at 200m per year with an estimated total cost of $3.4M with average annual cost of $170,000	Reserves	2015-2035	
Annual Pipe Replacement Program	Replace 3.5 km of AC pipe over the next 19 years at 200m per year with an estimated total cost of $3.4M with average annual cost of $170,000	Reserves	2015-2035	
PUMP STAT				
Replace Schooner Pump Station	Replace Schooner Pump Station	Captial	2013-2018	271,000
Replace Capstan Pump Station	Replace Capstan Pump Station	Captial	2013-2018	100,000
Replace Cutlass Pump Station	Replace Cutlass Pump Station	Captial	2013-2018	80,000
Replace Buchaneer Pump Station	Replace Buchaneer Pump Station	Captial	2013-2018	100,000
Replace Masthead Pump Station	Replace Masthead Pump Station	Captial	2013-2018	100,000
Replace Galleon Pump Station	Replace Galleon Pump Station	Captial	2013-2018	108,000
WASTEWATER TREAT				
New Chart Drive Pump Station & FM	New Chart Drive Pump Station & Forcemain	Captial	2015	360,000
New Cannon Pump Station & Forcemain	New Cannon Pump Station & 610m Forcemain	Captial	2015	870,000
**Schooner WWTP Upgrades	New Clarifier and Equalization Tank	Capital	2012	1,000,000
Schooner WWTP Aeration Tank Eval	Engineering study to evaluate usable life of aeration tanks	Capital	2012	14,000
New Schooner WWTP	A New sequencing batch reactor (SBR) plant adjacent to the existing plant with a capacity of 536 m^3/day maximum monthly flow, peak flows of over 1,200 m^3/day	Captial	2012	2,150,000
TOTAL COST OF UPGRADES & REP				

APPENDIX D

1999 and 2002, the very high ratio of maximum day to annual average indicates that there may still be areas of high I&I or cross connections to the system either through roof leader or basement sump pumps as most of the high flow values are during the winter months.

3.2.2 Wastewater Characteristics

Raw wastewater sampling is carried out once a month and TSS, pH, TBOD, ammonia and fecal coliform counts are taken. The annual average TSS and TBOD concentrations are summarized in Table 3.8. As indicated, the strength of the wastewater has been decreasing over time (with the exception of 2008). The increase in TSS and BOD in 2008 corresponds with the reduced flows experienced that year, resulting in a less diluted raw wastewater. However, the low TSS and TBOD values for 2009 and 2010 are difficult to explain especially since the flows have remained constant. These low values are not typical of sewage and re-sampling using a composite sampler should be carried out.

Table 3.8 – Cannon WWTP Raw Wastewater Characteristics

Year	TSS (mg/L)	TBOD (mg/L)
2006	190	178
2007	103	188
2008	183	170
2009	90	120
2010	45	94
Plant Design Value	***200***	***200***
5 Year Average	***122***	***150***

Table 3.9 below summarizes the average summer month (June to September) loading values, as well as ADWF.

Table 3.9 – Cannon WWTP Raw Wastewater Characteristics Average Summer Month (June to September)

Year	TSS (mg/L)	TBOD (mg/L)	ADWF (m^3/day)
2006	183	155	34
2007	120	194	36
2008	65	108	38
2009	118	196	36
2010	46	124	48
5 Year Average	***106***	***155***	***38***
Plant Design Value	***200***	***200***	-

The population the Cannon WWTP services should remain constant. There has been no increase in serviceable area since 2006. A possible explanation for the lower TSS and TBOD values could be that grab samples are taken at a time when flows are high but the discharge of toilet waste is low. Composite samples made up of several small samples taken every hour might result in different concentration.

3.2.3 Treated Effluent Quality

The Cannon wastewater treatment plant is regulated under Permit PE-0220 dated April 28, 1981, with the permitted levels outlined in Table 3.10 below:

Table 3.10 – Cannon WWTP Effluent Criteria

Parameter	Effluent Criteria
Maximum Daily Flow	68 m3/d
Maximum cBOD	45 mg/L
Maximum TSS	60 mg/L
Maximum Fecal Coliform	N/A
Toxicity Test	N/A

The treated effluent quality is summarized in Table 3.11 below. The plant has met the permit requirements for cBOD and TSS for the last five years. The effluent parameter listed is for secondary treated effluent. Surface water fecal coliform samples have not been taken at this site to date; however there is now an MOE requirement to undertake a surface water monitoring program. The CRD is aware of this program, but due to budget constraints does not expect to undertake such a program until 2012. Toxicity testing is not required for this site.

Table 3.11 – Summary of Effluent Quality Cannon WWTP

Year	TSS (mg/L)		cBOD (mg/L)		Secondary Effluent Fecal Coliform (CFU/100 mL)		Ammonia (mgN/L)	
	Mean	Max	Mean	Max	Mean	Max	Mean	Max
Permit		***60***		***45***		***n.a.***		***n.a.***
2006	12	33	6	22	31,000	810,000 2nd high 290,000	2.16	13.5
2007	18	39	6	13	41,000	530,000	0.87	4.6
2008	16	30	4	8	34,000	360,000	0.37	2.19
2009	15	46	6	12	11,849	74,000	1.0	7.1
2010	14	25	5	12	20,908	78,000	1.2	11.1

4.0 ANALYSIS OF SEWAGE SYSTEM

4.1 PROJECTED FLOW

Unless the sewer service area is expanded or there are changes to land use, significant increases in flow are not anticipated. There are still a number of vacant lots within the sewer service area and as new houses are constructed, minor increases in sewage flows are possible. Projected increase in sewage flow resulting from the development of existing vacant lots is discussed in Section 4.3.1 and 4.3.2.

4.2 CAPACITY OF COLLECTION SYSTEM

As there is no current SANSYS model for this system, a detailed analysis of the sewage collection system capacity was not performed because it is outside of the scope of work. Other than the 410m of 150mm AC sewer pipe servicing the lots adjacent to Buck Lake along Galleon Way, discussed in section 2.3.1, a cursory review of low slope areas identified that the 112m, 150mm AC pipe between Dubloon and Brigadoon Rd on Privateers Rd is undersized and should be replaced with a 200mm PVC pipe. The estimated cost of this replacement is $60,000.

The remaining pipes have sufficient capacity based on a cursory review of pipe slope and size. However as previously noted replacement of pipes should include for pipes to be upsized to 200mm with exception of the last 350m of non-extendable pipe where 150mm is generally acceptable.

4.3 CAPACITY OF TREATMENT PLANTS

4.3.1 Schooner Way WWTP

The peak flow capacity of the plant is 710 m^3/day as indicated in the October 2000 CRD report titled " Schooner Way Wastewater Treatment Plant Treatment System Upgrade Report". This peak flow is based on operating the plant in step feed configuration with the aeration tank divided into 3 compartments and 1/3 of incoming flow feeding into the aerated tank inlet, 1/3 in the middle compartment and 1/3 in the lower compartment. This capacity exceeds the MSR permit of 640m^3/d, but there are recorded maximum day flows that exceed the plant's capacity even during step feed operation. The October 2000 report indicates that when the plant is operated in the normal, extended aeration mode, the plant is capable of handling only 270 m^3/d of sewage flow.

As 529 lots are currently serviced there are potentially 63 lots able to tie to the Schooner WWTP. This equates to an approximate increase of 39 m^3/d flow to the plant (assuming 90% of 680 L/SFE of potable water is sent to sewer). It is proposed that the backwash flows from the DAF WTP be discharged to the Schooner plant which would add a minimal 0.9 -1.2 m^3/day flow

@ 1.6% solids content. As discussed further, it is proposed to pump the flows from the existing Chart Drive septic system to the Schooner plant which would increase flows by 14 m^3/d (based on design flow). As a result of the above, the current average annual flow of 200m^3/day could increase to approximately 250 m^3/day. Except for high winter flows, the Schooner plant has the capacity to accommodate the future flows described above.

4.3.2 Cannon Crescent WWTP

The existing plant currently exceeds the permitted discharge of 68m^3/d frequently; however its levels of TSS and BOD remain compliant. A written record of the plants design capacity was not found, but based on the size of the aeration tank of 65 m^3, the plant capacity is approximately 65 m^3/day. There are approximately 4 lots are potentially remaining to tie to the Cannon WWTP. This equates to an approximate increase of 3 m^3/d flow to the plant (assuming 90% of 680 L/SFE of potable water is sent to sewer).

The outfall appears to be capable to date of handling even the very high maximum day flows, although the level of BOD and TSS during these high flows is not known. During peak flow events, the hydraulic retention time would be far less than the typical 24 hours for an extended aeration plant.

4.3.3 Chart Drive Septic System

The Chart Drive septic field is failing under its current loads, and is cited by Giles Environmental Engineering as only having 10-15% of the trench bottom infiltration surface required by today's standards. A hydrogeological analysis of the site was not performed. The existing site would only be able to accommodate a design meeting 50% of the infiltration surface as required by today's standards. No alternative site was identified in the Thurber report and although that does not mean that an alternative site cannot found, based on the topography and soil condition, it is highly unlikely that a suitable sized vacant parcel with desirable percolation rate could be found.

4.4 OUTFALLS

The Schooner plant outfall was investigated by Seaconsult Marine Research in May 1999, and by Advanced Subsea Services in May 2002. No reports were located for the Cannon WWTP outfall. The 150mm diameter Schooner plant outfall extends approximately 130m from the shore to a depth of 12m below mean sea level. The pipe has a concrete cap that begins from the top of the embankment and continues for approximately 40m in the intertidal zone. Discharge depth ranges from 10m at low low water level to 14m at high high water level. The results of the performance evaluation in both reports have the same conclusions as listed below.

- The present outfall fails to meet performance objectives (surface water fecal coliform greater than 200 cfu/100ml) and effluent surfacing may occur during summer months at low water slack tide and during the winter months at both low and high water slack tide;

- Extending the outfall to a depth of 34m would provide subsurface trapping under winter conditions for AWWF (234m^3/d) and a depth of 42m for PWWF (640 m^3/d);
- The addition of a 9 port diffuser would reduce these depths to 22m for AWWF and 32m for PWWF and,
- Weak onshore currents occur during the summer and winter, but strong currents would produce subsurface trapping and remove risk of shoreline contact.

Although the 1999 Seaconsult report was carried out prior to the addition of UV disinfection (in 2000), the 2002 Advanced Subsea report used concentrations of treated effluent of 200,000 cfu/100ml for ADWF (155m^3/d), 2,000,000 for AWWF (234m^3/d) and 1,000,000 for PWWF (640 m^3/d). It is assumed these values were used in case the UV disinfection system failed. Disinfected effluent quality between 2007 and 2010 averaged had a maximum value of 11,000 cfu/100ml in 2007 and 4 year average of mean fecal coliform of 100 cfu/100ml. These are significantly reduced values which would change the results of the report's findings. As such the CRD and MOE developed a surface water fecal coliform monitoring program in 2001. As discussed in Section 3.1.3 of this report, surface fecal coliform counts are well below the 200 cfu/100ml.

The 2002 report included a diver inspection of the exterior of the outfall. This inspection noted that there were approximately two areas of 25m and 30m length where the weights which hold the pipe to the seabed had fallen off. This has caused the pipe to become buoyant and the pipe has lifted up to 2m from the seabed. Several other areas were noted to have severe corrosion on the metal bands securing the weights to the pipes. In addition, palm and bull kelp growth attached to the pipe may be causing horizontal drag on the pipe in strong currents. It is unknown at this time if these issues have been remediated. If not, the pipe weights should have bands replaced and new weights reattached to secure the pipe to the seabed.

5.0 Upgrading and Expansion Plan

5.1 COLLECTION SYSTEM

Table 5.1 provides budget costs for the deficiencies listed in Section 2.3. Budgets are not provided for any deficiencies which may arise out of the CCTV inspection, smoke testing or manhole condition survey, nor are budgets provided for the relocation of the pipes running under structures as negotiations with property owners may need to be undertaken, easement locations determined and whether new property is required.

Instead, the budgetary cost estimate for addressing the back up of sewers in the approximately 325m of pipe along Buck Lake is based on the installation of a new pump station, installation of a low pressure to 15 lots, and a new forcemain along Galleon Way. An alternate approach which may satisfy shorter term requirements would be to pipe burst the existing 150mm AC line with a 200mm HDPE line to increase the hydraulic capacity. A budget cost for pipe bursting the 325m of pipe is $250,000.

Table - 5.1 - 20 Year Capital Plan for Replacement and Upgrades Collection System				
Item	**Issue**	**Recommendation**	**Schedule**	**Budget (2011$)**
COLLECTION SYSTEM				
Gravity sewer Mains (PVC)	Hydraulic Restrictions, Structural Integrity, Hydraulic Capacity	CCTV	0-5 Years	$30,000
Gravity sewer Mains (AC)	Hydraulic Restrictions, Structural Integrity, Hydraulic Capacity	CCTV	0-5 Years	$48,000
Gravity Sewer Mains (PVC)	Infiltration and Inflow (I&I)	Smoke Test	0-5 Years	$15,000
Gravity Sewer Mains (AC)	Infiltration and Inflow (I&I)	Smoke Test	0-5 Years	$25,000
Manholes	I&I, structural Integrity	Manhole Condition Survey	0-5 Years	$22,000
Backup of Sewer along Buck Lake	Hydraulic Capacity	New LS, FM, and LP system	0-5 Years	$1,400,000
Pipe Upgrades	Substandard Pipe Size on 3.5 km of AC Pipe	Replacement (350m/year)	10-20 years	$1,800,000
Total				**$3,340,000**

5.2 PUMPING STATIONS

Table 5.2 provides budget costs for the deficiencies listed in Section 2.2. Budget prices are in 2011 dollars and do not include temporary pumping, individual General Conditions (it is assumed several items will be completed at the same time to reduce mobilization/demobilization costs), or taxes. Note that the time lines given for the Schooner LS account for upsizing capacity for Cannon flows and completing all work at once and would be adjusted to completer prior the Cannon WWTP decommissioning.

Table - 5.2 - 20 Year Capital Plan for Replacement and Upgrades to Lift Stations				
Item	**Issue**	**Recommendation**	**Schedule**	**Budget (2011$)**
Schooner LS				
Pumps	Grinding	Replacement and upgrade to handle Cannon flow diversion	0-5 Years	$75,000
Process Piping	Corroded Pipes, Couplings and Valves	Replacement	0-5 Years	$35,000
Lift Out Rails	Heavily Corroded	Replacement w/ Pumps	0-5 Years	$15,000
Access	Ladder in Hazardous location	Replacement	0-5 Years	$7,000
Back Up Power	No Backup Power Available	Install Disconnect for Mobile Generator	0-5 Years	$10,000
Air Valve	Pumps airlock - High Point in System	Install Air Valve Upstream of LS	0-5 Years	$10,000
Check Valve	Significant When Pumps Shut Off	Replacement	0-5 Years	$3,000
Floats	Minor Hanger Corrosion, Age	Replacement (Pressure Transducers)	0-5 Years	$15,000
Electrical (Including Kiosk)	Age, No SCADA	Replace Kiosk, Upgrade Electrical, Install SCADA	0-5 Years	$100,000
Total Schooner				***$270,000***
Capstan LS				
Pumps	30 years old	Replacement	0-5 Years	$40,000
Process Piping	Corroded Pipes, Couplings and Valves	Replacement	0-5 Years	$35,000
Lift Out Rails	Minor Corrosion on Rails, Connections Heavily Corroded	Replacement	5-10 Years	$10,000
Access	Ladder in Hazardous location	Replacement	5-10 Years	$5,000
Well Lid	Heavily Corroded	Replacement	0-5 Years	$10,000
Floats	No Hanger, Age of Floats	Install hanger and Float Replacement (Pressure Transducers)	5-10 Years	$15,000
Electrical (Including Kiosk)	Age, No SCADA	Replace Kiosk, Upgrade Electrical, Install SCADA	10-20 Years	$100,000
Total Capstan				***$115,000***

Cutlass LS				
Pumps	30 years old - New VFDs	Replacement	0-5 Years	$50,000
Back Up Power	No Backup Power Available	Install Disconnect for Mobile Generator	5-10 Years	$10,000
Air Valve	Air valve missing on top of outlet piping after ball valves	Install Air Valve	0-5 Years	$10,000
Check Valve	Shutters When Pump Shut Off	Monitor After New Air Valve Installed - Replace if Problem Persists	N/A	N/A
Back Up Power	No Backup Power Available	Install Disconnect for Mobile Generator	5-10 Years	$10,000
Electrical (Including Kiosk)	Age, No SCADA	Replace Kiosk, Upgrade Electrical, Install SCADA	10-20 Years	$100,000
Total Cutlass				***$180,000***
Buccaneer LS				
Pumps	30 years old	Replacement	0-5 Years	$40,000
Process Piping	Corroded Pipes, Couplings and Valves	Replacement	0-5 Years	$35,000
Lift Out Rails	Minor Corrosion on Rails, Connections Heavily Corroded	Replacement	5-10 Years	$10,000
Access	Hazardous location	Replacement	0-5 Years	$5,000
Well Lid	Surface Corrosion	Recoating	5-10 Years	$5,000
Back Up Power	No Backup Power Available	Install Disconnect for Mobile Generator	5-10 Years	$10,000
Floats	No Hanger, Age of Floats	Install hanger and Float Replacement (Pressure Transducers)	5-10 Years	$15,000
Electrical (Including Kiosk)	Age, No SCADA	Replace Kiosk, Upgrade Electrical, Install SCADA	10-20 Years	$100,000
Buccaneer Total				***$220,000***

Masthead LS				
Pumps	30 years old	Replacement	0-5 Years	$40,000
Process Piping	Corroded Pipes, Couplings and Valves	Replacement	0-5 Years	$35,000
Lift Out Rails	Minor Corrosion on Rails, Connections Heavily Corroded	Replacement	5-10 Years	$10,000
Access	Hazardous location	Replacement	0-5 Years	$5,000
Well Lid	Surface Corrosion	Recoating	5-10 Years	$5,000
Back Up Power	No Backup Power Available	Install Disconnect for Mobile Generator	5-10 Years	$10,000
Floats	No Hanger, Age of Floats	Install hanger and Float Replacement (Pressure Transducers)	5-10 Years	$15,000
Electrical (Including Kiosk)	Age, No SCADA	Replace Kiosk, Upgrade Electrical, Install SCADA	10-20 Years	$100,000
Masthead Total				***$220,000***
Galleon LS				
Pumps	40 years old	Replacement	0-5 Years	$40,000
Process Piping	Corroded Pipes, Couplings and Valves	Replacement	0-5 Years	$35,000
Lift Out Rails	Minor Corrosion on Rails, Connections Heavily Corroded	Replacement	5-10 Years	$10,000
Access	Hazardous location	Corrected if Outlet Piping Adjusted	N/A	N/A
Well Lid	Build Up	Power Wash and Concrete Conditioning	5-10 Years	$2,000
Back Up Power	No Backup Power Available	Install Disconnect for Mobile Generator	5-10 Years	$10,000
Water Service	No Apparent Wash down Hose bib	Water Service, Meter, Backflow preventer	0-5 Years	$8,000
Floats	Poor Hanger Setup, Age of Floats	Install hanger and Float Replacement (Pressure Transducers)	5-10 Years	$15,000

Electrical (Including Kiosk)	Age, No Blower	Replace Kiosk, Upgrade Electrical, Install Blower	10-20 Years	$100,000
Galleon Total				***$220,000***

5.3 TREATMENT PLANTS

5.3.1 Schooner Way WWTP

As a first step, ultrasonic testing and fitness for service evaluations should be carried out on the metal aeration and clarifier tanks to confirm tank condition and provide an estimate of the remaining service life. The ultrasonic testing could typically be carried out over a day and a half and approximately 1-2 weeks for the engineering analysis. The aeration tank will require its sides to be excavated and exposed to allow for testing where below grade.

Two options have been identified for the long-term upgrades of the Schooner plant. Option 1 consists of replacing Clarifier #1 and adding an equalization tank while Option 2 consists of building a new treatment plant at the existing site. To some extent, the selection of the preferred option for upgrading the treatment plant depends on the results of the ultrasonic testing on the metal tanks. Metal tanks typically have a service life of 50 years. The existing metal tanks for Clarifier 1 and the aeration tanks were installed in 1971 and have a theoretical remaining service life of 10 years. However, replacing the wastewater treatment plant is a costly endeavor and a more accurate estimate of the remaining service life should be provided to assist in the evaluation of options.

The estimated cost for the ultrasonic testing and fitness for service evaluation for clarifier #1 and the aeration tank is $14,000.

<u>OPTION 1</u>

If the results of the ultrasonic testing indicate that the aeration tank has 15-20 years of useful life remaining then it is recommended that Clarifier #1 be replaced because of its age, poor condition of its mechanical components, and the on-going operating difficulties. The new clarifier should be sized to allow for additional flows from the Chart Drive septic system, backwash from the DAF plant, and future build out of all existing lots within the existing sewer service area. A seasonally operated equalization tank would be required to handle flows in excess of the permitted flows of 640m^3/d, which would typically occur when the plant is operating in step feed mode.

In order to avoid complex and/or manual control of flows to the equalization tank, it is recommended that all flows be discharged into the equalization tank and then pumped at a constant rate to the aeration tank. This configuration would require that the equalization tank be aerated to prevent odour and solids settling. A budgetary cost for Option 1 is summarized in Table 5.3 below:

Table 5.3 – Option 1 Budgetary Costs	
Item	**Budget (2011$)**
Clarifier	$100,000
Equalization Tank	$720,000
Installation	$180,000
Subtotal	$1,000,000
General Conditions (10%)	$100,000
Engineering (15%)	$165,000
Contingency (25%)	$275,000
Total (rounded nearest $10K)	***$1,540,000***

Taxes not included

To provide cost savings, if ultrasonic testing on the clarifier tank indicates it still has a service life equal to that of the aeration tank, the replace the mechanical equipment only could be considered.

OPTION 2

If the ultrasonic testing indicates that the aeration tanks useful life is less than 15 years, then it is recommended to forgo the replacement of Clarifier#1, and instead to build a new sequencing batch reactor (SBR) plant adjacent to the existing plant.

As discussed later in Section 5.3.2, it is also recommended to divert the flows from the Cannon WWTP and Chart Drive septic field to the Schooner plant and decommission those facilities. This new plant would be sized to an average day flow 307 m^3/day and a maximum day flow of 918 m^3/day with occasional exceedances to 1,200 m^3/day. This flow would include sewage flows from all 714 lots included in the catchment areas for the Schooner, Cannon and Chart Drive facilities. Once the new plant is commissioned, the existing Schooner plant would be decommissioned. Table 5.4 summarizes the plant design flow. The design values for both the influent BOD and TSS would be increased to 225 mg/L. The influent BOD and TSS would be applied to the maximum month flow during summer months.

Table 5.4 – Future Schooner WWTP Flows	
Source	**Flow (m^3/d)**
Existing Schooner Flows	200
Future Schooner Connections	39
Diverted Chart Drive	14
Diverted Cannon Flows	50
Future Cannon Connections	3
DAF Backwash	1
Plant Design Average Annual Flow Value (1)	***307***
Maximum Month Flow (Max month peaking factor of 1.75)	***537***
Maximum Day Flow (Max day peaking factor of 4.0)	***1,228***

(1) Note the total average dry weather flow (**ADWF**) is estimated at **250m3/day**.

The type of SBR process recommended to replace the existing extended aeration (EA) treatment plant at Schooner is an Intermittent Cycle Extended Aeration System (ICEAS) process, which is a modification and enhancement to conventional SBR and extended aeration technologies allowing a continuous influent flow throughout the cycle. Conventional SBR technology operates on the fill and draw principle: fill, react, settle, decant and idle phases sequentially occur on a cyclic basis. This requires flows to be diverted from the basin during settling and decanting and requires two or more basins or a pre-equalization tank to receive flows during the settling and decanting phases.

With the ICEAS process, influent is received continuously throughout the cycle, which allows the process to be controlled on a time basis rather than a flow basis, which allows for equal loading and flow to all basins. This is an important feature for this system due to the flow variations resulting from high I&I in the wet winter months. Time based control allows for a simple method to facilitate a change to the entire system as the duration of each phase is the same among all basins, as opposed to flow control which would require separate control over each basin. This feature allows the ICEAS process to handle peak flows 3-6 times the average dry weather flow (ADWF) in comparison to the conventional SBR or EA in step mode which typically can efficiently handle flows of up to 3 times ADWF. The Schooner site is expected to have future peaks flows of approximately 5 times ADWF when the flows from Cannon Crescent, Chart Drive, DAF backwash, and all vacant lots are connected.

The ICEAS cycle is summarized as follows:

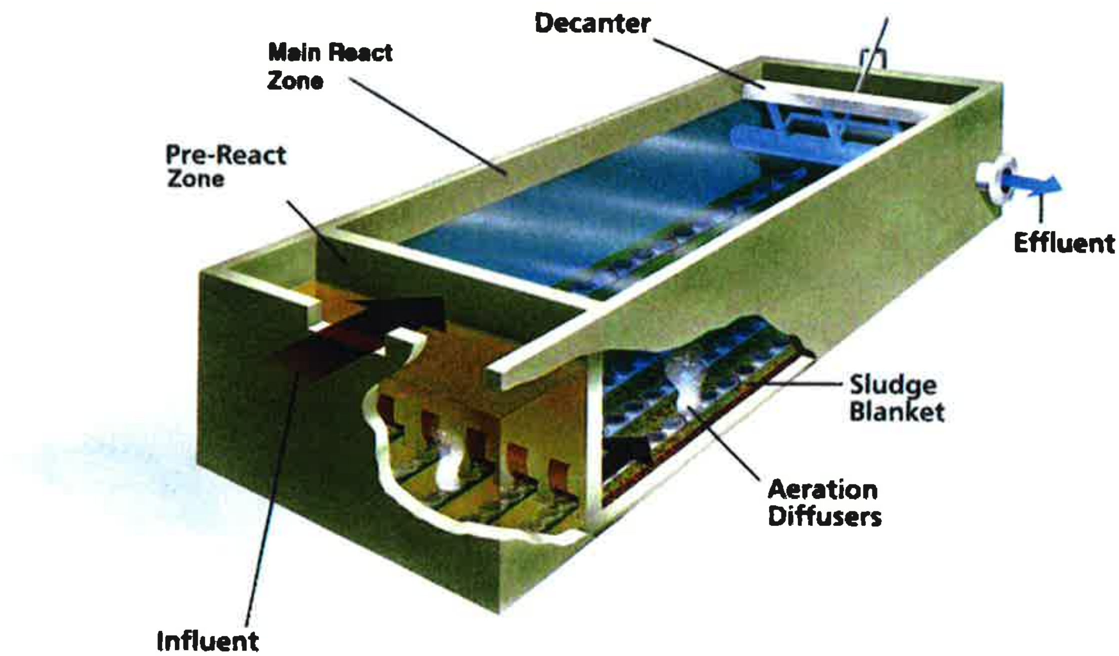
1. Aerate/React: Raw wastewater, having undergone pre-screening and grit removal, flows into the basin and mixes with the mixed liquor. The basin is simultaneously filled, aerated and/or mixed to achieve the desired biological treatment.

2. Settle: Aeration and/or mixing is stopped and solids are allowed to settle to the basin's bottom, leaving a layer of clean, treated water on top.

3. Decant: The clear treated water is discharged from the top of the basin by an automated time-controlled decant mechanism, while the basin continuously receives influent and sludge is wasted.

Figure 1 below illustrates how the ICEAS basin is divided into a pre-react zone (which allows for the continuously flow of influent) and the main react zone, separated by a non-hydrostatic baffle wall. The pre-react zone typically has a volume of 10-15% of the total basin volume. The pre-react zone also creates a high food to microorganism (F:M) ratio, which encourages microorganism growth and causes the pre-react zone to act as a biological selector. Having this located at the front of the plant minimizes the growth of bacteria which can cause sludge bulking and poor settling.

Figure 1: ICEAS Basin Layout



Source: www.sanitare.com

An ICEAS plants capability to handle high fluctuations of flows typically eliminates the need for pre-equalization tanks. However, our experience with these plants has shown that there is value to adding a post equalization plant to eliminate downstream hydraulic surges and allow for continuous operation of UV disinfection. This prevents the UV system from excess start and stops which tend to lower the lifespan of the UV and reduces the need to oversize the UV system to treat larger intermittent flows. Also the installation of a downstream equalization tank would eliminate the need to replace the outfall with a larger pipe. A budgetary cost for Option 2 is summarized below.

Table 5.5 – Option 2 Budgetary Costs

Item	**Budget (2011$)**
SBR (ICEAS)	$1,750,000
Post Equalization Tank	$400,000
Subtotal	$2,150,000
Engineering (15%)	$322,500
Contingency (25%)	$537,500
Total (rounded nearest $10K)	***$3,010,000***

Taxes not included

This budget price includes a 2 basin ICEAS SBR, new headworks with screening and grit removal, solids handling via digesters and rotary press, UV disinfection, Genset, post equalization tank (non-aerated), and MCC/control room structure. Cost savings may be realized through the reuse of the continued use of the existing sludge handling process (ie tanks with decant and offsite disposal of sludge), UV re-use, and headworks reuse for screening. These items could be identified for further study during design.

5.3.2 Cannon Crescent WWTP

The Cannon Crescent treatment plant is over 40 years old and is not in compliance with the permitted discharge of 68 m^3/d. The property where the packaged plant is located is very small and steep, and would not accommodate an equalization tank of a size to handle the flows to this plant. There is also insufficient space to install an adjacent packaged plant while keeping the existing system operational at this site. It is therefore recommended that this plant be decommissioned and have its flows diverted the upgraded or new Schooner WWTP.

A lift station station would have to be constructed to pump flows to the manhole where the Cutlass LS ties into the gravity line, and the downstream piping and Schooner LS will have to have their capacity to take this additional flow confirmed. Note that I&I and cross connection should be dealt with prior to undertaking this diversion of flows as the peaking factors associated with these are unacceptable. A budgetary cost for a new pump station located in the road ROW and 670m of forcemain is summarized in Table 5.6 below.

Table 5.6 – New Cannon LS Budgetary Costs	
Item	**Budget (2011$)**
Pump Station	$350,000
Emergency Generator	$80,000
Electrical and SCADA	$200,000
Forcemain (670m)	$240,000
Subtotal	$870,000
Engineering (15%)	$130,500
Contingency (15%)	$130,500
Total (rounded nearest $10K)	***$1,130,000***

Taxes not included

The scheduling of abandoning the Cannon Crescent plant will depend on the results of ultrasonic testing which will indicate the remaining life of both the Cannon and the Schooner plants. Depending on the results of the ultrasonic testing, further refinements of the two options identified above may be required. For example, if ultrasonic testing indicates that the Cannon plant has a significant shorter remaining service life than the Schooner plant, a more extensive upgrade to the Schooner Way plant may be required. Alternatively, the replacement of the Schooner plant with an ICEAS plant may have to be carried out sooner.

The estimated cost for the ultrasonic testing and fitness for service evaluation for the clarifier and the aeration tank is $10,000.

5.3.3 Chart Drive Septic System

The 2011 Thurber Engineering report recommends either replacement of the septic field or pumping of sewer to the Schooner Way plant. The first option includes remediating the existing site, and installing a packaged plant treatment (10/10 BOD/TSS) and a new leaching bed. If built on the existing site, constraints would lead to an undersized disposal field and lifespan would be reduced. In addition, a hydrogeological assessment will have to be performed first which can be expensive. A preliminary estimate of $200,000 was provided for this upgrade Giles Environmental in their report. With a small treatment plant, engineering and a hydrogeological assessment, it is expected that this estimate should be closer to $400,000. A more detailed investigation into this option should be carried out as specified in Thurber's report.

The second option is to provide a new septic tank, pump chamber and small diameter forcemain to connect to the gravity sewer on Spyglass Road. This will increase flows to the Schooner WWTP by approximately 11 m^3/d. A budgetary cost for a basic fiberglass reinforced plastic (FRP) pump station (No SCADA, no emergency power), and approximately 1.2km of small diameter forcemain is summarized in Table 5.7 below.

Table 5.7 – Chart Drive PS Budgetary Costs	
Item	**Budget (2011$)**
Pump Station	$150,000
Site work	$10,000
Electrical	$40,000
Forcemain (1.2km)	$350,000
Subtotal	$550,000
Engineering (15%)	$82,500
Contingency (15%)	$95,000
Total (rounded nearest $10K)	***$730,000***

Taxes not included

5.4 BUILDING CANADA FUND

The CRD has indicated that a $0.5M Building Canada Fund was approved for the upgrade of the Schooner wastewater treatment plant to handle the increased flows from the new water treatment plant servicing Magic Lake Estates. This funding is required to be used by March 14th, 2014. Therefore it is possible to put the $0.5M toward the Schooner plant upgrades or potentially apply for a scope change for the fund to address more immediate concerns such as the Chart Drive system.

The amount of funding is insufficient to address some of the major concerns such as the backup of the sewer system along Buck Lake or the needed replacement of the Cannon WWTP, but possible projects could include the following:

5. Undertake ultrasonic evaluations of tanks at Schooner and if sufficient aeration tank service life remains, proceed with new Clarifier #1 at Schooner Treatment Plant and rebuild of Blower#2. Budget Price: $345,000+HST. The design of an aeration tank, and associated modifications to the intake system could also be done at this point to have a shelf ready project when funding becomes available. The estimated cost for design is $75,000.

6. Assessment of sewer collection (CCTV, smoke test, manhole assessment) and replacement and or upgrade of some areas of damaged, leaking, or substandard piping. The assessment of the entire system has a budget price of $140,000+HST with the remaining $360,000 replacing up to 700m of pipe.

7. Replacement of Chart Drive Septic system (Option #1). This option may be considered of value if funding for upgrades to or replacement of the Schooner Plant within the next

5-10 years is unlikely. A revised scope for the funding agreement may be required for this option. Budget price: $400,000 +HST.

8. Upgrades to Schooner and Galleon lift stations. These lift stations require the most immediate attention. Budget Price $490,000+HST.

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Public Engagement Strategy - Magic Lake Estates System Improvement Program

Purpose

1. To consult with Pender Island residents who are on the Magic Lake Estates system about the proposed infrastructure upgrades.
2. To inform residents and stakeholders who are on the Magic Lake Estates system about the scope, implications and cost of the planned infrastructure upgrades. Education will cover basic background information on the upgrades, preparing the public for a referendum vote on whether to undertake the improvement project.

Proposed Strategy

The strategy includes hosting an open house on a weekday evening in October 2014. This timing will allow the majority of residents who work during the day to attend to session. At the open house, there will be display boards and take-away fact sheets explaining the work program and its scope and implications. Experts will attend the session to answer any questions and hear any concerns that attendees express with the goal to have meaningful conversations about the project. We will also make use of the session to gather feedback through a survey that questions how they would vote in a referendum and what factors are influencing that decision. The open house will be promoted using the CRD website, posters at public bulletin boards, a media release distributed to local news outlets and print advertisements run in the Island Tides and Driftwood newspapers. The strategy should also include a means of engaging with residents who are unable to attend the open house through providing information and comment forms at the CRD Island Office and on the website.

Budget – Magic Lake Estates	**$3,000 - $3,500**
Materials (Boards, FAQ Sheet, Survey, Signage)	$1,000
Open House (Rental, 5 hours)	$45
Accommodations (last ferry 8:15 pm)	$600
Travel	$45-$90
Refreshments (Coffee, Tea, Water, Pastries)	$750
Media – Advertising	$750
Total	**$3,155**

Alternative: Victoria-based staff leave early to reach last ferry at 8:15 pm. This would require island staff to complete tear down and clean up, as well as remain at the event until concluded. This would remove the need for accommodations in the budget and bring total down to $2,555.

Detailed Public Engagement Plan

To be created once Commission decides on most appropriate improvement program and approves funding for public engagement activities.