# Appendix A:
# Navy and Water Street WWPS & Collection System Modernization Feasibility Study

# NAVY AND WATER STREET WWPS & COLLECTION SYSTEM MODERNIZATION

## Feasibility Study

**B&V PROJECT NO. 178676**



**PREPARED FOR**

Halton Region

12 APRIL 2013

BLACK & VEATCH
Building a world of difference.®

# Table of Contents

## LIST OF TABLES

## LIST OF FIGURES

# ABBREVIATIONS AND SYMBOLS

| | |
|---|---|
| AACE | Association for the Advancement of Costing International |
| Class EA | Class Environmental Assessment |
| ESR | Environmental Study Report |
| FM | Wastewater Forcemain |
| HDT | Hydraulic Detention Time |
| HGL | Hydraulic Grade Line |
| kW | Kilowatts |
| m | Metre |
| $m^3/d$ | Cubic Metres per Day |
| MOE | Ontario Ministry of the Environment |
| NFPA | National Fire Protection Agency |
| NPV | Net Present Value |
| O&M | Operation and Maintenance |
| OCPA | Oakville Centre for the Performing Arts |
| OPC | Opinion of Probable Cost |
| PS | Pumping Station |
| VFD | Variable Frequency Drive |
| WLC | Whole Life Cost |
| WWTP | Wastewater Treatment Plant |

# 1 Introduction

The Halton Region (the Region) retained Black & Veatch to complete a feasibility study to evaluate options for improving sewer collection servicing in the area currently serviced by the Navy St. and the Water St. Pumping Stations (PS).

## 1.1 PURPOSE OF STUDY

The Regional Municipality of Halton Pumping Station Master Plan 2012 (Master Plan) identified three concepts for future servicing of the drainage area: i) maintain the current system of pumping stations; ii) adopt a partial deep gravity trunk sewer and retain some pumping stations; and iii) adopt a deep gravity trunk sewer and eliminate all pumping stations. The preferred strategy was to eliminate as many pumping stations as possible but in alignment with future projects. In keeping with the Master Plan preferred concept, the Navy St. and Water St. PSs and collection system have been identified as candidates for further evaluation and a preferred servicing strategy is required.

The Navy St. and Water St. PSs serve the Oakville South West WWTP East drainage area. This drainage area consists of 14 pumping stations over a 6 km wide area (Figure 1-1). The drainage area covers the land east of Lakeshore Road and Sandwell Drive, to just west of the Lakeshore Road and 2nd St. The trunk sewer drains in a westerly direction, with flows terminating at the Oakville Southwest WWTP. Overall, the drainage area consists of three submersible type pumping stations, 8 prefabricated type pumping stations and three large stations with significant above ground superstructures.

In Figure 1-1 below, Navy St. PS and Water St. PS are represented by PS #18 and #7 as per the Master Plan.

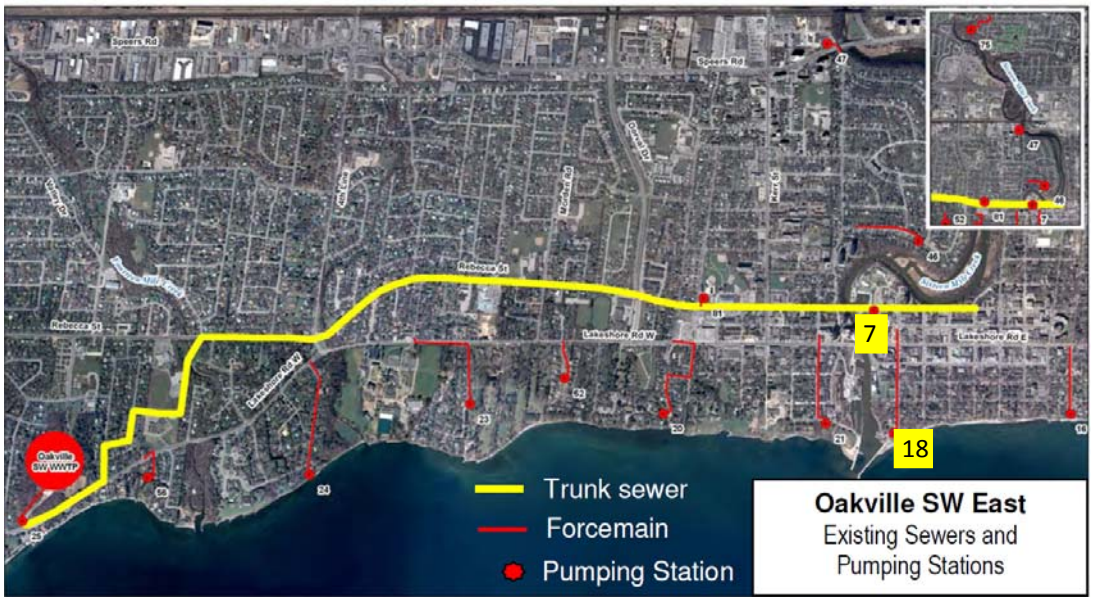



Figure 1-1: Oakville SW East Sub-Drainage Area (Source: Regional Municipality of Halton Pumping Station Master Plan, 2012)

Navy St. PS has a wet well / dry well concrete sub-structure configuration and Water St. PS is a packaged fabricated steel buried station housing two dry pit pumps with an access manhole. Exterior views of Navy St. PS and Water St. PS are found below in Figure 1-2 and Figure 1-3.

Figure 1-2: Navy St. PS (South East view)

Figure 1-3: Water St. PS (South East view)

Details of the current capacity and future demand of the stations are described in Section 3.

## 1.2 SCOPE OF STUDY

The scope of study is defined through three major tasks described below:

### 1.2.1 Project Initiation & Data Collection

- Meet with Region staff to confirm background data available;
- Obtain operational information;
- Gather and review background information and data;
- Establish current and planned capital works;
- Identify specific issues of concern affecting the future servicing strategy for the drainage area
- Review the Regional Municipality of Halton WWPS Master Plan and the associated condition assessments for the two pumping stations;
- Perform site visit to make visual inspections and validate the condition assessment data.

### 1.2.2 Identify and Evaluate Servicing Alternatives

- Identify and evaluate the servicing alternatives based on the following design considerations:
  - Passing flows into the Oakville SW East Trunk (Rebecca St) sewer;
  - Expansion of the Water St. PS;
  - Upgrading or decommissioning the Navy St. PS; and
  - Partial/complete diversion of flows to nearby PS.
- Develop a plan, profile and scope of work required for each alternative while considering the following:
  - Present condition and operation performance of the PS;
  - Back-up power for each PS;
  - Planned capital works for the area; and
  - Economic, environmental, and social factors.
- Perform hydraulic assessment of pumping station delivery options to establish pipe sizes, pump duty and power requirements;
- Provide cost estimates for each alternative at a feasibility planning level; and
- Document each alternative at a feasibility design level.

### 1.2.3 Prepare a Draft and Final Feasibility Study Report and Recommendations

- Prepare a draft feasibility study for Halton Region which describes the following:
  - Identified servicing options;
  - Scope of work associated with each alternative;
  - Incorporated cost estimate for each alternative;
  - Evaluation and comparison of each alternative;
  - Recommendation of a strategy for the modernization of Navy St. and Water St. PSs & Collection System;
  - Prepare a list of capital projects that include the scope, timing and budget requirements for the recommended option;
  - Identify the Class EA schedule associated with each capital project identified; and
  - Provide recommendations for further studies, if required, prior to the implementation of the modernization strategy.
- Submit the draft feasibility study to the Halton Region and hold a half day meeting to review the report and solicit comments;
- Finalize the feasibility study based on one revision of the report.

## 1.3 STUDY REFERENCE DATA

This study has been based on an assessment of a broad range of reference materials, including:

- Record drawings;
- Reports from previous projects;
- Applicable guidelines and regulations;
- Meetings with the Region's staff.

The relevant reference materials that form the basis for the development of this Report are listed in Table 1-1

Table 1-1: List of References

| NAME | DATE |
|---|---|
| As Built Drawings | |
| Certificate of Approval | September, 1997 |
| Condition Assessment Report (13 Water St, #7) | March, 2010 |
| Condition Assessment Report (19 Navy St. #18) | March, 2010 |
| Geotechnical Information | March, 1983 |
| Regional Municipality of Halton Pumping Station Master Plan | June, 2012 |
| Sanitary Drainage Study - Melrose Investments | July, 2010 |
| Flood plain map with service laterals | December, 2012 |
| Parcel maps identifying property ownership | December, 2012 |
| Regional Municipality of Halton Water and Wastewater Facilities Design Manual | January, 2012 |
| Regional Municipality of Halton Pre-Qualified Equipment List | July, 2012 |
| Terraprobe Geotechnical Investigation Proposed Watermain Navy St, Oakville, Ontario | July, 1997 |
| Halton Region Upgrade of Navy St. Wastewater Pumping Station Pre-Design Report, Winter Associates | March, 1997 |
| Halton Region Sustainable Halton Water and Wastewater Master Plan, Appendix 1-4 | October, 2011 |

# 2 Background

In this section, background information and the design basis and approach for the Navy St. and Water St. PSs improvements are provided.

The Navy St. and Water St. PSs service the Oakville South West WWTP East drainage area as shown in Figure 1-1.

The Navy St. and Water St. PSs drainage area is limited by Palmer St. on the North, First St. on the East, Sixteen Mile Creek on the West and Lake Ontario on the South. It is typically made up of

residential units mixed with commercial uses and parkland. It also includes the centre of the Town of Oakville, where a wide variety of businesses (e.g. stores, restaurants and entertainment venues) are located along Lakeshore Road, with high touristic and economical relevance to the community. The study sub-drainage area, serviced by Navy & Water St. PS, is shown in Figure 2-1.

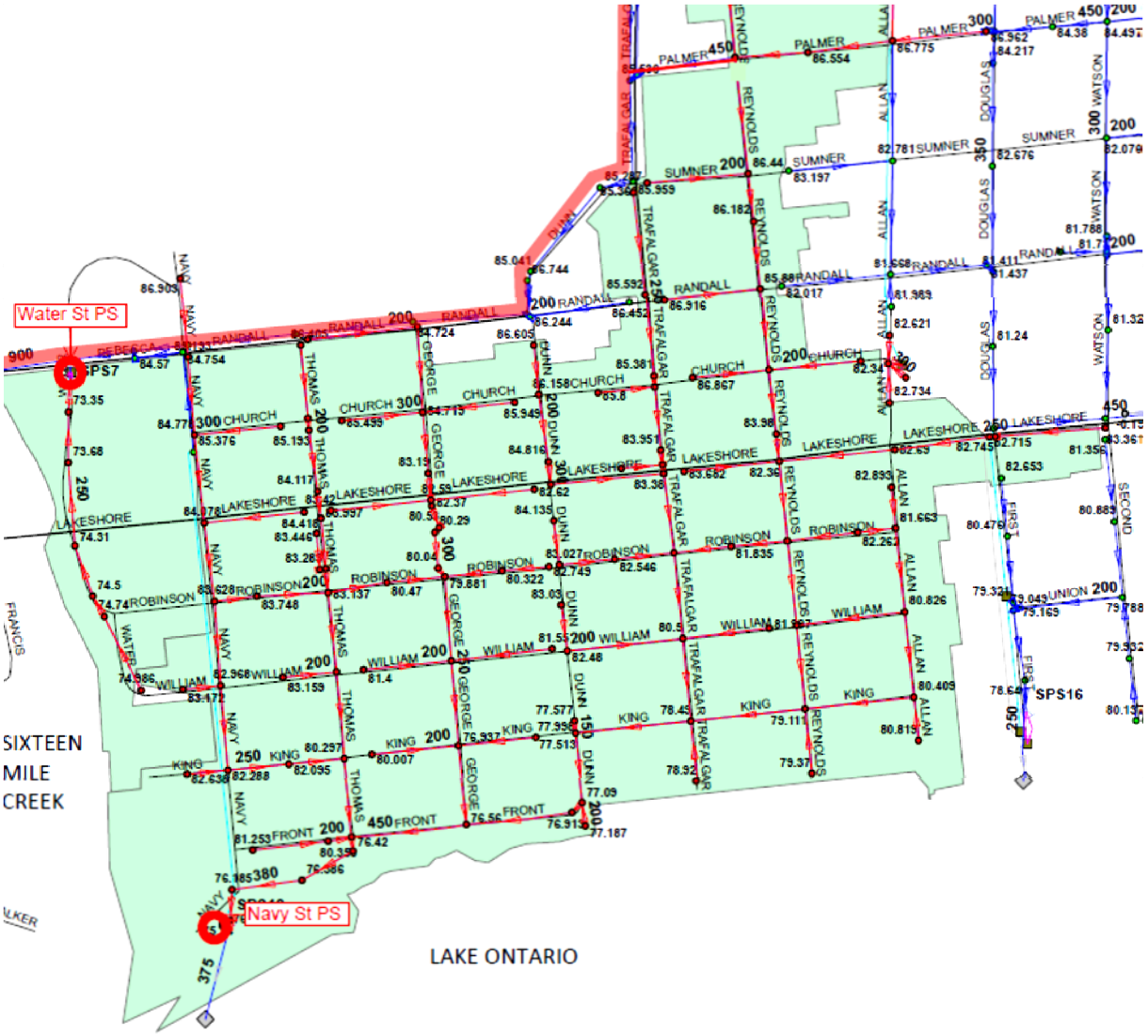



Figure 2-1: Navy St. PS and Water St. PS Drainage Area

## 2.1 PROBLEM STATEMENT

As illustrated in the Sustainable Halton Water and Wastewater Master Plan (2011), the Province of Ontario's (Province) Growth Plan provides the framework for implementing the Province's vision for managing population and employment growth to 2031. It expresses the Province's interests and direction about how and where municipalities will grow and Halton Region is required to fulfill the requirements of this policy document.

The Region of Halton is undertaking a Growth Plan conformity exercise called Sustainable Halton. This process is integrating planning for growth with the development of master servicing plans. An

important component of Sustainable Halton is intensification. Intensification is considered to be any new residential development located within existing urban areas. The Province's Growth Plan identifies that by 2015 and for each year thereafter Halton Region must have a minimum of 40 per cent of all residential development occurring annually within the built-up area.

The Oakville downtown core area serviced by Navy St. and Water St. PSs is designated for infill and intensification under this policy. The future servicing strategy for these areas needs to be identified. This feasibility study is further to servicing concepts proposed in the South Halton Wastewater Pumping Station Master Plan Study (2012).

The Navy St. PS is currently close to maximum capacity. The Water St. PS presently has a limited service area and has capacity available for future growth. The future servicing requirements for these pumping stations need to be established.

While considering the Master Plan preferred concept described in Section 1, there are a number of solutions for a preferred servicing strategy for the Navy St. PS drainage area, these fall into three alternative approaches:

- Expansion of the Navy St. PS;
- Elimination of the Navy St. PS and divert all flows to the Oakville SW East Trunk (Rebecca St) or adjacent PS;
- Divert partial flows to the Oakville SW East Trunk (Rebecca St) or adjacent PS and keep the Navy St. PS.

## 2.2 STUDY OBJECTIVES

The objectives of this study are as follows:

- Define the most appropriate solution for each of the three alternatives evaluated;
- Develop a scope of work related to each alternative;
- Evaluate each alternative using a triple bottom line approach based on parameters of environmental, socio-economical and financial relevance.

## 2.3 RELATED HALTON REGION CAPITAL PROJECTS

The following on-going capital projects (Table 2-1), identified as being in various stages of design or construction, all have potential impacts on this project. These projects have been taken into account in the preparation of this report.

Table 2-1: Related Projects

| PROJECT | CURRENT PROJECT PHASE | REMARKS |
|---|---|---|
| Oakville SW East Trunk (Rebecca St) | Early stage of the Design Phase. | The feasibility study cannot rely on diverting any flows to the sewer trunk. |
| Navy St. PS Upgrade | Forcemain is undergoing upgrades to replace its lining. This capital program is estimated to be completed by April 2013. | Navy St. PS project will proceed independently from the feasibility study as upgrades are urgent for security of operation. |

# 3 Collected Data and Condition Assessment

## 3.1 COLLECTED DATA

Collected data was extracted from the references listed in Table 1-1 and various communications with the Region's staff.

The current characteristics of the pumping station being assessed as part of the study are outlined in Table 3-1.

Table 3-1: Navy St. and Water St. PSs Background Information

| PUMP STATION | ADDRESS | YEAR | COMMENTS |
|---|---|---|---|
| Navy St. PS | 4 Navy St | 1985 | Separate wet well and dry well.<br>Dry well located on east side of the building.<br>Vertical access wet well located on west side of the building.<br>Two (2) Flygt dry pit submersible pumps downstairs; control panels upstairs<br>Portable pump hook-up which discharges to the forcemain.<br>Wet well includes water hose hook up for flushing.<br>Last modification in 1998; with on-going project concurrently as described in Table 2-1. |
| Water St. PS | 130 Water St | 1967 | Below grade can station (Smith & Loveless).<br>Two dry pit pumps and controls.<br>Separate wet well.<br>No major modifications since original construction. |

Observations of the existing facilities and discussions with Region staff revealed the following additional characteristics of the area:

- The Navy St. PS is located near the Sixteen Mile Creek and Lake Ontario, and is surrounded by the Town of Oakville property, including parkland, the Oakville Rescue Unit, boat mooring and the garden of the Oakville Museum. The area is categorized as a recreational area of great relevance to the local community and the Region;
- The Water St. PS is located under the Randall St. Bridge (and existing Oakville SW East Trunk), and is surrounded by parking lots of the Town of Oakville;
- Drainage area of the PS is limited by Palmer St. to the North;
- A duplicate PS or upgrade of current pumps would be acceptable to improve capacity;
- There is a portable washroom near the Water St. PS, which is not serviced by the PS;

## 3.2 CONDITION ASSESSMENT

Condition assessments of physical condition, hydraulic capacity and the overall efficiency of Navy St. and Water St. PSs were published in 2010 highlighting the overall state of both pumping stations, which were reviewed by the Project Team.

A site visit by the Project Team to the area surrounding the Navy St. and Water St. PSs allowed a visual inspection of the facilities and validation of some of the aspects recorded in the 2010 condition assessment reports. Feedback from staff responsible for operation and maintenance (O&M) was also conducted, adding more detail to the assessment.

After a thorough review of the collected data and O&M staff input, the following deficiencies were identified for the Navy St. PS:

- Pumping station is not serviced by permanent reliable backup power. Currently, a portable generator needs to be transported to site in case of power failure. Response time is reported to be approximately 30 minutes;
- Due to low retention time in the wetwell (approximately 1.4 minutes at peak flow), overflow of wastewater into Lake Ontario may occur during power failure events;
- The overflow does not have screens and the discharge of raw wastewater into Lake Ontario may cause major visual and odorous impact to the environment and pollution of surface water;
- Frequency of start/stop of the pumps is very short (approximately 16 minute at peak flow), which reduces the life of the equipment;
- Ventilation in the wetwell room appears to be insufficient for an unclassified use and not safe for workers, according to NFPA requirements. Operators are currently required to carry a gas detector when entering the room. ;
- The structure is original and appears to be in acceptable condition based on visual observation. The building elevations have some external deterioration from weathering and vegetation, as shown in Figure 3-1;
- The mechanical and electrical equipment has been previously upgraded but will need an ongoing medium level of maintenance inputs. Process pipe work is original and will need assessment to determine need for future replacement.

Based on age and condition the pumping station is assessed to have a medium term life horizon of approximately 20 years. Operationally, however, the pumping station does not meet the design requirements of the latest Region's Design Manual, as wet well capacity is inadequate resulting in unsatisfactory operation.

Figure 3-1: Navy St. PS – Deteriorated Stucco

The following deficiencies were identified for the Water St. PS:

- Pumping station is not serviced by permanent reliable backup power. Currently, a portable generator needs to be transported to site in case of power failure. Average response time is reported to be approximately 30 minutes;
- Due to low retention time in the wetwell, overflow of wastewater into the Sixteen Mile Creek may occur during power failure events;
- The overflow does not have screens and the discharge of raw wastewater into the Sixteen Mile Creek may cause visual and odorous impact to the environment, further to pollution of surface water;
- The pumping equipment is fully operational. However, it is original and has not undergone upgrades.;
- Based on the age (40 years+) and experience elsewhere with this type of pumping station, it is possible that there are corrosion issues with the fabricated steel underground structure of the facility.;
- The concrete wet well could not be accessed. It was noted that there were low flows in the pumping station catchment these could potentially produce adverse corrosive conditions. Considering the age of the structure it is assessed to be in the later stages of its operational life.

Based on age and condition, the pumping station is assessed to have a short term remaining life horizon, it is recommended that replacement should be planned within the next 5 years. Operationally, the pumping station has spare capacity.

## 3.3 SOLUTION GUIDELINES

Review of the project background and discussions with the Region staff, the following set of parameters were used as guidelines for the development of alternative solutions:

- As advised by the Region, wastewater flow projections of year 2031 are 10 L/s and 100 L/s for current Water St. and Navy St. PS sewershed areas, respectively;
- The lands of interest are all Town of Oakville's properties. This may ease the land acquisition in the future;
- Diverting flows to First St. PS located at 20 First St. was deemed not viable due to a combination of factors, as follows:
  - The PS (including discharge piping) is currently operating at its limiting capacity and an upgrade would be required;
  - Analysis of the drainage area topography determined that diverting flows into the PS would represent major linear works;
  - The linear works would be on private properties. The easement acquisitions would be difficult.
- Navy St. PS is located in a sensitive area due to the proximity to residential homes and being located near Lake Ontario in a tourist area. The alternatives need to consider the impacts of construction and permanent facilities to the community;
- Water St. PS is located in the flood plain of Sixteen Mile Creek. Electrical and generator equipment must be located above flood level;
- Standby power for both Navy St. and Water St. is required for all alternatives developed;
- Excavating along Lakeshore Rd for new sewer connections to divert flows directly to the Oakville SW East Trunk (Rebecca St) is not viable, due to the extensive community disturbance

construction would cause. In addition, because the final vertical alignment of the Oakville SW East Trunk relief sewer has not been finalized, hydraulic viability of gravity connections is uncertain.

Table 3-2 presents current flows and future design flows to be utilized in this Report to evaluate the alternatives.

Table 3-2: Balance of Pumping Capacity for Navy St. and Water St. PSs

| PUMP STATION | CURRENT FLOW (L/S) | FUTURE DESIGN FLOW (L/S) | BALANCE (L/S) |
|---|---|---|---|
| Navy St. PS | 66 | 100 | -33.9 |
| Water St. PS | 21 | 10 | +11.0 |

## 3.4 BASIS OF HYDRAULIC ANALYSIS

For each alternative, hydraulic analyses were conducted to investigate the hydraulic capacity of sewers feeding the Navy St. and Water St. PSs, as well as for evaluating the required pump capacities.

### 3.4.1 Pumping Station

The following assumptions were made in order to conduct the hydraulic analysis of the Navy St. and Water St. PSs.

- Pumping station elevations and pump control levels are based on Navy St. Wastewater Pumping Station Pre-Design Report published by Winter Associates for Navy St. PS and on As-Built drawings for Water St. PS;
- As PS discharge forcemain drawings are not available at present, the static lift at zero flow for both Navy St. and Water St. PSs are based on system curves provided in Condition Assessment Reports 19 Navy St. #18 and 13 Water St. #7, respectively:
  - Static lift at Navy St. PS is 11.32 m;
  - Static lift at Water St. PS is 11.55 m.
- For new pumping stations, a minimum storage volume equivalent to 1 hour of peak flow is required;
- Wet well storage capacities are assumed to be from the low water level to the overflow level in the wet well;
- Hazen-Williams equation used to model forcemain flow;
- The following C-values will be used in the Hazen-Williams equation:
  - Forcemains with diameters 200 – 250 mm, C-value 110;
  - Forcemains with diameters 300 – 600 mm, C-value 120.
- Forcemain velocities will be designed to maintain a minimum discharge velocity of 0.8m/s;
- The forcemain from the Navy St. PS to the Oakville SW East Trunk (Rebecca St) gravity sewer is estimated via Google Mapping to be 635 m in length; the forcemain from Water St. PS which lifts to the Oakville SW East Trunk (Rebecca St) gravity sewer is approximately 23 m in length.

### 3.4.2 Collection System

The following assumptions were made in order to conduct the hydraulic analysis on the sewers feeding the Navy St. and Water St. Pump Stations.

- Manning's equation is used to model gravity sewer flow;
- The design flow rate shall be conveyed through the sewer at a depth equal to 70% of the sewer diameter;
- Pipe material shall be concrete for new and existing sewers;
- The roughness coefficient used (Manning's n) shall be 0.015 for existing sewers (rough concrete) and 0.013 for new sewers (normal concrete);
- Distances between manholes as visible on Google Earth satellite imagery shall be used to determine sewer reaches between manholes – reach distances are approximate;
- Manhole identification, invert elevations and sewer diameters shall be as provided by the Region
- The self cleansing velocity (minimum velocity) shall be 0.6 m/s;
- Estimated sewer diameters and capacities shall be based on the Circular Channel Ratios shown in Appendix 19.C of the Civil Engineering Reference Manual, 12th Edition.

In addition to the evaluation of the sewers feeding the Navy St. PS, the hydraulics of the existing Water St. sewer were also evaluated to determine if additional flow could be diverted from Navy St. through this sewer without modifying the existing system. The 250 mm diameter Water St. sewer was found to have a maximum hydraulic capacity of approximately 25 L/s based on the sewer diameter, slope, and the assumptions outlined above. Existing sewer flow is 10 L/s although a maximum flow of 25 L/s was recorded on July 10, 2012. Therefore, for the purpose of this analysis, it is assumed that the existing sewer does not have capacity to accept additional flow from Navy St, system hydraulic calculations are shown in Appendix B.

# 4 Alternative Solutions

During the analyses of the background information referenced in this Report and based on discussions with the Region, three alternatives have been identified as potential solutions for the future servicing strategy of the sewershed serviced by Navy St. and Water St. PSs:

- Alternative 1: New Navy St. PS – Navy St. PS is upgraded to future capacity (100 L/s) and Water St. PS remains operational at its current capacity;
- Alternative 2: New Water St. PS - Eliminate Navy St. PS and divert total flows to new Water St. PS (110 L/s);
- Alternative 3: Partial Diversion - Navy St. remains operational at current capacity (66 L/s) and divert partial sewer inflows to Water St. PS.

A description of each alternative solution and respective technical analysis are presented below. The final evaluation considering technical, cost, socio-economical and environmental aspects is presented in Section 7.

## 4.1 ALTERNATIVE 1: NEW NAVY ST. PUMPING STATION

Alternative 1 does not require the diversion of any flow from the Navy St. PS. The alternative includes a pump station upgrade to handle 100 L/s of flow from the system at the existing Navy St. PS site. Due to extremely limited site constraints the pump station upgrade will require the replacement of the Navy St. PS with a pump station and wet well capable of providing 1 hour of detention time, as required by the Region. The entire flow of 100 L/s will be pumped through the existing 250 mm diameter forcemain to the existing Oakville SW East Trunk (Rebecca St) sewer. No

upgrades or modifications will be made to the Water St. PS or Water St. sewer and it will continue operating at 10 L/s.

### 4.1.1 System Improvements

#### 4.1.1.1 Pumping Stations

**Navy St. PS**

With a current total capacity of 66 L/s, the Navy St. PS is not able to handle the peak flow to the pumping station of 100 L/s and a larger pumping system is required.

The current wet well capacity only has a storage time of 1.4 minutes under peak flow conditions of 100 L/s, far short of the required 1 hour storage. For pump capacity of 100 L/s, with 1 hour storage, the required storage volume is 360 $m^3$.

To meet expected peak flow conditions, the existing Navy St. PS would require major upgrades, as the wet well would need to be much bigger and a pumping system with larger capacity installed. Site restraints limit expanding the current PS. Expanding the PS would not meet operational performance requirements and would incur major constructability and commissioning challenges, as the collection and pumping system would need to remain operational during construction.

Three types of replacement submersible pumping station arrangements have been considered, as follows:

- One new wet well with submersible pumps. This arrangement is not in compliance with the Region's Design Manual and has not been analysed further;
- New wet well/dry well in a shared sub-structure. Due to the volume required for the wet well storage, this structure would be large and likely not cost effective compared to the separate wet well and dry well arrangement discussed next;
- New wet well and dry well in separate sub- structure. This layout meets the Region's Design Manual requirements. By separating the wet well and dry well structure the dry well size will be dictated by the pump requirements and will be smaller than the combined wet well/dry well structure.

At peak flow, 100 L/s, the velocity through the discharge forcemain is 2.0 m/s, which is considered to be satisfactory. If the condition of the forcemain is satisfactory it could be reused. Based on a forcemain of this diameter hydraulic modeling indicates that the total dynamic head (TDH) required at Navy St. PS is 24.7 m. However, previous modeling documented in Condition Assessment Report 19 Navy Street #18 indicates that a TDH of 27.9 m is necessary. Due to uncertainties with forcemain length, the higher value of the Condition Assessment Report has been used to set the pump TDH requirements. As per the Condition Assessment Report, an additional 5 m head has been added to the TDH requirement. The total TDH necessary for the new PS is 33 m for 100 L/s flow.

If the existing forcemain was replaced with a larger one of 300 mm diameter, the velocity through the forcemain would be reduced to 1.4 m/s at peak flow. Furthermore, hydraulic modeling indicates that the TDH required at the pumps would be reduced by 8.2 m. This lower TDH represents an operational savings as less power would be required by the pumps, however, this savings is

significantly less than the cost to replace the forcemain with a larger one. It is recommended that the existing 250 mm forcemain remain in service and that the pumps be operated at a higher TDH. Refer to the Cost Estimate in Appendix D for a cost comparison of maintaining the current forcemain diameter of 250 mm against increasing the forcemain diameter to 300 mm.

It is recommended that the Navy St. PS be replaced with a larger, underground packaged type PS with separate wet well and dry well. Per the Region's Design Manual the new PS will operate with four dry well pumps (3 duty + 1 standby) with VFDs and the wet well will have a minimum storage volume of 360 $m^3$, split into two chambers connected by an isolation gate. The new underground PS can be located across the service road on Town of Oakville's parkland, as shown in Sketch 1 of Appendix A. A 250kW generator set and an electrical panel should be provided above ground in the location of the current Navy St. PS, and a ductbank passing under the service road will connect the generator set and electrical panel to the pumping station.

The generator set will be installed on an outdoors concrete pad and self-contained provided with its own weatherproof enclosure and sound attenuation measures.

**Water St. PS**

The current capacity of the Water St. PS is 21 L/s, therefore it has sufficient capacity for the future peak flow of 10 L/s. However, at 10 L/s flow the available storage time is 14.8 minutes. For 1 hour storage a 36 $m^3$ storage volume would be required. To maintain corrosion protection of the PS it is recommended that an anode test box be mounted on the PS entrance tube and new anode packs be installed.

It is recommended that the Water St. PS remain as is until life expired, continuing operation with less than 1 hour storage available. A generator set is to be installed across Water St, at elevation above flood line, as required by Conservation Halton. A 100 kW generator set will provide backup power to the pumps to minimize the number of overflows that occur as a result of the storage volume being less than 1 hour. The proposed location of the new generator set is within the parking lot of the Oakville Centre for Performing Arts (OCPA), as shown on Sketch 2 of Appendix A. A ductbank passing under Water St. will connect the generator set and electrical panel to the pumping station.

The generator set will be installed on an outdoors concrete pad and self-contained provided with its own whether proof enclosure and sound attenuation measures. Structure should be built at elevation 79.80m (regulated flood elevation is 79.36m per Conservation Halton requirements) to maintain a minimum height of 300 mm above the regulated flood elevation.

Table 4-1 below summarizes the modifications to take place at the locations of each existing PS.

Table 4-1: Summary of Pumping Station Modifications - Alternative 1

| PS LOCATION | MODIFICATIONS | DESIGN FIRM CAPACITY |
|---|---|---|
| Navy St. PS | ■ Replace Navy St. PS with larger underground can type PS to be located across service road on Town of Oakville's parkland.<br>■ Provide a 250 kW generator set and electrical panel located above ground in the location of the current Navy St. PS.<br>■ Provide 4 dry well pumps (3 duty + 1 standby) with VFDs. | 100 L/s |
| Water St. PS | ■ Water St. PS will remain unchanged (note less than 1 hour storage available).<br>■ Provide 100 kW generator set to be installed within OCPA's parking lot.<br>■ Provide anode test box and new anode packs. | 21 L/s |

#### 4.1.1.2 Collection System

Because of the increased flow reaching the Navy St. PS, the hydraulic analysis presented in Appendix B shows that 160 m of sewer will need to be replaced in parkland and along Navy St. between manholes SMH4784 and SMH 4840 with 450 mm diameter sewer pipe.

Although the flow rate along King St. between Navy St. and Thomas St. (specifically manholes SMH16371 and SMH2259) is not affected by Alternative 1, it was noted during the hydraulic analysis that this area had a flow rate below the self cleaning velocity of 0.6 m/s. This may result in the deposition of solids that could limit the level of service of the sewer. Subsequent investigations should determine if system modifications are required along these reaches as shown in Sketch 6 in Appendix C to increase flow velocity. System hydraulic calculations are shown in Appendix B.

#### 4.1.1.3 Construction Considerations

The new pump station will be constructed within the Navy St. right of way utilizing trenched excavation. The depth and width of the excavation may require the contractor to install excavation support. Possible excavation support methods include wooden lagging with whalers, liner plate, soldier piles with lagging and sheet piling. Use of soldier piles and sheet piles may cause localized noise and vibration. Construction will result in a closure of Navy St. until the pump station and wet well installation can be completed. Once completed, the roadway will be reconstructed on top of the pump station. Construction will also have to provide a new connection to the existing 250 mm diameter force main that will convey flow to the Oakville SW East Trunk (Rebecca St) sewer.

The new 450mm collection pipe from SMH4784 will be installed by utilizing a trenched excavation. Since a portion of the sewer will be installed within parkland, a significant portion of the park will need to be closed during construction. Additionally, because of space constraints surrounding the existing Navy St. PS, road access by tanker trucks to the station may be difficult.

A portion of Navy St. may see complete or partial closure to remove the existing sewer and install the new sewer. This step will take place after the new Navy St. PS is fully built and ready to receive diverted flows from the drainage area. Details of the procedure for transitioning from the existing

Navy St PS to the new facility will need to be carefully examined during the following stages of this project, considering the constraints highlighted in this report.

Based on the analysis performed in the study, there are no constructability concerns with this alternative that would deem this proposed solution not feasible.

## 4.2 ALTERNATIVE 2: NEW WATER ST. PUMPING STATION

Alternative 2 will divert all flow away from Navy St. PS and allow it to be taken out of service. Flow diversion will be accomplished by constructing a new sewer along Navy St. and William St. to divert flow to the Water St. Sewer at Navy St. and William St. Furthermore, due to high flow rates near Navy St. PS, this alternative will require the replacement of collection pipe upstream of Navy St.

### 4.2.1 System Improvements

#### 4.2.1.1 Pumping Stations

**Navy St. PS**

Without the PS, the Oakville Rescue Unit building will no longer be able to be serviced by gravity sewer. The construction of a small lift station capable of pumping the flows from the unit to SMH 4839 is recommended. The station will entail a sump and submersible pump package.

**Water St. PS**

The current total PS capacity is 38 L/s, which is not sufficient to handle the peak flow of 110 L/s. A larger pumping system is required.

The current wet well capacity has a storage time of 1.3 minutes under peak flow conditions of 110 L/s. This does not meet the requirement for 1 hour of storage. For pump capacity of 110 L/s, with 1 hour storage, the required storage volume is 396 $m^3$.

Three types of new submersible pumping station arrangement have been considered, as follows:

- One wet well with submersible pumps. This arrangement is not in compliance with the Region's Design Manual and has not been analysed further.
- Wet well/dry well in shared well pit. Due to the volume required for the wet well storage, this structure will be large and probably not cost effective compared to the separate wet well and dry well arrangement discussed next.
- Wet well and dry well in separate pit structure. This layout meets the Region's Design Manual requirements. By separating the wet well and dry well structure the dry well size will be dictated by the pump requirements and will be smaller than the combined wet well/dry well structure.

At 110 L/s peak flow the velocity through the existing 200 mm discharge forcemain is 3.5 m/s, which is considered to be too high. It is recommended a 300 mm diameter forcemain be constructed to replace the current one and thereby reduce the velocity at peak flow to 1.6 m/s.

If a 300 mm forcemain is constructed, hydraulic modeling indicates that the TDH required at the new Water St. PS is 11.7 m. Previous modeling documented in Condition Assessment Report 13 Water St. #7 indicates the current pumping station operates at 38 L/s at 22 m TDH. A TDH of 22 m is considered high for the future pumping station. The new PS pump heads should be based on the

modeled TDH of 11.7 m. Due to uncertainties with future forcemain hydraulic conditions, a TDH of 13.5 m has been used for the new pumps at 110 L/s flow. During the detailed phase of this project, it is recommended that the new forcemain be evaluated to verify that a minimum flow velocity of 0.8 m/s is provided when one pump is operational to prevent settling in the forcemain and plugging of the pump.

It is recommended that the Water St. PS be replaced with a larger, underground can-type PS. Per the Region's Design Manual the new PS will operate with four dry well pumps (3 duty + 1 standby) with VFDs and the wet well will have a minimum storage volume of 396 $m^3$, split into two chambers connected by an isolation gate. A 250 kW generator set will provide backup power to the pumps to minimize the number of overflows into Sixteen Mile Creek. The generator set will be self-contained provided with its own whether proof enclosure and sound attenuation measures.

The new underground PS, its servicing generator set and respective electrical panels can be located within the parking lot of the OCPA. The electrical panels, the PS access hatch and vent discharge and entrance to generator set should be at elevation 79.80m to maintain a minimum height of 300 mm above the regulated flood elevation. Sketch 3 of Appendix A presents a general arrangement of these structures on Water St.

The generator set should be self-contained provided with its own weather proof enclosure and sound attenuation measures. The generator set should be installed on an outdoor concrete pad.

Table 4-2 below summarizes the modifications to take place at the locations of each existing PS. Water St. PS will need major upgrades to meet expected peak flow conditions of 110 L/s, as the wet well would need to be much bigger and a pumping system with larger capacity installed. At present, site restraints limit expanding the current PS. Additionally, expanding the current PS would not meet operational performance requirements and would incur major constructability and operational challenges, as the collection and pumping system would need to remain operational during construction.

Table 4-2: Summary of Pumping Station Modifications - Alternative 2

| PS LOCATION | MODIFICATIONS | DESIGN FIRM CAPACITY |
|---|---|---|
| Navy St. PS | Demolish existing Navy St. PS. | NA |
| Water St. PS | Replace Water St. PS with larger underground can type PS to be located within OCPS's parking lot.<br>Provide 4 dry well pumps (3 duty + 1 standby) with VFDs.<br>Provide 250 kW generator set to be installed within OCPS's parking lot. | 110 L/s |

#### 4.2.1.2 Collection System

The hydraulic analysis presented in Appendix B was used to evaluate possibilities for diverting total flows from the Navy St. PS influent to the new Water St. PS. A thorough assessment revealed that the best way to divert these flows would be to construct a new pipeline along Navy St. and William St. parallel to the existing sewer to create a connection between the Navy St. PS and Water St. PS sewer

collection streams. Pipelines leading to the new Water St. PS will need to be upgraded in size to be able to handle the additional flows.

The findings of the hydraulic analysis showed that the following modifications are required:

- Replace 80 m of sewer in parkland between manholes SMH4784 and SMH 4839 with 450 mm diameter sewer pipe;
- Divert 100 L/s to Water St. PS:
  - Install approximately 300 m of new 400 mm sewer to route flow to Water St. PS along Navy and William St;
  - Install or replace 400 m of sewer along Water St. to convey added flow. Use 450 mm pipe for replacing or 400mm for parallel pipe. Because the cost difference between installing new and replacing existing pipeline is marginal, it has been assumed that pipe will be replaced instead of installed in parallel. In this case, 450mm diameter is assumed for replacement of existing pipe;
  - Install approximately 60 m of 150 mm diameter connector from new lift station at the Oakville Rescue Unit Building to new sewer at manhole SMH4389.

Although the flow rate along King St. between Navy St. and Thomas St. (specifically manholes SMH16371 and SMH2259) is not affected by Alternative 2, it was noted during the hydraulic analysis that this area had a flow rate below the self cleaning velocity of 0.6 m/s. This may result in the deposition of solids that could limit the level of service of the sewer. Subsequent investigations should determine if system modifications are required along these reaches as shown on Sketch 7 in Appendix C to increase flow velocity. System hydraulic calculations are shown in Appendix B.

#### 4.2.1.3 Construction Considerations

The new diversion sewer along Navy St. and William St. will be constructed by trenched excavation within the right of way. Construction will result in the closure of at least one lane of traffic along Navy St. between William and Front St. and along William St. between Navy and Water St. Construction should be staged to minimize traffic and community disruption. Flow will be diverted into the new sewer by installing a manhole and subterranean diversion structure at manhole SMH4839. Due to high flows between manholes SMH4784 and SMH4839 this portion of the sewer will need to be replaced with a larger diameter sewer. The sewer replacement will be done by trenched excavation and will take place within Lakeside Park and may result in closure of the park during construction. Additionally a small diameter sewer will need to be installed along Navy St. from the lift station at the Oakville Rescue Unit Building to SMH4839, to divert flow away from the building. This sewer will be installed by trenched excavation. The existing 380 mm sewer flowing towards the pump station may be abandoned following new sewer installation.

In order to convey diverted flow along Water St. the existing sewer will need to be upgraded. The new sewer will act as an express sewer to the pump station and the Water St. PS will have to be modified to accept flow from two sewers. The existing manholes collecting flow will need to be modified to work with the larger diameter sewer pipe. This method will require the temporary closure of at least one lane of traffic along Water St. Construction should be staged to minimize traffic and community disruption.

## 4.3 ALTERNATIVE 3: PARTIAL SEWERSHED DIVERSION TO WATER ST. PUMPING STATION

Alternative 3 requires the Navy St. PS to continue operating at its existing capacity of 66 L/s. Flow in excess of 66 L/s will be diverted to the Water St. PS through a new sewer along Robinson St. and Navy St, diverted flow is introduced to the Water St. sewer at the junction of William St. and Water St.

### 4.3.1 System Improvements

#### 4.3.1.1 Pumping Stations

**Navy St. PS**

Navy St. PS will remain in operation at its maximum total capacity of 66 L/s. At this flow the maximum storage time available in the wet well is 2.2 minutes. For 1 hour storage, 238 $m^3$ storage volume would be required. For the current wet well to be expanded to store this volume, the bottom water level (74.5 m) and overflow level (76.28 m) set in the current wet well must be maintained for hydraulic operation of the pumping station. Therefore the wet well would be required to expand horizontally, to an area of 134 $m^2$. Due to the infeasibility of constructing a wet well with such a large area, the Halton Region has advised that a new wet well sized to store 20 minutes of peak flow should be investigated. For 20 minutes of peak flow, a volume of 79 $m^3$ is required. Again respecting the current wet well bottom water and overflow levels, the area of the upsized wet well would be 45 $m^2$.

Site restraints limit expanding the current PS wet well and the existing wet well would be required to remain in service during the construction period. It is recommended that a new wet well be constructed across the service road on Town of Oakville's parkland, as shown in Sketch 4 of Appendix A. The PS will be connected to the wet well via a sloped suction pipeline.

A 125 kW generator set should be provided above ground near the new wetwell shaft. A ductbank passing under the service road will connect the generator set and electrical panel to the pumping station.

The generator set will be installed on an outdoors concrete pad and self-contained provided with its own whether proof enclosure and sound attenuation measures.

As noted in Section 3, certain aspects of the existing Navy St. PS building will require upgrades in order to improve internal environmental conditions for operators and the appearance of the building façade to diminish visual impact to surrounding landscape. In the existing wetwell room, lighting will need to be upgraded and 12 air changes per hour ventilation provided, according to NFPA 820. Brick finishing is recommended for renovating the building exterior.

**Water St. PS**

In this alternative the capacity of the Water St. PS is 44 L/s. This flow is only slightly larger than the current total capacity of 38 L/s and therefore it is recommended that the current pumping station remain in service but that the pumps are replaced with larger units. To maintain cathodic protection of the PS it is recommended that an anode test box be mounted on the PS entrance tube and new anode packs be installed.

The wet well has a storage time of 3.4 minutes under peak flow conditions of 44 L/s, which does not meet the requirement for 1 hour of storage. For 1 hour storage, the required storage volume is 158 $m^3$.

For the existing 200 mm forcemain a velocity of 1.4 m/s will occur during peak flow conditions, which is considered acceptable. Hydraulic modeling of the system indicates that the new pumps would require a TDH of 11.6 m at a flow of 44 L/s. As discussed in Alternative 2, Assessment Report 13 Water St. #7 indicates the current pumping station operates at 38 L/s at a high TDH of 22 m. The new PS pump heads should be based on the modeled TDH of 11.6 m. Due to uncertainties with forcemain conditions, a TDH of 13.5 m is recommended for the new pumps at 44 L/s flow.

It is recommended that the Water St. PS remain in service, if the condition of the current pumping station steel can is suitable, but with larger pumps installed, despite less than 1 hour storage available. The current pump configuration of 1 lead + 1 lag pump will be maintained. To maintain corrosion protection of the PS it is recommended that an anode test box be mounted on the PS entrance tube and new anode packs be installed.

Due to the age of the Water St. PS (construction 1967) it is likely that it will need to be replaced in near the future. Per the Region's Design Manual, this new PS would be a submersible type with 3 pumps (1 lead, 1 lag, 1 standby). However, to maintain familiarity and ease of operation for the operators it is recommended that the replacement pumping station be a can-type wet well/dry well configuration similar to the current facility. In line with the Region's other new wet well/dry well configured pumping stations 4 pumps (3 duty + 1 standby) are recommended. When replaced, the PS should be provided with a new 158 $m^3$ wetwell to comply with the Region's Design Standards.

A 100 kW generator set will provide backup power to the pumps to minimize the number of overflows that occur as a result of the storage volume being less than 1 hour. The proposed location of the new generator set is within the parking lot of the OCPA, as shown on Sketch 5 of Appendix A. A ductbank passing under Water St. will connect the generator set and new control panel to the pumping station.

The generator set will be installed on an outdoors concrete pad and self-contained provided with its own weatherproof enclosure and sound attenuation measures. Structure should be built at elevation 79.80m to maintain a minimum height of 300 mm above the regulated flood elevation.

Table 4-3 below summarizes the modifications to take place at the locations of each existing PS.

Table 4-3: Summary of Pumping Station Modifications - Alternative 3

| PS LOCATION | MODIFICATIONS | DESIGN FIRM CAPACITY |
|---|---|---|
| Navy St. PS | Navy St. PS capacity will remain unchanged (note less than 1 hour storage available).<br>Wetwell extension for additional 20 minutes of storage capacity.<br>Repair façade of building with brick finishing.<br>Upgrade ventilation and lighting in the existing wetwell room.<br>Provide a 125kW generator set located above ground across the service road on Town of Oakville's parkland. | 66 L/s |

| PS LOCATION | MODIFICATIONS | DESIGN FIRM CAPACITY |
|---|---|---|
| Water St. PS | Water St. PS pumps be replaced with larger pumps (1 lead + 1 lag) with VFDs<br>Wet well storage will remain unchanged (note less than 1 hour storage available)<br>Provide 80 kW generator set to be installed in OCPA parking lot.<br>Provide anode test box and new anode packs. | 44 L/s |

#### 4.3.1.2 Collection System

The hydraulic analysis presented in Appendix B was used to evaluate possibilities for diverting partial flows from the Navy St. PS drainage area to the new Water St. PS. A thorough assessment revealed that the best way to divert these flows would be to intercept the sewer along Robinson St. to capture the extra 34 L/s flow. Furthermore, pipelines leading to the new Water St. PS will need to be upgraded in size to be able to handle the additional flows.

The findings of the hydraulic analysis showed that the following modifications are required:

- Install approximately 400 m of 200 mm new sewer and 3 manholes to divert flow along Robinson and Navy St. beginning at manhole SMH2606.
- Replace 400 m sewer along Water St. with 350mm pipe to convey added flow.
- Install 20 m of 150 mm diameter connector sewer and a flow diversion structure at Lakeshore Rd and Dunn St. between manholes SMH2650 and SMH2652

Flow diversion to Water St. PS will result in lower flow along Thomas St. and George St. sewers near Navy St. PS, as well as along King St. Specifically between manholes SMH2250 and SMH2656 on George St, SMH2257 and SMH2254 on Thomas St. and SMH16371 and SMH2259 on King St. System modifications will lower flows in these sewers below the self cleansing velocity of 0.6 m/s and may result in deposition of solids that could limit the level of service. Subsequent investigations should determine if system modifications are required along these reaches as shown in Appendix C to increase flow velocity. System hydraulic calculations are shown in Appendix B.

#### 4.3.1.3 Construction Considerations

The new collector sewer along Robinson St. and Navy St. will be constructed by trenched excavation within the right-of-way. Construction will result in the closure of at least one lane of traffic along Robinson St. between Navy St. and George St, along Navy St. between Robinson St. and William St., and along William St. between Navy St. and Water St. and should be staged to minimize traffic and community disruption. Flow will be diverted into the new sewer by installing manholes and subterranean diversion structures at the intersections of George St. and Robinson St., Thomas St. and Robinson St. and William St. and Navy St.

In order to convey diverted flow along Water St. the existing sewer will either need to be replaced and constructed with trenched excavation. The existing manholes collecting flow will need to be modified to work with the larger diameter sewer pipe. Either method will require the temporary

closure of at least one lane of traffic along Water St., construction should be staged to minimize traffic and community disruption.

# 5 Opinion of Probable Cost

## 5.1 METHODOLOGY

The economic assessment of three alternatives for the Navy and Water St. WWPS & Collection System Modernization is based on an Opinion of Probable Cost (OPC) of each alternative.

The OPC includes capital cost estimates for each alternative and whole life costs (WLC). The reference period of operation for the whole life analysis was taken as 30 years.

In general, existing financial sources of information were reviewed to develop a Class 5 Estimate in accordance with the Recommended Practice No. 17R-97 and No. 18R-97 developed by the Association for the Advancement of Costing International (AACE). These levels of estimates are based on concept limited scope definition and are used for strategic-level decision-making purposes. The tools used are generally stochastic parametric estimators such as cost-per-unit area or cost-per-unit capacity. The estimates are based on defined location, capacity and technology selection to provide a -50% to +100% accuracy range.

The methodology used financial information from cost estimation manuals (RS Means) other similar projects in scope/nature and size, professional judgment and experience based on conceptual level defined parameters, and applied allowances for local market conditions and variability.

## 5.2 CAPITAL COST

Capital costs were based on design components identified in Section 4 and sketches presented in Appendices A and C.

A number of factors were applied to the total raw cost estimate to determine a realistic outturn cost for the project. Allowances were applied to the capital cost estimate for overhead and profit (10%), mobilization/Bond/Insurance (5%), and engineering (15%).

Other factors associated with outturn project costs relate to unforeseen construction issues, the ability to efficiently sequence work and the additional operational costs resulting from construction disruption. The following allowances were applied; construction contingency (20%), construction staging allowance (3%), Halton internal expenses (10%). In addition, an overall project contingency (10%) was applied, in accordance with standard cost estimating procedures for Halton projects.

The mid-year point of construction for each option was estimated at 6 months.

Note that capital cost estimates exclude tax and all costs are in Year 2013 Canadian dollars.

The individual cost elements were compiled into an overall spreadsheet for each alternative. The spreadsheets define the total capital cost estimated for each major scope element and the total raw capital cost of the complete option.

Pumping package costs are based on information provided by Smith & Loveless, who are not currently on the Region's list of pre-approved equipment suppliers. However, they have been

included in this study as the current Water St. PS is a Smith & Loveless facility and the Halton Region has indicated that they are happy with the performance and Smith & Loveless units would be considered for the upgrade works.

Costs for collection system upgrades were based on 2011 benchmark data from the Halton Region Sustainable Halton Water and Wastewater Master Plan. A cost increase factor of 4% was added to update costs to 2013.

The detailed capital cost estimate is presented in Appendix D.

## 5.3 WHOLE LIFE COST

Whole life cost assessment was based on Net Present Value (NPV) for a 30-year design-life, based on the following components:

- Capital cost;
- Energy usage;
- Monthly O&M costs;
- Periodic major equipment refurbishment/replacement.

Routine energy costs for operating the pumping stations were calculated based on the power usage associated with operation of the main pumps. Minor energy for lighting and building services was ignored. A usage factor was estimated for each pump group representing the number of pumps running on average over a month. This allowed the kWh per pump group to be determined.

The dollar per kWh power cost for all alternatives was assumed at $0.10/kWh.

Routine maintenance costs were estimated for the pumping station. Labor and materials requirements were estimated to give an indication of cost sufficient for alternative comparison. The following annual maintenance costs were estimated:

- Staff time requirements: 0.5-1 operator required. Each operator cost was calculated based on an assumed typical salary plus a cost multiplier for overheads. The cost for each operator was estimated at $45,000 per year;
- Transport: $7,000 - $10,000 per year for the cost of a truck for the operators, depending on alternative. This was estimated based on a leased vehicle and includes fuel and maintenance;
- Electrical maintenance: $3,500 - $5,000 for minor electrical faults, use of consumables and replacement of small parts, depending on alternative. This includes the cost for material and labour and assumes part time attendance by maintenance staff as needed;
- Mechanical maintenance: $3,500 - $5,000 annually for consumable items, minor spare parts and small wearing items, depending on alternative. This includes the cost for material and labour and assumes part time attendance by maintenance staff as needed;
- Civil maintenance: $3,500 - $5,000 annually for repairs to hard surfaces, minor building maintenance (windows, roofs etc.);
- Security and safety: $5,000 - $10,000 annually required as buildings located in a public space. This cost includes staff time and materials (security on doors and windows, lighting, access cover locks etc);
- Administration costs: costs associated with administering staff, ordering materials, record keeping, office paper supplies, etc. $1,000 allowed per year;

Major refurbishments and replacements of equipment over the life of the pumping stations have been identified and scheduled. The periodic refurbishment costs include manufacture and installation of replacement equipment, testing and supervision of installation. Costs for replacing major items were based on capital costs estimated for a new installation.

- Electrics: pump electrics: to be replaced once every 30 years and cost $20,000 - $30,000 on average per pump group, depending on the alternative.
- Controls: pump station controls to be replaced every 15 years at a cost of $10,000 - $15,000 depending on pumping station size, depending on the alternative.
- Pumps: pump groups will need to be replaced every 30 years. Costs vary based on pump sizes.
- Building services: maintenance to heating, lighting and ventilation systems. Required every 20 years at a cost of $20,000 - $25,000 per building, depending on building sizes and confined space entry requirements.
- Civil refurbishment: repair to the building structure, including minor patching of concrete, fixing leaks etc. To occur every 30 years.
- Replacement of pumping station: complete replacement of pumping station will be required after 50 years from construction. As Navy St. and Water St. PSs were built in 1985 and 1967, respectively, the cost for complete replacement of pumping stations were added to the NPV calculation for Alternative 1 and Alternative 2.

The whole life project cost was then estimated by summing the capital and refurbishment costs, and O&M costs incurred each year over the 30-year design-life. In addition to the regular refurbishments and O&M costs, specific considerations that impact the total WLC of each alternative are as follows:

- Alternative 1 – New Navy Street pumping Station, current forcemain is re-used and Water St. PS needs to be replaced within 5 years due to age (pumps and generator included in initial Water Street investment may be re-used);
- Alternative 2 –Eliminate Navy Street PS, replace Water Street PS. As all new infrastructure, only regular refurbishment costs and O&M costs are expected for WLC;
- Alternative 3 – Upgrade Navy Street, add a wet well, current forcemain is re-used. New pumps and electrics in Water Street PS. Water St. PS needs to be replaced within 5 years and Navy St. PS replaced in 20 years due to age.

The design-life of both Water St. and Navy St. PS is expected to be approximately 50 years, after which additional capital investments will be necessary to maintain the level of operation required at the PS.

A discounted cash flow analysis was used to determine the NPV for each alternative. NPV costs were estimated from the sum of the annual capital, refurbishment and O&M costs to which a 5% discount rate was applied. Annual present value costs were then summed over the project design-life to total the present value of the whole life cost. Table 5-1 shows the estimated costs for the three alternatives.

Table 5-1: Summary of Study Cost Estimate

| ALTERNATIVES | CAPITAL COST ($ MILLION) | WHOLE LIFE COST ($ MILLION) | NET PRESENT VALUE ($ MILLION) |
|---|---|---|---|
| ALTERNATIVE 1<br>New Navy St. PS | 4.4 | 10.9 | 8.6 |
| ALTERNATIVE 2<br>New Water St. PS | 5.8 | 8.1 | 6.9 |
| ALTERNATIVE 3<br>Partial Sewershed Diversion to Water St. PS | 3.1 | 12.5 | 10.6 |

Capital costs shown above must be viewed with care. Water street pumping station will probably require replacement within 5 years. If this is considered, capital cost expenditure within the financial horizon of this project for alternatives 1 and 3 is effectively $1.6 million higher than shown.

Alternative 3 gains on capital cost because Navy Street pumping station refurbishment is comparatively inexpensive. However this is because of the reduced size of the wet well which provides 20mins retention rather than the 1 hour provided by the other alternatives. A reduced level of service is achieved because of the greater risk of overflow. WLC is high because both pumping stations will eventually need to be replaced.

Alternative 2 has the lowest whole life cost because two pumping stations are being replaced by a single site.

The NPV costs provide the economic comparison between the alternatives. This shows alternative 2 to be the economic solution.

# 6 Environmental Requirements

## 6.1 CONSERVATION HALTON CONSULTATION

As part of the feasibility study for modernization of Navy St. and Water St. PSs and collection system, Conservation Halton was consulted, in relation to the three alternatives being presented in this Report, to gather environmental concerns pertinent to the areas affected.

Halton Region's Design Manual specifies that for building new infrastructure in the floodplain, at a minimum, vents must be terminated at a suitable elevation above the floodplain, and wet well and above ground access hatches must be sealed water tight. In addition, the following requirements were presented by Conservation Halton:

- All above ground components (i.e. vents, hatches, generator stations, etc.) are to be able to withstand the static and dynamic forces anticipated under a Regional Storm Event, which may also including debris impact and loading from debris jamming;

- The generator station must be dry flood-proofed due to the electrical connection, as well as to allow access to the generator during a flood event. The building should contain only the minimum required amount of hazardous materials (i.e. oils, etc.) for the operation of the generating station, and all hazardous materials are to be located a minimum of 0.3 m above the regulated flood elevation;
- Any network modifications (pipe size increases, etc.) required to increase capacity to the pumping station that cross through the regulated floodplain should be sealed at the surface to prevent inundation of the system, if feasible.

Conservation Halton requested that the environmental risk associated with the operation of the alternatives under the regulatory storm be considered as part of the evaluation matrix, noting the following:

- Water St. Pumping Station appears to be approximately 1.5 m below the regulatory floodplain. The floodplain elevation is 79.36m;
- Navy St. Pumping Station appears to be outside of the floodplain associated with both Sixteen Mile Creek and Lake Ontario, based on an assumption that the pumping station elevation is above 79.00 m.

While Conservation Halton's policies allow for new infrastructures to be placed within hazard lands (i.e. floodplain) where the need has been fully justified, it is preferred that expansion does not increase the environmental risk relative to the existing conditions. Expanded pumping station capacity should be located outside of the floodplain or minimally be protected from the floodplain. With respect to the drainage network capacity, it is preferred that network expansions be located outside of the floodplain, however, if this is not feasible, expansions that cross through the floodplain should be sealed watertight.

As such, the alternatives described in Section 4 have incorporated these design requirements and the preferences of Conservation Halton were considered in the evaluation presented in Section 6.

## 6.2 CLASS ENVIRONMENTAL ASSESSMENT SCHEDULE

Under the Ontario Environmental Assessment Act R.S.O. (1990), projects that have the potential to cause adverse environmental impacts, ranging from minimal to significant, with major public interest, must prepare an EA to be approved by the Ministry of the Environment (MOE). The Ontario Environment Assessment Act (EA Act) considers two types of environmental assessments (EAs) as described below in Table 6-1.

Table 6-1: Classification of Ontario Environmental Assessments

| TYPE | DESCRIPTION |
|---|---|
| Individual Environmental Assessment (IEA) | IEAs are prepared for large-scale, complex projects that have potential for significant environmental effects and require ministry approval. |
| Class Environmental Assessment (EA) | Class EAs are used as municipalities undertake hundreds of projects and is offered to streamline the process for routine projects with predictable and management environmental effects. These projects can be pre-approved or exempt. |

As the work involved with the Navy St. and Water St. Pumping Stations is relatively minor and simple, a Class EA can be used. There are currently ten types of Class EAs in Ontario. A Municipal Class Environmental Assessment is one that includes municipal road, water, and sewer projects. As per this definition, upgrading a wastewater pumping station falls under the Municipal Class EA. As projects can vary in their environmental impacts, they are further categorized in schedules as shown below in Table 6-2.

Table 6-2: Classification of Schedules

| SCHEDULE | DESCRIPTION |
|---|---|
| Schedule A | ■ Pre-approved projects as the environmental impacts are minimal (e.g. normal or emergency operational and maintenance activities). |
| Schedule A+ | ■ Pre-approved projects that must advise public prior to implementation. |
| Schedule B | ■ Potential for adverse environmental impacts.<br>■ Proponent is required to proceed with a screening process involving mandatory consultation with those affected (public, review agencies).<br>■ Projects include minor expansions and improvements to existing facilities. |
| Schedule C | ■ Potential for significant adverse environmental impacts<br>■ Proponent is required to proceed with a full EA planning and documentation process as outlined in the Class EA. The Environmental Study Report (ESR) must be prepared and filed for review by the public and review agencies.<br>■ Projects include major expansions to existing facilities or the construction of new facilities |

The alternatives evaluated in this Report have been assessed to determine the appropriate Schedule to follow in the Municipal Class EA process. Below in Table 6-3, criteria to select Schedule A/A+ are described with the applicability for each alternative.

Table 6-3: Schedule A/A+ Criteria and Applicability

| CRITERIA | ALTERNATIVE 1<br>NEW NAVY ST. PS | ALTERNATIVE 2<br>NEW WATER ST. PS | ALTERNATIVE 3<br>PARTIAL SEWERSHED DIVERSION TO WATER ST. PS |
|---|---|---|---|
| The undertaking pertains to normal or emergency operational activities. | Replacement of PS facilities does not fall under normal or emergency operational activities. **It does not apply.** | Replacement of PS facilities does not fall under normal or emergency operational activities. **It does not apply.** | Upgrade of PS facilities does not fall under normal or emergency operational activities. **It does not apply**. |

| CRITERIA | ALTERNATIVE 1 NEW NAVY ST. PS | ALTERNATIVE 2 NEW WATER ST. PS | ALTERNATIVE 3 PARTIAL SEWERSHED DIVERSION TO WATER ST. PS |
|---|---|---|---|
| Increasing PS capacity is a Schedule A activity through adding or replacing new equipment where it is located within an existing building or structure and where the rated capacity is not exceeded. | No equipment is being replaced or added within existing buildings or structures. **It does not apply.** | No equipment is being replaced or added within existing buildings or structures. **It does not apply.** | Pumps are being replaced at Water St. PS. **It applies.** |
| Under the 2007 MCEA the retirement of a facility would have been subject to either Schedule B or C of the Municipal Class EA for its establishment. However, the August 2011 amendments to the MCEA made decommissioning of existing wastewater facilities a Schedule A activity. | The existing Navy St. PS will be decommissioned. **It applies.** | The existing Navy St. PS and Water St. PS will be decommissioned. **It applies.** | No systems will be decommissioned. **It does not apply.** |
| Installation or replacement of standby power equipment where new equipment is located in a new building or structure. | New standby generator to be installed at new Navy St. PS and at existing Water St. PS. **It applies.** | New standby generator to be installed at new Water St. PS. **It applies.** | New standby generators to be installed at structure beside existing Navy St. PS and Water St. PS. **It applies.** |

As at least one criterion outlined in Table 6-3applies to each alternative, the minimum classification for all alternatives is a Schedule A/A+ activity.

Below in Table 6-4, criteria to select Schedule B are described with the applicability for each alternative.

Table 6-4: Schedule B Criteria and Applicability

| CRITERIA | ALTERNATIVE 1 NEW NAVY ST. PS | ALTERNATIVE 2 NEW WATER ST. PS | ALTERNATIVE 3 PARTIAL SEWERSHED DIVERSION TO WATER ST. PS |
|---|---|---|---|
| Projects which take place partially outside the proponent's municipal boundary shall be planned at least under Schedule B, other than "normal or emergency operational activities" which shall be Schedule B. | Scope within Halton Region's municipal boundary. **It does not apply.** | Scope within Halton Region's municipal boundary. **It does not apply.** | Scope within Halton Region's municipal boundary. **It does not apply.** |

| CRITERIA | ALTERNATIVE 1 NEW NAVY ST. PS | ALTERNATIVE 2 NEW WATER ST. PS | ALTERNATIVE 3 PARTIAL SEWERSHED DIVERSION TO WATER ST. PS |
|---|---|---|---|
| Wastewater management projects that establish, extend, or enlarge a sewage collection system and all work necessary to connect the system to an existing sewage outlet where such facilities are not in an existing road allowance or an existing utility corridor. | Extension or enlarging of a sewage collection systems to connect the system to an existing sewage outlet are within existing road allowances. **It does not apply.** | Extension or enlarging of a sewage collection systems to connect the system to an existing sewage outlet are within existing road allowances. **It does not apply.** | Extension or enlarging of a sewage collection systems to connect the system to an existing sewage outlet are within existing road allowances. I**t does not apply.** |
| Construct new pumping station or increase pumping station capacity. | Constructing new pumping station at Navy St. PS. **It applies.** | Constructing new pumping station at Water St. PS. **It applies.** | Increasing capacity of Water St. PS. **It applies.** |

The classification criteria for Schedule C involve construction of a new sewage treatment plant or expansion of an existing one. None of the alternatives evaluated in this Report present this condition.

Based on assessment presented in Table 6-3 and Table 6-4, all alternatives will need to undergo a Schedule B Municipal Class EA planning process, including Phases 1 and 2 of the process.

Table 8-2 presents the Class EA classification for each capital project associated with the selected alternative solution.

# 7 Evaluation

## 7.1 METHODOLOGY

Evaluation criteria that considered a range of technical, natural environment, socio-economic, cultural, and financial concerns were developed. These criteria represent aspects of the site alternatives that could be potentially impacted by the facilities. These criteria were selected based on the following:

- Requirements of the feasibility study;
- Discussions with various stakeholders;
- The professional judgment and experience of the project team.

For each criterion, a qualitative rating scale was established, as shown in Table 7-1. Using a development constraint evaluation approach, a “low” rating was assigned to an option which the evaluation criterion posed little or no constraint to the proposed development. An option with a “low” rating was one that would be preferred for the proposed infrastructure, based upon the criterion being considered. A rating of “high” was assigned to an option which its condition or character with respect to the evaluation criterion under consideration represented a high degree of

concern or potential difficulty with respect to the proposed infrastructure. An option with a "high" rating was one that was least preferred for the proposed infrastructure, based upon the criterion being considered. An intermediate rating, "moderate", was applied in the case where some negative concerns or difficulties attended development of a given option with respect to the criterion being considered and addressing that concern or difficulty would require adjustments in other projects (i.e. additional capital investment). One rating, i.e. low, moderate or high, was assigned to each option for each criterion under consideration to guide the evaluation and determine the relative feasibility of each option.

Table 7-1: Evaluation Legend Table - Degree of Concern / Difficulty

| SYMBOL | RATING |
|---|---|
|  | Low |
|  | Moderate |
|  | High |

## 7.2 EVALUATION CRITERIA

The criteria under which alternatives have been evaluated have been selected based on the specific characteristics of each site location. The evaluation criteria listed in Table 7-2 are relevant to the strategic decision-making process, considering that the area impacted by the alternatives discussed in this Report is of high relevance to the local community and to Halton Region especially due to its environmental and socio-economical value.

Table 7-2 describes each criteria and respective rating definitions.

Table 7-2: Evaluation Criteria and Rating

| CRITERIA | RATING DEFINITION |
|---|---|
| Socio-economical | *Low:* minimum impact to regular community and business activities. Moderate: some impact to community or business activities. *High:* high impact to regular community and business activities. |
| Environmental Impacts | *Low:* low visual impact, minimum potential for sewer discharge into Ontario Lake through PS overflow, located outside of a floodplain. *Moderate:* moderate visual impact, minimum potential for sewer discharge into Ontario Lake through PS overflow, located outside floodplain. *High:* high visual impact, potential for sewer discharge into Ontario Lake through PS overflow remains, located within floodplain. |
| Cost | *Low:* lowest NPV cost. Moderate: intermediary NPV cost. *High:* highest NPV cost. |

| CRITERIA | RATING DEFINITION |
|---|---|
| Land Ownership | *Low:* required land is owned by the Halton Region. *Moderate*: new structures will be located in a small portion of land owned by the Town of Oakville. *High:* new structures will be located in a large portion of land owned by the Town of Oakville. |
| Constructability | *Low:* construction will have minimum impact on current systems/operation and pedestrian and pedestrian/road traffic. *Moderate*: construction will have moderate impact on current operation and pedestrian/road traffic. *High*: construction will have major impact on current operation and pedestrian/road traffic. |
| O&M | *Low:* provide improvement to pumping station and sewer collection system, with one pumping station. *Moderate*: provide improvement to pumping station and sewer collection system, with two pumping station. *High*: provide no improvement to pumping station and/or sewer collection system, with two pumping station. |

## 7.3 EVALUATION OF ALTERNATIVES

Each alternative was assessed based on the definitions presented in Table 7-2 and discussions of the assigned rating are presented in Table 7-3.

Environmental impacts related to water pollution of Lake Ontario were considered equal for all alternatives, as the addition of standby power generator has been considered to all systems, minimizing potential for sewer discharge through the wetwell overflow. In addition, in terms requirements for a Class EA as required by the MOE, all alternatives are rated equally, as a Schedule B Class EA process is required for all of them.

All alternatives have been developed to similar technical standards, by prioritizing compliance with Halton Region's Design Manual and the use of latest technology. Also, good practices of engineering and the preferences of the Region's staff were considered in all alternatives. All three alternatives presented in this Report represent major improvement compared to the technology and condition of the systems currently installed. Therefore, a technology evaluation is not relevant in the context of this Report.

Table 7-3: Alternative Evaluation

| CRITERIA | ALTERNATIVE 1<br>NEW NAVY ST. PS | ALTERNATIVE 2<br>NEW WATER ST. PS | ALTERNATIVE 3<br>PARTIAL SEWERSHED DIVERSION TO WATER ST. PS |
|---|---|---|---|
| Socio-economical | **Moderate** | **Low** | **High** |
| | Since the new Navy St. PS will be underground, there will be marginal increase in interference with community activities. The Water St. PS generator will be located in the parking lot of the OCPA, which may have business impacted due to decrease in the number of parking spots. | With the demolition of Navy St. PS, the area will be free of sewer servicing facilities, improving the condition of the area for recreation. | New generator structures will be added to Navy St. and Water St. facilities. There will be two above ground structures in a recreation area. The OCPA may have its business impacted due to decrease in the number of parking spots. |

| CRITERIA | ALTERNATIVE 1<br>NEW NAVY ST. PS | ALTERNATIVE 2<br>NEW WATER ST. PS | ALTERNATIVE 3<br>PARTIAL SEWERSHED DIVERSION TO WATER ST. PS |
|---|---|---|---|
| Environmental Impacts | **High** | **Low** | **High** |
| | Although the new Navy St. PS will be underground, the generator structure will occupy the current location of the PS, causing moderate visual. The Water St. PS generator will be located in the parking lot of the OCPA under the Randall St. bridge, causing low visual impact. The existing Water St. will remain located within the floodplain. | Visual impact will lower, as there will be no more sewer servicing facilities in the surroundings of an active recreation area. The Water St. PS generator will be located in the parking lot of the Oakville Centre for the Performing Arts under the Randall St. bridge, causing low visual impact. | The existing Navy St. PS will remain in its current location, and the generator will be located in parkland increasing the already high visual impact. The Water St. PS generator will be located in the parking lot of the OCPA under the Randall St. bridge, causing low visual impact. The existing Water St. will remain located within the floodplain. |
| Cost | **High** | **Low** | **Moderate** |
| | Highest NPV. | Lowest NPV. | NPV similar to alternative 1. |
| Land Ownership | **High** | **Moderate** | **High** |
| | The new Navy St. PS and Water St. PS generator will be located within Town's property. The future replacement of Water St. PS will also be located within the Town's property. | Town's property will be required for the new Water St. PS and its generator only. | Although only the generators for both Navy St. and Water St. PSs will require Town's property initially, replacement of both pumping stations will require larger Town properties. |
| Constructability | **Low** | **Moderate** | **Moderate** |
| | Construction of new PS and replacement of short section of pipeline on parkland and Navy St. will cause minimal impact to operations and traffic. Construction will take place at one site only. Construction of future new Water St. PS will cause minimal impact to operations and traffic. | Construction of new PS will cause minimal impact to operations and traffic. Sewer collection system works will cause considerable disruption to traffic. | Replacement of pumps in existing facility will have moderate impact on operations. Construction of future new PS will cause minimal impact to operations and traffic. Sewer collection system works will cause considerable disruption to traffic. |
| Operations | **Moderate** | **Low** | **High** |
| | Improved O&M in PS and sewers, with two PS. Low flows in a short section of sewers. | Improved O&M in PS and sewers, with one PS. Low flows in a short section of sewers. | Improved O&M in PS and sewers, with two PS. Low flows in long section of sewers will limit the level of service. Lower service level as higher risk of overflow. |

The rating colour scheme described in Table 7-1 was utilized to represent the degree of concern/difficulty of each alternative regarding the criteria in which they were evaluated. Table 7-4 summarizes the evaluation ratings.

Table 7-4: Evaluation Rating

| CRITERIA | ALTERNATIVE 1 | ALTERNATIVE 2 | ALTERNATIVE 3 |
|---|---|---|---|
| Socio-economical |  |  |  |
| Environmental Impacts |  |  |  |
| Cost |  |  |  |
| Land Ownership |  |  |  |
| Constructability |  |  |  |
| Operations |  |  |  |

# 8 Recommendations

Based on a comparative evaluation of the alternatives in Table 7-4, Alternative 2 is the preferred solution for modernization of Navy St. and Water St. PSs and collection system.

Main advantages of Alternative 2 are as follows:

- Complete replacement of old facilities.
- Removal of Navy St. PS from an area of high interest to the local community and businesses.
- Removal of Water St. PS from the floodplain.
- Centralized operation of the drainage area at the new Water St. PS.

The scope of capital projects associated with the recommended alternative is outlined in Table 8-1.

Table 8-1: Capital Project Scope – Recommended Alternative 2

| AREA | CAPITAL PROJECT SCOPE |
|---|---|
| General Requirements | ■ Mobilization<br>■ Supervision<br>■ Temporary facilities and utilities<br>■ Equipment Rental<br>■ Sitework<br>■ Bypass pumping for diversions |

| AREA | CAPITAL PROJECT SCOPE |
|---|---|
| Navy St. PS | ■ Demolition of existing Navy St. PS, including structural, mechanical, electrical, I&C and yard piping demolition<br>■ Restoration of landscaping to match surroundings |
| Water St. PS | ■ New can-type packaged Water St. PS (110 L/s) located within the OCPA parking lot, complete with all required metals, process piping, valves, instruments, interior finishing, accessories and appurtenances.<br>■ Electrical and I&C panels<br>■ Yard piping<br>■ 396 $m^3$ Pre-cast concrete wetwell<br>■ Self contained 250 kW genset on an outdoors concrete pad, provided with sound attenuation enclosure.<br>■ Demolition of existing Water St. PS, including structural, mechanical, electrical and I&C demolition. |
| Collection System | ■ Replace 80 m of sewer in parkland between manholes SMH4784 and SMH 4839 with 450 mm diameter sewer pipe.<br>■ Divert 100 L/s to Water St. PS<br>● Install approximately 300 m of new 400 mm sewer to route flow to Water St. PS along Navy and William St<br>● Replace 400 m of sewer along Water St. with 450mm pipe to convey added flow.<br>● Install approximately 60 m of 150 mm diameter connector from new lift station at Oakville Rescue Unit Building to new sewer at manhole SMH4389. |

The estimated total capital cost for the preferred Alternative 2 as presented in Table 5-1 is $5.8 million dollars. It is estimated that the execution of the scope of work described in Table 8-1 will require approximately 18 months for completion, from contract award date to substantial completion.

Table 8-2 presents a list of identified capital projects with associated costs and Class EA schedules.

Table 8-2: Capital Projects

| PROJECT | DESCRIPTION | COST | CLASS EA SCHEDULE |
|---|---|---|---|
| 1 – Facility | ■ Demolition of Existing Navy St. PS | $587,896 | Schedule A+ |
| 2 - Facility | ■ Replacement of Existing Water St. PS | $ 3,416,626 | Schedule B |

| PROJECT | DESCRIPTION | COST | CLASS EA SCHEDULE |
|---|---|---|---|
| 3 - Linear | ■ Replace 80 m of sewer in parkland between manholes SMH4784 and SMH 4839 with 450 mm diameter sewer pipe.<br>■ Install approximately 300 m of new 400 mm sewer to route flow to Water St. PS along Navy and William St<br>■ Replace 400 m of sewer along Water St. with 450mm pipe to convey added flow.<br>■ Install approximately 60 m of 150 mm diameter connector from new lift station at Oakville Rescue Unit Building to new sewer at manhole SMH4389. | $1,668,685 | Schedule A |
| | Total | $5.7 million | |

# 9 Further Studies

Prior to commencement of the detailed design phase preceding implementation of the recommended modernization strategy, further studies are required to confirm the scope outlined above, as follows:

- Schedule B Municipal Class EA planning process, including Phases 1 and 2;
- Complete hydraulic analysis of the study pipeline network to address low velocity issues in sewers identified in Section 4 of this Report;
- Investigation of underground utilities and structures;
- Geotechnical investigation of the area intended for the new Water St. PS, within the OCPA parking lot;
- Investigation of land issues;
- Investigation of permitting issues.

# 10 Conclusion

The recommended servicing alternative for Oakville SW( East) drainage area is to eliminate Navy Street pumping station and divert collection sewer flows to Water Street pumping Station. Replace Water Street pumping Station with a larger facility rated at 110l/s. Locate the new pumping station in the nearby OCPA parking lot and design the above ground structure to be higher than the Sixteen Mile Creek flood plain level.

The recommended solution replaces all the old life limited infrastructure, addresses current problems with frequent overflow discharges and optimises future O&M requirements. The service area pumping station is placed at a more appropriate location, removing the Navy St. PS from an area of high sensitivity to the local community and businesses.

The recommended solution has the lowest whole life cost and net present value.

# Appendix A – Pumping Station Improvement Sketches


## ALTERNATIVE 1 - PUMPING STATION MODIFICATIONS

| NO. | BY | CK | APP | REVISIONS AND RECORD OF ISSUE | DATE |
|---|---|---|---|---|---|
| | | | | | |

CYGNET ID:
WP:
SAVED:
PLOTTED:
USER:
XREF1:
XREF2:
XREF3:
XREF4:
XREF5:
DWG VER:

BLACK & VEATCH

HALTON

WATER STREET

ALTERNATIVE 1 - PUMPING STATION MODIFICATIONS

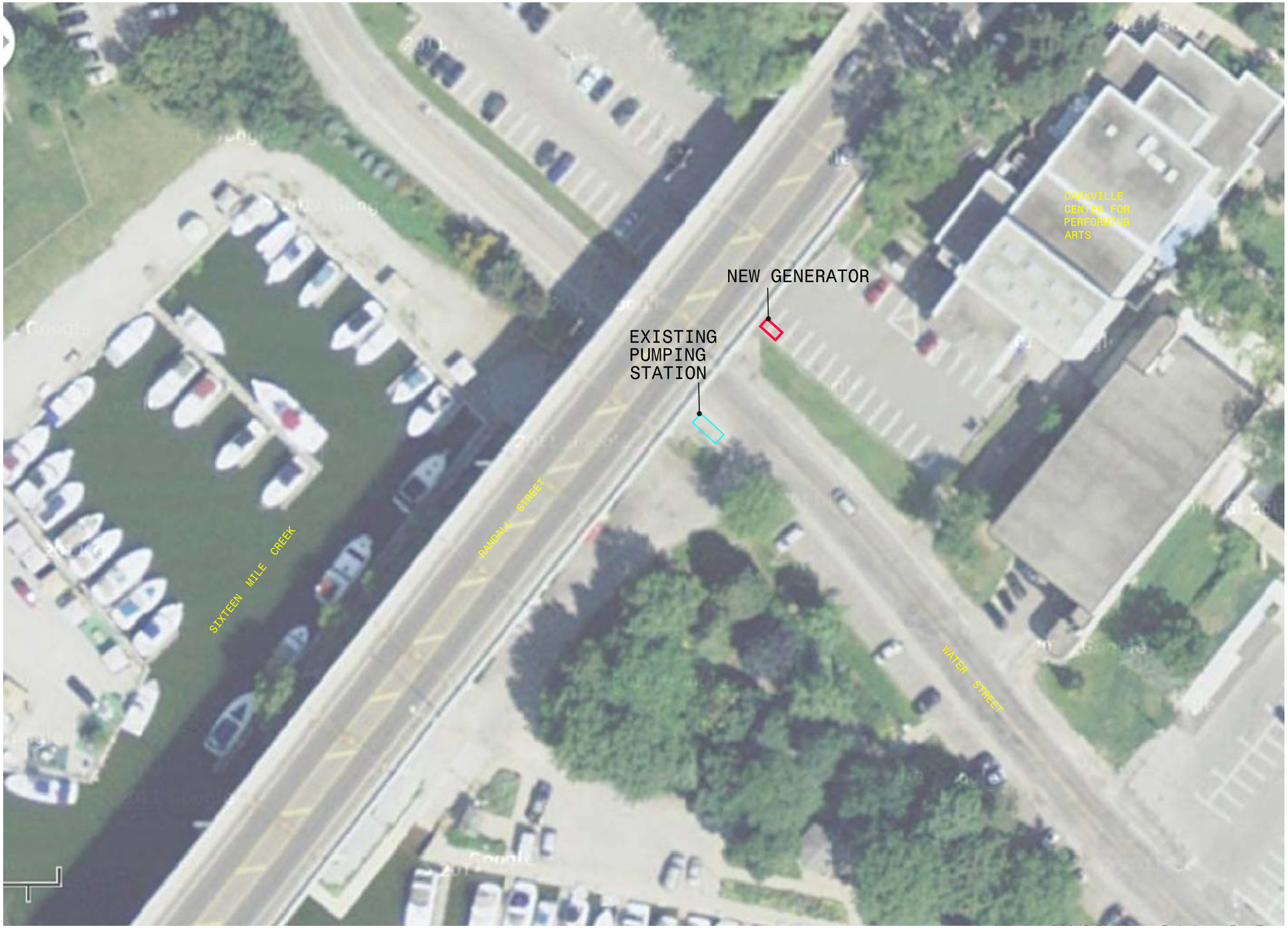
SCALE:
DESIGNED:
DETAILED:
CHECKED:
APPROVED:
DATE:

PROJECT NO.

DWG No.: SKETCH 1

SHEET OF

D163528
C:\pw working\cngpw\d0689689\Main Street Site Development.dwg Plotted: Feb 26, 2013 - 6:00pm by bra71604




## ALTERNATIVE 1 - NEW GENERATOR AND CONTROL PANEL AT WATER STREET PUMPING STATION

| NO. | BY | CK | APP | REVISIONS AND RECORD OF ISSUE | DATE |
|---|---|---|---|---|---|

CYGNET ID:
WP:
SAVED:
PLOTTED:
USER:
XREF1:
XREF2:
XREF3:
XREF4:
XREF5:
DWG VER:

BLACK & VEATCH

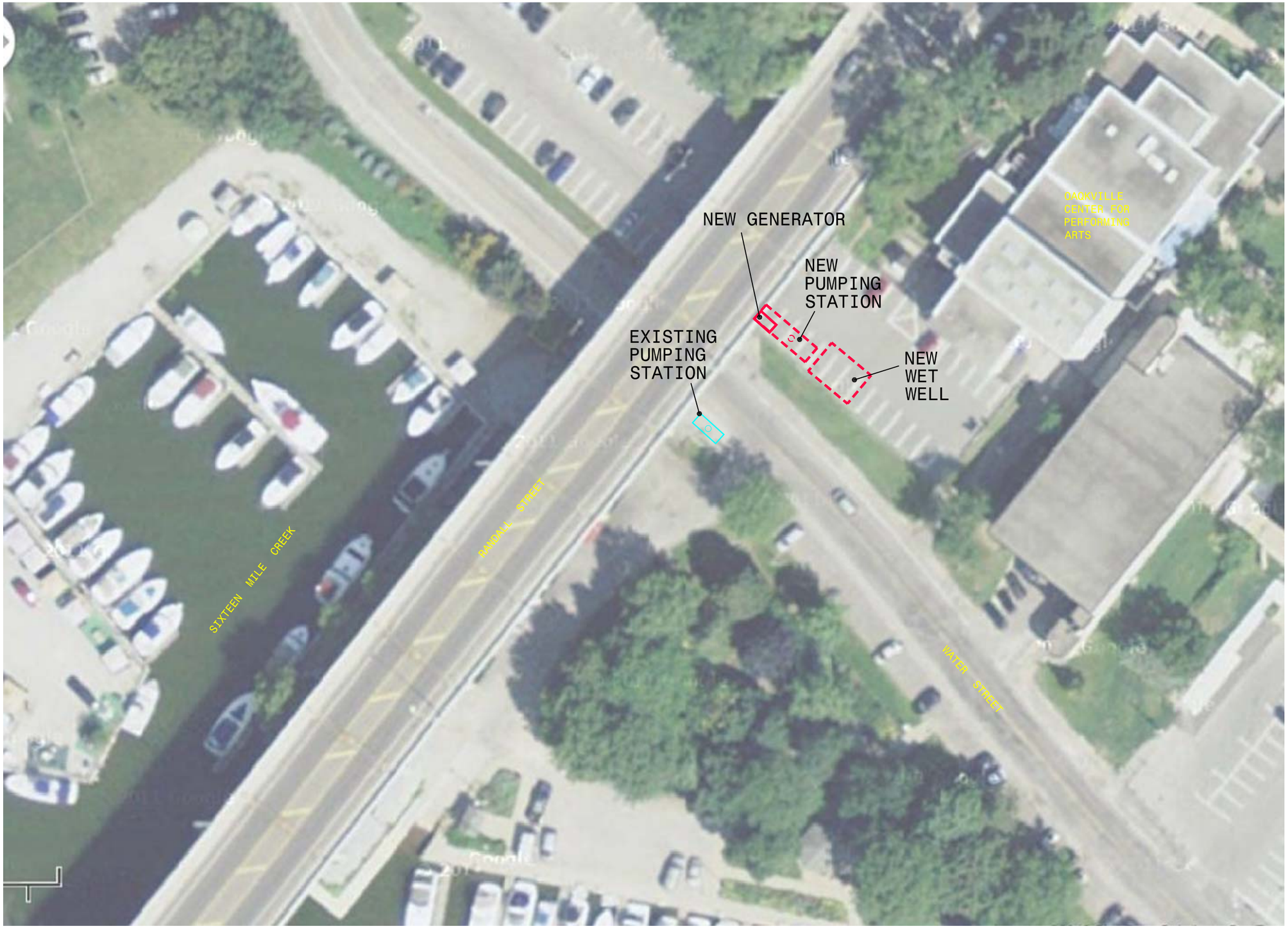
HALTON
WATER STREET
GENERATOR AND CONTROL PANEL

SCALE:
DESIGNED:
DETAILED:
CHECKED:
APPROVED:
DATE:

PROJECT NO.

DWG No.: SKETCH 2
SHEET
OF

D163528
C:\pw_working\cngpw\d0089669\Water Street Site Development.dwg Plotted: Feb 26, 2013 - 5:59pm by amo62969




## ALTERNATIVE 2- NEW WATER STREET PUMPING STATION

| NO. | BY | CK | APP | REVISIONS AND RECORD OF ISSUE | DATE |
|---|---|---|---|---|---|

CYGNET ID:
W:
SAVED:
PLOTTED:
USER:
XREF1:
XREF2:
XREF3:
XREF4:
XREF5:
DWG VER:

BLACK & VEATCH

HALTON
WATER STREET
NEW PUMPING STATION

SCALE:
DESIGNED:
DETAILED:
CHECKED:
APPROVED:
DATE:

PROJECT NO.

DWG No.:
SKETCH 3
SHEET
OF

D163528
C:\pw_working\cngpw\d0089669\Water Street Site Development.dwg Plotted: Feb 26, 2013 - 6:02pm by amo62969


**ALTERNATIVE 3 - NEW GENERATOR AND WET WELL EXPANSION AT NAVY ST. PS**

| NO. | BY | CK | APP | REVISIONS AND RECORD OF ISSUE | DATE |
|---|---|---|---|---|---|
| | | | | | |

CYGNET ID:
WP:
SAVED:
PLOTTED:
USER:
XREF1:
XREF2:
XREF3:
XREF4:
XREF5:
DWG VER:

BLACK & VEATCH

HALTON

WATER STREET

NEW GENERATOR AND WET WELL EXPANSION

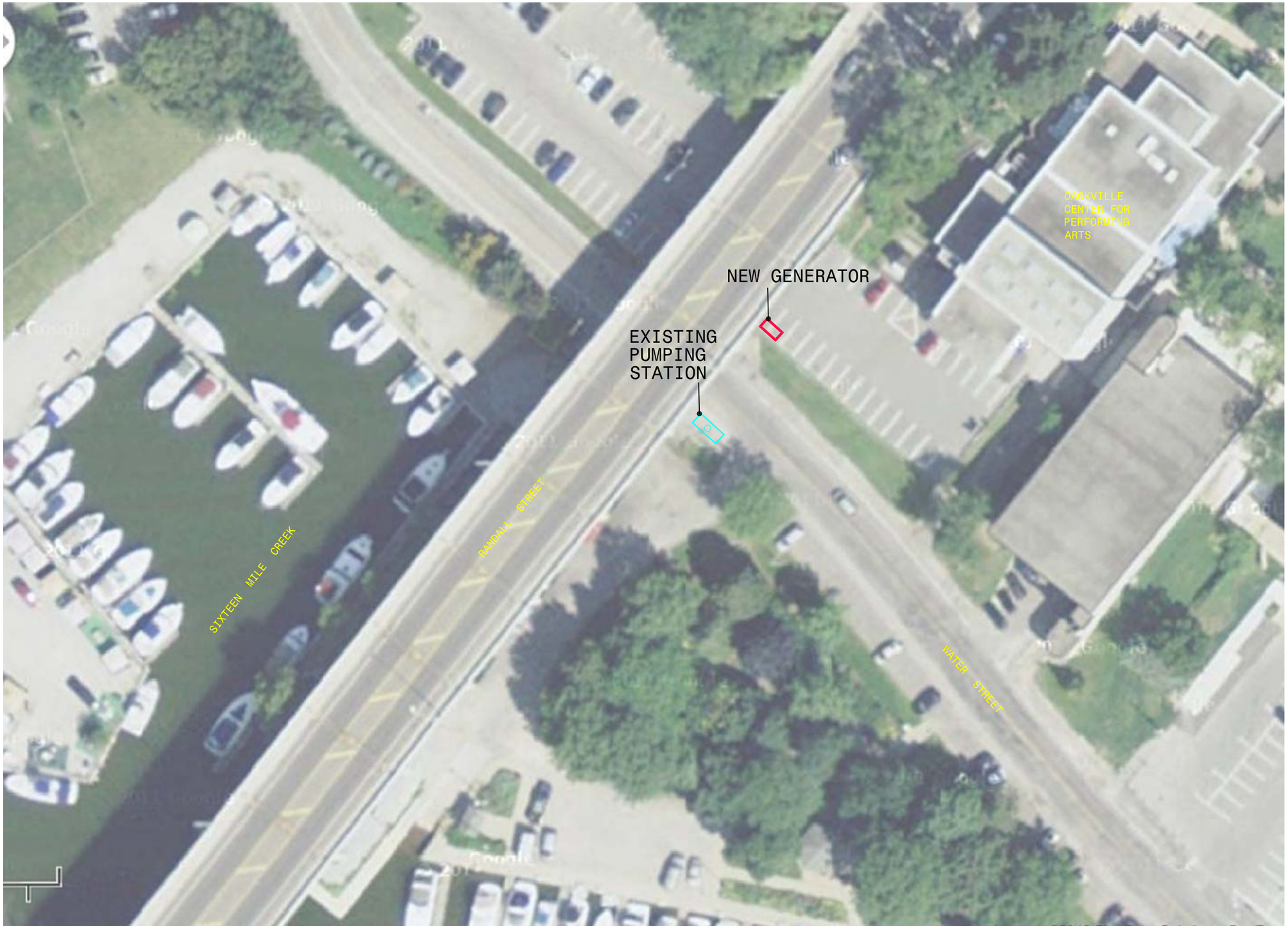
SCALE:
DESIGNED:
DETAILED:
CHECKED:
APPROVED:
DATE:

PROJECT NO.

DWG No.: SKETCH 4

SHEET OF

D163528
C:\pw working\cngpw\d0689689\Main Street Site Development.dwg Plotted: Feb 26, 2013 - 5:59pm by bra71604




## ALTERNATIVE 3 - NEW GENERATOR AT WATER STREET PUMPING STATION

| NO. | BY | CK | APP | REVISIONS AND RECORD OF ISSUE | DATE |
|---|---|---|---|---|---|

CYGNET ID:
W#:
SAVED:
PLOTTED:
USER:
XREF1:
XREF2:
XREF3:
XREF4:
XREF5:
DWG VER:

BLACK & VEATCH

HALTON
WATER STREET
NEW GENERATOR

SCALE:
DESIGNED:
DETAILED:
CHECKED:
APPROVED:
DATE:

PROJECT NO.

DWG No.:
SKETCH 5
SHEET
OF

D163528
C:\pw_working\cngpw\d0089669\Water Street Site Development.dwg Plotted: Feb 26, 2013 - 6:00pm by amo62969

# Appendix B – Collection System Design Sheets

BLACK & VEATCH
Building a world of difference.

# Navy and Water St WWPS & Collection System Modernization Feasibility Study

## Appendix B - Collection System Design Sheets

2/27/2013

### EXISTING Water Street Sewer to Water Street Pump Station

| | | | | | | | | | | | Alternative 1 | | | | | | | Alternative 2 | | | | Alternative 3 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ID # | Manhole Invert Elevation | Reach | New/ Existing | Pipe Diameter (m) | Distance (m) | Δ ELEV (m) | Slope, S | Hydraulic Radius, R (m) | Velocity V (m/s) | Flow Capacity, Q (L/s) | Flow Required (L/S) | Adequate | $Q/Q_{full}$ | d/D Flow Depth vs Diameter | $V/V_{full}$ from Table | Flow Velocity | Greater than 0.6 m/s self cleaning velocity | Flow Required (L/S) | Adequate | Min Replacement Pipe Dia Required | Min Parallel Pip Dia Req | Flow Required (L/S) | Adequate Capacity? | Min Replacement Pipe Dia Required | Min Parallel Pip Dia Req |
| ??? | 74.986 | | | | | | | | | | | | | | | | | | | | | | | | |
| ??? | 74.74 | Water St - William to Robinson | EXIST | 0.25 | 78 | 0.246 | 0.0032 | 0.0625 | 0.66 | **24.6** | 25.4 | NO | 0.88 | 0.73 | 1.13 | 0.67 | YES | 110 | NO | 0.44 | 0.42 | **44.0** | NO | 0.31 | 0.28 |
| ??? | 74.5 | Water St - Robinson Corner | EXIST | 0.25 | 24 | 0.24 | 0.0100 | 0.0625 | 1.18 | **43.8** | 25.4 | YES | 0.49 | 0.49 | 1 | 1.05 | YES | 110 | NO | 0.35 | 0.34 | **44.0** | NO | 0.25 | 0.22 |
| ??? | 74.31 | Water St - Robinson to Lakeshore | EXIST | 0.25 | 53 | 0.19 | 0.0036 | 0.0625 | 0.70 | **26.2** | 25.4 | YES | 0.82 | 0.69 | 1.11 | 0.70 | YES | 110 | NO | 0.43 | 0.42 | **44.0** | NO | 0.30 | 0.28 |
| ??? | 73.68 | Water St - Lakeshore to Church | EXIST | 0.25 | 72 | 0.63 | 0.0087 | 0.0625 | 1.10 | **41.0** | 25.4 | YES | 0.53 | 0.51 | 1.02 | 1.00 | YES | 110 | NO | 0.36 | 0.35 | **44.0** | NO | 0.26 | 0.24 |
| ??? | 73.35 | Water St - Church to Mid Block | EXIST | 0.25 | 52 | 0.33 | 0.0063 | 0.0625 | 0.94 | **34.9** | 25.4 | YES | 0.62 | 0.57 | 1.05 | 0.88 | YES | 110 | NO | 0.38 | 0.38 | **44.0** | NO | 0.28 | 0.25 |
| ??? | 72.54 | Water St - Mid Block to PS at Randall | EXIST | 0.25 | 45 | 0.81 | 0.0180 | 0.0625 | 1.58 | **69.1** | 25.4 | YES | 0.37 | 0.57 | 1.05 | 1.48 | YES | 110 | NO | 0.30 | 0.29 | **44.0** | YES | - | 0.19 |

**Assumptions**

| | |
|---|---|
| Existin Sewer Mannings n | 0.015 Rough concrete |
| Depth ration d/D | 0.7 |
| $Q/Q_{full}$ | 0.85 |
| $v/v_{Full}$ | 1.12 |

$$v = \left(\frac{1}{n}\right) R^{3/4}\sqrt{S} \qquad Q = vA = \left(\frac{1}{n}\right) AR^{2/3}\sqrt{S}$$

| | | |
|---|---|---|
| Current Water St Flow Rate | 10 | L/s |
| Partial Flow Diversion from Navy St | 34 | L/s |
| Total Flow Diversion from Navy St | 100 | L/s |

### EXISTING High Flow Rate Sewers Feeding Navy St Pump Station

| | | | | | | | | | | | Alternative 1 | | | | | | | Alternative 2 & 3 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ID # | Manhole Invert Elevation | Reach | New/ Existing | Pipe Diameter (m) | Distance (m) | Δ ELEV (m) | Slope, S | Hydraulic Radius, R (m) | Velocity V (m/s) | Flow Capacity, Q (L/s) | Alt 1 Flow Required (L/S) | Adequate Capacity? | $Q/Q_{full}$ | d/D Flow Depth vs Diameter | $V/V_{full}$ from Table | Flow Velocity | Greater than 0.6 m/s self cleaning velocity | Alt 2 & 3 Flow Required (L/S) | Adequate Capacity | $Q/Q_{full}$ | d/D Flow Depth vs Diameter | V/Vfull from Table | Flow Velocity | Greater than 0.6 m/s self cleaning velocity | Min Pipe Dia Required |
| SMH2912 | 79.111 | | | | | | | | | | | | | | | | | | | | | | | | |
| SMH2237 | 78.49 | King St - Reynolds to Trafalgar | EXIST | 0.3 | 115 | 0.621 | 0.0054 | 0.075 | 0.98 | **52.3** | 28.9 | YES | 0.47 | 0.47 | 0.97 | 0.85 | YES | 28.9 | YES | 0.47 | 0.47 | 0.97 | 0.85 | YES | - |
| SMH2244 | 77.513 | King St - Trafalgar to Dunn | EXIST | 0.3 | 115 | 0.977 | 0.0085 | 0.075 | 1.22 | **65.7** | 45 | YES | 0.58 | 0.53 | 1.04 | 1.14 | YES | 47.7 | YES | 0.62 | 0.56 | 1.07 | 1.17 | YES | - |
| SMH2245 | 77.09 | Dunn St - King to Front | EXIST | 0.3 | 70 | 0.423 | 0.0060 | 0.075 | 1.03 | **55.4** | 46.1 | YES | 0.71 | 0.62 | 1.08 | 1.00 | YES | 48.8 | YES | 0.75 | 0.65 | 1.13 | 1.04 | YES | - |
| SMH2246 | 76.913 | Corner of King & Front | EXIST | 0.3 | 18 | 0.177 | 0.0098 | 0.075 | 1.32 | **70.6** | 46.2 | YES | 0.56 | 0.52 | 1.02 | 1.20 | YES | 48.9 | YES | 0.59 | 0.55 | 1.03 | 1.21 | YES | - |
| SMH2656 | 76.56 | Front St - Dunn to George | EXIST | 0.45 | 108 | 0.353 | 0.0033 | 0.1125 | 0.99 | **120.1** | 47.6 | YES | 0.34 | 0.40 | 0.92 | 0.82 | YES | 50.3 | YES | 0.36 | 0.41 | 0.86 | 0.76 | YES | - |
| SMH2660 | 76.42 | Front St - George to Thomas | EXIST | 0.45 | 112 | 0.14 | 0.0013 | 0.1125 | 0.62 | **74.3** | 55 | YES | 0.63 | 0.58 | 1.06 | 0.58 | NO | 72.6 | YES | 0.83 | 0.70 | 1.14 | 0.63 | YES | - |
| SMH2259 | 80.297 | Thomas St - King to Front | EXIST | 0.25 | 78 | 3.877 | 0.0497 | 0.0625 | 2.62 | **97.7** | 4.7 | YES | 0.04 | 0.14 | 0.45 | 1.05 | YES | 21.3 | YES | 0.19 | 0.29 | 0.58 | 1.36 | YES | - |
| SMH2657 | 76.327 | Thomas St - into Park | EXIST | 0.45 | 12 | 0.093 | 0.0078 | 0.1125 | 1.53 | **184.9** | 61.4 | YES | 0.28 | 0.35 | 0.87 | 1.19 | YES | 95.6 | YES | 0.44 | 0.45 | 0.95 | 1.30 | YES | - |
| SMH4784 | 76.386 | Park | EXIST | 0.45 | 35 | 0.059 | 0.0017 | 0.1125 | 0.71 | **86.2** | 61.4 | YES | 0.61 | 0.55 | 1.05 | 0.67 | YES | 95.6 | NO | 0.94 | 0.77 | 1.08 | 0.69 | YES | - |
| SMH4839 | 76.185 | Park to Navy St | EXIST | 0.38 | 80 | 0.201 | 0.0025 | 0.095 | 0.78 | **67.1** | 62.7 | YES | 0.79 | 0.66 | 1.12 | 0.78 | YES | 96.9 | NO | 1.23 | - | - | - | YES | 0.44 |
| SMH4840 | 75.94 | Navy St to Pump Station | EXIST | 0.38 | 66 | 0.245 | 0.0037 | 0.095 | 0.95 | **81.5** | 64 | YES | 0.67 | 0.60 | 1.06 | 0.90 | YES | 98.2 | NO | 1.02 | - | - | - | YES | 0.41 |
| SMH2189 | 80.642 | Reynolds St - William to King | EXIST | 0.3 | 85 | 1.531 | 0.0180 | 0.075 | 1.78 | **95.6** | 21 | YES | 0.19 | 0.30 | 0.74 | 1.18 | YES | 21 | YES | 0.19 | 0.29 | 0.58 | 0.92 | YES | - |
| SMH2188 | 80.906 | Reynolds St - Robinson to William | EXIST | 0.3 | 79 | 0.264 | 0.0033 | 0.075 | 0.77 | **41.2** | 19.6 | YES | 0.40 | 0.45 | 0.95 | 0.65 | YES | 19.6 | YES | 0.40 | 0.44 | 0.9 | 0.62 | YES | - |
| SMH13892 | 82.36 | Reynolds St - Lakeshore to Robinson | EXIST | 0.3 | 88 | 1.454 | 0.0165 | 0.075 | 1.71 | **91.6** | 16.3 | YES | 0.15 | 0.26 | 0.71 | 1.08 | YES | 16.3 | YES | 0.15 | 0.25 | 0.5 | 0.76 | YES | - |
| SMH13891 | 83.98 | Reynolds St - Mid block to Lakeshore | EXIST | 0.3 | 21 | 1.62 | 0.0771 | 0.075 | 3.69 | **197.9** | 10.1 | YES | 0.04 | 0.15 | 0.45 | 1.48 | YES | 10.1 | YES | 0.04 | 0.15 | 0.3 | 0.99 | YES | - |
| SMH2236 | 80.5 | Trafalgar St - William to King | EXIST | 0.3 | 83 | 2.01 | 0.0242 | 0.075 | 2.07 | **110.9** | 13.9 | YES | 0.11 | 0.22 | 0.66 | 1.22 | YES | 16.6 | YES | 0.13 | 0.24 | 0.64 | 1.18 | YES | - |
| SMH2645 | 82.04 | Trafalgar St - Robinson to William | EXIST | 0.3 | 83 | 1.54 | 0.0186 | 0.075 | 1.81 | **97.0** | 10.2 | YES | 0.09 | 0.20 | 0.64 | 1.03 | YES | 12.9 | YES | 0.11 | 0.22 | 0.42 | 0.68 | YES | - |
| SMH2252 | 76.937 | George St - King to Front | EXIST | 0.25 | 80 | 0.377 | 0.0047 | 0.0625 | 0.81 | **30.1** | 6.2 | YES | 0.18 | 0.29 | 0.76 | 0.55 | NO | 21.1 | YES | 0.60 | 0.55 | 1.08 | 0.78 | YES | - |
| SMH2250 | 78.501 | George St - William to King | EXIST | 0.25 | 81 | 1.564 | 0.0193 | 0.0625 | 1.63 | **60.9** | 3.2 | YES | 0.04 | 0.15 | 0.45 | 0.66 | YES | 18.1 | YES | 0.25 | 0.34 | 0.7 | 1.02 | YES | - |
| SMH2259 | 82.095 | King St - Mid Block to Thomas | EXIST | 0.25 | 54 | 1.798 | 0.0333 | 0.0625 | 2.15 | **79.9** | 2.4 | YES | 0.03 | 0.13 | 0.43 | 0.82 | YES | 12.5 | YES | 0.13 | 0.24 | 0.48 | 0.92 | YES | - |
| SMH16371 | 82.288 | King St - Navy to Mid Block | EXIST | 0.25 | 58 | 0.193 | 0.0033 | 0.0625 | 0.68 | **25.3** | 1.4 | YES | 0.05 | 0.17 | 0.48 | 0.29 | NO | 11.5 | YES | 0.39 | 0.43 | 0.88 | 0.53 | NO | - |

**Assumptions**

| | |
|---|---|
| Mannings n | 0.015 Rough concrete |
| Depth ration d/D | 0.7 |
| $Q/Q_{full}$ | 0.85 |
| $v/v_{Full}$ | 1.12 |

$$v = \left(\frac{1}{n}\right) R^{3/4}\sqrt{S} \qquad Q = vA = \left(\frac{1}{n}\right) AR^{2/3}\sqrt{S}$$

## Alternative 1 - NEW Flow Diversion to Water Street

| ID # | Manhole Invert Elevation | Reach | New/ Existing | Pipe Diameter (m) | Distance (m) | Δ ELEV (m) | Slope, S | Hydraulic Radius, R (m) | Velocity V (m/s) | Flow Capacity, Q (L/s) | | | | | | | | Flowrate Required (L/S) | Adequate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| - | 79.5 | | | | | | | | | | | | | | | | | | |
| - | 79 | Robinson St - George to Thomas | NEW | 0.2 | 119 | 0.5 | 0.0042 | 0.05 | 0.76 | **18.1** | | | | | | | | 17.6 | YES |
| - | 78 | Robinson St - Thomas to Navy | NEW | 0.2 | 114 | 1 | 0.0088 | 0.05 | 1.10 | **26.1** | | | | | | | | 24.1 | YES |
| - | 76.5 | Navy St - Robinson to William | NEW | 0.2 | 85 | 1.5 | 0.0176 | 0.05 | 1.55 | **37.0** | | | | | | | | 24.1 | YES |
| - | 74.986 | William St - Navy to Water | NEW | 0.2 | 95 | 1.514 | 0.0159 | 0.05 | 1.48 | **35.2** | | | | | | | | 34.2 | YES |

**Assumptions**

| | | |
|---|---|---|
| Mannings n | 0.013 | Standard Concrete Pipe |
| Depth ration d/D | 0.7 | |
| $Q/Q_{full}$ | 0.85 | |
| $v/v_{Full}$ | 1.12 | |

$$v = \left(\frac{1}{n}\right) R^{3/4}\sqrt{S} \qquad Q = vA = \left(\frac{1}{n}\right) AR^{2/3}\sqrt{S}$$

## Alternative 2 - NEW Navy Street Pump Station Bypass Sewer to Water Street

| ID # | Manhole Invert Elevation | Reach | New/ Existing | Pipe Diameter (m) | Distance (m) | Δ ELEV (m) | Slope, S | Hydraulic Radius, R (m) | Velocity V (m/s) | Flow Capacity, Q (L/s) | | | | | | | | Flow Required (L/S) | Adequate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SMH4839 | 76.185 | | | | | | | | | | | | | | | | | | |
| - | 75.385 | Navy St - PS to William St | NEW | 0.4 | 200 | 0.8 | 0.0040 | 0.1 | 1.17 | **112.0** | | | | | | | | 100 | YES |
| - | 74.986 | William St - Navy St to Water St | NEW | 0.4 | 100 | 0.399 | 0.0040 | 0.1 | 1.17 | **111.8** | | | | | | | | 100 | YES |

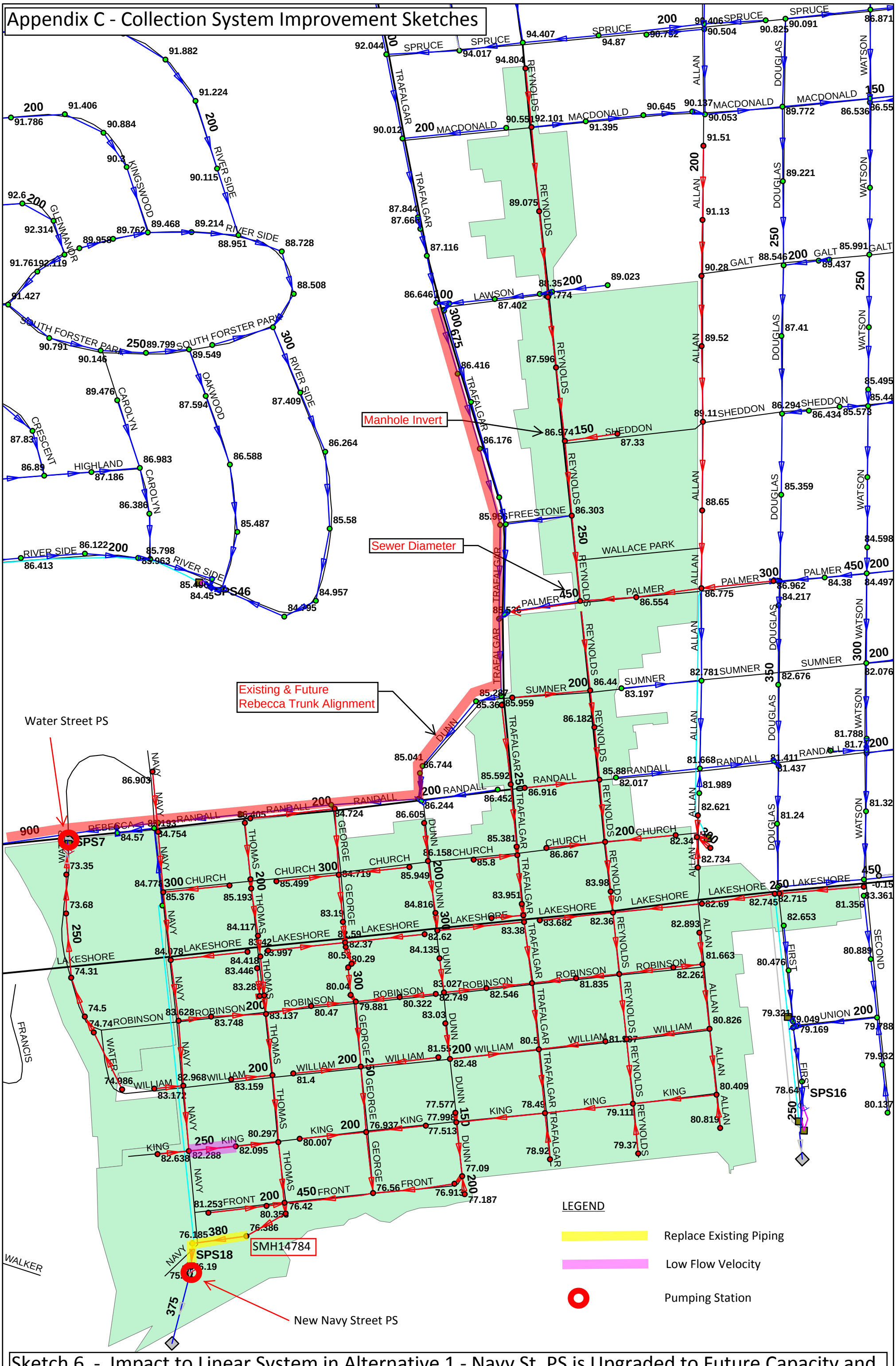
**Assumptions**

| | | |
|---|---|---|
| Mannings n | 0.013 | Standard Concrete Pipe |
| Depth ration d/D | 0.7 | |
| $Q/Q_{full}$ | 0.85 | |
| $v/v_{Full}$ | 1.12 | |

$$v = \left(\frac{1}{n}\right) R^{3/4}\sqrt{S} \qquad Q = vA = \left(\frac{1}{n}\right) AR^{2/3}\sqrt{S}$$

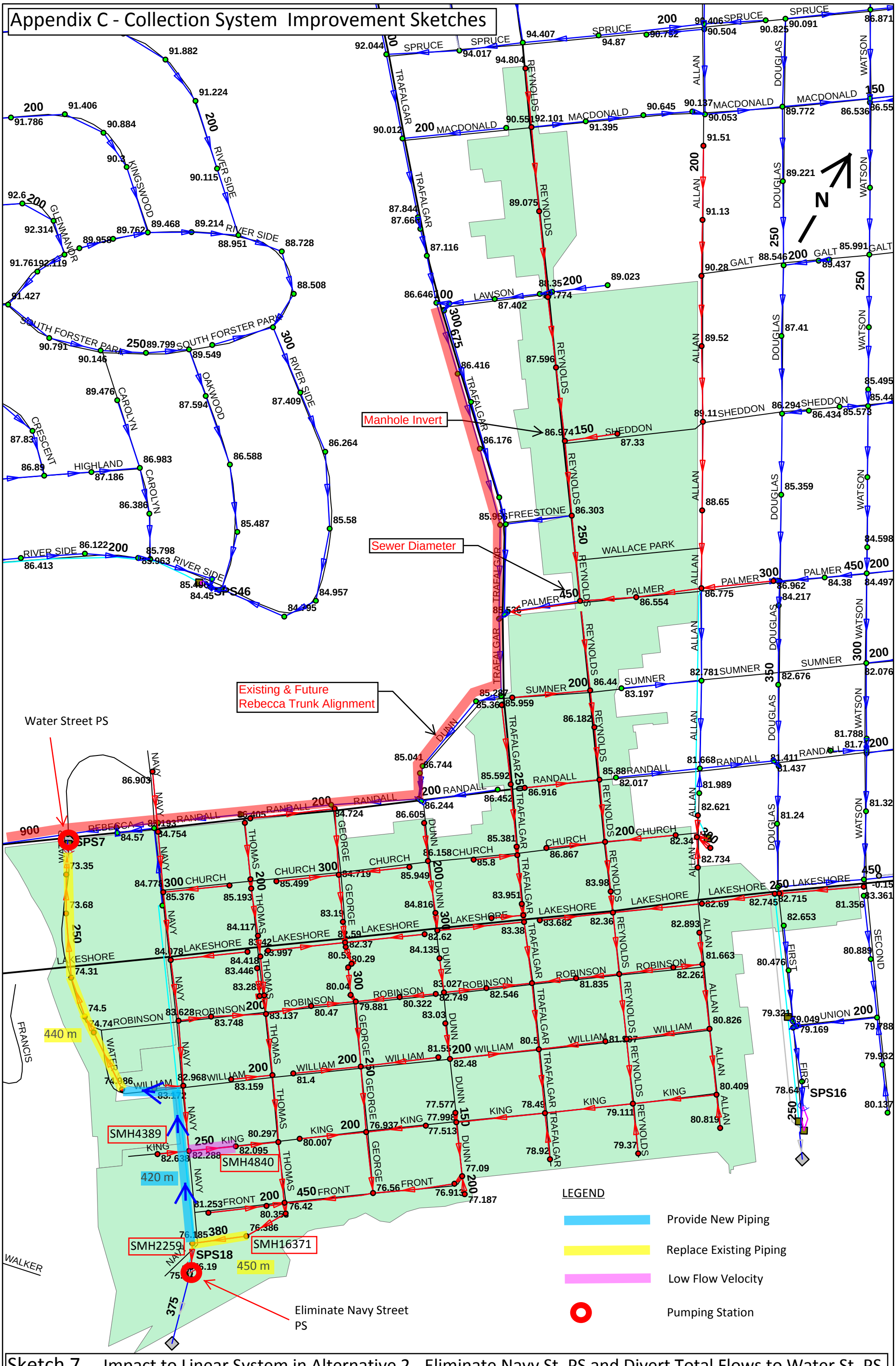
# Appendix C – Collection System Improvement Sketches

# Appendix C - Collection System Improvement Sketches



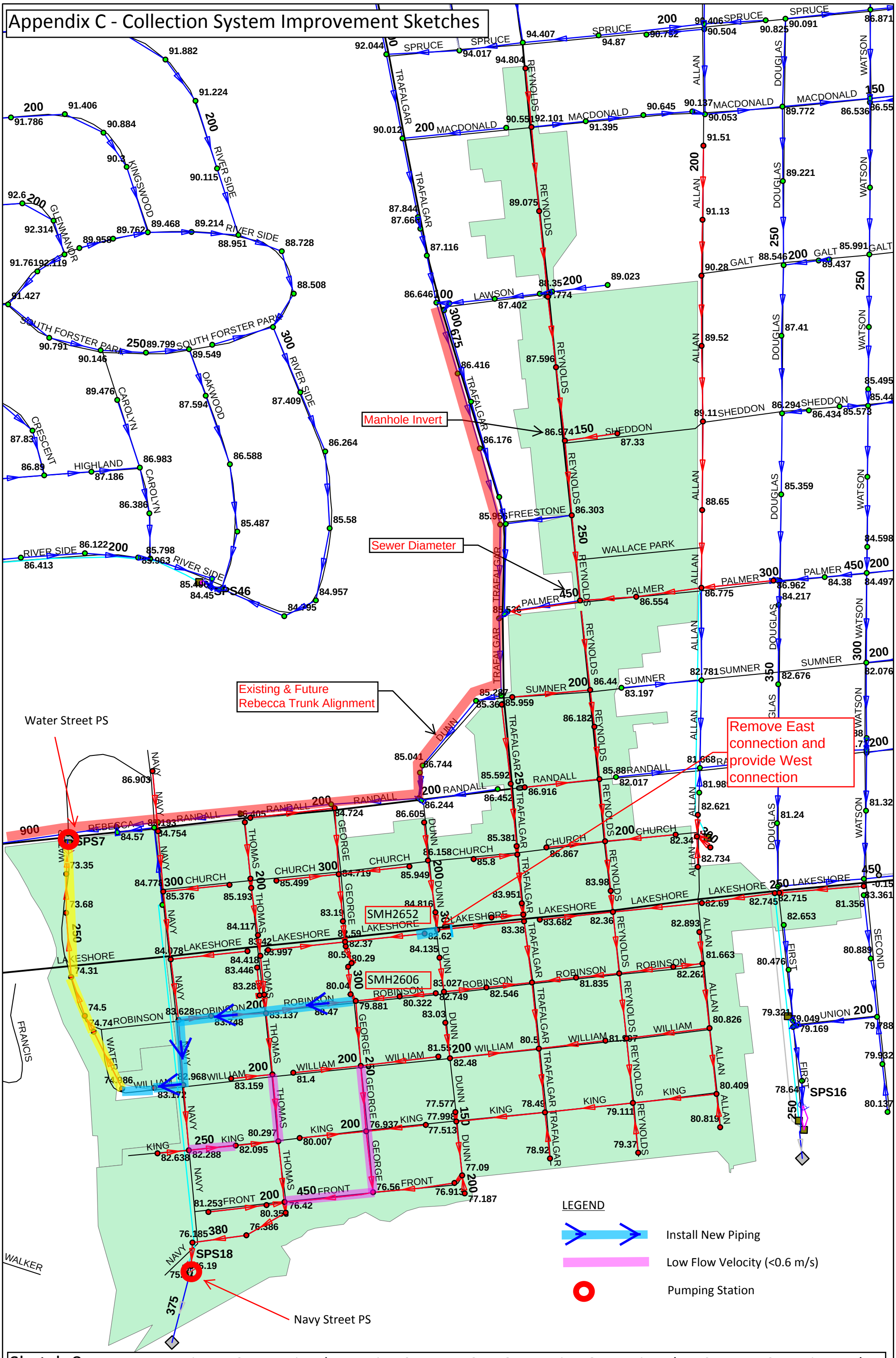

Sketch 6 - Impact to Linear System in Alternative 1 - Navy St. PS is Upgraded to Future Capacity and Water St. PS Remains at Current Capacity

# Appendix C - Collection System Improvement Sketches




Sketch 7 - Impact to Linear System in Alternative 2 - Eliminate Navy St. PS and Divert Total Flows to Water St. PS

# Appendix C - Collection System Improvement Sketches




Sketch 8 - Impact to Linear System in Alternative 3 - Navy St. PS Remains Operational at Current Capacity and Provide Partial Flow Diversion to Water St. PS

# Appendix D – Opinion of Probable Cost

BLACK & VEATCH
Building a world of difference.

**Opinion of Probable Cost Summary (2013 dollars and no escalation provided)**

**Navy and Water St WWPS & Collection System Modernization Feasibility Study** **4/10/2013**

| | Description | CAD $ |
|---|---|---|
| **Alternative 1: Navy St. Pumping Station is Upgraded to Future Capacity and Water St. PS Remains Operational at Current Capacity** | | |
| | General Requirements | $ 190,489 |
| | Percentage of Capital Equipment (excludes collection system) | $ 714,488 |
| | Replacement of Navy St. PS | $ 1,089,150 |
| | Improvements to Water St. PS | $ 63,250 |
| | Collection System (includes site work, excavation, shoring, backfill, and asphalt restoration) | $ 250,837 |
| | **Subtotal Capital Facility (A)** | **$ 2,308,214** |
| | Overhead & Profit (10% of A) | $ 230,821 |
| | MOB/Bond/Insurance (5% of A) | $ 115,411 |
| | Construction Contingency (20% of A) | $ 461,643 |
| | Construction Sequencing Allowance (3% of A) | $ 69,246 |
| | **Subtotal Construction (E)** | **$ 3,185,336** |
| | Engineering Design (15% of E) - includes EA, destailed design and contr admin | $ 477,800 |
| | Halton Internal Costs (10% of E) | $ 318,534 |
| | Project Overall Contingency (10% of E) | $ 318,534 |
| | Mid-Year Point of Construction | $ 64,000 |
| | **Capital Cost Alternative 1** | **$ 4,364,203** |
| | **Whole Life Cost Alternative 1** | **$ 10,868,410** |
| | **NPV Alternative 1** | **$ 8,614,647** |
| **Alternative 2: Eliminate Navy St. Pumping Station and Divert Total Flows to Water St. PS** | | |
| | General Requirements | $ 278,123 |
| | Percentage of Capital Equipment (excludes collection system) | $ 718,286 |
| | Demolition of Navy St PS | $ 185,000 |
| | Replacement of Water St. PS | $ 1,075,150 |
| | Collection System (includes site work, excavation, shoring, backfill, and asphalt restoration) | $ 788,640 |
| | **Subtotal Capital Facility (A)** | **$ 3,045,199** |
| | Overhead & Profit (10% of A) | $ 304,520 |
| | MOB/Bond/Insurance (5% of A) | $ 152,260 |
| | Construction Contingency (20% of A) | $ 609,040 |
| | Construction Sequencing Allowance (3% of A) | $ 91,356 |
| | **Subtotal Construction (E)** | **$ 4,202,375** |
| | Engineering Design (15% of E) - includes EA, destailed design and contr admin | $ 630,356 |
| | Internal Halton Costs (10% of E) | $ 420,238 |
| | Project Overall Contingency (10% of E) | $ 420,238 |
| | Mid-Year Point of Construction | $ 84,000 |
| | **Capital Alternative 2** | **$ 5,757,206** |
| | **Whole Life Cost Alternative 2** | **$ 8,146,650** |
| | **NPV Alternative 2** | **$ 6,919,529** |
| **Alternative 3: Navy St. Remains Operational at Current Capacity and Divert Partial Flows to Water St. PS** | | |
| | General Requirements | $ 152,581 |
| | Percentage of Capital Equipment (excludes collection system) | $ 339,663 |
| | Improvements to Navy St PS | $ 313,370 |
| | Improvements to Water St. PS | $ 127,750 |
| | Collection System (includes site work, excavation, shoring, backfill, and asphalt restoration) | $ 682,868 |
| | **Subtotal Capital Facility (A)** | **$ 1,616,233** |
| | Overhead & Profit (10% of A) | $ 161,623 |
| | MOB/Bond/Insurance (5% of A) | $ 80,812 |
| | Contingency (20% of A) | $ 323,247 |
| | Construction Sequencing Allowance (3% of A) | $ 48,487 |
| | **Subtotal Construction (E)** | **$ 2,230,401** |
| | Engineering Design (15% of E) - includes EA, destailed design and contr admin | $ 334,560 |
| | Internal Halton Costs (10% of E) | $ 223,040 |
| | Project Overall Contingency (10% of E) | $ 223,040 |
| | Mid-Year Point of Construction | $ 45,000 |
| | **Capital Alternative 3** | **$ 3,056,041** |
| | **Whole Life Cost Alternative 3** | **$ 12,516,429** |
| | **NPV Alternative 3** | **$ 10,593,776** |

**Navy and Water St WWPS & Collection System Modernization Feasibility Study**

## BUDGET COST ESTIMATE

**4/10/2013**

## Alternative 1: Navy St. Pumping Station is Upgraded to Future Capacity and Water St. PS Remains Operational at Current Capacity

Prepared by: G. Nunes and J. Stevenson
Project Manager: Brian R. Edwards

Black & Veatch

| No. | Description | Quantity | Unit | Unit Cost | Total Cost | Equipment Installation (15% unless indicated) | Total | Comments |
|---|---|---|---|---|---|---|---|---|
| | **General Requirements** | | | | | | | |
| | Mobilization | 1 | % | 2% | $ 28,065 | $ - | $ 28,065 | |
| | Supervision | 1 | % | 6% | $ 84,194 | $ - | $ 84,194 | |
| | Temporary Facilities | 1 | % | 4% | $ 56,129 | $ - | $ 56,129 | |
| | Temporary Utilities | 1 | % | 1% | $ 14,032 | $ - | $ 14,032 | |
| | Equipment Rental | 1 | % | 0.5% | $ 7,016 | $ 1,052 (15%) | $ 8,069 | |
| | **Sub-total General** | | | | $ 189,437 | $ 1,052 | $ 190,489 | |
| | **Percentage of Capital Equipment (excludes collection system)** | | | | | | | |
| 1 | Sitework | | % | 10% | $ 115,240 | | $115,240 | |
| 2 | Excavation, shoring and backfill | | % | 10% | $ 115,240 | | $115,240 | |
| 3 | Yard Piping | | % | 5% | $ 57,620 | | $57,620 | |
| 4 | Metals | | % | 2% | $ 23,048 | | $23,048 | |
| 5 | Additional Finishes | | % | 5% | $ 57,620 | | $57,620 | |
| 6 | Process Piping and Supports | | % | 5% | $ 57,620 | | $57,620 | |
| 7 | Electrical | | % | 20% | $ 230,480 | | $230,480 | 20% for electrical + |
| 8 | I&C | | % | 5% | $ 57,620 | | $57,620 | ductbank cost |
| | **Subtotal capital facility costs** | | | | | | $ 714,488 | |
| | **Replacement of Navy St. PS** | | | | | | | |
| | Packaged Pumping Station | 1 | Lump Sum | $ 375,000 | $ 375,000 | $ 93,750 (20%) | $ 468,750 | |
| | Concrete Wetwell | 360 | m3 | $ 1,000 | $ 360,000 | | $ 360,000 | |
| | Genset (250 kW) | 1 | Lump Sum | $ 96,000 | $ 96,000 | $ 14,400 (15%) | $ 110,400 | |
| | Demolition of Existing PS | 1 | Lump Sum | $ 150,000 | $ 150,000 | | $ 150,000 | |
| | **Sub-total Replacement of Navy St. PS** | | | | $ 981,000 | $ 108,150 | $ 1,089,150 | |
| | **Improvements to Water St. PS** | | | | | | | |
| | New Cathodic Protection System | 1 | Lump Sum | $ 10,000 | $ 10,000 | $ 1,500 (15%) | $ 11,500 | |
| | Genset (100 kW) | 1 | Lump Sum | $ 45,000 | $ 45,000 | $ 6,750 (15%) | $ 51,750 | |
| | **Sub-total Improvements to Water St. PS** | | | | $ 55,000 | $ 8,250 | $ 63,250 | |
| | **Collection System (includes site work, excavation, shoring, backfill, and asphalt restoration)** | | | | | | | |
| | New 450mm Piping | 160 | m | $ 1,448 | $ 231,629 | | $ 231,629 | |
| | Manhole | 2 | unit | $ 6,860 | $ 13,720 | $ 5,488 (40%) | $ 19,208 | |
| | **Sub-total Collection System** | | | | $ 245,349 | $ 5,488 | $ 250,837 | |
| A | **Subtotal capital facility costs (A)** | | | | | | **$ 2,308,214** | |
| B | Overhead & Profit (10% of A) | | | 10% | | | **$ 230,821** | |
| C | MOB/Bond/Insurance (5% of A) | | | 5% | | | **$ 115,411** | |
| D | Construction Contingency (20% of A) | | | 20% | | | **$ 461,643** | |
| | Construction Sequencing Allowance (3% of A) | | | 3% | | | **$ 69,246** | |
| E | **Total est. construction costs** | | | | | | **$ 3,185,336** | |
| | **Non-Construction costs** | | | | | | | |
| F | Engineering Design (15% of E) - includes EA, destailed design and contr admin | | | 15% | | | 477,800 | |
| G | Halton Internal Costs (10% of E) | | | 10% | | | 318,534 | |
| H | Project Overall Contingency (10% of E) | | | 10% | | | 318,534 | |
| I | **Total Estimated Capital Costs** | | | | | | **$ 4,300,203** | |

Note:
The Order-of-Magnitude cost estimates shown have been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. The final costs of the project will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule and other variable factors. As a result, the final project costs will vary from the estimates presented herein. Because of this, project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions to help ensure proper project evaluation and adequate funding.
This estimate does not include any costs for acquiring the necessary permits or Rights-of-way for the above specified equipment, including railway crossings and electrical supply modifications or relocations.

## BUDGET COST ESTIMATE 4/10/2013

## Alternative 2: Eliminate Navy St. Pumping Station and Divert Total Flows to Water St. PS

Prepared by: G. Nunes and J. Stevenson
Project Manager: Brian R. Edwards

Black & Veatch

| No. | Major Equipment Description | Quantity | Unit | Unit Cost | Total Cost | Equipment Installation (15% unless indicated) | Total | Comments |
|---|---|---|---|---|---|---|---|---|
| | **General Requirements** | | | | | | | |
| | Mobilization | 1 | % | 2% | $ 40,976 | $ - | $ 40,976 | |
| | Supervision | 1 | % | 6% | $ 122,927 | $ - | $ 122,927 | |
| | Temporary Facilities | 1 | % | 4% | $ 81,952 | $ - | $ 81,952 | |
| | Temporary Utilities | 1 | % | 1% | $ 20,488 | $ - | $ 20,488 | |
| | Equipment Rental | 1 | % | 0.5% | $ 10,244 | $ 1,537 (15%) | $ 11,781 | |
| | **Sub-total General** | | | | $ 276,587 | $ 1,537 | $ 278,123 | |
| | **Percentage of Capital Equipment (excludes collection system)** | | | | | | | |
| 1 | Sitework | | % | 10% | $ 126,015 | | $126,015 | |
| 2 | Excavation, shoring and backfill | | % | 10% | $ 126,015 | | $126,015 | |
| 3 | Yard Piping | | % | 5% | $ 63,008 | | $63,008 | |
| 4 | Metals | | % | 2% | $ 25,203 | | $25,203 | |
| 5 | Additional Finishes | | % | 5% | $ 63,008 | | $63,008 | |
| 6 | Process Piping and Supports | | % | 5% | $ 63,008 | | $63,008 | |
| 7 | Electrical | | % | 15% | $ 189,023 | | $189,023 | |
| 8 | I&C | | % | 5% | $ 63,008 | | $63,008 | |
| | **Subtotal capital facility costs** | | | | | | $ 718,286 | |
| | **Demolition of Navy St PS** | | | | | | | |
| | Demolition of Existing PS | 1 | Lump Sum | $ 150,000 | $ 150,000 | | $ 150,000 | |
| | Landscaping | 1 | Lump Sum | $ 15,000 | $ 15,000 | | $ 15,000 | |
| | Sewage Lift Connection | 1 | Lump Sum | $ 20,000 | $ 20,000 | | $ 20,000 | |
| | **Sub-total Replacement of Navy St. PS** | | | | $ 185,000 | $ - | $ 185,000 | |
| | **Replacement of Water St. PS** | | | | | | | |
| | Packaged Pumping Station | 1 | Lump Sum | $ 375,000 | $ 375,000 | $ 93,750 (25%) | $ 468,750 | |
| | Concrete Wetwell | 396 | m3 | $ 1,000 | $ 396,000 | | $ 396,000 | |
| | Genset (250 kW) | 1 | Lump Sum | $ 96,000 | $ 96,000 | $ 14,400 (15%) | $ 110,400 | |
| | Demolition of Existing PS | 1 | Lump Sum | $ 100,000 | $ 100,000 | | $ 100,000 | |
| | **Sub-total Improvements to Water St. PS** | | | | $ 196,000 | $ 14,400 | $ 1,075,150 | |
| | **Collection System (includes site work, excavation, shoring, backfill, and asphalt restoration)** | | | | | | | |
| | New 450mm Piping | 480 | m | $ 551 | $ 264,576 | | $ 264,576 | Shallow pipe. |
| | New 400mm Piping | 300 | m | $ 1,362 | $ 408,720 | | $ 408,720 | |
| | New 150mm Piping | 60 | m | $ 962 | $ 57,720 | | $ 57,720 | |
| | Manhole | 6 | unit | $ 6,860 | $ 41,160 | $ 16,464 (40%) | $ 57,624 | |
| | **Sub-total Collection System** | | | | $ 772,176 | $ 16,464 | $ 788,640 | |
| 5 | | | | | | | | |
| A | **Subtotal capital facility costs (A)** | | | | | | **$ 3,045,199** | |
| B | Overhead & Profit (10% of A) | | | 10% | | | **$ 304,520** | |
| C | MOB/Bond/Insurance (5% of A) | | | 5% | | | **$ 152,260** | |
| D | Construction Contingency (20% of A) | | | 20% | | | **$ 609,040** | |
| | Construction Sequencing Allowance (3% of A) | | | 3% | | | **$ 91,356** | |
| E | **Total est. construction costs** | | | | | | **$ 4,202,375** | |
| | | | | | | | | |
| | **Non-Construction costs (E)** | | | | | | | |
| F | Engineering Design (15% of E) - includes EA, destailed design and contr admin | | | 15% | | | 630,356.25 | |
| G | Internal Halton Costs (10% of E) | | | 10% | | | 420,237.50 | |
| H | Project Overall Contingency (10% of E) | | | 10% | | | 420,237.50 | |
| I | **Total Estimated Capital Costs** | | | | | | **$ 5,673,207** | |

Note:
The Order-of-Magnitude cost estimates shown have been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. The final costs of the project will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule and other variable factors. As a result, the final project costs will vary from the estimates presented herein. Because of this, project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions to help ensure proper project evaluation and adequate funding.
This estimate does not include any costs for acquiring the necessary permits or Rights-of-way for the above specified equipment, including

## BUDGET COST ESTIMATE 4/10/2013

## Alternative 3: Navy St. Remains Operational at Current Capacity and Divert Partial Flows to Water St. PS

Prepared by: G. Nunes and J. Stevenson
Project Manager: Brian R. Edwards

Black & Veatch

| No. | Major Equipment Description | Quantity | Unit | Unit Cost | Total Cost | Equipment Installation (15% unless indicated) | Total | Comments |
|---|---|---|---|---|---|---|---|---|
| | **General Requirements** | | | | | | | |
| | Mobilization | | % | 2% | $ 22,480 | $ - | $ 22,480 | |
| | Supervision | | % | 6% | $ 67,439 | $ - | $ 67,439 | |
| | Temporary Facilities | 1 | % | 4% | $ 44,960 | $ - | $ 44,960 | |
| | Temporary Utilities | 1 | % | 1% | $ 11,240 | $ - | $ 11,240 | |
| | Equipment Rental | 1 | % | 0.5% | $ 5,620 | $ 843 (15%) | $ 6,463 | |
| | **Sub-total General** | | | | $ 151,738 | $ 843 | $ 152,581 | |
| | **Percentage of Capital Equipment (excludes collection system)** | | | | | | | |
| 1 | Sitework | | % | 15% | $ 66,168 | | $66,168 | |
| 2 | Excavation, shoring and backfill | | % | 10% | $ 44,112 | | $44,112 | |
| 3 | Yard Piping | | % | 10% | $ 44,112 | | $44,112 | |
| 4 | Metals | | % | 2% | $ 8,822 | | $8,822 | |
| 5 | Additional Finishes | | % | 5% | $ 22,056 | | $22,056 | |
| 6 | Process Piping and Supports | | % | 5% | $ 22,056 | | $22,056 | |
| 7 | Electrical | | % | 25% | $ 110,280 | | $110,280 | 25% for electrical + |
| 8 | I&C | | % | 5% | $ 22,056 | | $22,056 | ductbank cost (x2) |
| | **Subtotal capital facility costs** | | | | | | $ 339,663 | |
| | **Improvements to Navy St PS** | | | | | | | |
| | Genset (125 kW) | 1 | Lump Sum | $ 54,000 | $ 54,000 | $ 8,100 (15%) | $ 62,100 | |
| | Concrete Wetwell Expansion | 79 | m3 | $ 1,500 | $ 118,500 | | $ 118,500 | Higher unit cost for |
| | Refurbish existing sub-structure | 1 | Lump Sum | $ 100,000 | $ 100,000 | | $ 100,000 | smaller size |
| | Building services improvements | 6 | m2 | $ 800 | $ 4,770 | | $ 4,770 | |
| | Brick finishing | 70 | m2 | $ 400 | $ 28,000 | | $ 28,000 | |
| | **Sub-total Improvements Navy St. PS** | | | | $ 305,270 | $ 8,100 | $ 313,370 | |
| | **Improvements to Water St. PS** | | | | | | | |
| | Replace Pumps | 2 | unit | $ 30,000 | $ 60,000 | $ 4,500 (15%) | $ 64,500 | |
| | Cathodic Protection System | 1 | Lump Sum | $ 10,000 | $ 10,000 | $ 1,500 (15%) | $ 11,500 | |
| | Genset (100 kW) | 1 | Lump Sum | $ 45,000 | $ 45,000 | $ 6,750 (15%) | $ 51,750 | |
| | **Sub-total Improvements to Water St. PS** | | | | $ 45,000 | $ 6,750 | $ 127,750 | |
| | **Collection System (includes site work, excavation, shoring, backfill, and asphalt restoration)** | | | | | | | |
| | New 200mm Piping | 400 | m | $ 1,076 | $ 430,560 | | $ 430,560 | |
| | New 350mm Piping | 400 | m | $ 511 | $ 204,256 | | $ 204,256 | Shallow pipe |
| | New 150mm Piping | 20 | m | $ 962 | $ 19,240 | | $ 19,240 | |
| | Manhole | 3 | unit | $ 6,860 | $ 20,580 | $ 8,232 (40%) | $ 28,812 | |
| | **Sub-total Collection System** | | | | $ 674,636 | $ 8,232 | $ 682,868 | |
| A | **Subtotal capital facility costs** | | | | | | **$ 1,616,233** | |
| B | Overhead & Profit (10% of A) | | | 10% | | | **$ 161,623** | |
| C | MOB/Bond/Insurance (5% of A) | | | 5% | | | **$ 80,812** | |
| D | Contingency (20% of A) | | | 20% | | | **$ 323,247** | |
| | Construction Sequencing Allowance (3% of A) | | | 3% | | | **$ 48,487** | |
| E | **Total est. construction costs** | | | | | | **$ 2,230,401** | |
| | **Non-Construction costs** | | | | | | | |
| F | Engineering Design (15% of E) - includes EA, destailed design and contr admin | | | 15% | | | 334,560.17 | |
| G | Internal Halton Costs (10% of E) | | | 10% | | | 223,040.11 | |
| H | Project Overall Contingency (10% of E) | | | 10% | | | 223,040.11 | |
| I | **Total Estimated Capital Costs** | | | | | | **$ 3,011,042** | |

Note:
The Order-of-Magnitude cost estimates shown have been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. The final costs of the project will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule and other variable factors. As a result, the final project costs will vary from the estimates presented herein. Because of this, project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions to help ensure proper project evaluation and adequate funding.
This estimate does not include any costs for acquiring the necessary permits or Rights-of-way for the above specified equipment, including

**Navy and Water St WWPS & Collection System Modernization Feasibility Study**

**BUDGET COST ESTIMATE**

**4/10/2013**

## Alternative 1 & 3 - Cost to Replace Water St to be Considered in Whole Life Cost

Prepared by: G. Nunes and J. Stevenson
Project Manager: Brian R. Edwards

Black & Veatch

| No. | Major Equipment Description | Quantity | Unit | Unit Cost | Total Cost | Equipment Installation (15% unless indicated) | Total | Comments |
|---|---|---|---|---|---|---|---|---|
| | **General Requirements** | | | | | | | |
| | Mobilization | 1 | % | 2% | $ 12,098 | $ - | $ 12,098 | |
| | Supervision | 1 | % | 6% | $ 36,293 | $ - | $ 36,293 | |
| | Temporary Facilities | 1 | % | 4% | $ 24,195 | $ - | $ 24,195 | |
| | Temporary Utilities | 1 | % | 1% | $ 6,049 | $ - | $ 6,049 | |
| | Equipment Rental | 1 | % | 0.5% | $ 3,024 | $ 454 (15%) | $ 3,478 | |
| | **Sub-total General** | | | | | | $ 82,112 | |
| | **Percentage of Capital Equipment** | | | | | | | |
| 1 | Sitework | | % | 10% | $ 60,488 | | $60,488 | |
| 2 | Excavation, shoring and backfill | | % | 10% | $ 60,488 | | $60,488 | |
| 3 | Yard Piping | | % | 5% | $ 30,244 | | $30,244 | |
| 4 | Metals | | % | 2% | $ 12,098 | | $12,098 | |
| 5 | Additional Finishes | | % | 5% | $ 30,244 | | $30,244 | |
| 6 | Process Piping and Supports | | % | 5% | $ 30,244 | | $30,244 | |
| 7 | Electrical | | % | 15% | $ 90,731 | | $90,731 | |
| 8 | I&C | | % | 5% | $ 30,244 | | $30,244 | |
| | **Subtotal capital facility costs** | | | | | | $ 344,779 | |
| | **Replacement of Water St. PS** | | | | | | | |
| | Packaged Pumping Station | 1 | Lump Sum | $ 187,500 | $ 187,500 | $ 46,875 (25%) | $ 234,375 | |
| | Concrete Wetwell | 158 | m3 | $ 1,000 | $ 158,000 | | $ 158,000 | |
| | Demolition of Existing PS | 1 | Lump Sum | $ 100,000 | $ 100,000 | | $ 100,000 | |
| | Genset (200 kW) | 1 | Lump Sum | $ 90,000 | $ 90,000 | $ 22,500 (25%) | $ 112,500 | |
| | **Sub-total Improvements to Water St. PS** | | | | | | $ 604,875 | |
| A | **Subtotal capital facility costs (A)** | | | | | | **$ 1,031,766** | |
| B | Overhead & Profit (10% of A) | | | 10% | | | **$ 103,177** | |
| C | MOB/Bond/Insurance (5% of A) | | | 5% | | | **$ 51,588** | |
| D | Contingency (20% of A) | | | 20% | | | **$ 206,353** | |
| | Construction Sequencing Allowance (3% of A) | | | 3% | | | **$ 30,953** | |
| E | **Total est. construction costs** | | | | | | **$ 1,423,836** | |
| | **Non-Construction costs (E)** | | | | | | | |
| F | Engineering Design (15% of E) - includes EA, destailed design and contr admin | | | 15% | | | 213,575.46 | |
| G | Halton Internal Costs (10% of E) | | | 10% | | | 142,383.64 | |
| | Project Overall Contingency (10% of E) | | | 10% | | | 142,383.64 | |
| | Mid-Year Point of Construction (0.5 years, 3%) | | | | | | 29,000.00 | |
| H | **Total Estimated Capital Costs** | | | | | | **$ 1,951,179** | |

Note:
The Order-of-Magnitude cost estimates shown have been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. The final costs of the project will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule and other variable factors. As a result, the final project costs will vary from the estimates presented herein. Because of this, project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions to help ensure proper project evaluation and adequate funding.
This estimate does not include any costs for acquiring the necessary permits or Rights-of-way for the above specified equipment,

## BUDGET COST ESTIMATE 4/10/2013

## Alternative 3 - Cost to Replace Navy St PS to be Considered in Whole Life Cost

Prepared by: G. Nunes and J. Stevenson
Project Manager: Brian R. Edwards

Black & Veatch

| No. | Major Equipment Description | Quantity | Unit | Unit Cost | Total Cost | Equipment Installation (15% unless indicated) | Total | Comments |
|---|---|---|---|---|---|---|---|---|
| | **General Requirements** | | | | | | | |
| | Mobilization | 1 | % | 2% | $ 20,866 | $ - | $ 20,866 | |
| | Supervision | 1 | % | 6% | $ 62,599 | $ - | $ 62,599 | |
| | Temporary Facilities | 1 | % | 4% | $ 41,733 | $ - | $ 41,733 | |
| | Temporary Utilities | 1 | % | 1% | $ 10,433 | $ - | $ 10,433 | |
| | Equipment Rental | 1 | % | 0.5% | $ 5,217 | $ 782 (15%) | $ 5,999 | |
| | **Sub-total General** | | | | | | **$ 141,630** | |
| | **Percentage of Capital Equipment** | | | | | | | |
| 1 | Sitework | | % | 10% | $ 104,331 | | $104,331 | |
| 2 | Excavation, shoring and backfill | | % | 10% | $ 104,331 | | $104,331 | |
| 3 | Yard Piping | | % | 5% | $ 52,166 | | $52,166 | |
| 4 | Metals | | % | 2% | $ 20,866 | | $20,866 | |
| 5 | Additional Finishes | | % | 5% | $ 52,166 | | $52,166 | |
| 6 | Process Piping and Supports | | % | 5% | $ 52,166 | | $52,166 | |
| 7 | Electrical | | % | 20% | $ 208,663 | | $208,663 | 20% for electrical + |
| 8 | I&C | | % | 5% | $ 52,166 | | $52,166 | ductbank cost |
| | **Subtotal capital facility costs** | | | | | | **$ 646,854** | |
| | **Replacement of Navy St. PS** | | | | | | | |
| | Packaged Pumping Station | 1 | Lump Sum | $ 356,250 | $ 356,250 | $ 89,063 (25%) | $ 445,313 | |
| | Concrete Wetwell | 328 | m3 | $ 1,000 | $ 328,000 | | $ 328,000 | |
| | Demolition of Existing PS | 1 | Lump Sum | $ 150,000 | $ 150,000 | | $ 150,000 | |
| | Genset (250 kW) | 1 | Lump Sum | $ 96,000 | $ 96,000 | $ 24,000 (25%) | $ 120,000 | |
| | **Sub-total Replacement of Navy St. PS** | | | | | | **$ 1,043,313** | |
| A | **Subtotal capital facility costs (A)** | | | | | | **$ 1,831,796** | |
| B | Overhead & Profit (10% of A) | | | 10% | | | **$ 183,180** | |
| C | MOB/Bond/Insurance (5% of A) | | | 5% | | | **$ 91,590** | |
| D | Contingency (20% of A) | | | 20% | | | **$ 366,359** | |
| | Construction Sequencing Allowance (3% of A) | | | 3% | | | **$ 54,954** | |
| E | **Total est. construction costs** | | | | | | **$ 2,527,878** | |
| | **Non-Construction costs** | | | | | | | |
| F | Engineering Design (15% of E) - includes EA, destailed design and contr admin | | | 15% | | | 379,181.76 | |
| G | Halton Internal Costs (10% of E) | | | 10% | | | 252,787.84 | |
| | Project Overall Contingency (10% of E) | | | 10% | | | 252,787.84 | |
| | Mid-Year Point of Construction (0.5 years, 3%) | | | | | | 51,000.00 | |
| H | **Total Estimated Capital Costs** | | | | | | **$ 3,463,636** | |

Note:
The Order-of-Magnitude cost estimates shown have been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. The final costs of the project will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule and other variable factors. As a result, the final project costs will vary from the estimates presented herein. Because of this, project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions to help ensure proper project evaluation and adequate funding.

| Navy and Water St WWPS & Collection System Modernization Feasibility Study | BUDGET COST ESTIMATE | 4/10/2013 |
|---|---|---|

## Alternative 1: Navy St. Pumping Station Cost Comparison
## Higher Head Pumps v's Forcemain Replacement

Prepared by: G. Nunes and J. Stevenson
Project Manager: Brian R. Edwards

Black & Veatch

### 1. Replacement of Forcemain - Capital Cost

| Major Equipment Description | Quantity | Unit | Unit Cost | Total | Comments |
|---|---|---|---|---|---|
| **General Requirements** | | | | | |
| New 300mm Forcemain | 635 | m | $ 700 | $ 444,500 | |
| **Total** | | | | **$ 444,500** | |

### 2. Operation of Higher Head Pumps - 30-year Net Present Value

**Design Parameters**

| Item | Value | Notes |
|---|---|---|
| Pump TDH for existing 250 mm forcemain (m) | 24.7 | Value based on hydraulic modeling |
| Pump TDH for new 300 mm forcemain (m) | 16.5 | Value based on hydraulic modeling |
| Assumed pump efficientcy (%) | 70 | |
| Estimated pump power for 250 mm forcemain (kW) | 34.6 | |
| Estimated pump power for 300 mm forcemain (kW) | 23.1 | |

**Routine Operation Costs**

| Cost Item | Power (kw) | $per kwh[1] | Usage factor[2] | Annual cost[3] |
|---|---|---|---|---|
| Pump for 250 mm forcemain | 34.6 | 0.1 | 0.6 | $18,186 |
| Pump for 300 mm forcemain | 23.1 | 0.1 | 0.6 | $12,141 |
| Cost difference | | | | $6,044 |

1. The annual power costs were calculated using rate of 0.1$/kWh.
2. Assumed usage factor applied for expected frequency of use.
3. The annual cost of operation is the power consumption x power cost x usage factor (frequency of use).

**Whole Life Cost**

| Discount Rate | 0.05 |
|---|---|

| Year | Annual Operation Cost | PV |
|---|---|---|
| 0 | $6,044 | $6,044 |
| 1 | $6,044 | $5,757 |
| 2 | $6,044 | $5,482 |
| 3 | $6,044 | $5,221 |
| 4 | $6,044 | $4,973 |
| 5 | $6,044 | $4,736 |
| 6 | $6,044 | $4,510 |
| 7 | $6,044 | $4,296 |
| 8 | $6,044 | $4,091 |
| 9 | $6,044 | $3,896 |
| 10 | $6,044 | $3,711 |
| 11 | $6,044 | $3,534 |
| 12 | $6,044 | $3,366 |
| 13 | $6,044 | $3,205 |
| 14 | $6,044 | $3,053 |
| 15 | $6,044 | $2,907 |
| 16 | $6,044 | $2,769 |
| 17 | $6,044 | $2,637 |
| 18 | $6,044 | $2,512 |
| 19 | $6,044 | $2,392 |
| 20 | $6,044 | $2,278 |
| 21 | $6,044 | $2,170 |
| 22 | $6,044 | $2,066 |
| 23 | $6,044 | $1,968 |
| 24 | $6,044 | $1,874 |
| 25 | $6,044 | $1,785 |
| 26 | $6,044 | $1,700 |
| 27 | $6,044 | $1,619 |
| 28 | $6,044 | $1,542 |
| 29 | $6,044 | $1,468 |
| 30 | $6,044 | $1,399 |
| **Total** | | **$98,962** |

The capital cost to replace the 250 mm forcemain with a 300 mm forcemain ($444,500) is significantly greater than the 30-year net present value to operate the pump at a higher total dynamic head ($98,962). Therefore it is recommended that the forcemain is not replaced.

Note:
The Order-of-Magnitude cost estimates shown have been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. The final costs of the project will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule and other variable factors. As a result, the final project costs will vary from the estimates presented herein. Because of this, project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions to help ensure proper project evaluation and adequate funding.
This estimate does not include any costs for acquiring the necessary permits or Rights-of-way for the above specified equipment, including railway crossings and electrical supply modifications or relocations.

## Whole Life Cost and Net Present Value

4/10/2013

## Alternative 1: Navy St. Pumping Station is Upgraded to Future Capacity and Water St. PS Remains Operational at Current Capacity

**Capital Costs**

| Cost Item | CAD $ |
|---|---|
| **Construction** | |
| Subtotal capital facility costs (A) | $2,308,214 |
| Overhead & Profit (10% of A) | $230,821 |
| MOB/Bond/Insurance (5% of A) | $115,411 |
| Construction Contingency (20% of A) | $461,643 |
| Construction Sequencing Allowance (3% of A) | $69,246 |
| Construction sub total | $3,185,336 |
| **Non-construction (E)** | |
| Engineering Design (15% of E) - includes EA, destailed des | $477,800 |
| Halton Internal Costs (10% of E) | $318,534 |
| Project Overall Contingency (10% of E) | $318,534 |
| Non-construction sub total | $1,114,867 |
| Mid-Year Point of Construction | $64,000 |
| (mid-year, %) | (0.5 years, 3.0%) |
| **Total (no contingency applied)** | **$4,364,203** |

**Routine O&M Costs**

| Cost Item | Note | Power (kw) | $per kwh[1] | Usage factor[2] | Annual Cost[3] |
|---|---|---|---|---|---|
| Navy St PS | S&L selection | 60 | 0.1 | 0.6 | $31,536 |
| Water St PS | Existing Pumps | 30 | 0.1 | 0.9 | $23,652 |
| Staff time | 1 operator | | | | $45,000 |
| Transport | | | | | $10,000 |
| Electrics maintenance | | | | | $5,000 |
| Mechanical maintenance | | | | | $5,000 |
| Civil maintenance | | | | | $3,000 |
| Security/safety | | | | | $10,000 |
| Administration costs | | | | | $1,000 |
| **Total** | | | | | **$134,188** |

1. The annual power costs were calculated using rate of 0.1$/kWh.
2. Usage factor applied for expected frequency of use.
   Average operation 2 pumps at Navy St. PS; considering 1 hr retention time in wetwell at peak instantaneous flows.
   Average operation 2 pumps at Water St. PS; considering 15 min retention time in wetwell at peak instantaneous flows.
3. The annual cost of operation is the power consumption x power cost x usage factor (frequency of use).

**Periodic Maintenance Costs**

| Cost Item | Frequency | Cost | Note |
|---|---|---|---|
| Electrics | every 30 years | $30,000 | per pmp group |
| Controls | every 15 years | $15,000 | |
| Pumps and accessories | every 30 years | $193,200 | per pmp group |
| Building services | every 20 years | $20,000 | per building |
| Civil refurbishment | every 30 years | $100,000 | |
| Replacement of Water St. PS | every 50 years | $1,951,179 | from original construction |

| Discount Rate | 0.05 |
|---|---|

**Whole Life Cost**

| Yr | Note | Annual O&M | Capital and Refurbishment Costs | | | Annual Cost | PV |
|---|---|---|---|---|---|---|---|
| 0 | Capital Investiment | $134,188 | $4,364,203 | | | $4,498,391 | $4,498,391 |
| 1 | | $134,188 | | | | $134,188 | $127,798 |
| 2 | | $134,188 | | | | $134,188 | $121,712 |
| 3 | Replace Water St. PS due to age, built in 1967. | $134,188 | $1,951,179 | | | $2,085,367 | $2,067,096 |
| 4 | | $134,188 | | | | $134,188 | $110,397 |
| 5 | | $134,188 | | | | $134,188 | $105,140 |
| 6 | | $134,188 | | | | $134,188 | $100,133 |
| 7 | | $134,188 | | | | $134,188 | $95,365 |
| 8 | | $134,188 | | | | $134,188 | $90,824 |
| 9 | | $134,188 | | | | $134,188 | $86,499 |
| 10 | | $134,188 | | | | $134,188 | $82,380 |
| 11 | | $134,188 | | | | $134,188 | $78,457 |
| 12 | | $134,188 | | | | $134,188 | $74,721 |
| 13 | | $134,188 | | | | $134,188 | $71,163 |
| 14 | | $134,188 | | | | $134,188 | $67,774 |
| 15 | Controls for new Navy St. PS | $134,188 | $15,000 | | | $149,188 | $71,762 |
| 16 | | $134,188 | | | | $134,188 | $61,473 |
| 17 | | $134,188 | | | | $134,188 | $58,546 |
| 18 | Controls for new Water St. PS | $134,188 | $15,000 | | | $149,188 | $61,991 |
| 19 | | $134,188 | | | | $134,188 | $53,103 |
| 20 | Building services for new Navy St PS | $134,188 | $20,000 | | | $154,188 | $58,112 |
| 21 | | $134,188 | | | | $134,188 | $48,166 |
| 22 | | $134,188 | | | | $134,188 | $45,872 |
| 23 | Building services for new Water St PS | $134,188 | $20,000 | | | $154,188 | $50,199 |
| 24 | | $134,188 | | | | $134,188 | $41,607 |
| 25 | | $134,188 | | | | $134,188 | $39,626 |
| 26 | | $134,188 | | | | $134,188 | $37,739 |
| 27 | | $134,188 | | | | $134,188 | $35,942 |
| 28 | | $134,188 | | | | $134,188 | $34,231 |
| 29 | | $134,188 | | | | $134,188 | $32,600 |
| 30 | Major refurb Navy St.PS - elect, pmps and civil | $134,188 | $30,000 | $193,200 | $100,000 | $457,388 | $105,829 |
| **Total** | | | | | | **$10,868,410** | **$8,614,647** |

## Whole Life Cost and Net Present Value

4/10/2013

## Alternative 2: Eliminate Navy St. Pumping Station and Divert Total Flows to Water St. PS

**Capital Costs**

| Cost Item | |
|---|---|
| **Construction** | |
| Subtotal capital facility costs (A) | $3,045,199 |
| Overhead & Profit (10% of A) | $304,520 |
| MOB/Bond/Insurance (5% of A) | $152,260 |
| Construction Contingency (20% of A) | $609,040 |
| Construction Sequencing Allowance (3% of A) | $91,356 |
| Construction sub total | $4,202,375 |
| **Non-construction (E)** | |
| Engineering Design (15% of E) - includes EA, destailed | $630,356 |
| Internal Halton Costs (10% of E) | $420,238 |
| Project Overall Contingency (10% of E) | $420,238 |
| Non-construction sub total | $1,470,831 |
| | |
| Mid-Year Point of Construction | $84,000 |
| (mid-year, %) | (0.5 years, 3.0%) |
| **Total (no contingency applied)** | **$5,757,206** |

**Routine O&M Costs**

| Cost Item | Note | Power (kw) | $per kwh[1] | Usage factor[2] | Annual cost[3] |
|---|---|---|---|---|---|
| Water St PS | S&L selection | 40 | 0.1 | 0.6 | $21,024 |
| Staff time | Part-time operator | | | | $22,500 |
| Transport | 70% Alt 1 | | | | $7,000 |
| Electrics maintenance | 70% Alt 1 | | | | $3,500 |
| Mechanical maintenance | 70% Alt 1 | | | | $3,500 |
| Civil maintenance | 70% Alt 1 | | | | $2,000 |
| Security/safety | 50% Alt 1 | | | | $5,000 |
| Administration costs | Alt 1 | | | | $1,000 |
| **Total** | | | | | **$65,524** |

1. The annual power costs were calculated using rate of 0.1$/kWh.
2. Usage factor applied for expected frequency of use.
   Average operation 2 pumps at Water St. PS; considering 1 hr retention time in wetwell at peak instantaneous flows
3. The annual cost of operation is the power consumption x power cost x usage factor (frequency of use).

**PeriodicMaintenance Costs**

| Cost Item | Frequency | Cost | Note |
|---|---|---|---|
| Electrics | every 30 years | 30,000.00 | per pmp group |
| Controls | every 15 years | 15,000.00 | |
| Pumps and accessories | every 30 years | 193,200.00 | per pmp group |
| Building services | every 20 years | 20,000.00 | per building |
| Civil refurbishment | every 30 years | 100,000.00 | |

| Discount Rate | 0.05 |
|---|---|

**Whole Life Cost**

| Year | Note | Annual O&M | Capital and Refurbishment Costs | | | Annual Cost | PV |
|---|---|---|---|---|---|---|---|
| 0 | Capital investment | $65,524 | $5,757,206 | | | $5,822,730 | $5,822,730 |
| 1 | | $65,524 | | | | $65,524 | $62,404 |
| 2 | | $65,524 | | | | $65,524 | $59,432 |
| 3 | | $65,524 | | | | $65,524 | $56,602 |
| 4 | | $65,524 | | | | $65,524 | $53,907 |
| 5 | | $65,524 | | | | $65,524 | $51,340 |
| 6 | | $65,524 | | | | $65,524 | $48,895 |
| 7 | | $65,524 | | | | $65,524 | $46,567 |
| 8 | | $65,524 | | | | $65,524 | $44,349 |
| 9 | | $65,524 | | | | $65,524 | $42,237 |
| 10 | | $65,524 | | | | $65,524 | $40,226 |
| 11 | | $65,524 | | | | $65,524 | $38,311 |
| 12 | | $65,524 | | | | $65,524 | $36,486 |
| 13 | | $65,524 | | | | $65,524 | $34,749 |
| 14 | | $65,524 | | | | $65,524 | $33,094 |
| 15 | Controls for Water St PS | $65,524 | $15,000 | | | $80,524 | $38,733 |
| 16 | | $65,524 | | | | $65,524 | $30,017 |
| 17 | | $65,524 | | | | $65,524 | $28,588 |
| 18 | | $65,524 | | | | $65,524 | $27,227 |
| 19 | | $65,524 | | | | $65,524 | $25,930 |
| 20 | Building for Water St PS | $65,524 | $20,000 | | | $85,524 | $32,233 |
| 21 | | $65,524 | | | | $65,524 | $23,519 |
| 22 | | $65,524 | | | | $65,524 | $22,399 |
| 23 | | $65,524 | | | | $65,524 | $21,333 |
| 24 | | $65,524 | | | | $65,524 | $20,317 |
| 25 | | $65,524 | | | | $65,524 | $19,349 |
| 26 | | $65,524 | | | | $65,524 | $18,428 |
| 27 | | $65,524 | | | | $65,524 | $17,550 |
| 28 | | $65,524 | | | | $65,524 | $16,715 |
| 29 | | $65,524 | | | | $65,524 | $15,919 |
| 30 | Major refurb Water St PS elect, pmps and civil | $65,524 | $30,000 | $193,200 | $100,000 | $388,724 | $89,942 |
| **Total** | | | | | | **$8,146,650** | **$6,919,529** |

## Whole Life Cost and Net Present Value

4/10/2013

## Alternative 3: Navy St. Remains Operational at Current Capacity and Divert Partial Flows to Water St. PS

**Capital Costs**

| Cost Item | |
|---|---|
| **Construction** | |
| Subtotal capital facility costs | $1,616,233 |
| Overhead & Profit (10% of A) | $161,623 |
| MOB/Bond/Insurance (5% of A) | $80,812 |
| Contingency (20% of A) | $323,247 |
| Construction Sequencing Allowance (3% of A) | $48,487 |
| Construction sub total | $2,230,401 |
| **Non-construction (E)** | |
| Engineering Design (15% of E) - includes EA, destaile | $334,560 |
| Internal Halton Costs (10% of E) | $223,040 |
| Project Overall Contingency (10% of E) | $223,040 |
| Non-construction sub total | $780,640 |
| Mid-Year Point of Construction | $45,000 |
| (mid-year, %) | (0.5 years, 3.0%) |
| **Total (no contingency applied)** | **$3,056,041** |

**Routine O&M costs**

| Cost Item | Note | Power (kw) | $per kwh[1] | Usage factor[2] | Annual cost[3] |
|---|---|---|---|---|---|
| Navy St PS | | 68 | 0.1 | 0.6 | $35,741 |
| Water St PS | | 30 | 0.1 | 0.6 | $15,768 |
| Staff time | 1 operator | | | | $45,000 |
| Transport | Alt 1 | | | | $10,000 |
| Electrics maintenance | Alt 1 | | | | $5,000 |
| Mechanical maintenance | Alt 1 | | | | $5,000 |
| Civil maintenance | Alt 1 | | | | $3,000 |
| Security/safety | Alt 1 | | | | $10,000 |
| Administration costs | Alt 1 | | | | $1,000 |
| **Total** | | | | | **$130,509** |

1. The annual power costs were calculated using rate of 0.1$/kWh.
2. Usage factor applied for expected frequency of use.
   Average operation 2 pumps at Water St. PS; considering 15 min retention time in wetwell at peak instantaneous flows.
3. The annual cost of operation is the power consumption x power cost x usage factor (frequency of use).

**Periodic maintenance costs**

| Cost Item | Frequency | Cost Navy | Cost Water | Note |
|---|---|---|---|---|
| Electrics | every 30 years | 30,000.00 | 20,000.00 | per pup group |
| Controls | every 15 years | 15,000.00 | 10,000.00 | |
| Pumps and accessories | every 30 years | 124,200.00 | 82,800.00 | per pup group |
| Building services | every 20 years | 25,000.00 | 25,000.00 | per building |
| Civil refurbishment | every 30 years | 100,000.00 | 70,000.00 | |
| Replacement of Pumping Station | every 50 years | $3,463,636 | $1,951,179 | from original construction |
| Credit for equipment re-use | every 50 years | | -$25,200 | |

| Discount Rate | 0.05 |
|---|---|

**Whole life cost**

| Year | Note | Annual O&M | Capital and refurbishment costs | | Annual cost | PV |
|---|---|---|---|---|---|---|
| 0 | Capital Invstment | $130,509 | $3,056,041 | | $3,186,550 | $3,186,550 |
| 1 | | $130,509 | | | $130,509 | $124,294 |
| 2 | | $130,509 | | | $130,509 | $118,375 |
| 3 | Replace Water St. PS due to age, built in 1967. | $130,509 | $1,951,179 | -$25,200 | $2,056,488 | $2,038,718 |
| 4 | | $130,509 | | | $130,509 | $107,370 |
| 5 | | $130,509 | | | $130,509 | $102,257 |
| 6 | | $130,509 | | | $130,509 | $97,388 |
| 7 | | $130,509 | | | $130,509 | $92,750 |
| 8 | | $130,509 | | | $130,509 | $88,333 |
| 9 | | $130,509 | | | $130,509 | $84,127 |
| 10 | | $130,509 | | | $130,509 | $80,121 |
| 11 | | $130,509 | | | $130,509 | $76,306 |
| 12 | | $130,509 | | | $130,509 | $72,672 |
| 13 | | $130,509 | | | $130,509 | $69,212 |
| 14 | | $130,509 | | | $130,509 | $65,916 |
| 15 | Controls for Navy St PS | $130,509 | $15,000 | | $145,509 | $69,992 |
| 16 | | $130,509 | | | $130,509 | $59,788 |
| 17 | | $130,509 | | | $130,509 | $56,941 |
| 18 | Controls for new Water St. PS | $130,509 | $10,000 | | $140,509 | $58,384 |
| 19 | | $130,509 | | | $130,509 | $51,647 |
| 20 | | $130,509 | | | $130,509 | $49,187 |
| 21 | Replace Navy St. PS due to age, built in 1985. | $130,509 | $3,463,636 | $0 | $3,594,145 | $3,510,481 |
| 22 | | $130,509 | | | $130,509 | $44,614 |
| 23 | | $130,509 | | | $130,509 | $42,490 |
| 24 | | $130,509 | | | $130,509 | $40,467 |
| 25 | | $130,509 | | | $130,509 | $38,540 |
| 26 | | $130,509 | | | $130,509 | $36,704 |
| 27 | | $130,509 | | | $130,509 | $34,957 |
| 28 | | $130,509 | | | $130,509 | $33,292 |
| 29 | | $130,509 | | | $130,509 | $31,707 |
| 30 | | $130,509 | | | $130,509 | $30,197 |
| **Total** | | | | | **$12,516,429** | **$10,593,776** |

## BUDGET COST ESTIMATE 4/10/2013

## Alternative 2: Eliminate Navy St. Pumping Station and Divert Total Flows to Water St. PS

## COST PER FACILITY

Prepared by: G. Nunes and J. Stevenson
Project Manager: Brian R. Edwards

Black & Veatch

| No. | Major Equipment Description | Quantity | Unit | Unit Cost | Total Cost | Equipment Installation (15% unless indicated) | Total | Comments |
|---|---|---|---|---|---|---|---|---|
| | **DEMOLITION OF NAVY ST PS** | | | | | | | |
| | **General Requirements** | | | | | | | |
| | Mobilization | 1 | % | 2% | $ 3,700 | $ - | $ 3,700 | |
| | Supervision | 1 | % | 6% | $ 11,100 | $ - | $ 11,100 | |
| | Temporary Facilities | 1 | % | 4% | $ 7,400 | $ - | $ 7,400 | |
| | Temporary Utilities | 1 | % | 1% | $ 1,850 | $ - | $ 1,850 | |
| | Equipment Rental | 1 | % | 0.5% | $ 925 | $ 139 (15%) | $ 1,064 | |
| | **Sub-total General** | | | | $ 24,975 | $ 139 | $ 25,114 | |
| | **Percentage of Capital Equipment (excludes collection system)** | | | | | | | |
| 1 | Sitework | | % | 10% | $ 18,500 | | $18,500 | |
| 2 | Excavation, shoring and backfill | | % | 10% | $ 18,500 | | $18,500 | |
| 3 | Yard Piping | | % | 5% | $ 9,250 | | $9,250 | |
| 4 | Metals | | % | 2% | $ 3,700 | | $3,700 | |
| 5 | Additional Finishes | | % | 5% | $ 9,250 | | $9,250 | |
| 6 | Process Piping and Supports | | % | 5% | $ 9,250 | | $9,250 | |
| 7 | Electrical | | % | 15% | $ 27,750 | | $27,750 | |
| 8 | I&C | | % | 5% | $ 9,250 | | $9,250 | |
| | **Subtotal capital facility costs** | | | | | | $ 105,450 | |
| | **Demolition of Navy St PS** | | | | | | | |
| | Demolition of Existing PS | 1 | Lump Sum | $ 150,000 | $ 150,000 | | $ 150,000 | |
| | Landscaping | 1 | Lump Sum | $ 15,000 | $ 15,000 | | $ 15,000 | |
| | Sewage Lift Connection | 1 | Lump Sum | $ 20,000 | $ 20,000 | | $ 20,000 | |
| | **Sub-total Replacement of Navy St. PS** | | | | $ 185,000 | $ - | $ 185,000 | |
| A | **Subtotal capital facility costs (A)** | | | | | | **$ 315,564** | |
| B | Overhead & Profit (10% of A) | | | 10% | | | **$ 31,556** | |
| C | MOB/Bond/Insurance (5% of A) | | | 5% | | | **$ 15,778** | |
| D | Construction Contingency (20% of A) | | | 20% | | | **$ 63,113** | |
| | Construction Sequencing Allowance (3% of A) | | | 3% | | | **$ 9,467** | |
| E | **Total est. construction costs** | | | | | | **$ 435,478** | |
| | **Non-Construction costs (E)** | | | | | | | |
| F | Engineering Design (15% of E) - includes EA, destailed design and contr admin | | | 15% | | | 65,321.70 | |
| G | Internal Halton Costs (10% of E) | | | 10% | | | 43,547.80 | |
| H | Project Overall Contingency (10% of E) | | | 10% | | | 43,547.80 | |
| I1 | **Total Estimated Capital Costs - Demolition of Navy St PS** | | | | | | **$ 587,896** | |
| | **REPLACEMENT OF WATER ST PS** | | | | | | | |
| | **General Requirements** | | | | | | | |
| | Mobilization | 1 | % | 2% | $ 21,503 | $ - | $ 21,503 | |
| | Supervision | 1 | % | 6% | $ 64,509 | $ - | $ 64,509 | |
| | Temporary Facilities | 1 | % | 4% | $ 43,006 | $ - | $ 43,006 | |
| | Temporary Utilities | 1 | % | 1% | $ 10,752 | $ - | $ 10,752 | |
| | Equipment Rental | 1 | % | 0.5% | $ 5,376 | $ 806 (15%) | $ 6,182 | |
| | **Sub-total General** | | | | $ 145,145 | $ 806 | $ 145,952 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Percentage of Capital Equipment (excludes collection system)** | | | | | | | |
| 1 | Sitework | | | % | 10% | $ 107,515 | | $107,515 |
| 2 | Excavation, shoring and backfill | | | % | 10% | $ 107,515 | | $107,515 |
| 3 | Yard Piping | | | % | 5% | $ 53,758 | | $53,758 |
| 4 | Metals | | | % | 2% | $ 21,503 | | $21,503 |
| 5 | Additional Finishes | | | % | 5% | $ 53,758 | | $53,758 |
| 6 | Process Piping and Supports | | | % | 5% | $ 53,758 | | $53,758 |
| 7 | Electrical | | | % | 15% | $ 161,273 | | $161,273 |
| 8 | I&C | | | % | 5% | $ 53,758 | | $53,758 |
| | **Subtotal capital facility costs** | | | | | | | $ 612,836 |
| | **Replacement of Water St. PS** | | | | | | | |
| | Packaged Pumping Station | 1 | Lump Sum | $ 375,000 | | $ 375,000 | $ 93,750 (25%) | $ 468,750 |
| | Concrete Wetwell | 396 | m3 | $ 1,000 | | $ 396,000 | | $ 396,000 |
| | Genset (250 kW) | 1 | Lump Sum | $ 96,000 | | $ 96,000 | $ 14,400 (15%) | $ 110,400 |
| | Demolition of Existing PS | 1 | Lump Sum | $ 100,000 | | $ 100,000 | | $ 100,000 |
| | **Sub-total Improvements to Water St. PS** | | | | | $ 196,000 | $ 14,400 | $ 1,075,150 |
| A | **Subtotal capital facility costs (A)** | | | | | | | **$ 1,833,937** |
| B | Overhead & Profit (10% of A) | | | | 10% | | | **$ 183,394** |
| C | MOB/Bond/Insurance (5% of A) | | | | 5% | | | **$ 91,697** |
| D | Construction Contingency (20% of A) | | | | 20% | | | **$ 366,787** |
| | Construction Sequencing Allowance (3% of A) | | | | 3% | | | **$ 55,018** |
| E | **Total est. construction costs** | | | | | | | **$ 2,530,834** |
| | **Non-Construction costs (E)** | | | | | | | |
| F | Engineering Design (15% of E) - includes EA, destailed design and contr admin | | | | 15% | | | 379,625.10 |
| G | Internal Halton Costs (10% of E) | | | | 10% | | | 253,083.40 |
| H | Project Overall Contingency (10% of E) | | | | 10% | | | 253,083.40 |
| I2 | **Total Estimated Capital Costs - Replacement of Water St PS** | | | | | | | **$ 3,416,626** |
| | **LINEAR WORKS** | | | | | | | |
| | **General Requirements** | | | | | | | |
| | Mobilization | 1 | % | | 2% | $ 15,773 | $ - | $ 15,773 |
| | Supervision | 1 | % | | 6% | $ 47,318 | $ - | $ 47,318 |
| | Temporary Facilities | 1 | % | | 4% | $ 31,546 | $ - | $ 31,546 |
| | Temporary Utilities | 1 | % | | 1% | $ 7,886 | $ - | $ 7,886 |
| | Equipment Rental | 1 | % | | 0.5% | $ 3,943 | $ 591 (15%) | $ 4,535 |
| | **Sub-total General** | | | | | $ 106,466 | $ 591 | $ 107,058 |
| | **Collection System (includes site work, excavation, shoring, backfill, and asphalt restoration)** | | | | | | | |
| | New 450mm Piping | 480 | m | $ 551 | | $ 264,576 | | $ 264,576 Shallow pipe. |
| | New 400mm Piping | 300 | m | $ 1,362 | | $ 408,720 | | $ 408,720 |
| | New 150mm Piping | 60 | m | $ 962 | | $ 57,720 | | $ 57,720 |
| | Manhole | 6 | unit | $ 6,860 | | $ 41,160 | $ 16,464 (40%) | $ 57,624 |
| | **Sub-total Collection System** | | | | | $ 772,176 | $ 16,464 | $ 788,640 |
| A | **Subtotal capital facility costs (A)** | | | | | | | **$ 895,698** |
| B | Overhead & Profit (10% of A) | | | | 10% | | | **$ 89,570** |
| C | MOB/Bond/Insurance (5% of A) | | | | 5% | | | **$ 44,785** |
| D | Construction Contingency (20% of A) | | | | 20% | | | **$ 179,140** |
| | Construction Sequencing Allowance (3% of A) | | | | 3% | | | **$ 26,871** |
| E | **Total est. construction costs** | | | | | | | **$ 1,236,063** |
| | **Non-Construction costs (E)** | | | | | | | |
| F | Engineering Design (15% of E) - includes EA, destailed design and contr admin | | | | 15% | | | 185,409.46 |
| G | Internal Halton Costs (10% of E) | | | | 10% | | | 123,606.31 |
| H | Project Overall Contingency (10% of E) | | | | 10% | | | 123,606.31 |
| I3 | **Total Estimated Capital Costs - Linear Works** | | | | | | | **$ 1,668,685** |
| | | | | | | **Total Estimated Capital Cost** | | **$ 5,673,207** |

Note:
The Order-of-Magnitude cost estimates shown have been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. The final costs of the project will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule and other variable factors. As a result, the final project costs will vary from the estimates presented herein. Because of this, project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions to help ensure proper project evaluation and adequate funding.
This estimate does not include any costs for acquiring the necessary permits or Rights-of-way for the above specified equipment,