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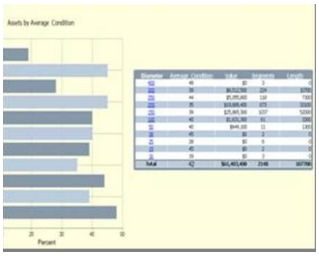
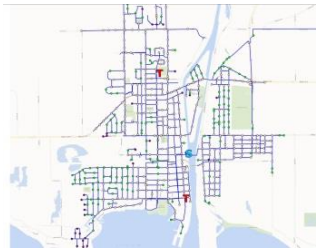
REPORT

City of Port Colborne

Water Distribution Infrastructure Needs Study





CANADA'S BEST MANAGED COMPANIES

Executive Summary

BACKGROUND

The City of Port Colborne is responsible for water distribution to approximately 16,000 of the 19,300 residents. The City's current Water Distribution System Infrastructure Needs Study (WDINS) was completed in 1996; the majority of the recommended capital upgrades from that report have been implemented.

Associated Engineering (AE) was retained by the City of Port Colborne's Engineering and Operations Department to provide an updated, evidence-based Infrastructure Needs Study to identify the short and long-term maintenance and capital investment needs of the water distribution system. In addition, the City requires a solid financial plan for the distribution system to ensure that a uniform level of service is provided to the City's customer base and that the City complies with all applicable financial and water quality legislation and regulatory requirements.

STUDY AREA DESCRIPTION

Since this is a master planning project, the study area encompasses the whole of the City of Port Colborne, specifically the City owned and operated water distribution network.

MASTER PLAN OBJECTIVES AND GOALS

A master plan is a long-range plan that examines the entire infrastructure system and recommends a series of separate projects that are dispersed geographically over a broad study area and are intended to be implemented individually or in groups, over an extended period of time. Master plans are not prepared to address site-specific problems such as extending water servicing to an area of new development or isolated upgrades that do not affect the system's ability to meet its operating criteria as a whole.
By utilizing environmental planning principles, this master plan follows Phases 1 and 2 of the Municipal Class Environmental Assessment (EA) process. Approvals for watermain replacements and/or modifications, as well as most new mains set out in the capital plan will fall under the City's Drinking Water Works Permit (DWWP) and as such are pre-authorized. The City is thus only required to keep record of changes to the system and most projects will require only the filing of a record of the change (Form-1 or Form-2 under the DWWP).

Primary conclusions and recommendations derived from this study are presented in Section 11.

Following the main body of this report are **Appendices A through H**. Many of these appendices were developed as a Technical Memorandum to discuss and provide details for the summaries included in this Executive Summary and the body of this report.

Problem Statement

Phase 1 of the Class EA planning process concludes with the clear definition of the problem (deficiency) or opportunity to be investigated. This study is being undertaken in response to deficiencies as identified by the City of Port Colborne. This study also looks at alternatives to addressing and resolving the discrepancies, which is part of Phase 2 of the EA planning process.

The Problem Statement for this study is as follows:

'The City of Port Colborne required an update to their previous Infrastructure Needs Study (INS) completed in 1996. The City completed the previous recommend capital upgrades and an updated INS is required in order to determine the financial needs for the next 20 years. Through the INS, opportunities exist to clearly define historical watermain breaks, maintenance issues, estimated replacements costs and a long range capital and operation plan for the City's potable water distribution system.'

Objectives of this Update

The objective of this study is to create a living plan that all stakeholders, from operations through senior management, can access to evaluate and make investment decisions going forward, to ensure a uniform level of service to City end users and the long-term financial sustainability of the system. The WDSINS will provide the City with the strategies necessary to identify and manage the needed infrastructure improvements in the most effective and efficient manner. The study will also identify the individual projects required to complement these strategies, and prioritize these projects based on need.

SERVICING REQUIREMENTS

Water demand criteria were developed based on existing utility billing records.

New watermains are recommended to integrate water supply systems, improve reliability and hydraulic efficiency, optimize the use of existing capacity, address future servicing needs for long-term sustainability, improve water quality and quantity of supply, and to reduce overall operational costs.

PUBLIC AND AGENCY CONSULTATIONS

A Notice of Study Commencement was published in the 'Niagara This Week' newspaper on May 3, 2012 to advise the public of the project. A letter dated May 22, 2012 was sent to key stakeholders.

Upon review of this Draft Report by City of Port Colborne staff, a Public Information Centre (PIC) will be arranged for the purpose of presenting the key components of the study and to solicit input from the public and other stakeholders. Notice of the PIC will be published in advance and letters sent to key stakeholders. Comments from public and stakeholders will then be incorporated into the final report.

HYDRAULIC / RELIABILITY ANALYSES AND CAPITAL PLAN

From our hydraulic analysis of the City's distribution system, we find the following:

- Fireflow modeling results indicate that there are twenty-four (24) hydrants (about 3% of all hydrants) that do not meet the City of Port Colborne pressure requirements under the fireflow scenario.
- Hydraulic and fireflow modeling results indicate that there are no additional pressure or fireflow deficiencies in the future scenarios using the existing water system.
- Approximately 20 hydraulic capacity improvements are required to alleviate the existing twenty-four (24) fireflow deficiencies. These projects are listed in Table 5-11.

Assessment of reliability and risk of failure is primarily based on the age and material of the watermains. The developed list of 'Risk" associated projects encompass the replacement of approximately 2000 m of primarily cast iron mains ranging from 150 mm to 300 mm. Hydraulic based replacements projects encompass approximately 4000 m of primarily cast iron mains ranging from 150 mm to 300 mm diameter. This totals almost 6,000 m of main replacements over the next 13 years related to increasing both the reliability and hydraulic performance of the system.

The City's replacement program should be focused on a combination of 'risk' and 'hydraulic' projects, many of which are the replacement of small diameter cast iron watermains. 'Risk' projects involving the replacement of the smaller diameter cast iron mains will have a secondary benefit in improving the hydraulic performance of the system. When evaluating any given watermain replacement, prioritization should be considered based on the following:

1. Reliability / Risk / Fireflow and hydraulic adequacy (risk of loss of human life and property damage)
2. Local user sensitivity to outages
3. Diameter (consequence of failure, impact on customers)
4. Condition of proximal infrastructure

Going forward, City Staff should implement the following data management actions to allow for the refinement of this analysis on an ongoing basis:

1. Reference future watermain break information to the appropriate unique asset identifier versus purely within the GIS data set to avoid the assignment of legacy pipe break information to new or newly constructed pipe segments.

2. Refine the reliability analysis for cast iron with consideration given to cathodic protection if present in the system to better understand the failure rates presented in this report.

3. Implement a pipe inspection program on a sample set of cast iron piping based on the results of this analysis. Ideally this inspection should be non-destructive and span several vintages to allow for a better understanding of pipe deterioration.

4. Continuously monitor break rates and unexpected service outages as a performance indicator for the determination of the efficacy of maintenance and capital investments.

5. Clearly delineate, within the GIS inventory, **replacement versus new construction** as changes are committed. This will allow for the quantification of return on investment for any given replacement in terms of level of service provided.

6. Investigate trenchless rehabilitation methods as an alternative to open cut watermain replacement given the unique constructability constraints in Port Colborne.

The complete list of the preferred Capital plan projects is reproduced in Table ES-1.

Table ES-1
Capital Plan Projects

Year	Project Name	Description	Size (mm)	Length (m)	Linear Cost	Current Cost	Projected Total
1	Risk/Reliability 1	Elm St from Main St. W to Union St.	300	508	$1,494	$759,232	$759,232
2	Risk/Reliability 2	Main St. W. from King St. to Canal Bank Rd.	300	211	$1,494	$315,234	
		Main St. W. from Elm St. to King St.	300	200	$1,494	$298,800	
		King St. from Main St. W. to Neff St.	150	105	$943	$99,015	$734,288
3	Risk/Reliability 3	Main St. W. from Weir Rd. to Ramey Ave.	300	340	$1,494	$507,960	
		Installation of additional DMA flow meters	Vari-ous	n/a	n/a	$200,000	$750,118
4	Risk/Reliability 4	Fares St. from Saint Arnaud St. to Killaly St. E.	150	144	$943	$135,792	
		Catharine St. from Killaly St. W to S. of Delhi St	300	302	$1,494	$451,188	$641,407

Year	Project Name	Description	Size (mm)	Length (m)	Linear Cost	Current Cost	Projected Total
5	Risk/Reliability 5	Steele St. from Killaly St. W. to Brady St.	150	391	$943	$368,713	
		West Canal Crossing at Main St. W	300	60	$3,320	$199,200	$639,606
6	Hydraulic 1	Barrick Road from Elm St to Intersection	300	30	$1,494	$44,820	
	Hydraulic 2	Prosperity Ave from Elm St to End of Cul-de-sac	200	140	$1,244	$174,160	
	Hydraulic 3	Rosedale Ave from Elm St to End of Cul-de-sac	200	125	$1,244	$155,500	
	Hydraulic 7	Highland Ave from Oakwood St to Cul-de-sac	200	125	$1,244	$155,500	$614,218
7	Hydraulic 9	Elm St at Intersection of Snider	300	21	$1,494	$31,374	
	Hydraulic 10	Brady St from Steele St to Fielden Ave	150	218	$943	$205,574	
	Hydraulic 11	Oakwood St from Helen St to Killaly	150	275	$943	$259,325	$592,007
8 and 9	Hydraulic 13	Marina Rd from Sugarloaf to King St	300	675	$1,494	$1,008,450	$620,785
10	Hydraulic 16	Hwy 140 from Ramey Rd to Chippawa Rd	300	170	$1,494	$253,980	
	Hydraulic 5	Omer Ave from Elm St to Intersection	300	6	$1,494	$8,964	
	Hydraulic 8	Steele St from Highland Ave to Intersection	150	15	$943	$14,145	
	Hydraulic 12	King St from Elgin St to Princess St	150	101	$943	$95,243	$484,985

Year	Project Name	Description	Size (mm)	Length (m)	Linear Cost	Current Cost	Projected Total
11	Hydraulic 17	Janet St and Crescent Ave	200/ 150	597	varies	$562,971	$756,991
12	Hydraulic 18	Killaly St E and Davis St	200	370	$1,244	$460,280	$636,749
13	Hydraulic 6	Paul St from Queen St to Intersection	300	7	$1,494	$10,458	
	Hydraulic 20	Reuter Rd from Johnston St to 40m south of Johnson St	300	35	$1,494	$52,290	
	Hydraulic 21	Rodney St, Welland St, and Lake Rd	150/ 300	356	varies	$420,181	$688,131

FINANCIAL SUSTAINABILITY

The Master Plan recommends a strategy for continued capital improvements of the existing water distribution system. The recommended strategy is to improve system reliability, minimize risks associated with operation of the system and to address current and future regulatory requirements.

A detailed summary of the recommended capital projects is included within Section 5.

Estimated capital costs in 2014 dollars are summarized for each of the recommendations outlined for capital works budgeting purposes. Budgetary estimates for the mid to long-term recommendations are preliminary in nature and are subject to Class EA and Preliminary Design recommendations to confirm the estimated costs provided and relative timing shown.

The financial analysis documented in this report focuses on the financial impact of proposed capital plans to replace and upgrade the hydraulic capacity of older components of the water distribution system in Port Colborne.

An analysis of customer data, completed as part of the analysis, indicated that residential customer demand is only 13 cubic meters per month compared to the norm for metered residential demand in other urban areas in Ontario of 17 to 20 cubic meters. This result bears further scrutiny. It may be accurate but, if not, then this has significant implications for non-revenue water management and cost recovery.

A number of conclusions follow from the financial analysis:

- Rate adjustments of 8% in 2015 followed by annual adjustments of 2% to offset inflation will generate enough revenue to finance the Base Case capital plan as well as the accelerated capital plans. Recovery of operating costs and the capacity to service existing and new debt is adequate.
- The annual cost of water for typical residential and small commercial customers increases by an average of $11 and $16 per year respectively. The higher retail rates needed to assure long-term financial health cause increases of $14 and $20 per year respectively.
- The proposed pipe inspection program, at only 0.1% of operating costs, is likely to be a cost saving addition to the distribution system maintenance program.
- Beyond 2024 the life cycle replacement of assets will impose a considerable burden on the City. Average annual investments are likely to reach or exceed $2.0 million by 2024 and beyond. A preliminary assessment of this issue considered rate increases that would be required to generate annual cash surpluses and reserves that are commensurate with future funding requirements. Increases in retail rates of 8% per year in 2015 and 2016, returning to the proposed 2% annual adjustment thereafter appear to suffice. With these rates annual cash surpluses reach $1.0 by 2022.
- Certain risk factors, including slower population growth and higher wholesale rates, can have a significant impact on financial performance.

ADDITIONAL REVIEWS AND ASSESSMENTS

Level of Service

The following Levels of Service (LOS's) and Key Performance Indicators (KPI's) were developed as a result of our review and a workshop with City staff.

Table ES-2
Port Colborne – Levels of Service and Key Performance Indicators

LoS Description	Purpose	KPI
Reliability of Service – Water Supply	Quantify the frequency of Service Interruptions	Number of customers experiencing disruption of service. Frequency and location of watermain breaks.
	Assess customer service during repairs	Time to repair breaks and restore service (within 24 hours) Number of customers receiving temporary water service during repairs.

LoS Description	Purpose	KPI
Quality of Service – Water Supply	Available residual system pressure	Customers have sufficient pressure at peak hour demand.
	Available Fireflow	Sufficient fireflow is available to the hydrants.
		Hydrants are located where needed.
Compliance with Regulatory Requirements	Quantify the time each year that provided water meets the requirements as per regulations (DWQMS)	Number, frequency and % of sample failures
Quality of Customer Service	Response time to service supply interruptions.	Number of responses in less than 30 minutes, (24 hours a day)
	Response time to general complaints	Number of responses within 24 hours.
		Number of follow up visits if required

Operational Review

The City of Port Colborne's resourcing levels for water distribution specific staff appear to be as efficient or better when compared to the benchmarked municipalities. The City employs 22 Engineering and Operations staff (other than senior management) responsible for reliability of service, regulatory requirements and customer service.

Existing level of service goals are not being met. Our analysis of watermain failure records shows that the majority of the response and resolution times greatly exceed the levels set, meeting the response goal only 26% of the time and meeting the resolution goal only 19% of the time.

However, many inconsistencies were found in the records as well as with the manner in which information was documented. A change in procedural methods could reduce many of the inconsistencies found. For example: the inconsistencies in data regarding service calls (complaints, main breaks, repairs etc.) made it difficult to evaluate whether or not existing levels of service goals are being met. It appears from the records provided that they are not being met; however inconsistent work order closures and the fact that the current Service 4.6 system does not exclude holidays, weekends and non-operating hours could result in a call having been recorded at 3:30 pm, (30 minutes before shift end) and not been completed until the following day. This can make it look like target was not met - when in fact it may have been. Additionally, response goals less than 1 day may not be realistic, as the success of meeting that goal is dependent upon the individual logging into the computer and closing out the work order within that time.

For our review of the Water department's operation procedures, we recommend the following improvements:

- Expand the existing QMS procedure (QMS-SOP15-1) with a detailed DOMS (Distribution Operation and Maintenance Strategy) that can be referenced in the QMS.
- Collect appropriate data to support level of service indicators
- Revised level of service indicators to more realistic goals to be able to show compliance with levels set.
- Revise the procedure for entering and maintaining the system Failure Reports to increase the accuracy of the information documented.

Review of Billing Meters / District Metering Area Meters

It is anticipated that the currently in progress District Metering Area (DMA) program will be a useful tool for identifying areas where water loss is occurring. Data collected through the DMA monitoring tool should be compared against customer meter readings. The development of an efficient and accurate procedure for metering flows (both consumption and supply) to and from the system should be the main priority with respect to identifying and minimizing water loss from the distribution system. Full time metering of DMA flows should be implemented in order to provide accurate information to use in any water loss assessment, and subsequent reduction of system losses. However, in order to ensure that the information being collected to be accurate, and usable; and that the hydraulic and quality performance of the system is not adversely affected; we find that this will require the installation of several additional DMA meters.

Given the above, we recommended that the City consider the following:

- Perform a hydraulic analysis to identify any adverse effects on fireflow availability and/or disinfectant residuals caused by the closure of the non-metered pipes between the DMAs.
- Consider Installing meters on ALL pipes connecting the current DMAs so that no valves have to be closed in order to meter flow between the DMAs. This need can be verified through further hydraulic analysis mentioned above.
- Moving forward, closely evaluate data to ensure proper assignment of water customer billing accounts to the DMAs, thus ensuring accurate accounting of water usage in each DMA.

Undertake an investigation to identify and install meters on currently non-metered water services. As a starting point, such an investigation should involve identification of known and potential Institutional/Commercial/Industrial (ICI users with non-metered services and inspection of properties and water services.

Recommendations for Customer Water Metering

It is recommended that the City undertake an investigation to identify and install meters on currently non-metered water services. As a starting point, such an investigation should involve identification of known and potential ICI users with non-metered services and inspection of properties and water services. It is anticipated that the currently in progress DMA program will be a useful tool for identifying and locating

potential system leaks and points of un-authorized, or non-metered, water consumption usage. Data collected through the DMA monitoring tool should be compared against customer meter readings. As part of the City's Integration of Water Loss Analysis Tools into a Water SCADA System project, the City has installed a portable flow monitoring panel at the feed entering one industrial client in order to compare the flows to the water meter readings and determine if the unmetered fire service is being used. The City intends to install portable units at up to two additional industrial locations in 2014 in order to directly compare the monitored flows to the site's water meter.

In addition to the above, it is recommended that the City's current water use bylaw be reviewed by legal counsel to ensure that it includes appropriate and enforceable provisions for:

- Inspection of private property connections to ensure conformance with the bylaw
- Metering of all private property connections, regardless of use, or legislation at the time of the original connection, and
- Penalties and/or fines for unauthorized connections.

Recommendations for Meter Reading and Billing

We recommend the following in order to make improvements to the meter reading and billing process.

- Account information should clearly indicate if the account is associated with a water service only, or both water and sewer services.
- The City should consider automating the process of collecting and inputting account and consumption data from the bulk water.
- The process of verifying and correcting meter reads should be clearly documented, including a description of the possible error messages, their causes, how errors are corrected and how corrected reads are identified in the billing system. In addition, the documented process should include provisions for identifying and investigating high and low reads.

NEXT STEPS

The Master Plan should be revisited every five (5) years to update population projections and water demand requirements (incorporating any upgrades made to the system, successes in water conservation and Inflow/Infiltration (I/I) reduction, to review regulatory status and to include advances in water technologies.

Master Plan Study

The following activities will be undertaken to complete the Master Plan process:

- Circulate draft Master Plan Report for government and agency review;
- Post the Draft Master Plan Report for a 30-day public comment period - consistent with Class EA process;

- Document feedback from draft review and report as required; and
- Municipality adopts the 2012 Needs Study Report.

Class EA Process

The work undertaken in preparation of this study is the initiation of the planning and design process for municipal water and wastewater infrastructure projects. The Master Plan Study generally satisfies Phase 1 and Phase 2 of the Planning & Design Process of the MEA Class EA.

We expect that all of the water projects arising from this plan will be listed as Schedule A and A+ projects under the Class EA , these projects are pre-approved and the proponent need not follow the procedures set out in the Class EA. Approvals for watermain replacements and/or modifications, as well as most new mains set out in the capital plan will fall under the City's Drinking Water Works Permit (DWWP) and as such are pre-authorized. The City is thus only required to keep record of changes to the system and most projects will require only the filing of a record of the change (Form-1 or Form-2 under the DWWP).

No projects from this Plan are expected to fall under Schedule C, which would need to fulfill additional requirements of Phases 3, 4, and 5 Class EA and would be beyond the scope of this Study.

Land Acquisition

It is unlikely that any of the recommended projects involving new infrastructure would require a new site location. If so, the municipality may need to acquire additional land in accordance with City of Port Colborne's policy as design of these improvements is further developed. Cost of land has not been factored into costs in this report as the need would be site specific.

Technical Approvals

Approvals for watermain replacements and/or modifications, as well as most new mains, fall under the City's Drinking Water Works Permit (DWWP) and as such are pre-authorized. The City is thus only required to keep record of changes to the system and most projects will require only the filing of a record of the change (Form-1 or Form-2 under the DWWP).

Detailed Design and Construction

For the recommended improvements, the City, with Council approval, will need to complete additional design investigations, contract drawings and tender documents. Following a tendering process, recommended works can be constructed and placed into operations over the near term.

Monitoring and Flexibility of Plan

It should be noted that this Master Plan is a living document that was prepared through a review process in order to address issues, needs, opportunities and constraints of the existing water system, identify needed infrastructure and timing based on the municipal-wide needs and the direction and policy of the City.

As time progresses, the adequacy and validity of the Financial Plan should be reviewed periodically (every 5-10 years) in order to assess the recommendations contained herein, and to validate the timing and need for improvement of infrastructure. The policies of the municipality and future legislation may dictate adjustments to the Plan recommendations. Population patterns over time may also dictate a different approach to future servicing and timing. As demands fluctuate, there may be a need to implement additional water and wastewater strategies, such as water conservation, unaccounted water management, and water reuse programs.

We recommend that the City continue to implement improvements and capital projects required for sustainability of the water and wastewater servicing systems, with a periodic review and update of the capital improvements program.