CITY OF CAMBRIDGE, ONTARIO

ASSET MANAGEMENT PLAN

CORE SERVICE SUSTAINABILITY

January 2013

Asset Management Plan

Preface

This Asset Management Plan is intended to describe the infrastructure owned, operated, and maintained by the City of Cambridge to support its core services. It is a compilation of many documents that describe the evolution of the Asset Management implementation in Cambridge over the past 7 years aligned to the content and format described in the Province of Ontario's Guide for Municipal Asset Management Plans.

This document identifies what has been achieved, what is being done and what needs to be done to ensure core services provided to citizens, business, and institutions attain sustainability.

This document provides information regarding the implementation of Asset Management in Cambridge, current state of the infrastructure along with current and future activities. While this document contains some detail, many external documents contain additional levels of detail and are referenced at the end of this document.

Table of Contents

EXECUTIVE SUMMARY

Cambridge began its journey into Asset Management in 2005 among a small number of other Municipalities across Canada. Over the past 7 years, the implementation of Asset Management has provided a number of benefits through improved accountability and a deeper understanding of the extent and affect of aging infrastructure and shortfalls in sustainable funding levels.

Through the implementation of asset management best practices, infrastructure assets that support core municipal services are monitored and maintained at levels that enable Cambridge to provide these services at manageable risks and a high level of reliability and confidence to those that receive these services.

Funding remains an ongoing challenge to overcome the accumulated backlog of capital renewals and maintenance deficits. However, through the implementation of technology and increased data capture, knowledge of the infrastructure and associated operating activities is providing new insights on how to increase accountability, increase productivity, and maximize return on capital re-investments. Through business process re-engineering and use of this new found knowledge, there has been significant progress, some measureable (i.e. reduction of water losses and inflow/infiltration), with many other improvements where prior metrics did not exist (more activities being done with same resources) and are difficult to measure. Improvements in this regard don't translate into current financial surpluses or savings – they do contribute to increased effectiveness and efficiencies that either defer future costs or reduce current backlogs/deficits to smaller levels.

Cambridge, with the support of Provincial and Federal levels of government and commitments of residents and local elected officials is well on its way of achieving sustainability with water distribution and sanitary sewer collection services through aggressive rate increases and through the mitigation of expenses associated with water loss in the water distribution network, reduction of infiltration and inflow to the sewer network, and a collaborative and integrated approach to infrastructure management.

At this time, funding and associated resources remain the most significant challenge in reaching sustainable core infrastructure services, particularly with property tax funded core services such as drainage, roads, dams, and bridges.

INTRODUCTION

The Province of Ontario defines municipal core services as water, sewer, drainage, and road networks[i]. These core services provide essential safe drinking water, effective sewage removal, protection from flooding, and primary transportation. Without these core services, the viability of our municipality from an economic, health, and environmental perspective would be in jeopardy. The Asset Management Plan includes the infrastructure assets that support these core services: Water Distribution Network, Sanitary Sewer Collection Network and Pump Stations, Storm Drainage Network, Storm Water Management Facilities, Dams, Local Roads and Bridges.

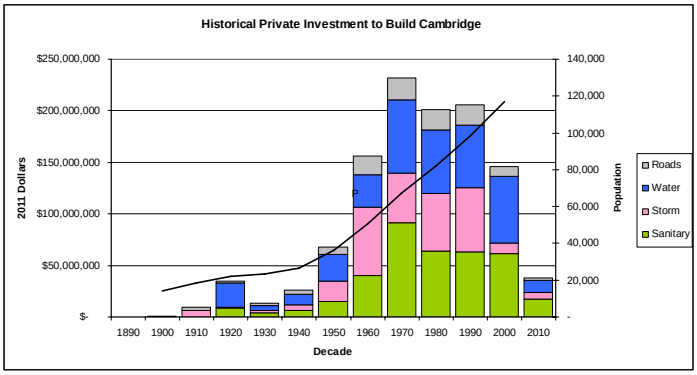
Cambridge is a lower-tier municipality within the Region of Waterloo (The Region) in which rationalization of many services with respect to core services as already occurred.

Core Service	Region of Waterloo Responsibility	City of Cambridge Responsibility
Social Housing	All social housing and related services	none
Roads	Capital Renewal and Construction, Capacity Planning, and Signalization of all Arterial roads.	Local roads and collectors. Capital renewal, construction, inspection, and maintenance. *Cambridge provides inspection and maintenance of all Regional Roads through a formal maintenance agreement.*
Sanitary Sewage	Sewage Treatment Facilities	Collection system, pumping stations, and billing.
Water System	Water supply, treatment, storage, and pressurization.	Distribution network, metering, and billing.
Drainage	Drainage structures servicing regional roads only	Drainage network and Storm water management facilities.

This document provides a historic perspective of Cambridge's Asset Management implementation, ongoing activities, and areas of improvement or implementation. This document is expected to be updated every 5 years.

In 2011, Cambridge adopted a Corporate Sustainability Plan[ii] which incorporates Cambridge's corporate vision, and, among other things, has the intent of 'Promoting health, productivity and safety of the community through design and maintenance of the City's infrastructure and built environment.". Additionally, the mandate of "Developing financial and planning tools to enable comparative analysis of sustainability implications and to support long-term decision making that is culturally, economic, environmental and socially responsible" support ongoing implementation and evolution of Asset Management activities.

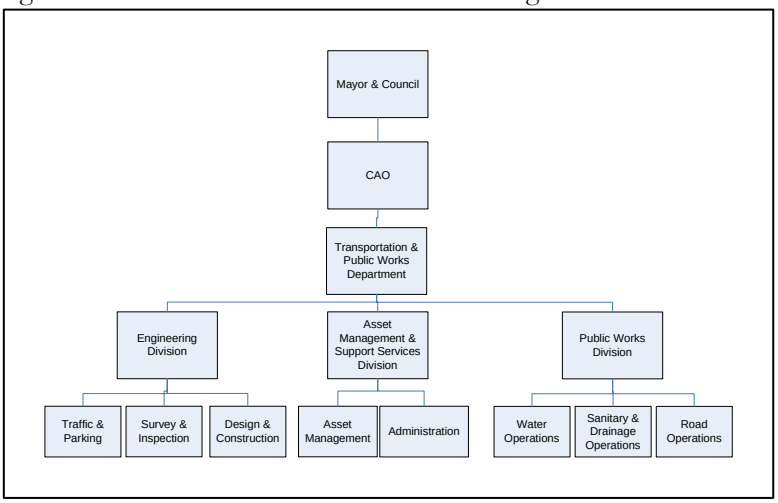
Cities across the globe have been constructed largely through private investments with the expectation that core infrastructure assets constructed and funded through private development would be sustained by local municipalities as public utilities funded through a combination of local taxation and user fees. The figure to the right provides a perspective of the degree of private investment that has occurred historically in Cambridge represented in 2011 dollars[1].



Taxation and user rates have historically fallen short of recognizing the true life-cycle cost of ownership of infrastructure assets resulting in a growing backlog of capital renewals, deferred pro-active maintenance, and increasing re-active repairs and replacements. The Walkerton incident, although tragic, was the catalyst that identified the need for better oversight, management, and funding of municipal core infrastructure. In this light, City of Cambridge Commissioner of Transportation & Public Works initiated an Organizational Audit and a parallel Asset Management Needs Study in 2003 that would help quantify the backlog and shortfalls in Cambridge's core services infrastructure.

ASSET MANAGEMENT IMPLEMENTATION IN CAMBRIDGE

Cambridge began its journey in Asset Management in 2005 as a result of an *'Asset Management System Needs Study, Earth Tech / Applied Geologics Inc. – January 31, 2005'.* (AMSNS).[iii] The AMSNS, endorsed by Council, outlined organizational change through the creation of a dedicated Asset Management Division within the Transportation & Public Works Department that included a Director level position to ensure there was sufficient authority to invoke change management within Engineering and Operations Divisions. It was felt that this level authority was needed to support the re-alignment of business practices with Asset Management concepts. Additionally, this division would assume responsibility for administrative support that would further re-enforce the need for change in administrative processes and procedures to align with asset management principles.



In this plan, Asset Management would take on the following roles:

- Maintain inventory of assets
- Undertake condition assessments
- Take lead on capital planning with Engineering
- Long-term funding requirements projections
- A collaborative role with Operations to move towards formalized record keeping and transition to a more pro-active maintenance and inspection focus

[1] *Chart represents infrastructure still in service and infrastructure replaced in past 12 years*

- Foster collaboration between Engineering, Operations, Planning, and Finance
- Implement technology as a key enabler of more effective and efficient means of conducting business that supports business decisions.

The Asset Management Division was incrementally staffed beginning in July of 2005. The following outlines the chronology of implementation to date and the status of areas of focus identified in the 2005 AMSNS.

Asset Inventory/Data Management

Goal: Construction and population of an official asset registry

Implementation Date: Initiated in June 2005 substantially completed in 2008.

Current Status: Fully implemented and continuously maintained by the Asset Management Technologist reflecting all assets planned, in service, and removed/abandoned. Reconciled with bi-annual high resolution aerial photography and updated through field observations and measurements on an ongoing basis. It is at a high level of confidence and accuracy. The Asset Registry in GIS is compiled data resource is now considered a better resource then historical as-built drawings and is now the primary internal source of infrastructure information for the Corporation.

Initial inventory build included a comprehensive field-level audit that ensured the asset registry reflected actual infrastructure in operation. This was a key step as it was recognized early in this effort that as-built records were often a poor source of information and many drawings were never created or submitted. Additionally, over many years, system modifications took place in the field to resolve localized issues that were not documented through engineering drawings. The field-level audit conducted by the most experienced operations staff proved to be an invaluable step in the process of building the asset registry.

In 2008, a business process re-engineering effort of the development and capital reconstruction programs identified a number of gaps and controls that contributed to issues with as-built drawing submissions. As a result, business practices were changed to ensure that construction and as-built drawings were being submitted and formally accepted on a timely basis. This had a significant positive effect on the ability to maintain an accurate, complete, and current asset registry.

Geographic Information System

Goal: Core Asset Management Technology that is an electronic compilation of land and infrastructure connected to business systems.

Implementation Date: Initially implemented in Asset Management in 2007 on ESRI / Oracle platform as the technology containing the formal Asset Registry in various GIS layers. Adopted as the Corporate GIS in 2009.

Current Status: ESRI Geodatabase and Oracle has been fully adopted as the corporate standard and is deployed using Rolta Onpoint as the GIS portal to all staff in the organization with access to information reflecting property, right-of-way and underground infrastructure and related business transactions and is fully integrated with most business systems. .

Drawing Management

Goal: Registry of all construction and as-built drawings of infrastructure.

Implementation Date: 2007

Current Status: Maintained within the corporate GIS on a continuous bases by graphics staff within the Technology Services Division. Direct and automated monitoring of new drawings alert Asset Management Technologist of new posted drawings that need to be incorporated into the Asset Registry providing an auditable link between the asset recorded in the asset registry with source documentation. Process encompasses all drawings of infrastructure from development and re-construction activities.

Service Request / Complaint Management

Goal: Computer application and database to formally record all re-active activities related to core services.

Implementation Date: Implemented in March of 2008 utilizing IBM Maximo and is part of the Maintenance Management System fully integrated with workflow and automation containing knowledge base and pre-defined issue specific response plans.

Current Status: Fully implemented and in operation to handle all public calls related to services provided by the Transportation & Public Works Department (Roads, water, sewer, drainage, sidewalk, signage, parking, street lighting, walkways, retaining walls). Additionally is a formal record of all re-active repairs and maintenance needs identified by internal staff. System incorporates extensive business intelligence and automation to minimize effort and maximizes quality of records.

Road Allowance Permit Management

Goal: Records of all 3rd party activities within the right-of-way (except electrical authority).

Implementation Date: Implemented in 2010 with direct feed to public website and auto-notification of all interested external parties (i.e. fire, police, transit, etc..)

Current Status: Fully implemented including the recording of all road closures performed by the Operations Division for road and utility activities performed by internal staff. Website reflects all internal and external activities in 'near real time' within the right-of-way. Further enhancements are planned for 2013/2014.

Work/Maintenance Management

Goal: Computer System to record and monitor all re-active and pro-active activities for infrastructure assets.

Implementation Date: Implemented March 2008 including the automatic generation of all routine scheduled pro-active inspection/maintenance activities and all re-active activities.

Current Status: Includes concepts such as activity, program, and gl based costing. High level of automation and embedded business intelligence and automated monitoring of workorders to ensure they are completed on a timely basis. Includes full cost accounting of all inspection/maintenance/operational/and repair activities directly connected to financial systems and GIS. System is now a significant source of information regarding service levels and indicators of asset conditions. Year over year trending and information is being used to manage and adjust resource levels to match projected needs based on trends shown from the system.

Current Condition Assessment

Goal: Formalized assessment of individual assets based on field observations.

Implementation Date:
Roads – 2006 and repeated every 3 years
Sanitary & Storm – Initiated in 2007 and ongoing
Water System – 2010 – repeated annually.
Bridges – 2008 – repeated every two years.

Current Status: Sanitary & Storm is being done via CCTV inspection utilizing CSA standards. Approximately 75% of system has been fully inspected to date. Data is being used to confirm inventory, connectivity and drive capital project planning and where required, re-active repairs or maintenance. Process is fully electronic between contractor and GIS systems having current and historical results online and accessible to all staff.

Large diameter sanitary lines and siphons have been inspected in 2011 using CCTV/Sonar/H2S detectors.

Sanitary forcemains remain an outstanding item to be addressed and prioritized within the Sanitary Servicing Master Plan.

Sanitary Pumping Stations condition is in progress via a Sanitary Servicing Master Plan to be completed in 2013.

Water System has been interpreted based on history of watermain breaks, material, and vintage of construction. Deteriation is based on observed failure rates and probabilities.

Bridges undergo a formal inspection every 2 years as per Provincial requirements. In 2012, all bridges and culverts as well as those within parks and trails have been assessed and are being implemented in a bridge management system via external service contract.

Storm Water Management Facilities and major drainage structures have been assessed via the 2011 Storm Water Management Master Plan.

Treatment Analysis

Goal: Assessment and applicability of various renewal options for various assets based on current state and local factors.

Implementation Date: Roads – several pavement preservation techniques have been piloted in 2009.

Water – several trenchless pilots have taken place between 2010 and 2012 to establish applicability of various methods as well as true level of disruption to customers and economics in comparison to full replacement.

Sanitary/Storm – Trenchless methods have been and continue to be piloted to evaluate applicability in various localized scenarios.

Current Status: Ongoing

Predictive Modeling

Goal: A model of expected failure of assets supported by empirical data.

Implementation Date: No formal model implemented at this time.

Current Status: Life expectancy of water mains have been adjusted that aligns with observed high failure rates of thin-walled cast iron installed in 1960-70's.

Life expectancy of local roads have been adjusted to 40 years based on observed deteriation patterns.

Sanitary life span of clay tile pipe has shown to be stable until disturbed – life expectancy is dependant on adjacent renewal activity.

Ongoing research with University of Waterloo and IBM to model future state of infrastructure.

Optimized Priority Programming

Goal: An integrated capital planning approach in which all infrastructure in same location are considered in an effort to minimize service disruption and to avoid re-trenching same location during service life of pavements.

Implementation Date: Integrated capital planning was first conducted in 2010 resulting in capital projects that were driven by underground infrastructure rather then road condition.

Current Status: Initially performed using internal expertise of GIS and database technologies with annual improvements/evolution.

Currently in partnership through IBM Research to incorporate the methods into a single toolset with potential for commercialization and availability to other municipalities. Tool encompasses an ROI approach that additionally optimizes available and applicable funding to needs of various asset groups.

Long Term Budget Planning

Goal: 80 year forecast of operating and capital funding needs using life-cycle analysis of assets.

Implementation Date: First completed via a top-down approach by Stantec in the 2007 State of Infrastructure Report [vi].

2010 Sustainable Financial Plan (10 yr horizon) completed via BMA Consulting Ltd. for Water and Sewer system and submitted and approved by the Province.

Current Status: Ongoing updates that identify current backlog, short and long term funding requirements. Annual update of valuation of assets based on current year tender bids provides an annually revised funding needs forecast.

A revised 10 yr water/sewer sustainable financial plan will be completed and submitted to the province based on findings of the 2013 Sanitary servicing master plan and updated information on the water system.

Expect 5 year updates.

Budget Tracking, Analysis and Management System

Goal: Higher level of expense tracking and analysis of how budgets and expenses are allocated to assets, consumed by resources, and management accounting information that supports management decisions on future budget and resource allocations.

Implementation Date: Operational budget and expense tracking embedded in Maintenance Management System in 2008 with automated alerts when expenses near or exceed budgets.

Current Status: Annual review and reporting of water/sewer budgets and expenses conducted as part of NWWBI since 2010.
Through a Management Accounting approach, information is used annually to assess and monitor resource utilization at operational level and identify/support budget/rate increases as well as FTE requests.
Future goal is to gradually eliminate maintenance deficits through a transition from historic financial based-budgeting to a work-based budget that reflects funding requirements that fully fund re-active and pro-active maintenance, inspection, and repair programs.

Test / Inspection Management

Goal: Monitor and record inspection activities

Implementation Date: Implemented for road condition assessments and CCTV inspection of sanitary and storm network.

2007 - Implemented for annual inspection of sidewalks using mobile computing and GPS tracking technologies – fully integrated to MMS to initiate and monitor defect repairs over defined thresholds in accordance with Ontario Minimum Maintenance Standards.

2007 – Implemented for ongoing road patrol using mobile computing and GPS tracking technologies – fully integrated with MMS to initiate and monitor defect repairs in accordance with Ontario Minimum Maintenance Standards.

Pump station inspections, hydrant inspections, and others embedded in MMS implementation as part of PM schedule.

Current Status: Sidewalk and road patrol inspection technology to be transitioned to new Rolta Onpoint Mobile technology in 2013.

Current method of having transitory paper records (generated from MMS) but recorded in paper in the field and post-entered into MMS in office limits practicality of implementing this on any large scale.

Mobile computing implementation on a broader scale will significantly increase and improve inspection records for water/sanitary/storm infrastructure incrementally through 2013/2014.

Mobile Field Applications

Goal: Use of mobile computers to direct crews and record their activities in electronic form.

Implementation Date: Partially implemented (as per above section).

Current Status: Full implementation to begin in 2012 and incrementally through 2013 and perhaps in to 2014.

Automated Vehicle Location (AVL)

Goal: GPS tracking of vehicles and crews.

Implementation Date: Vehicle tracking implemented prior to 2005 using external service (Grey Island).

Current Status: GPS tracking of crews will be transitioned to IBM Maximo and Rolta Mobile as mobile computing is implemented.

COLLABORATION AND PARTNERSHIPS

Implementation of Asset Management has evolved continuously in strong collaboration with other Municipalities across Canada through active participation in various industry groups and associations such as CATT, NWWBI, CNAM. Cambridge Asset Management staff are regularly invited to present in workshops and seminars from various other industry organizations. Partnerships and formal collaborations have also provided opportunities to advance knowledge and technologies towards more effective asset management tools. Examples include Development Partnership with IBM (Maximo MMS), Development Partner with Rolta Canada (Onpoint GIS Portal), IBM First-of-a-kind Research, University of Waterloo / National Research Council "Optimal Strategies for the financially sustainable management of drinking water and wastewater networks".

INDUSTRY STANDARDS AND REGULATIONS

Of particular note, Cambridge was an early adopter of InfraGuide[iv] adapting the implementation to the guidance provided in this framework. Through early adoption of asset management, implementation of PSAB 3150 was relatively straight-forward and Cambridge is one of the few municipalities in Canada that has a monthly direct auditable feed of asset changes from the GIS asset registry into a PSAB compliant TCA reporting system implemented by Cambridge Department of Finance in collaboration with Asset Management.

Through collaboration with a number of Canadian municipalities and industry partners and Canadian Standards Association (CSA) Cambridge was part of the team that has developed the first Pipeline Inspection Guideline (CSA Plus 4012)[v] that aligns with a standard in the USA based on standards also used in the UK and throughout the world.

OTHER STUDIES AND DOCUMENTS

In 2007, a top-down 'State of Infrastructure Report'[vi] commissioned by Cambridge and produced by Stantec provided an early perspective of the infrastructure in Cambridge based on the initial inventory contained in the City's asset registry.

This report identified an annual revenue deficit in O&M and Capital renewal of $15.2M.

This report provided Council an early perspective of the infrastructure and financial challenges ahead – particularly with water/sewer rates required to sustainably fund water supply and sewage collection.

This information initiated follow-up studies on Water/Sewer Cost of Servicing and Rate structures. See Financial Strategy Section of this document for further details.

Table E.1: Sustainable Revenue Impact

Program		2006 Revenue ($M)		Sustainable Revenue ($M)		Overall Deficit ($M)	% to $ Ratio	Impact on Rates/Taxes (%)
		O&M	Capital	O&M	Capital			
Rate	Water	$3.1	$1.3	$3.2	$4.4	$3.2	1%=$102K	31%
	Sanitary Sewer	$2.0	$1.1	$3.7	$3.7	$4.3	1%=$78K	55%
Levy	Roads	$7.0	$4.2	$4.7	$8.8	$2.3	1%=$523K	4%
	Storm Sewer	$0.6	$1.2	$3.8	$3.4	$5.4	1%=$523K	10%

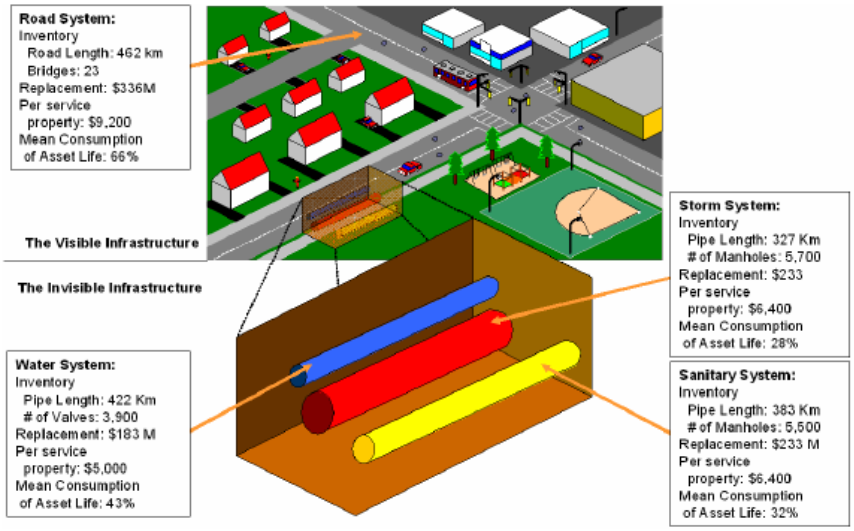


Figure E.1: Asset Replacement Value per Serviced Property

FUTURE DEMAND ON INFRASTRUCTURE

In recent years, the Province has developed the Places to Grow[vii] Program which provides guidance and expectations for growth within urban boundaries in southern Ontario. A Region of Waterloo Official Plan is in progress of finalization along with a revised City of Cambridge Official Plan that align with the Provincial Places to Grow program. The Cambridge Official Plan provides guidance on where development through expansion of servicing and where additional demand on existing services will occur over the next 20 years. This includes mandated intensification targets in which green-field development must be matched by at least 40% residential development through intensification of existing urban areas by 2015 within the Region of Waterloo.

Additionally a recent Regional approval for a new rapid transit corridor that will introduce dedicated bus lanes to service Cambridge connecting to rapid rail in Kitchener/Waterloo with anticipated future extension of rapid rail in Cambridge is expected to increase demand along the transit corridor and at identified transit nodes.

Sanitary System

Cambridge's Official Plan and the rapid transit corridor project are providing planning information that is being used to model the sanitary collection system and pumping stations to evaluate the ability of the existing system to service these growth and intensification locations through a Sanitary Servicing Master Plan anticipated to be complete in 2013. The model will provide insight into current and future servicing issues that may require upgrades to be incorporated into the capital renewal program. In turn, this information will be used to help establish future Development Charges to ensure that upgrades to infrastructure are funded by the developments that introduced the demands without further burdening current rate payers.

The sanitary model is intended to be used on an ongoing basis in conjunction with development applications to verify the system has the capacity to support development as requested without compromising existing commitments and expected future developments.

Water System

Water supply modeling to confirm ability of system to support growth is currently being provided by the Region of Waterloo. A collaboration with area municipalities (Kitchener, Waterloo, Cambridge) and the Region of Waterloo is in progress to collectively build and maintain an 'all-pipes' water model which will provide further insights into criticality of pipes in the distribution system and ability to meet current and future demands from both a supply and distribution perspective. A collaborative approach has been chosen as water supply is distributed throughout the network primarily from ground sources managed by the Region of Waterloo.

Drainage System

A Storm Water Management Master Plan was undertaken in 2009 and completed in 2012 which identifies required upgrades to the drainage system and other structures to meet anticipated weather pattern changes and to increase service level expectations regarding protection against flooding from major rain events.

Significant funding shortfalls have deferred the consideration of implementing the recommendations of this master plan until 2015 at the earliest.

Road Network

A Transportation Master Plan is anticipated to begin in 2013 that will include a number of transportation related items including the following:

- Parking in downtown cores
- Design standards for reconstruction of limited right-of-way width road allowances (less then 12m)
- Cycling, multi-use, active transportation
- Traffic calming
- Bus routes (Operated by the Region of Waterloo) impact on city roads and services.
- Impact on local roads by future light-rail transit implementation.
- Streetscaping
- Round-about intersections on regional roads
- Potential need for additional water crossings
- Capacity of provincial Highway 401 crossings
- Avenue road improvements, alignment, capacity, and perceived heritage impact.
- West side bypass
- Speedsville road and bridges to accommodate demand expected from development of north-west of Cambridge.
- Townline road demand to meet changing traffic patterns.
- Blackbridge road and associated bridge to meet demand from development.
- Development charges related to demand on roads by growth and intensification.

- FUTURE IMPLEMENTATION SCHEDULE

The following itemizes action items that will either extend the Asset Management Implementation or provide improvements to items already in place.

Item	Description	Current Status	Expected Implementation
Mobile Computing Implementation	Implementation of IBM Maximo mobile work order management using mobile technology by field crews Implementation of Rolta Onpoint Mobile GIS to bring real-time GIS into hands of crews.	In Progress. Development Partner with IBM to advance functionality to higher levels. In progress. Development partner with Rolta	2012 - 2014
Sanitary Servicing Master Plan	Comprehensive review of Pumping Stations, Sanitary Hydraulic Model, Criticality Assessment, Levels of Services Review, Policy & Procedures Review, Identify System needs to support future growth, and review of O&M programs	In Progress	June 2013
Creation of Financial and Project Support Role	New Position in AM to focus on capital and operating budget and expense tracking, statistical analysis, benchmarking, and overall capital project co-ordination.	Position approved and incumbent begins Dec 17,2012	2013
Bridge Management	Implementation of a formal bridge management system that manages current needs and provides future needs analysis.	Comprehensive inventory and condition assessment completed in 2012 and system chosen. System implementation and training to be done in 2013	2013
Addition of Staff to increase support of Maintenance Management Systems	2 new positions that will focus on the configuration, training, and support of the Maximo MMS that will provide resources for continuous improvement and additional support for mobile computing implementation.	Positions approved for 2013	2013
Configure additional pro-active inspection programs.	Configure GIS/Maximo using mobile toolsets to direct and record operations crews towards increased pro-active activities in water and sanitary sewer.	Desired functionality and programs identified and documented. System and technology upgrades and configuration pending additional staff being hired.	2013
Updated Sustainable Financial Plan – Water/Sewer	Complete a revised 10yr sustainable financial plan for water/sewer for submission to Province.	Is a component of the Sanitary Sewer Master Plan.	2013
Sanitary Model	A hydraulic model of the sanitary collection system to be used by AM staff on an ongoing basis to support development applications.	In development as part of the Sanitary Master Plan	2013
Dams Renewal/Removal	Decision and planning on the future of 3 dams under stewardship of Cambridge.	EA in process on Riverside Dam to address imminent failure.	2014
Transportation Master Plan	Comprehensive plan encompassing expected demands from intensification and development, multi-modal transportation, and affects of rapid bus and future light-rail transit corridor.	Project funded in 2012 capital budget – expect to begin in 2013	2014
Enhance Needs Assessment and Capital Planning Toolset	Migrate internally developed tools and processes that produces an integrated asset needs assessment optimized capital program.	Completing First-of-a-kind research partnership with IBM. Software toolset known as PALM in progress for development as a commercialized tool by IBM with anticipated initial release in 2013.	2014
Development Charges Update	Review current DC funding program in light of revised official plan and modeled demand on infrastructure to determine required funding from DC to support growth and intensification	To begin in 2013	2014
Water Distribution Model	An 'all-pipes' model to identified criticality of individual pipes, ability to meet current and future demand, water quality	Early stages of collaboration with Waterloo, Kitchener, and Region of Waterloo	2015
Improve capital project tracking	Design and implement a simple capital project tracking method that incorporates all milestones and increased internal/external communications along with increased records management.	Efforts will begin in 2013	2016
Storm Water Funding	Review of current property tax funding and options to improve funding of storm water drainage and management infrastructure with consideration of moving to a storm water utility approach.	Expected to begin in 2015	TBD

STATE OF CAMBRIDGE'S INFRASTRUCTURE

Cambridge, like all Municipalities in North America, has been quietly building a significant backlog of capital renewals and deferred maintenance over the past 20-30 years. Cambridge is one of the first municipalities that initiated the implementation of Asset Management through the creation of a formal Asset Management Division within the Transportation and Public Works Department.

INVENTORY

Through intensive data collection efforts both in the office and the field, Cambridge's asset registry within the GIS is considered to be a reliable and comprehensive resource for asset information. Through business process re-engineering efforts, construction and as-built drawings from development and renewal activities are being provided on a timely basis enabling the asset registry to be maintained in near-real-time. Additionally, change to assets and repairs conducted by crews, as well as survey activity, is providing continuous information to asset management staff to update and reconcile the asset registry.

Current replacement costs shown in the following sections represent average tendered reconstruction costs for projects in the prior year for individual assets components taking into account various factors such as size, depth, length, etc. of individual components.

Note that historical PSAB values are not utilized in this analysis as Cambridge utilizes a $50,000 capitalization threshold which would exclude a significant portion of the city's infrastructure. PSAB figures are available through the City's annual financial report.

WATER DISTRIBUTION SYSTEM

Water System Summary

	Length (km)	Average Age	Average Remaining Life	Oldest Pipe	Newest Pipe
WATER MAIN	502	35.00	42.0	1901	2012

Source: Asset Inventory Registry

Inventory Summary

Asset Type	*Asset Code*	*Quantity*	*Current Status*	*Current Replacement Cost*
IN SERVICE				
WATER PIPE	WP	502,468 m	IN SERVICE	$222,792,486
WATER HYDRANT	WH	3,267 EACH	IN SERVICE	$23,380,988
WATER VALVE	WV	4,808 EACH	IN SERVICE	$11,720,926
WATER METER BYPASS	WM	354 EACH	IN SERVICE	$0
WATER JUNCTION	WJ	2,609 EACH	IN SERVICE	$2,084,995
WATER CHAMBER	WC	959 EACH	IN SERVICE	$11,906,869
WATER SERVICE	WS	2,216 EACH	IN SERVICE	$3,601,000
WATER SERVICE	WS	341,874 m	IN SERVICE	$62,325,045
				$337,812,308
Source: Asset Inventory Registry				$337,812,308

Water Age Profile by Material (m)

MATERIAL		0 - 25 Yrs	25 - 50 Yrs	5 0 - 75 Yrs	75 - 100 Yrs	Over 100 yrs
ASBESTOS CEMENT			124	157		
CAST IRON		5,751	41,775	39,066	16,316	
CONCRETE		79	423			
COPPER		5	171	45		
DUCTILE IRON		61,649	92,828	4,937	2,564	
POLYETHYLENE		579	513			
PVC		146,616	25,118	298	117	
STEEL			1,168			
UNKNOWN		11,056	20,785	10,917	19,402	10
	502,468	**225,734**	**182,905**	**55,420**	**38,399**	**10**

Source: Asset Inventory Registry

Summary of System

	Length (m)	Ave Pipe Age	Average remaining Life	Minimum Installation Year	Maximum Installation Year
SANITARY MAIN	509	33.0	43	1914	2012

Inventory Summary - City Owned Assets

Asset Type	*Asset Code*		*Current Status*	*Current Replacement Cost*
IN SERVICE				
SANITARY MANHOLE	SM	7,321 EACH	IN SERVICE	$48,455,860
SANITARY PIPE	SP	508,733 M	IN SERVICE	$237,689,213
GENERATOR	SG	9 EACH	IN SERVICE	$630,000
PUMP	SU	32 EACH	IN SERVICE	$673,000
SCADA SYSTEM	SA	15 EACH	IN SERVICE	$309,800
PUMPING STATION	SL	16 EACH	IN SERVICE	
SANITARY SERVICE	SS	39,424 EACH	IN SERVICE	$66,752,194
				$354,510,066
				$354,510,066

Source: Asset Inventory Registry

Sanitary Age Profile By Material

	Length of Pipe (m)				
Material	0 to 25 Yrs	25 to 50 Yrs	50 to 75 Yrs	75 to 100 Yrs	100 Yrs Plus
UNKNOWN	355	1,788	230	118	
VITRIFIED CLAY	4,428	47,220	27,980	15,360	
PVC	179,147	40,062			
ASBESTOS CEMENT	2,779	82,487	10,542	978	
CONCRETE	19,174	47,116	12,417	1,882	
DUCTILE IRON	115				
STEEL		1,750	89		
POLYETHYLENE	10,160	1,781			
	216,157	**222,203**	**51,258**	**18,338**	

Source : Asset Inventory Registry

DRAINAGE SYSTEM

Summary of System

	Length (km)	Ave Pipe Age	Average Remaining Life	Minimum Installation Year	Maximum Installation Year
STORM MAIN	351	34.0	49.0	1920	2012

Inventory Summary - City Owned Assets

Asset Type	Asset Code			Replacement Cost
IN SERVICE				
STORM CEPTOR	DR	26	EACH	$878,306
STORM INLET	DI	102	EACH	$242,964
STORM POND	DW	75	EACH	$103,666,647
DAM	DA	3	EACH	$3,000,000
CULVERT	DV	12,992	M	$6,515,379
STORM LEAD	DL	113,201	M	$24,148,175
STORM PIPE	DP	351,301	M	$152,388,810
STORM CATCHBASIN	DC	9,298	EACH	$29,572,983
STORM OUTLET	DO	344	EACH	$1,967,575
STORM MANHOLE	DM	6,321	EACH	$43,367,670
				$365,748,508
				$365,748,508

Storm Age Profile By Material

	Length of Pipe (m)			
MATERIAL	AGE_0_25	AGE_25_50	AGE_50_75	AGE_75_100
UNKNOWN	2,035	5,838	689	764
VITRIFIED CLAY	489	10,164	1,037	2,437
PVC	60,021	1,825		
STONE		20		
CONCRETE	117,548	123,872	11,404	3,350
ASBESTOS CEMENT	22	929	18	
POLYETHYLENE	6,198	355		
STEEL	926	489	6	49
	187,238	**143,492**	**13,154**	**6,601**

Source: Asset Inventory Registry

ROAD NETWORK

Inventory Summary

Asset Type	Asset Code	Quantity	Replacement Cost
PAVEMENT	RS	982 lane-km	$185,050,267
PAVEMENT EDGE	RC	960,724 M	$101,710,804
SIGN	RT	13,970 EACH	$6,111,875
SAND BOX	RX	107 each	$42,796
PARKING LOT	PL	22 EACH	$1,863,022
WALKWAY	RW	14,969 M	$9,355,375
GUIDE RAIL	RG	2,636 M	$1,265,306
RETAINING WALL	RR	11,232 M	$5,189,933
STREET LIGHT	RL	10,311 Each	$41,872,000
SIDEWALK	RK	644,539 M	$104,739,359
		Total Replacement Value	**$457,200,736**

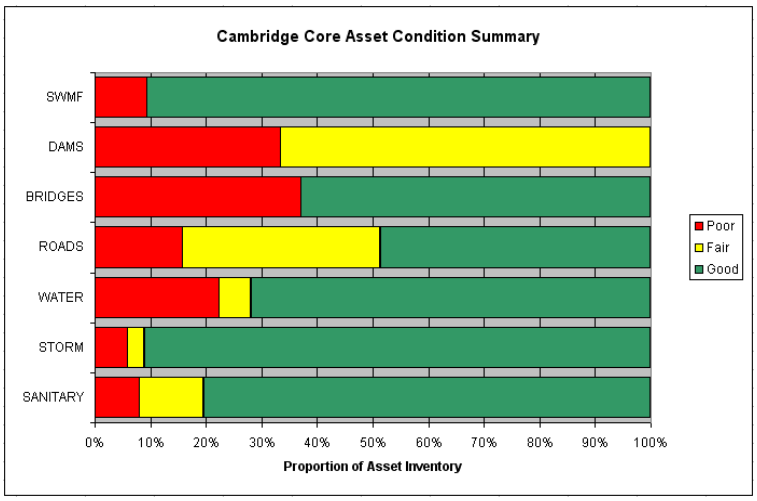
BRIDGES AND MAJOR CULVERTS

Cambridge has complied with Provincial bi-annual inspection of bridges, however, a comprehensive inventory of all bridges (including those within parks and trail systems) and culverts had not taken place. In 2012, this activity was undertaken along with a detailed inspection, condition assessment, valuation, maintenance and capital forecast. The final results are in progress of compilation. Preliminary inventory and valuation is shown to the right.

	Count	Replacement $
Arch	1	$1,013,564
Culvert	37	$19,540,047
PostTensioned_Rect_Voids	1	$3,567,500
Rigid_Frame	4	$4,315,813
Slab_On_I_Girders	10	$874,677
Solid_Slab	8	$645,761
Through_Plate_Girder	1	$2,150,540
Truss	6	$777,787
		$32,885,689

CONDITION

The chart to the right provides a perspective of the condition[viii] of the City's core infrastructure.



STORM DRAINAGE NETWORK

In Cambridge, combined sanitary/storm drainage was eliminated in the 1970's and 1980's to separate the two systems. The result is that the vast majority of the storm system is in good condition with very little physical renewal needs. Recent implementation of catch-basin cleaning programs have almost eliminated instances of street flooding during typical rain events.

STORM WATER MANAGEMENT FACILITIES

Storm water management facilities are in need of major maintenance to remove built-up sediment to restore the design capacity and function of these facilities. Additionally, the older 3 core urban areas of Cambridge do not contain storm water management facilities that would improve water quality entering the Grand River.

DAMS

In recent years, Cambridge has assumed responsibility for 3 aging dams on the Speed River. One has already experienced structural failure and has been temporarily reinforced. An EA is currently in progress that will lead to remediation, replacement, or removal of this structure. Remaining 2 dams are considered currently stable.

WATER DISTRIBUTION SYSTEM

The water distribution system has a significant remaining portion of original infrastructure in addition to a significant inventory of thin-walled cast iron pipe installed in the 1960's and 1970's which is failing. 90% of the water main breaks occur on pipes of this vintage and comprise a significant portion of the current renewal backlog. Additionally, residential developments constructed in the early 1900's were serviced with 4" mainlines and lead services. Pipes of this size cannot be cleaned resulting in water quality and pressure below current consumer expectations. Small mainlines in these locations do not provide fire flow protection to current standards. The inventory of 4" water mains are also considered part of the renewal backlog and is considered of high priority. Additionally, water service leaks over the past decade have increased. Copper services and fittings as a result of historic installation practices (i.e. goosenecks, flared fittings) have created failure points along with corrosion has shown that copper service life expectancy in Cambridge is approximately 50 years. Additionally, early plastic fittings are also showing signs of increased risk of failure.

SANITARY SEWAGE COLLECTION SYSTEM

The sanitary system is generally in good condition with only a small portion of original sewer collection pipes still in service. Being primarily of clay-tile construction, these pipelines remain structurally sound provided they are not disturbed. From this perspective, original sanitary pipelines in proximity of water pipes that are in need of renewal (i.e. 4" water mains) also need to be replaced. Cambridge rarely experiences mainline blockages or basement flooding events induced by wet weather. Although there is a fairly high inflow and infiltration (I&I) volume (currently 38% based on a water-balance calculation), flow

monitoring and modeling has shown that the I&I is primarily a base-flow issue from ground water sources and that the sources are often from newer infrastructure. Service blockage from fats, oils, grease (FOG) and from root intrusion remain the primary cause of service interruptions to customers.

SANITARY SEWAGE PUMPING STATIONS

Pumping stations are currently undergoing a full assessment as part of the Sanitary Servicing Master Plan. Generally, there is a backlog of component replacements as well as the need to replace 3 of the 16 pumping stations currently in operation. Further information will be available through the Sanitary Servicing Master Plan.

BRIDGES

Comprehensive assessment is in progress. Initial estimates show that approximately 37% of replacement value is the re-investment needed within 10 years to maintain bridges and culverts in good condition. Several bridges are in need of expansion to meet increased traffic demands from expected growth and intensification. One bridge is currently under load restrictions and requires both replacement and expansion for growth and is not represented on the chart below. An EA process is currently in progress to address this particular bridge.

	Rehabilitation Needs $					
	Urgent	< 1 Year	1 - 5 Years	6 - 10 Years	>10 Years	
Arch	$490,458			$253,972	$324,024	**$1,068,454**
Culvert	$109,622	$487,923	$696,066	$1,450,598	$3,395,953	**$6,140,162**
PostTensioned_Rect_Voids	$127,963		$18,829	$488,792	$87,564	**$723,148**
Rigid_Frame	$87,880	$21,450	$79,425	$72,065	$145,640	**$406,460**
Slab_On_I_Girders	$84,034	$163,095	$191,615	$83,712		**$522,456**
Solid_Slab	$106,240	$113,426	$89,135	$227,284	$57,250	**$593,335**
Through_Plate_Girder	$53,513		$11,051	$2,208,824		**$2,273,388**
Truss	$24,914	$11,950	$139,359	$49,553	$113,710	**$339,486**
	$1,084,624	**$797,844**	**$1,225,480**	**$4,834,800**	**$4,124,141**	

EXPECTED LEVELS OF SERVICE

Levels of Service within Cambridge have been adopted through a number of documents developed in the industry and internally focusing primarily on technical requirements that meet generally expected levels of operation and safety:

- Cambridge Drinking Water Quality Management System (DWQMS)
- Region of Waterloo and Area Municipalities Design Guidelines and Supplemental Specifications for Municipal Services (DGSSMS) (2010)
- Cambridge Engineering Standards and Development Manual.
- Provincial Minimum Maintenance Standards for roads, sidewalks, and street lighting.

The implementation of a formal Maintenance Management System (MMS) in 2008 is providing valuable information, trends, and insight in the ability for Cambridge to respond to issues. The MMS, among many other items, measures the response time, lag time, total time to resolution, resources involved, and communication logs for all issues identified internally and by customers. Going forward, this type of information not only provides the basis of resource and program management decisions, but is key information that will provide council and the public with the service level information in relation to the cost of service.

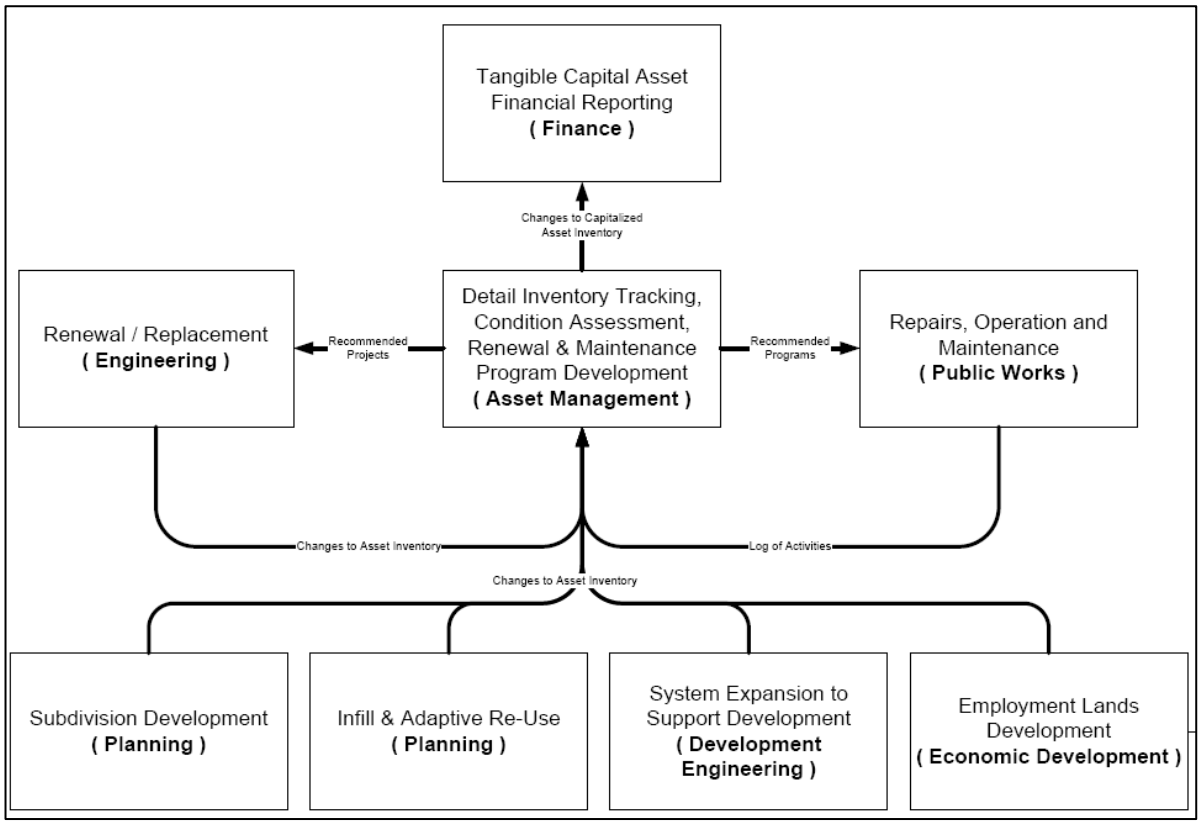
Additionally, Cambridge has been an active participant with the National Water and WasteWater Benchmarking Initiative (NWWBI). This annual activity provides a perspective comparing approximately 50 municipalities in Canada in a range of technical and service level metrics. These annual comparative metrics has and will continue to identify differences as well opportunities to improve water and sewer service provision leveraging proven successes. Compilation of various statistics and metrics has been a challenge due to limited resources. This is expected to be addressed in 2013 with approved increase in staff that will enable additional focus on metrics, vital statistics, and active monitoring leveraging the information within the implemented systems. Some examples of metrics produced by the current system implementation are found in Appendix A.

There is further effort required to address and formally define levels of service from a customer perspective. Historically a significant portion of activities have been provided at a 'best we can do with what we have' basis. Through the development of Master Plans in alignment with Official Plans, review of design guidelines, and metrics being captured by the MMS, Cambridge is beginning to re-orientate service delivery that is driven by service level expectation that incorporate climate change, growth, and regulatory changes as listed below:

- Storm Water Master Plan (2012)
- Sanitary Servicing Master Plan (In progress)
- Design Guidelines for non-standard right-of-way widths (in progress)
- Transportation Master Plan (to begin in 2013)

ORGANIZATION

From an organizational perspective Asset Management has been structured to be a key element that fosters collaboration with multiple business units within and external to the Transportation and Public Works Department. The figure to the right depicts these interactions. In this sense, Asset Management has become a conduit of communication and co-ordination between traditional organizational silos.



ASSET MANAGEMENT BLUE-PRINT

In 2005, a technology blueprint was internally developed and has been used to guide the acquisition, implementation, and integration of technology and guide the business process re-engineering activities. This was an important first step and has proven to be an effective reference throughout the implementation of Asset Management in Cambridge.

Tangible Capital Asset Reporting

Financial Statements

Capitalized Assets (New, Removed, Replaced)

Needs Assessments

Asset Condition & Performance Analysis

Renewal, Maintenance, Replacement Needs

Capacity Modeling Systems(s)

Capacity Models

Current & Future Capacity

Current Demand

Future Growth Estimates

Integrated Life-Cycle Planning

Proximity Analysis

Block-by-Block Optimization of Life-Cycle Activities

Reconstruction Candidates

Maintenance Candidates

Renewal Candidates

Geographic Information System

Asset Inventory Input (Location, Physical Attributes + Age)

Asset Registry

Maintenance & Repair Records

Valuation, Condition, and Life-Cycle Information

Inspection Records

Usage & Environmental Information

References

Drawing Registry

Revisions & Corrections

Asset Inventory

Location References

Maintenance And Repair Records

Work Management & Customer Service System

Asset Maintenance & Repair Records, Field Observations

Activity Based Work Orders & Resource Utilization / Costs with relationship to location and physical assets

Filter

Service Requests

Public Complaints

Internal Requests & Follow-Up Work

Routine Inspection Programs

Maintenance Programs

Seasonal Activities

On-Demand Repairs & Minor Installations

Defects Identified That Need Immediate Repairs

Specialized Data Capture Programs (where applicable)

External Data (Region, GRCA, Water/Sewer Billing, Traffic, Flow Monitoring)

Design & AsBuilt Drawings

Site Development Plan (Adaptive Re-Use & In-Fill)

Subdivision Development Plans (GreenField)

Development Support Projects

Planning

Employment Land Development Projects

Economic Development

Re-Construction & Renewal Projects

Engineering

Regional / City Re-Construction Projects

Regional Construction

Municipal Official Plan

Engineering Design Standards

Invoices to Customers for Services Rendered or Utility Companies for Utility Cuts (Double-Entry)

Invoices for Materials And Contracted Services Manual Processing (Double-Entry)

Electronic Transfer

Electronic Transfer

Accounts Receivable

Accounts Payable

Payroll

Equipment Revenue

10 Year Capital Forecast & Annual Project / Program Development

TITLE

Asset Management Work Flow & Systems Schematic

July 1, 2005	N/A
November 2, 2009	AM001 - Blueprint

Revisions

1 – Added possible feedback to as-built drawing from Field Observation/Work Order process
2 – Layout Changes
3 – Added Official Plan and related links
4 – Revised Asset Registry References
5 – Incorporated Asset Management Systems
6 – Incorporated Performance & Condition Data Collection
7 – Incorporated Tangible Capital Assets
8 – Added External Usage & Environmental Information
9 – Refined some level of detail @ GIS level

AUTHOR: Mike Hausser, P.Eng

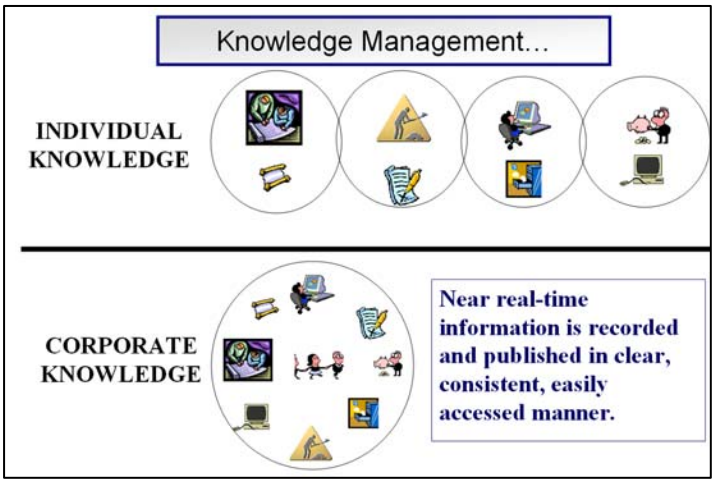
Notes
1) Additional detail for individual processes further documented on additional drawings in AM001 Series.
2) Schematic does not necessarily represent where information is physically stored.
4) Size and relative position on diagram does not indicate level of complexity or business focus.

The Corporation of the City of Cambridge

IMPLEMENTATION STRATEGY

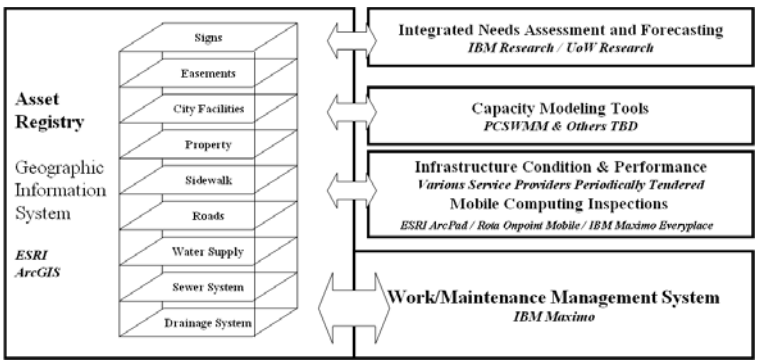
The Asset Management implementation in Cambridge is a continuum of change. This change is coordinated, communicated, and above all, collaborative to the extent possible. Changes have been, *and continue to be,* needed at many levels in the organization ranging from day-to-day routine activities in the office and in the field to overall financial and resource decisions along with changes with inter-departmental interaction as well as external organizations. Within the context of change, Cambridge has focused on a three-pronged Asset Management Implementation Strategy guided by the expertise of internal staff and the industry at large:

- Knowledge Management
  - Involves formalized records control and dissemination between business units thereby breaking down traditional silos of information and knowledge.
  - Involves the capture of information from long-term experienced staff both in the office and in the field to minimize the effect of knowledge loss when staff leave the organization. This is an important component in business continuity.
  - Involves quality control and quality assurance in records to ensure integrity, reliability, accuracy, and a near-real-time representation of all business transactions and asset information.



  - This approach has created a fundamental shift in day-to-day business practices with an increasing level of confidence and desire to contribute to shared knowledge bases rather then independently maintained, isolated and unstructured records of past practices.
  - Working in conjunction and within a records management framework, knowledge management focuses on active and historic records as well as institutional knowledge that often go beyond traditional records management policies.
  - Involves an understanding of risks and claims associated with service delivery along with the direct and ancillary affects of asset component failure and the associated service interruptions on different customers.

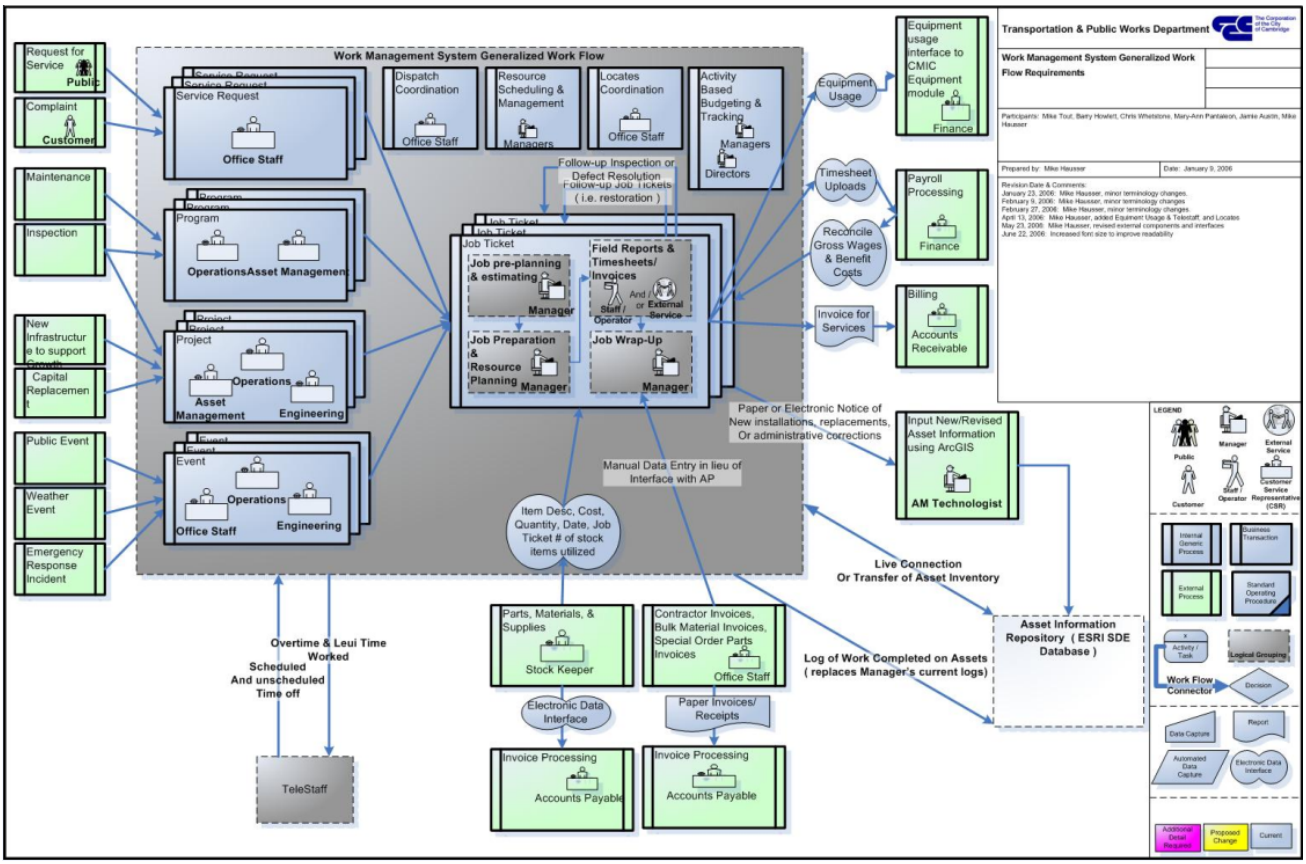
- Technology
  - Re-tooling with best of breed and leading edge technology providing the means to record information, reliable storage and retrieval, and disseminate it to all those that need access to it, when they need it, and where the need it.
  - Involves a high degree of automation and incorporation of business intelligence that promote business continuity, consistency, and reliability of information with least overall effort.
  - Establishing a solid relationship with technology providers and building in-house expertise has shown to be a key success factor in making the most of the current technology and shaping the technologies of the future.



- The diagram to the right depicts an outline of the technological components of Asset Management which is not a single piece of software, but a collection of tools that must be co-operatively interact.

- Business Process Re-Engineering

This particular perspective is as important as the other two, however, it seems that this is the portion that is often overlooked by other Asset Management implementations. Cambridge has invested significant effort and commitment to this activity and it has proven to be a key success factor.



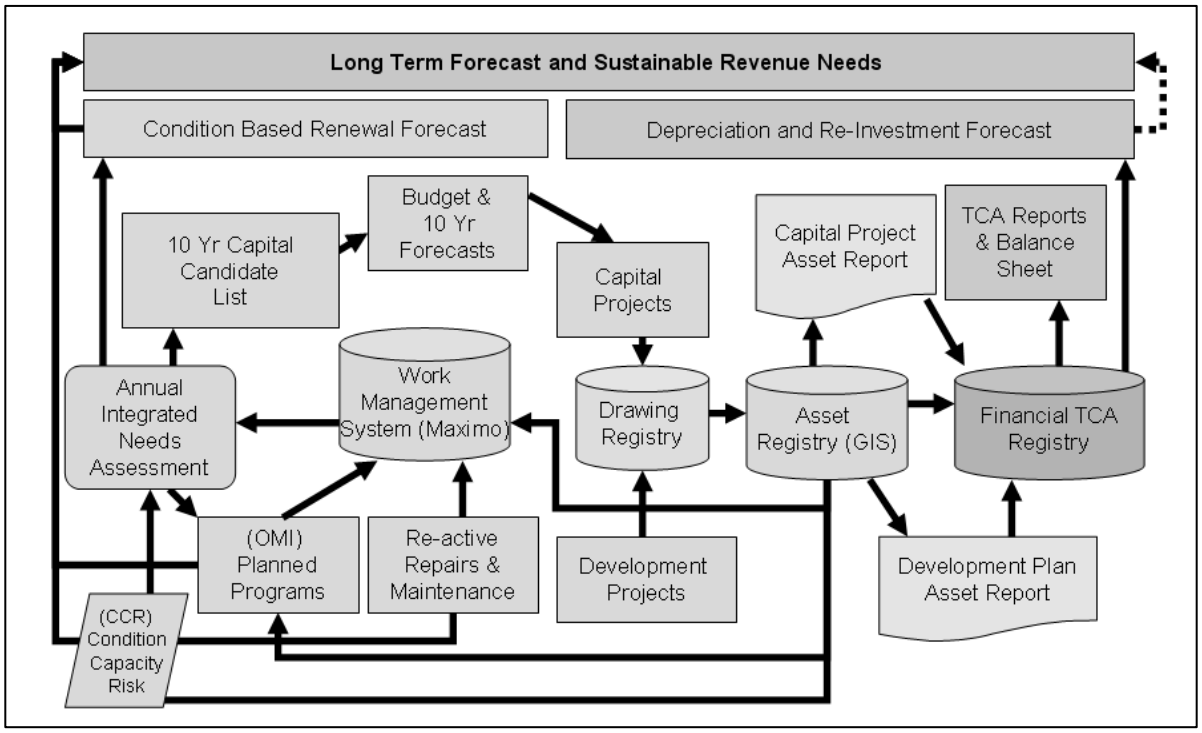
- Encompasses end-to-end review of business transactions with citizens (external clients) and internal services. This effort identifies opportunities to simplify workflow, eliminate duplication of effort, and clarify rules and policies associated with each process. The diagram to the right is an example of the resulting documentation from an extensive review of the complaint and maintenance management processes and associated record keeping.

- This effort has proven to be an essential first step in the conversion of traditional paper processes into computerized systems. When done in conjunction with technology, there are significant opportunities to take advantage of technology functions and features and further simplifying or addressing gaps in the business process that result in a smoother transition and an overall more effective and efficient process.

Going forward, this three prong approach will continue to be employed to incorporate additional business processes and continuously improve and adapt to changing demands/expectations of customers, the industry, and legislation.

ASSET MANAGEMENT PROCESS

The asset management process in Cambridge is depicted in the diagram shown to the right.



Physical Construction

Infrastructure is built through development projects or re-built through capital renewal projects. These produce construction and as-built drawings which are used to maintain a formal asset registry.

Project & Financial Controls

A quality control process provides detailed reporting of the assets constructed and their current value (based on tender unit values updated annually) in comparison to financial records of each capital project or development plan agreement. This approach has been successful in identifying installation shortfalls or 'scope creep' that require reconciliation between 'plan' and 'actual'. Upon approval and acceptance of the assets and closure of the capital project or development agreement, the Financial TCA registry is updated from the Asset Registry in GIS providing FIR and Balance sheet reporting through the Financial TCA Registry. Examples of these reports can be found in Appendix D of this document.

Monitoring Field Activities

Throughout the life of the asset, re-active repairs and maintenance, along with planned inspection, maintenance, and operational (OMI) activities are recorded in the work management system. In turn, this information provides input to integrated needs assessments which may drive changes in planned maintenance and inspection frequencies and, in conjunction with, condition, capacity, and risk analysis, is used to update and revise needs assessments.

Needs Assessment

Needs assessments provide the basis for pro-active maintenance program development, projections of re-active repairs, and capital renewal/reconstruction. Together, these provide a basis for short and long

term funding requirements that are used to develop operating budgets, current capital projects, 10 year capital forecasts and long term operational and renewal funding forecasts. These forecasts are used to the rates charged to customers to provide these services for the short and long term with a goal to achieve sustainability.

Renewal forecasts are developed based on expected remaining life of assets using a number of composite factors. The remaining life of an asset is based on the following drivers:

1. **Condition** – through field inspection and measurement using industry standard methods, where they exist, are utilized to establish the structural and operational condition of the asset. The remaining service life of an asset is estimated based on its structural condition and key parameters such as material of construction. Operational condition may also contribute to the remaining service life estimate where the asset is causing significant operational or service level issues that cannot be solved through routine maintenance (i.e. negative slope gravity pipe, sags, or low slope). This factor is the key input to defining capital renewal projects within a 10 year horizon. This information is often utilized to drive re-active maintenance needs and in some cases pro-active risk-mitigating pro-active maintenance programs. *This factor has been fully implemented to date and undergoes' refinement as industry knowledge or standards are developed.*

2. **Capacity** – through observation or modeling techniques, assets that are operating above design capacity or are expected to exceed design capacity through increased demands also contribute to remaining service life assignments. Other perspectives such as water loss in the water distribution system and Inflow & Infiltration (I&I) on the sanitary sewer system are also monitored and utilized in this factor as they reduce the capacity of the system to provide service to current and future users of those services. In particular, this factor may take precedent over physical condition if development (infill or growth) is being impeded by capacity of existing infrastructure assets. *This factor is currently in development and will incorporate capacity models (sanitary, storm, water, traffic) as the models are implemented over the next 5 years.*

3. **Risk** – Risk has been a primary driver of several programs including sidewalk inspections, road inspections, sign inspections, and street-lighting inspections. The next stage of implementation will incorporating risk factors on individual assets. Assets (and customers that individual assets provide direct service to) are identified having elevated levels of risk have a lower tolerance to failure or reduced service levels. Those assets are expected to be renewed at lower thresholds of degradation and capacity. Assets are assigned a level of criticality from a number of perspectives:

    a. **Environmental** – the level of impact to the environment should the asset fail. This would include proximity to environmental features such as rivers, creeks, wetlands, or other environmental features.

    b. **Institutional** – level of impact to institutional facility such as schools, seniors homes, day care centers, etc..

    c. **Health Care** – level of impact to health care facilities such as hospitals, medical centers, dental offices, etc..

    d. **Industry** - level of impact to large industrial or commercial businesses

    e. **Transportation** - level of impact to significant transportation corridors such as major roads or rail lines.

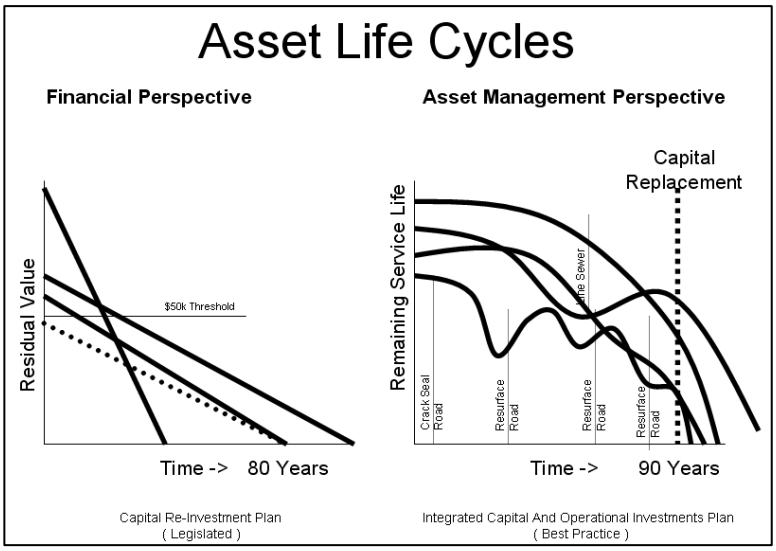
    The risk factor is currently in development and expect to be incorporated in 2013.

4. **Maintenance & Repair** – History of re-active repairs and maintenance provide insight into the current state of the asset and the physical assets sharing the same physical location (i.e. block of right-of-way). As the frequency of re-active repairs and maintenance activities increase, the asset is providing evidence of stress and strain. This information provides insight into the condition of the asset that can either confirm the observed formal condition, or be a surrogate in the absence of formal condition information. *This factor is currently implemented and will continue to evolve.*

5. **Conformance to Standards** – In some cases, existing infrastructure assets or their components no longer meet current standards. While that is not always an issue, it does become a factor when it affects the level of expected service, maintainability, or ability to repair (i.e. no spare parts or fittings available). In these cases, this information will be a factor in the decision to renew or replace infrastructure assets or components. *This factor is currently implemented for the water system (100mm distribution pipes having insufficient fire flow and poor water quality) and is also being used to identify roadways that have sub-standard right-of-way widths. Project is underway to develop alternate standards for reconstruction of these locations in future.*

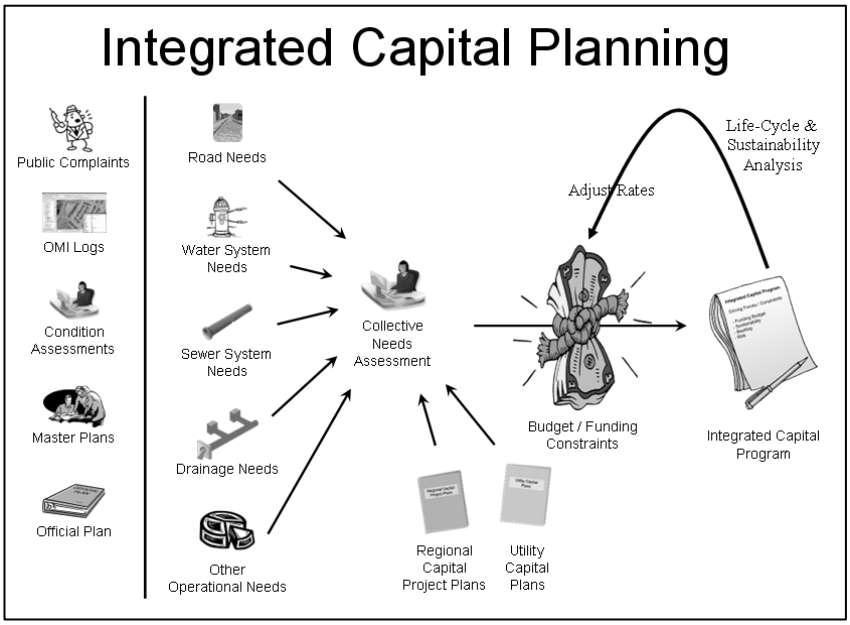
6. **Design Life** – In the absence of condition information or maintenance/repair information, the asset remaining service life is based on expected design life. This is typically used for new assets, however, it is considered the lowest confidence estimate as actual life of an asset is better understood over time in which installation, environmental, and demand stresses have been applied. There are many examples in which assets far exceed their design life as a result of exceptionally good installation and stable environment. Many other examples exist where assets fall well short of design life through one or more of the following factors: poor installation, movement of soils, extreme operating conditions, lack of maintenance, material defect. ***The application of a standard design life of an asset is an area of commonality with a financial approach (PSAB 3150) which assumes a life of an asset and its associated depreciation that defines minimal re-investment requirement levels. This factor is used primarily in long-range renewal need forecasting having the least level of confidence. Note that this approach has very limited value for the development of a short or medium term capital plan and does not adequately estimate funding requirements.***

INTEGRATED CAPITAL PLANNING



Cambridge is following a concept of integrated capital planning in which all infrastructure assets that share the same physical locations need to be managed together to achieve the highest overall return on investment (ROI) and lowest overall cost of ownership. By monitoring the life cycle of the assets of each system and strategically intervening with minor or major renewal activities, the life of assets sharing the same physical locations can be aligned. This alignment leverages the capital investment of the longest life asset in that location and extends the life of shorter lived assets through a series of lower-then-replacement cost actions until all assets in that shared location reach a common end-of-life, at which point, full reconstruction is the most cost effective alternative.

In some locations where full reconstruction is not feasible due to external factors, the assets can either under go a planned decommissioning, or perpetual strategic interventions to extend their life indefinitely.



The diagram to the right depicts how the integrated capital planning process is staged and what information feeds this process.

Core information about infrastructure such as public complaints and Operations, Maintenance, Inspection (OMI) logs come from the City's Work Management System.
Condition assessments, master plans, official plans, and other specialized data including capacity data from models or metering provides input for each asset group to identify individual asset needs.

The needs of assets that share the same physical space are combined and through a process of analytics and logistics, the process identifies the best value interventions or reconstruction activities that align life cycles of all assets in each location making the most of available funding.

The collective needs assessments identify to what degree funding shortfalls may exist and is used to identify adjustments in the revenue stream to achieve sustainability.

This methodology was developed and put into practice internally through database, GIS, and spreadsheet tools using internal technical expertise. Through a First-of-a-kind IBM Research initiative, this logistics and analytics is being developed by IBM for commercialization in partnership with the City of Cambridge and is currently in progess.

OPERATIONS, MAINTENANCE, INSPECTION PROGRAMS

A key component of the Cambridge Asset Management implementation is to increase the overall effectiveness, efficiency, transparency, and accountability of operational activities. Additionally, a critical goal is to shift from a highly re-active environment to a more balanced operations division that is pro-active in inspections and maintenance activities that enable planned re-action to minor repairs rather then a traditional approach of re-acting in response to failures reported by the public.

This is being accomplished through significant efforts on managing change, business process re-engineering, technology, and re-alignment of staff. It is also being done through a balance of increasing internal staffing and contracted services.

The implementation of a formal maintenance management system (MMS) – IBM Maximo, a large effort has been in the translation of desired business intelligence into the MMS that creates a system that automates the workflow, monitors and tracks progress and costs and becomes a formal system of record for all business transactions encompassing all public and internal requests for re-active activities as well as a system that drives scheduled pro-active maintenance and inspection activities. Having a tight seamless integration with the Asset Registry in GIS, all re-active and pro-active activities are being monitored and is available to understand what is happening in the field for all infrastructure assets as well as indicators of public satisfaction through the record of all customer calls in the system as service requests.

The MMS is a rich source of information providing key Level of Service metrics in terms of response time, resolution time, associated resources, # of site visits and costs. It also provides the near-real-time perspective of what issues exist in terms of service interruptions and overall indicators of individual or overall asset condition and performance.

Ongoing collaboration with IBM through a Development Partner relationship with Cambridge is continually enhancing the technology to assist in the transition from re-active to pro-active and from un-planned to more planned resource management as well as increase accountability, transparency, and information capture with least effort.

FINANCING STRATEGY

Cambridge, like many other organizations has traditionally followed a pay-as-you-go financial approach in which there was hesitation to assume debt as part of an overall financial strategy. Additionally, public pressure has resulted in many years of lower then inflation increases in rates and taxes that resulted in incremental increased deficits in capital renewal and operating programs. Infrastructure, being mostly buried, with service life of more then 50 years continued to perform without obvious effects. A number of public infrastructure failures in other jurisdictions and resulting regulations is changing the understanding of the need to fully finance the full life-cycle cost of infrastructure from both a capital and operating perspective that will continued service delivery of core services to Cambridge into the future.

Regulations associated with the Safe Drinking Water Act has required that Asset Management and Sustainable Financial Plans are developed that take into account aging infrastructure and all aspects of the water system. Bill 72 (2011) has recently extended those requirements to the sewage and drainage services. This legislation has provided guidance that has assisted Cambridge in developing a funding plan that fully addresses the needs of a sustainable safe drinking water supply and sewage services.

Following Cambridge's 2007 State of Infrastructure Report [vi] that identified significant backlog in Capital renewal and operating deficits, and Cost of Servicing and Long Range Financial Plan (10 yr horizon) was commissioned with BMA Management Consulting Inc. in 2009.

The long range financial plan incorporated updated figures on asset inventory identifying an estimated backlog of $54.3M in water and $17.5M in sanitary sewer linear assets keeping operating programs at same levels. The financial plan resulted in a proposed user rate increases ranging from 7 to 10% over a 10 year period. Financial projections showed that increases in funding would eliminate the renewal backlog in water within 15 years and the sanitary system backlog within 9 years. This plan incorporated the use of Gas Tax Funding to fund backlog in water renewal and other assets in the same location where full reconstruction was needed. Additionally, rate stabilization reserves, meter replacement reserve, capital renewal reserves, and an initial debenture of $5M to help advance the backlog of renewals were recommended.

This financial plan was submitted to the Province and has been adopted and implemented in Cambridge through annual rate increases as per the Sustainable Financial Plan. Currently, the plan is in it's forth year having had public and political support to significantly increase water and sewer rates by more then 28% in the past 3 years with an additional 9.5% approved increase for 2013. This funding plan is enabling Cambridge to incrementally address Operations/Maintenance/Inspection (OMI) deficits and address a backlog of capital renewal.

In September 2012, the Federation of Canadian Municipalities (FCM) released Canada's first report on the state of our Nation's infrastructure. In comparison, Cambridge is generally in better state then most municipalities.

The Canadian Infrastructure Report Card[ix] has estimated that the average household in Canada has a combined infrastructure deficit of $13,813 in water, stormwater, wastewater, and road infrastructure.

The ability for Cambridge to leverage its knowledge of infrastructure and re-designed business practices using best Asset Management practices has resulted in very positive improvements in infrastructure in relation to the average Canadian Municipality. It has also provided the means to effectively apply external funding opportunities that maximizing the value of those investments and, in the case of water/sewer, enabled Cambridge to build sustainable financial plans that addresses backlogs and maintenance deficits through phased-in rate increases as required by Provincial Legislation.

On average, Cambridge households are contributing $3,924 over the next 10 years to renew core infrastructure. $1,443 of this is through property taxation. This represents 10% of current Cambridge taxation revenue at 2011 rates. The remaining portion of capital renewal is funded through water and sewer rates.

City of Cambridge - Infrastructure Re-Investment Forecast **

	Tax Supported Infrastructure						Water / Sewer Rate Supported Infrastructure					
	Road Renewal / Reconstruciton		Bridge Renewal / Reconstruction		Drainage Renewal / Reconstruction		Water Renewal / Reconstruction *		Wastewater Renewal / Reconstruction *		Total Renewal/Reconstruction	
	Funded	Un-Funded	Funded	Un-Funded	Funded	Un-Funded	Funded	Un-Funded	Funded	Un-Funded	Funded	Un-Funded
2013	$3,091,000	$4,270,000	$400,000		$0	$2,400,000	$6,217,000		$4,403,000		$14,111,000	$6,670,000
2014	$3,115,000	$4,140,000	$400,000		$1,500,000	$2,650,000	$6,972,000		$2,535,000		$14,522,000	$6,790,000
2015	$2,786,000	$20,590,000	$500,000		$620,000	$3,150,000	$7,807,000		$2,690,000		$14,403,000	$23,740,000
2016	$3,832,000	$44,140,000	$475,000		$1,130,000	$3,150,000	$9,512,000		$2,745,000		$17,694,000	$47,290,000
2017	$4,355,000	$10,640,000	$625,000	$5,000,000	$1,729,000	$3,150,000	$9,607,000		$2,825,000		$19,141,000	$18,790,000
2018	$4,564,000	$4,140,000	$630,000		$1,100,000	$2,400,000	$10,347,000		$2,805,000		$19,446,000	$6,540,000
2019	$4,330,000	$4,140,000	$630,000		$1,164,000	$2,400,000	$10,637,000		$2,885,000		$19,646,000	$6,540,000
2020	$5,953,000	$4,140,000	$630,000		$1,843,000	$2,400,000	$10,797,000		$2,975,000		$22,198,000	$6,540,000
2021	$7,200,000	$4,140,000	$400,000		$1,500,000	$2,400,000	$7,602,000		$3,065,000		$19,767,000	$6,540,000
2022	$7,393,000	$4,140,000	$1,000,000	$5,000,000	$3,500,000	$2,400,000	$4,529,200		$3,155,000		$19,577,200	$11,540,000
	$46,619,000	**$104,480,000**	**$5,690,000**	**$10,000,000**	**$14,086,000**	**$26,500,000**	**$84,027,200**	**$0**	**$30,083,000**	**$0**	**$180,505,200**	**$140,980,000**
Avg Household Contribution & Deficit	$1,013	$2,271	$124	$341	$306	$576	$1,827	$0	$654	$0	$3,924	$3,065

** Water and Sewer Infrastructure Backlog in Capital and deferred maintenance is being addressed through aggressive annual rate increase between 9.8% and 7.2% annually for the next 7 years as detailed in the Sustainable Financial Plan submitted to the Province. Gas Tax Funding is primarily directed to water needs driven reconstruction and is included with the funding forecast.*

*** Estimated figures as of July 2012 based on initial draft of 2013 10 year capital forecast submission - funding allocation not adopted by Council*

An unfunded household infrastructure deficit is estimated to be $3,065. While this current state is substantially better then the average Canadian Municipality, it still presents a challenge to Cambridge as 44% of the needs remain unfunded in the current 10 year capital forecast.

It is important to note that the water system and sewer system is fully funded under the provincially approved sustainable financial plan that has embedded rate increases that address all projected capital and operating needs.

Roads, Bridges, and Drainage infrastructure remain significantly under-funded having property taxation as the primary source of funding at this time.

At this time, Federal support of infrastructure is being provided through the annual Gas Tax Grant and is being directed towards water needs driven reconstruction projects in which all infrastructure requires renewal in the same locations and have a history of water main failures. In this sense, Gas Tax Funding is equally contributing to water, sewer, storm, and road renewal backlogs beyond current taxation and rate revenues.

A fully funded financial strategy to address a backlog of road renewals, storm water management, bridges, and dams remains beyond the socially and political acceptable financial capacity of the current property taxation system. An annual compounding increase of approximately 3.6% each year for the next 10 years over and above inflation would be required to address this shortfall.

This level of increase is perceived to be beyond affordability to residents, particularly when water/sewer rates have already been aggressively raised for the past 4 consecutive years and will need to continue to be increased in the order of 6-8% annually for the foreseeable future.

Sustainable Funding for roads, drainage, bridges, and dams remain outstanding with significant backlogs and maintenance deficits.

FEDERAL AND PROVINCIAL SUPPORT

Cambridge has been able to leverage Provincial and Federal funding opportunities as listed:

Grant	Funding	Usage	Benefit
2006 Ontario Roads and Bridges Grant	$2,345,246	Reconstruction of a number of locations in the city	Replacement of water, sewer, drainage, and road infrastructure that had reached end of serviceable life.
2008 Investing in Ontario Act (IOA)	$5,764,344	Resurfacing of roads and bridge remediation.	Extended the life of a number of roads and bridges.
2008 Municipal Infrastructure Investment Initiative (MIII)	$1,703,000	Reconstruction of McKay & Ballantyne	Replacement of failed sanitary and storm infrastructure resolving ongoing issues of basement flooding and odour issues in areas south of this location.
2005 Federal Gas Tax Funding	$16,700,000 (2005-2011)	Full re-construction projects driven by water system needs, road renewal, Asset Management Capacity Building, Research and Development with Industry Partners. A full report is available as listed at the end of this document [x]	Ability to advance our knowledge of infrastructure to help implement Asset Management. Significant assistance addressing a backlog of water, sanitary, storm, and road needs. Advancement of renewal techniques of infrastructure and technological tools.
2009 Federal/Provincial/Municipal Stimulus Funding	$12,500,000 (equal contributions)	Road Resurfacing	Provided an opportunity to address a significant backlog of road surface renewal. Almost 10% of the city's roads were renewed under this funding program. The city issued debt to fund it's contribution for this work.

DEBT FINANCING

Cambridge has begun to leverage debt financing in a number of cases.

- Leveraging federal or provincial grant opportunities.
- Water system thin-walled cast iron pipe renewal program ($5M debt issued in 2011).

USER RATES

User rates have been adjusted for on-demand services (i.e. water on/off, service installs, sewage service clearing, etc..) related to water and sewer systems to reflect actual costs and expenses. Historically, many of the services were provided at subsidized flat-rate charges.

As noted in this document, a rate study and financial sustainable plan has also supported significant rate increase for water supply and sewage collection for both fixed charges and volume usage. At this time, this financial sustainable plan (10 yr horizon) is forecasting that water and sewer rate increases supplemented by ongoing Gas Tax Funding grants are supporting all short term needs operating and renewal needs including backlog.

A number of municipalities in Canada have begun a rate structure for storm water management. This approach will be considered within the 5 years to address the shortfalls in operations, maintenance, inspections (OMI) and capital renewal and remediation on drainage infrastructure.

There are no current user rates in place for other core infrastructure.

DEVELOPMENT CHARGES

Development charges will be reviewed and updated in 2013 utilizing inputs from recent Master Plans to ensure that revised demand estimates driven by growth and intensification are fairly funded by those development activities.

RESERVES

Cambridge utilizes reserves to fund various activities. With respect to core services, the following outlines the structure:

Water System

- Capital Reserve – Utilized to fund current and future capital projects. Funded annually through rates as well as prior year operating surpluses. Currently, this reserve is meeting only current needs and backlog, but is not at levels that will fund future renewal needs.

- Meter Reserve – Utilized to fund current and future meter replacements based on a 15 year renewal cycle. Funded annually at sustainable levels with expenditures for current stock of aged meters.

- Rate Stabilization Reserve – Funded annually through prior year operating surpluses (up to 50%) capped 5% of the operating budget. Currently, reserve is fully funded. Intent is to utilize this reserve for un-expected one-time operating expenses to prevent deficit being carried in to following year budgets as done prior to 2010.

Sewer System

- Capital Reserve – Utilized to fund current and future capital projects. Funded annually through rates as well as prior year operating surpluses. Currently, this reserve is meeting only current needs and backlog, but is not at levels that will fund future renewal needs.

- Rate Stabilization Reserve – Funded annually through prior year operating surpluses (up to 50%) capped at 10% of operating budget. Currently, reserve is fully funded. Intent is to utilize this reserve for un-expected one-time operating expenses to prevent deficit being carried in to following year budgets as done prior to 2010.

Roads, Bridges, Drainage

- Capital Reserve – a shared capital reserve at the corporate level. Funded annually through property taxation meeting 10 year approved capital forecast. Unfunded 10 year needs in the order of $140M for core infrastructure services.

ASSET RENEWAL FINANCIAL FORECASTING

Asset renewal forecasting is done at two levels: 10 Year Capital Plan and 80 Year Long-Range Forecast.

10 Year Capital Planning Forecast

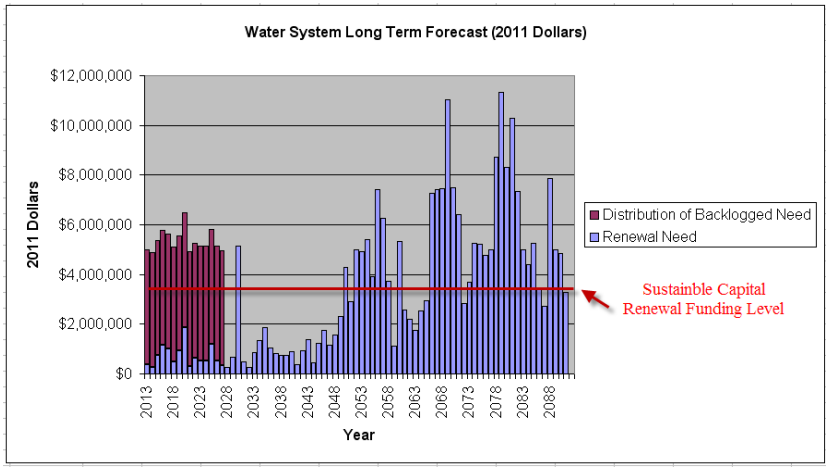
This is a public and Council endorsed plan that address short term financing needs for infrastructure through an annual official budget process.
The infrastructure needs are based on systematic integrated condition assessment process in which infrastructure needs based on condition are reviewed and prioritized and matched to available funding.

Typically, specific projects are identified in the 10 Year Capital Forecast document for a period of 5 years. Allocations for renewal are identified for years 6-10 based on condition-based needs assessments, estimates, and projected available funding. Some particularly large or contentious project may be identified and listed in years 6-10.

At this time, unfunded infrastructure renewal needs are not published as part of the budget process, but are identified within Asset Management. Many of these projects have been, or in process of, preliminary design to enable the project to start-up in relatively short time should additional funding opportunities become available.

80 Year Capital Planning Forecast

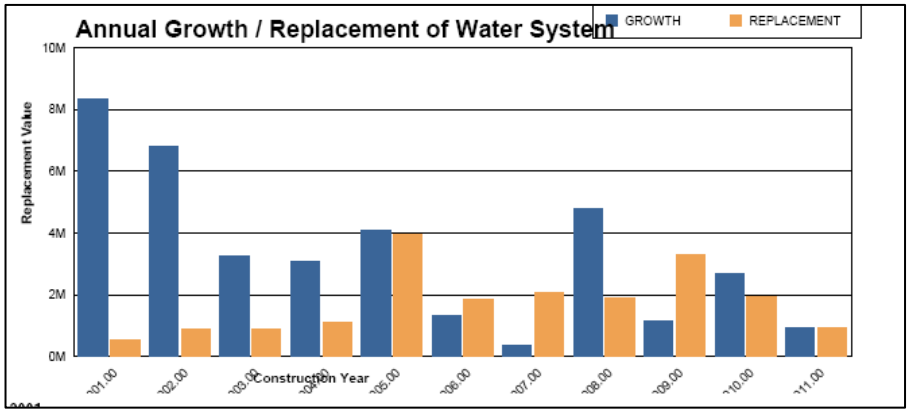
Forecast of infrastructure renewal needs are calculated annually based on current replacement value, funded and un-funded infrastructure needs, and supplemented with life-cycle estimates. These forecasts are done on individual infrastructure groups. Although not used to set rates, it provides insight into the degree of infrastructure renewal activity that needs to occur beyond the 10 year capital project plan adopted by Council. It provides a perspective that is used to identify the effect of carrying a backlog of renewal into the future. An example is shown to the right.

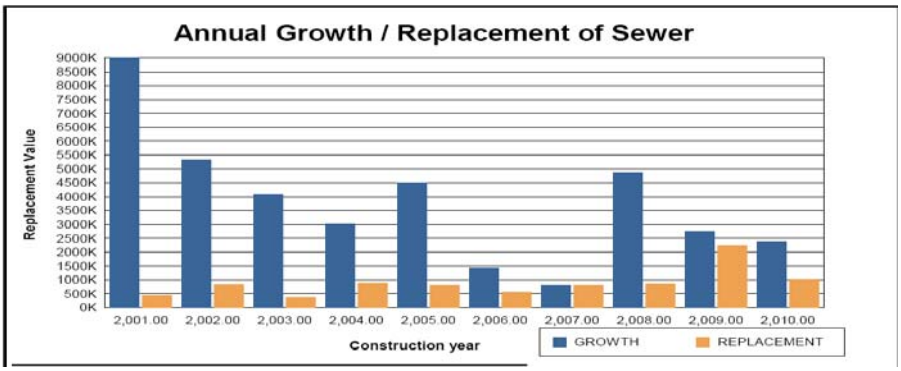


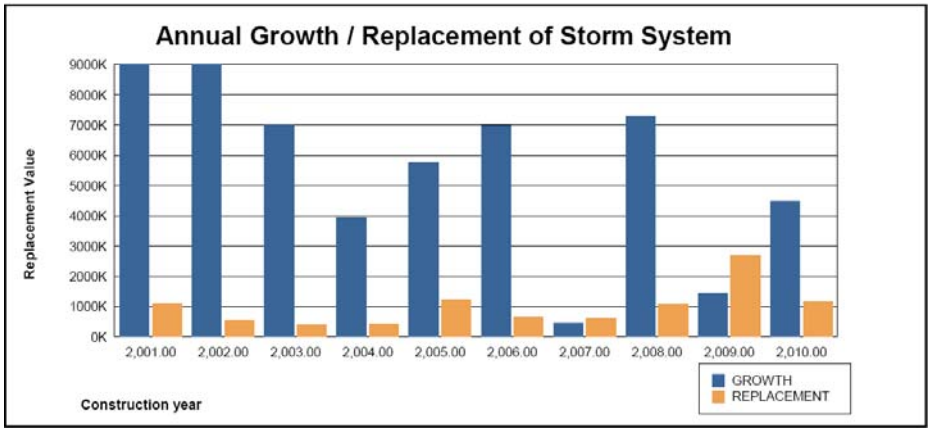
This information is a primary input to setting rates to fund current capital renewal along with building reserves that will address immediate and longer term renewal activities and provide a financial net for unexpected expenses.

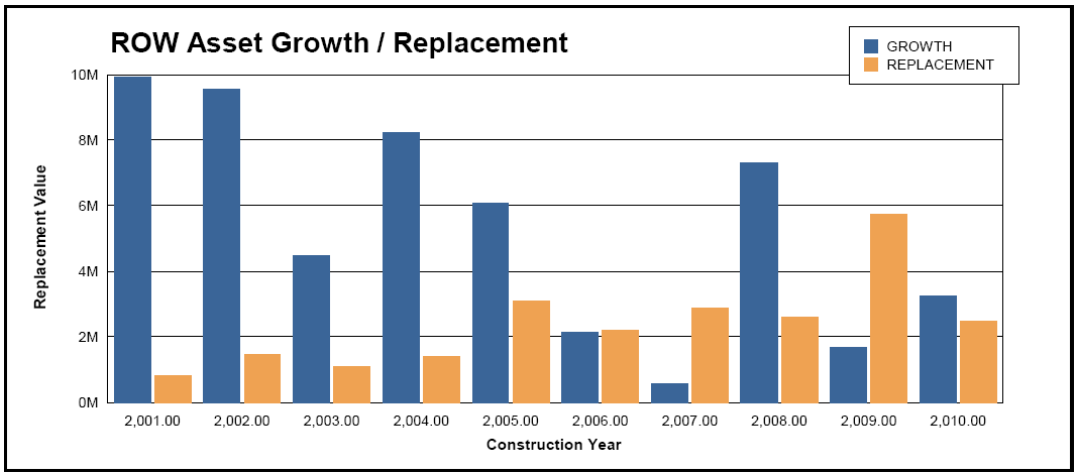
APPENDIX A – GROWTH AND RENEWAL OF INFRASTRUCTURE

As reflected in Cambridge's official plan and through Ontario's Places to Grow Program, the expansion of urban areas will continue to decline in comparison to historic growth. As expansion of urban areas decline, population and employment are expected to continue to grow through intensification of existing urbanized areas. Additionally, through the asset management implementation process, it is becoming clear that the need to renew existing infrastructure is beginning to exceed growth through expansion activities. Through increased funding from local rates and taxes as well as the support of Federal and Provincial programs, a significant increase in renewal activity has begun. A 10 year trend of infrastructure growth vs renewal using information from Cambridge's Asset Registry provides perspective to what degree that has occurred. 10 year capital forecasts continue to support this trend.









In recent years, significant investment has been made in road resurfacing. The implementation of Asset Management and investments in inventory and condition assessments of underground infrastructure between 2005 and 2007 provided a comprehensive understanding of core service infrastructure. This knowledge enabled Cambridge to identify roads that would benefit from re-surfacing with minimal risk of underground repairs or renewals taking place within 10-15 years. Provincial and Federal funding opportunities were then directed towards this inventory of roads ensuring a sound investment in road renewal activities.

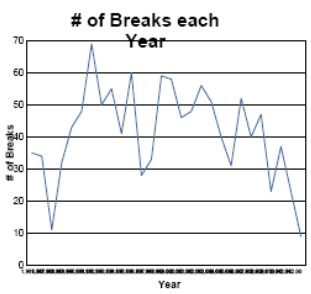
Road Resurface

	Length	Lane-Km	Pavement replacement Value
2005	102.00	0.20	25,743
2006	1,305.70	2.67	574,713
2007	1,757.80	4.64	788,023
2008	9,301.20	19.23	3,317,142
2009	34,721.70	72.50	13,712,479
2010	18,419.90	38.28	6,787,102
2011	2,593.50	5.19	850,451
2012	1,754.10	3.51	630,207
Grand Total:	69955.90	146.22	26,685,859

APPENDIX B – METRICS

A few examples of standard metrics produced in the implemented system. A number of other metrics are reported through NWWBI and ad-hoc as required.

Year	Breaks
1986	35
1987	34
1988	11
1989	32
1990	43
1991	48
1992	69
1993	50
1994	55
1995	41
1996	60
1997	28
1998	33
1999	59
2000	58
2001	46
2002	48
2003	56
2004	51
2005	40
2006	31
2007	52
2008	40
2009	47
2010	23
2011	37
2012	23
	9



Source: Asset Inventory - Water Break History

YEAR	MIN_DAY_SUPPLY	MAX_DAY_SUPPLY	AVG_DAY_SUPPLY	TOTAL_SUPPLY
1994	0.00	58,573.00	46,627.00	17,018,702.81
1995	0.00	72,699.00	45,865.00	16,740,543.78
1996	0.00	60,880.00	46,988.00	17,197,458.80
1997	0.00	64,414.00	46,348.00	16,916,918.57
1998	0.00	64,379.00	49,302.00	17,995,096.64
1999	0.00	78,247.00	52,680.00	19,228,232.36
2000	0.00	60,945.00	50,383.00	18,440,050.14
2001	40,745.00	70,322.00	52,515.00	19,167,908.34
2002	39,257.00	74,453.00	52,550.00	19,180,741.09
2003	34,500.00	71,708.00	50,846.00	18,558,771.26
2004	38,884.00	63,003.00	51,944.00	19,011,569.56
2005	40,117.00	70,029.00	51,477.00	18,788,928.76
2006	33,586.00	62,113.00	48,915.00	17,853,951.76
2007	39,578.00	65,646.00	49,137.00	17,934,988.84
2008	36,209.00	62,280.00	48,600.00	17,787,475.93
2009	38,333.00	59,515.00	47,086.00	17,186,406.14
2010	32,394.00	62,491.00	44,438.00	16,220,019.00
2011	33,624.00	52,896.00	42,182.00	15,396,519.00

Water Service Break History

BREAK_YEAR	BREAKS
2005	84
2006	254
2007	178
2008	192
2009	252
2010	259
2011	270
2012	264

Source: Asset Inventory - Water Service Break History

Main Break Analysis

Breaks	Material	Pipe Construction Decade
363	CAST IRON	
242	CAST IRON	1960
156	CAST IRON	1950
142	CAST IRON	1970
40	CAST IRON	1920
37	CAST IRON	1980
33	CAST IRON	1940
20	PVC	2000
18	DUCTILE IRON	1980
16	CAST IRON	1990
16	DUCTILE IRON	1990
15	CAST IRON	1930
12	DUCTILE IRON	1970
7		
6	DUCTILE IRON	1960
6	STEEL	1960
5	DUCTILE IRON	1920
5		1960
4	CAST IRON	2000
2	PVC	
2		1900
2	DUCTILE IRON	2000
2	DUCTILE IRON	
1	PVC	1980
1	DUCTILE IRON	1940
1	PVC	1970
1	PVC	1960
1		1980
1	ASBESTOS CEM	
1	ASBESTOS CEM	1970
1	PVC	1990

Source: Asset Inventory - Water Break History

Water Supply Statistics

YEAR	Supplied By Region (m3)	Total Metered Consumption	Accounts	Estimated Outdoor Usage *	Single Family Consumption	Multi-Family Consumption	# of Residential Accounts	Avg Daily SF Use per Account **	# of Heavy Users ***	Apparent Loss % ****	# of Days Above 30C	Total Rainfall (mm)	# of Rain days	Avg Mean Daily Temp
1994	17,018,703										10	578	93	6.2
1995	16,740,544										42	768	97	8.0
1996	17,197,459										13	1,008	111	7.3
1997	16,916,919										22	681	99	7.6
1998	17,995,097										41	632	86	10.1
1999	19,228,232										35	700	89	9.0
2000	18,440,050										8	837	108	8.2
2001	19,167,908										44	707	100	9.2
2002	19,180,741	15,464,088	37,308	1,005,147	7,277,219	2,189,951	34,497.00	0.72	9	19.4	56	610	98	9.2
2003	18,558,771	15,373,509	37,308	765,153	7,220,546	2,218,932	34,497.00	0.68	7	17.2	29	773	96	7.9
2004	19,011,570	15,571,698	37,308	684,690	7,221,114	2,241,238	34,497.00	0.63	8	18.1	17	716	111	7.9
2005	18,788,929	15,344,202	37,308	817,761	7,353,068	2,214,626	34,497.00	0.60	7	18.3	55	692	88	8.7
2006	17,853,952	14,821,131	37,308	752,665	7,113,589	2,180,044	34,497.00	0.64	7	17.0	37	1,119	124	9.5
2007	17,934,989	15,219,104	37,692	1,001,717	7,210,450	2,185,848	34,798.00	0.67	7	15.1	53	600	95	8.7
2008	17,787,476	14,253,250	38,385	566,743	6,713,381	2,138,720	34,972.00	0.58	5	19.9	29	953	129	8.0
2009	17,186,406	12,957,853	37,427	523,484	6,346,521	2,030,574	34,743.00	0.59	3	24.6	17	906	119	7.9
2010	16,220,019	13,167,851	37,767	313,003	6,176,402	2,335,800	35,439.00	0.52	4	18.8	31	851	99	10.1
2011	15,396,519	12,956,497	41,760	423,686	6,012,504	2,075,876	39,133.00	0.45	3	15.8	8	856	128	8.2

** Total of summer flow above avg of (Apr,May,Oct,Nov) baseline flow. ** Only SF Accounts not showding outdoor usage pattern is reflected here. *** Customers using over 100,000 m3 in the year*
***** Value would include accounted unmetered flow (i.e. fire suppression, swabbing/flushing, etc..*

Source: Asset Inventory - Monthly pro-rated Water Consumption History (Billing System), Daily Water Supply (Region of Waterloo), Daily Climate Data (Grand River Conservation Authority), Consumption Classifications (MPAC Building Codes), Corporate Parcel Database

Annual Sewage Treatment Statistics

YEAR	Sewage Treated	Total Water Supplied (m3)	Sewage Volume *	Total Precipitation (mm)	Estimated Inflow & Infiltration (m3)	Inflow and Infiltration % by Volume
2002	17,964,737	19,180,741	14,458,941	722	3,505,796	20%
2003	18,148,585	18,558,771	14,608,356	905	3,540,229	20%
2004	18,754,899	19,011,570	14,887,009	829	3,867,890	21%
2005	18,337,180	18,788,929	14,526,441	844	3,810,739	21%
2006	18,885,444	17,853,952	14,068,467	1,173	4,816,977	26%
2007	19,814,006	17,934,989	14,217,387	719	5,596,619	28%
2008	20,963,513	17,787,476	13,686,507	1,201	7,277,006	35%
2009	20,432,039	17,186,406	12,434,370	1,009	7,997,669	39%
2010	18,339,234	16,220,019	12,811,169	916	5,528,065	30%
2011	18,893,101	15,396,519	12,480,603	1,024	6,412,498	34%

* Metered Water Consumption Volume subtract Estimated Outdoor Use Water Volume

Source: Daily Treatment Volumes (Region of Waterloo), Account Monthly Water Consumption History (Water Billing System), Daily Climate Data (GRCA Shades Mills Weather Station)

APPENDIX C – TCA CONTROL PROCESS

Project Id:1291 CLARE AVENUE SANITARY SEWER

CLARE AVE FROM BERNHARDT TO ROSE

Project Type: RECONSTRUCTION

Project Status: COMPLETED

Project Description: REPLACEMENT OR UPGRADING OF EXISITNG SANITARY SEWER AS REQUIRED DUE TO DETERIORATION, ADDITIONAL CAPACITY, ETC. IN CONJUNCTION WITH OTHER WORKS.

Financial Status:CLOSED

Project Driver:DETERIORATION

Asset Driver:COMBINATION

Tender No:

Construction Year: 2005

Project Management: CAMBRIDGE

Project Consultant:

Primary Contractor:

City Contact:

Consultant Contact:

Contractor Contact:

Region Contact:

Survey Completion Date:

Design Approval Date:

Substantial Completion Date:

Warranty End Date:

Summary Of Project Locations	Water Value	Sewer Value	Drainage Value	ROW Value
RS17505 CLARE AVE : CLARE AVE - BERNHARDT ST	$105,471	$89,344	$8,490	$141,136
RS17312 CLARE AVE : CLARE AVE - CLARE AVE	$43,383	$43,452	$33,927	$72,207
RS17311 CLARE AVE : CLARE AVE - CLARE AVE	$50,684	$57,695	$10,533	$68,591
RS17313 CLARE AVE : ROSE ST - CLARE AVE	$25,052	$27,714	$28,342	$45,318
$851,337	**$224,589**	**$218,205**	**$81,292**	**$327,251**

Engineering Comments:

Operations Comments:

Asset Mgmt Comments:

Storm System Desc:	Sanitary System Desc:	Water System Desc:	Road Desc:
Storm System Length (m):	San System Length (m) :	Water System Length (m):	Road Lane*km : / Pavement M^2:
Storm System Remaining Years:	San System Remaining Years:	Water System Remaining Years:	Years Remaining:
Storm System Years Added:	San System Years Added:	Water System Years Added:	Road Years Added:

Asset Information Source Summary

Source Documentation	Project #	Construction / Revision Date	Drawing Category / Status	Comments
A380-2	1291	01-Jun-2005 / 17-Jul-2009	PLAN AND PROFILE - AS BUILT	
A380-1D	1291	01-Jun-2005 / 26-Sep-2008	PLAN AND PROFILE - AS BUILT	

TCA Assets Related to this Project @ **RS17311 CLARE AVE : CLARE AVE - CLARE AVE**

	TCA Class / Category	Qty	Ownership	Physical Status	Install Year	Replacement Value *	# of Physical Assets	Life Cycle Funding	TCA Status	FIR Code
Consolidated Asset	**14 1027 - Road - Urban**	**0.20 lane*km**	**CAMBRIDGE**	**IN SERVICE**	**2005**	**$68,591**	**4**	**CAPITAL**	**2**	
Components	*RS17311 PAVEMENT*	*0.2 lane-km*		*1043 m^2*		*$33,795*	*CLARE AVE: CLARE AVE-CLARE AVE*			
	RC11548 PAVEMENT EDGE	*120.0 M*		*2.35 blvd width (m)*	*CONCRETE CURB*	*$10,546*	*CLARE AVE: CLARE AVE-CLARE AVE*		*A380-1D*	
	RC14717 PAVEMENT EDGE	*77.6 M*		*0 blvd width (m)*	*CONCRETE CURB*	*$7,031*	*CLARE AVE: CLARE AVE-CLARE AVE*		*A380-1D*	
	RK1181 SIDEWALK	*123.7 M*		*1.2 width (m)*	*CONCRETE*	*$17,219*	*CLARE AVE: CLARE AVE-CLARE AVE*		*A380-1D*	
Consolidated Asset	**19 1043 - Sewer - Plastic**	**112.20 m**	**CAMBRIDGE**	**IN SERVICE**	**2005**	**$57,695**	**13**	**CAPITAL**	**2**	
Components	*SM13343 SANITARY MANHOLE*	*1.0 EACH*		*3.25 x 1200 depth(m) x width(mm)*		*$5,208*	*1032 CLARE AVE*		*A380-1D*	
	SM13344 SANITARY MANHOLE	*1.0 EACH*		*3 x 1200 depth(m) x width(mm)*		*$5,455*	*1060 CLARE AVE*		*A380-1D*	
	SM13345 SANITARY MANHOLE	*1.0 EACH*		*2 x 1200 depth(m) x width(mm)*		*$4,296*	*1072 CLARE AVE*		*A380-1D*	
	SP12884 SANITARY PIPE	*39.4 M*		*200 PVC*		*$10,858*	*CLARE AVE: -*		*A380-1D*	
	SP12885 SANITARY PIPE	*41.4 M*		*200 PVC*		*$12,374*	*CLARE AVE: -*		*A380-1D*	
	SP12886 SANITARY PIPE	*31.4 M*		*200 PVC*		*$8,654*	*CLARE AVE: -*		*A380-1D*	
	SS47934 SANITARY SERVICE	*1.0 EACH*		*100 mm PVC*		*$1,550*	*1084 CLARE AVE*		*A380-1D*	
	SS47936 SANITARY SERVICE	*1.0 EACH*		*100 mm PVC*		*$1,550*	*1072 CLARE AVE*		*A380-1D*	
	SS47937 SANITARY SERVICE	*1.0 EACH*		*100 mm PVC*		*$1,550*	*1060 CLARE AVE*		*A380-1D*	
	SS47938 SANITARY SERVICE	*1.0 EACH*		*100 mm PVC*		*$1,550*	*1032 CLARE AVE*		*A380-1D*	
	SS47939 SANITARY SERVICE	*1.0 EACH*		*100 mm PVC*		*$1,550*	*1016 CLARE AVE*		*A380-1D*	
	SS47940 SANITARY SERVICE	*1.0 EACH*		*100 mm PVC*		*$1,550*	*1006 CLARE AVE*		*A380-2*	
	SS47941 SANITARY SERVICE	*1.0 EACH*		*100 mm PVC*		*$1,550*	*1044 CLARE AVE*		*A380-1D*	
Consolidated Asset	**20 1046 - Storm - Plastic**	**0.00 m**	**CAMBRIDGE**	**IN SERVICE**	**2005**	**$10,533**	**5**	**OPERATING**	**2**	
Components	*DC12036 STORM CATCHBASIN*	*1.0 EACH*				*$2,118*	*1016 CLARE AVE*		*A380-1D*	
	DC12037 STORM CATCHBASIN	*1.0 EACH*				*$2,118*	*1016 CLARE AVE*		*A380-1D*	
	DL10657 STORM LEAD	*8.8 M*				*$1,352*	*CLARE AVE: -*		*A380-1D*	
	DL10814 STORM LEAD	*3.2 M*				*$576*	*CLARE AVE: -*		*A380-1D*	
	DM11827 STORM MANHOLE	*1.0 EACH*				*$4,370*	*1006 CLARE AVE*		*A380-2*	
Consolidated Asset	**21 1049 - Water - Plastic**	**103.90 m**	**CAMBRIDGE**	**IN SERVICE**	**2005**	**$50,684**	**13**	**CAPITAL**	**2**	
Components	*WJ12371 WATER JUNCTION*	*1.0 EACH*				*$574*	*1077 CLARE AVE*		*A380-2*	
	WP38215 WATER PIPE	*1.1 m*		*100 PVC*		*$369*	*CLARE AVE: CLARE AVE-CLARE AVE*		*A380-1D*	
	WP38217 WATER PIPE	*1.7 m*		*100 PVC*		*$571*	*CLARE AVE: CLARE AVE-CLARE AVE*		*A380-1D*	
	WP38220 WATER PIPE	*101.1 m*		*100 PVC*		*$34,859*	*CLARE AVE: CLARE AVE-CLARE AVE*		*A380-1D*	
	WS3041721 WATER SERVICE	*11.5 m*				*$1,614*	*1084 CLARE AVE*		*A380-1D*	
	WS3041722 WATER SERVICE	*11.3 m*				*$1,612*	*1072 CLARE AVE*		*A380-1D*	
	WS3041723 WATER SERVICE	*13.5 m*				*$1,638*	*1060 CLARE AVE*		*A380-1D*	
	WS3041724 WATER SERVICE	*11.4 m*				*$1,613*	*1044 CLARE AVE*		*A380-1D*	
	WS3041725 WATER SERVICE	*9.5 m*				*$1,590*	*1032 CLARE AVE*		*A380-1D*	
	WS3041726 WATER SERVICE	*15.2 m*				*$1,982*	*1016 CLARE AVE*		*A380-1D*	
	WS3042470 WATER SERVICE	*9.4 m*				*$1,589*	*1006 CLARE AVE*		*A380-2*	
	WV15045 WATER VALVE	*1.0 EACH*				*$1,337*	*1077 CLARE AVE*		*A380-1D*	
	WV15047 WATER VALVE	*1.0 EACH*				*$1,337*	*1017 CLARE AVE*		*A380-1D*	

*** Replacement Value: Estimated using avg unit costs of recent tenders assuming current standard materials and replacement of same asset in same location in same position. Actual replacement costs will vary according to specific site conditions and scenarios**

TCA Assets Related to this Project @ **RS17312 CLARE AVE : CLARE AVE - CLARE AVE**

	TCA Class / Category	Qty	Ownership	Physical Status	Install Year	Replacement Value *	# of Physical Assets	Life Cycle Funding	TCA Status	FIR Code
Consolidated Asset	**14 1027 - Road - Urban**	**0.20 lane*km**	**CAMBRIDGE**	**IN SERVICE**	**2005**	**$72,207**	**4**	**CAPITAL**	**2**	
Components	*RS17312 PAVEMENT*	*0.2 lane-km*		*1254 m^2*		*$39,488*	*CLARE AVE: CLARE AVE-CLARE AVE*			
	RC13914 PAVEMENT EDGE	*114.1 M*		*2.4 blvd width (m)*	*CONCRETE CURB*	*$10,128*	*CLARE AVE: CLARE AVE-CLARE AVE*		*A380-2*	
	RC17073 PAVEMENT EDGE	*74.8 M*		*0 blvd width (m)*	*CONCRETE CURB*	*$6,833*	*CLARE AVE: CLARE AVE-CLARE AVE*		*A380-2*	
	RK1182 SIDEWALK	*113.2 M*		*1.2 width (m)*	*CONCRETE*	*$15,757*	*CLARE AVE: CLARE AVE-CLARE AVE*		*A380-2*	
Consolidated Asset	**19 1043 - Sewer - Plastic**	**110.30 m**	**CAMBRIDGE**	**IN SERVICE**	**2005**	**$43,452**	**9**	**OPERATING**	**2**	
Components	*SM13347 SANITARY MANHOLE*	*1.0 EACH*		*3.32 x 1200 depth(m) x width(mm)*		*$5,301*	*1067 CLARE AVE*		*A380-2*	
	SP11527 SANITARY PIPE	*110.3 M*		*200 PVC*		*$27,301*	*CLARE AVE: -*		*A380-2*	
	SS47935 SANITARY SERVICE	*1.0 EACH*		*100 mm PVC*		*$1,550*	*1077 CLARE AVE*		*A380-2*	
	SS48509 SANITARY SERVICE	*1.0 EACH*		*100 mm PVC*		*$1,550*	*1067 CLARE AVE*		*A380-2*	
	SS48510 SANITARY SERVICE	*1.0 EACH*		*100 mm PVC*		*$1,550*	*1057 CLARE AVE*		*A380-2*	
	SS48511 SANITARY SERVICE	*1.0 EACH*		*100 mm PVC*		*$1,550*	*1047 CLARE AVE*		*A380-2*	
	SS48512 SANITARY SERVICE	*1.0 EACH*		*100 mm PVC*		*$1,550*	*1037 CLARE AVE*		*A380-2*	
	SS48513 SANITARY SERVICE	*1.0 EACH*		*100 mm PVC*		*$1,550*	*1027 CLARE AVE*		*A380-2*	
	SS48514 SANITARY SERVICE	*1.0 EACH*		*100 mm PVC*		*$1,550*	*1017 CLARE AVE*		*A380-2*	
Consolidated Asset	**20 1046 - Storm - Plastic**	**93.80 m**	**CAMBRIDGE**	**IN SERVICE**	**2005**	**$33,927**	**4**	**OPERATING**	**2**	
Components	*DC12035 STORM CATCHBASIN*	*1.0 EACH*				*$2,118*	*1027 CLARE AVE*		*A380-2*	
	DL10815 STORM LEAD	*10.7 M*				*$1,644*	*CLARE AVE: -*		*A380-2*	
	DM11831 STORM MANHOLE	*1.0 EACH*				*$4,851*	*1027 CLARE AVE*		*A380-2*	
	DP10704 STORM PIPE	*93.8 M*		*300 PVC*		*$25,314*	*CLARE AVE: -*		*A380-2*	
Consolidated Asset	**21 1049 - Water - Plastic**	**87.40 m**	**CAMBRIDGE**	**IN SERVICE**	**2005**	**$43,383**	**13**	**OPERATING**	**2**	
Components	*WJ12372 WATER JUNCTION*	*1.0 EACH*				*$574*	*1017 CLARE AVE*		*A380-2*	
	WP38216 WATER PIPE	*1.6 m*		*150 PVC*		*$537*	*CLARE AVE: CLARE AVE-CLARE AVE*		*A380-2*	
	WP38218 WATER PIPE	*1.7 m*		*150 PVC*		*$571*	*CLARE AVE: CLARE AVE-CLARE AVE*		*A380-2*	
	WP38219 WATER PIPE	*84.1 m*		*150 PVC*		*$28,233*	*CLARE AVE: CLARE AVE-CLARE AVE*		*A380-2*	
	WS3041699 WATER SERVICE	*6.2 m*				*$1,550*	*1047 CLARE AVE*		*A380-2*	
	WS3041700 WATER SERVICE	*6.8 m*				*$1,558*	*1057 CLARE AVE*		*A380-2*	
	WS3041701 WATER SERVICE	*6.0 m*				*$1,548*	*1067 CLARE AVE*		*A380-2*	
	WS3041702 WATER SERVICE	*6.5 m*				*$1,554*	*1077 CLARE AVE*		*A380-2*	
	WS3043136 WATER SERVICE	*4.2 m*				*$1,526*	*1017 CLARE AVE*		*A380-2*	
	WS3043137 WATER SERVICE	*4.2 m*				*$1,526*	*1027 CLARE AVE*		*A380-2*	
	WS3043138 WATER SERVICE	*4.6 m*				*$1,531*	*1037 CLARE AVE*		*A380-2*	
	WV15044 WATER VALVE	*1.0 EACH*				*$1,337*	*1077 CLARE AVE*		*A380-2*	
	WV15048 WATER VALVE	*1.0 EACH*				*$1,337*	*1017 CLARE AVE*		*A380-2*	

*** Replacement Value: Estimated using avg unit costs of recent tenders assuming current standard materials and replacement of same asset in same location in same position. Actual replacement costs will vary according to specific site conditions and scenarios**

TCA Assets Related to this Project @ **RS17313 CLARE AVE : ROSE ST - CLARE AVE**

	TCA Class / Category	Qty	Ownership	Physical Status	Install Year	Replacement Value *	# of Physical Assets	Life Cycle Funding	TCA Status	FIR Code
Consolidated Asset	**14 1027 - Road - Urban**	**0.10 lane*km**	**CAMBRIDGE**	**IN SERVICE**	**2005**	**$45,318**	**7**	**OPERATING**	**2**	
Components	*RS17313 PAVEMENT*	*0.1 lane-km*		*726 m^2*		*$22,883*	*CLARE AVE: ROSE ST-CLARE AVE*			
	RC15507 PAVEMENT EDGE	*52.6 M*		*2.36 blvd width (m)*	*CONCRETE CURB*	*$3,724*	*CLARE AVE: ROSE ST-CLARE AVE*		*A380-2*	
	RC16279 PAVEMENT EDGE	*52.8 M*		*2.47 blvd width (m)*	*CONCRETE CURB*	*$4,251*	*CLARE AVE: ROSE ST-CLARE AVE*		*A380-2*	
	RK1183 SIDEWALK	*50.7 M*		*1.2 width (m)*	*CONCRETE*	*$7,057*	*CLARE AVE: ROSE ST-CLARE AVE*		*A380-2*	
	RK1184 SIDEWALK	*50.7 M*		*1.2 width (m)*	*CONCRETE*	*$7,057*	*CLARE AVE: ROSE ST-CLARE AVE*		*A380-2*	
	RT6555 SIGN	*1.0 EACH*	*GUIDE AND INFORMATION Sign Category*		*UTILITY POLE*	*$173*	*CLARE AVE: ROSE ST-CLARE AVE*		*A380-2*	
	RT6556 SIGN	*1.0 EACH*	*REGULATORY Sign Category*		*U CHANNEL*	*$173*	*CLARE AVE: ROSE ST-CLARE AVE*		*A380-2*	
Consolidated Asset	**19 1043 - Sewer - Plastic**	**49.00 m**	**CAMBRIDGE**	**IN SERVICE**	**2005**	**$27,714**	**4**	**OPERATING**	**2**	
Components	*SM13274 SANITARY MANHOLE*	*1.0 EACH*	*3.11 x 1200 depth(m) x width(mm)*			*$5,301*	*1007 CLARE AVE*		*A380-2*	
	SM15496 SANITARY MANHOLE	*1.0 EACH*	*4.32 x depth(m) x width(mm)*			*$6,216*	*1054 ROSE ST*		*A380-2*	
	SP11428 SANITARY PIPE	*49.0 M*		*200*	*PVC*	*$14,647*	*CLARE AVE: ROSE ST-*		*A380-2*	
	SS48589 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*	*$1,550*	*1007 CLARE AVE*		*A380-2*	
Consolidated Asset	**20 1046 - Storm - Plastic**	**83.80 m**	**CAMBRIDGE**	**IN SERVICE**	**2005**	**$28,342**	**5**	**OPERATING**	**2**	
Components	*DC12034 STORM CATCHBASIN*	*1.0 EACH*				*$2,118*	*1007 CLARE AVE*		*A380-2*	
	DL18393 STORM LEAD	*11.3 M*				*$1,736*	*CLARE AVE: ROSE ST-*		*A380-2*	
	DM11826 STORM MANHOLE	*1.0 EACH*				*$5,297*	*1054 ROSE ST*		*A380-2*	
	DP10701 STORM PIPE	*15.5 M*		*300*	*PVC*	*$3,550*	*CLARE AVE: ROSE ST-*		*A380-2*	
	DP10703 STORM PIPE	*68.3 M*		*300*	*PVC*	*$15,642*	*CLARE AVE: ROSE ST-*		*A380-2*	
Consolidated Asset	**21 1049 - Water - Plastic**	**69.90 m**	**CAMBRIDGE**	**IN SERVICE**	**2005**	**$25,052**	**5**	**OPERATING**	**2**	
Components	*WJ12373 WATER JUNCTION*	*1.0 EACH*				*$574*	*1054 CLARE AVE*		*A380-2*	
	WP38223 WATER PIPE	*3.3 m*		*150*	*PVC*	*$960*	*CLARE AVE: CLARE AVE-BERNHARDT ST*		*A380-2*	
	WP38224 WATER PIPE	*66.6 m*		*150*	*PVC*	*$20,626*	*CLARE AVE: ROSE ST-CLARE AVE*		*A380-2*	
	WS3042471 WATER SERVICE	*6.6 m*				*$1,555*	*1007 CLARE AVE*		*A380-2*	
	WV15051 WATER VALVE	*1.0 EACH*				*$1,337*	*1039 CLARE AVE*		*A380-2*	

*** Replacement Value: Estimated using avg unit costs of recent tenders assuming current standard materials and replacement of same asset in same location in same position. Actual replacement costs will vary according to specific site conditions and scenarios**

TCA Assets Related to this Project @ **RS17505 CLARE AVE : CLARE AVE - BERNHARDT ST**

	TCA Class / Category	Qty	Ownership	Physical Status	Install Year	Replacement Value *	# of Physical Assets	Life Cycle Funding	TCA Status	FIR Code
Consolidated Asset	**14 1027 - Road - Urban**	**0.30 lane*km**	**CAMBRIDGE**	**IN SERVICE**	**2005**	**$141,136**	**6**	**CAPITAL**	**2**	
Components	*RS17505 PAVEMENT*	*0.3 lane-km*		*2043 m^2*		*$66,206*	*CLARE AVE: CLARE AVE-BERNHARDT ST*			
	RC12341 PAVEMENT EDGE	*156.6 M*		*2.3 blvd width (m)*	*CONCRETE CURB*	*$15,699*	*CLARE AVE: CLARE AVE-BERNHARDT ST*		*A380-2*	
	RC12343 PAVEMENT EDGE	*155.6 M*		*2.2 blvd width (m)*	*CONCRETE CURB*	*$15,628*	*CLARE AVE: CLARE AVE-BERNHARDT ST*		*A380-2*	
	RK1216 SIDEWALK	*157.9 M*		*1.2 width (m)*	*CONCRETE*	*$21,980*	*CLARE AVE: CLARE AVE-BERNHARDT ST*		*A380-2*	
	RK1217 SIDEWALK	*154.1 M*		*1.2 width (m)*	*CONCRETE*	*$21,451*	*CLARE AVE: CLARE AVE-BERNHARDT ST*		*A380-2*	
	RT6826 SIGN	*1.0 EACH*	*REGULATORY Sign Category*		*U CHANNEL*	*$173*	*CLARE AVE: CLARE AVE-BERNHARDT ST*		*A380-2*	
Consolidated Asset	**19 1043 - Sewer - Plastic**	**157.10 m**	**CAMBRIDGE**	**IN SERVICE**	**2005**	**$89,344**	**22**	**CAPITAL**	**2**	
Components	*SM13348 SANITARY MANHOLE*	*1.0 EACH*	*3.08 x 1200 depth(m) x width(mm)*			*$5,141*	*1117 CLARE AVE*		*A380-2*	
	SM13349 SANITARY MANHOLE	*1.0 EACH*	*2.26 x 1200 depth(m) x width(mm)*			*$4,296*	*1179 CLARE AVE*		*A380-2*	
	SP12887 SANITARY PIPE	*80.9 M*		*200*	*PVC*	*$26,501*	*CLARE AVE: -BERNHARDT ST*		*A380-2*	
	SP12888 SANITARY PIPE	*76.2 M*		*200*	*PVC*	*$25,506*	*CLARE AVE: -BERNHARDT ST*		*A380-2*	
	SS47912 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*	*$1,550*	*1178 CLARE AVE*		*A380-2*	
	SS47913 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*	*$1,550*	*1179 CLARE AVE*		*A380-2*	
	SS47914 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*	*$1,550*	*1167 CLARE AVE*		*A380-2*	
	SS47915 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*	*$1,550*	*1166 CLARE AVE*		*A380-2*	
	SS47916 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*	*$1,550*	*1157 CLARE AVE*		*A380-2*	
	SS47917 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*	*$1,550*	*1156 CLARE AVE*		*A380-2*	
	SS47918 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*	*$1,550*	*1146 CLARE AVE*		*A380-2*	
	SS47919 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*	*$1,550*	*1147 CLARE AVE*		*A380-2*	
	SS47920 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*	*$1,550*	*1134 CLARE AVE*		*A380-2*	
	SS47921 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*	*$1,550*	*1127 CLARE AVE*		*A380-2*	
	SS47922 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*	*$1,550*	*1124 CLARE AVE*		*A380-2*	
	SS47923 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*	*$1,550*	*1117 CLARE AVE*		*A380-2*	
	SS47924 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*	*$1,550*	*1137 CLARE AVE*		*A380-2*	
	SS47925 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*	*$1,550*	*1112 CLARE AVE*		*A380-2*	
	SS47926 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*	*$1,550*	*1097 CLARE AVE*		*A380-2*	
	SS47927 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*	*$1,550*	*1098 CLARE AVE*		*A380-2*	
	SS47928 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*	*$1,550*	*1107 CLARE AVE*		*A380-2*	
	SS47931 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*	*$1,550*	*1087 CLARE AVE*		*A380-2*	
Consolidated Asset	**20 1046 - Storm - Plastic**	**0.00 m**	**CAMBRIDGE**	**IN SERVICE**	**2005**	**$8,490**	**3**	**OPERATING**	**2**	
Components	*DC12038 STORM CATCHBASIN*	*1.0 EACH*				*$2,118*	*1087 CLARE AVE*		*A380-2*	
	DL10816 STORM LEAD	*9.9 M*				*$1,521*	*CLARE AVE: -BERNHARDT ST*		*A380-2*	
	DM11216 STORM MANHOLE	*1.0 EACH*				*$4,851*	*1087 CLARE AVE*		*A380-2*	
Consolidated Asset	**21 1049 - Water - Plastic**	**169.60 m**	**CAMBRIDGE**	**IN SERVICE**	**2005**	**$105,471**	**24**	**CAPITAL**	**2**	
Components	*WH11718 WATER HYDRANT*	*1.0 EACH*				*$6,226*	*1167 CLARE AVE*		*A380-2*	
	WH13105 WATER HYDRANT	*1.0 EACH*				*$6,226*	*1087 CLARE AVE*		*A380-2*	
	WJ12370 WATER JUNCTION	*1.0 EACH*				*$574*	*1055 CLARE AVE*		*A380-2*	
	WP38214 WATER PIPE	*2.1 m*		*150*	*PVC*	*$980*	*CLARE AVE: HOMUTH AVE-CLARE AVE*		*A380-2*	
	WP38225 WATER PIPE	*167.5 m*		*150*	*PVC*	*$61,726*	*CLARE AVE: CLARE AVE-BERNHARDT ST*		*A380-2*	
	WS3041703 WATER SERVICE	*7.6 m*				*$1,567*	*1087 CLARE AVE*		*A380-2*	
	WS3041704 WATER SERVICE	*7.6 m*				*$1,567*	*1097 CLARE AVE*		*A380-2*	
	WS3041705 WATER SERVICE	*7.0 m*				*$1,560*	*1107 CLARE AVE*		*A380-2*	

WS3041706 WATER SERVICE	7.0 m		$1,560	1117 CLARE AVE	A380-2
WS3041707 WATER SERVICE	7.0 m		$1,560	1127 CLARE AVE	A380-2
WS3041708 WATER SERVICE	7.6 m		$1,567	1137 CLARE AVE	A380-2
WS3041709 WATER SERVICE	6.5 m		$1,554	1147 CLARE AVE	A380-2
WS3041710 WATER SERVICE	5.9 m		$1,547	1157 CLARE AVE	A380-2
WS3041711 WATER SERVICE	4.6 m		$1,531	1167 CLARE AVE	A380-2
WS3041712 WATER SERVICE	4.2 m		$1,526	1179 CLARE AVE	A380-2
WS3041713 WATER SERVICE	11.8 m		$1,618	1178 CLARE AVE	A380-2
WS3041714 WATER SERVICE	13.5 m		$1,638	1166 CLARE AVE	A380-2
WS3041715 WATER SERVICE	9.7 m		$1,592	1156 CLARE AVE	A380-2
WS3041716 WATER SERVICE	9.8 m		$1,594	1146 CLARE AVE	A380-2
WS3041717 WATER SERVICE	9.7 m		$1,592	1134 CLARE AVE	A380-2
WS3041718 WATER SERVICE	13.3 m		$1,636	1124 CLARE AVE	A380-2
WS3041719 WATER SERVICE	10.3 m		$1,600	1112 CLARE AVE	A380-2
WS3041720 WATER SERVICE	9.9 m		$1,595	1098 CLARE AVE	A380-2
WV15046 WATER VALVE	1.0 EACH		$1,337	1179 CLARE AVE	A380-2

*** Replacement Value: Estimated using avg unit costs of recent tenders assuming current standard materials and replacement of same asset in same location in same position. Actual replacement costs will vary according to specific site conditions and scenarios**

Application Number: 30T-95007 Phase:

Financial Status: CLOSED

Developer: KABSAS DEVELOPMENTS INC.

Name of Subdivision: CHATEAU CRES SUBDIVISION /COBBLESTONE GATES

Engineering Firm: R.G. SHUGG ENGINEERING LTD.

Plan Registration Date / Year: 23-Jul-2001/2001

Construction Contractor:

Final Service Acceptance dates...

Underground: 2-Jan-2007

Sidewalk: 2-Jan-2007

Curb & Gutter: 02-Jan-2007

Road Asphalt: 3-Aug-2007

Trees : 2-Jan-2007

Total Units Added :46

Apartments:

Row Houses:

Semi Detached:

Single Detached: 46

Plan Locations

Current Replacement Value* Summary for Assets Registered Against Plan

		Water	Sewer	Drainage	Right-of-Way	Install Year Range
RS28385 CHATEAU CRES : TRICO DR - TRICO DR		$209,517	$179,341	$148,476	$232,410	2001 - 2001
UC2030 30 - 34 CHATEAU CRES		$0	$0	$13,016	$0	2001 - 2001
UC2031 70-74 CHATEAU CRES		$0	$0	$13,871	$0	2001 - 2001
	$796,632	**$209,517**	**$179,341**	**$175,364**	**$232,410**	

Drawing Index

Drawing #	Street Name	Construction year	Last Revision	Drawing Status	Drawing Category	Drawing Index Date	Comments
DT946-1	CHATEAU CRES	2001	16-Nov-2004	AS BUILT	DRAINAGE PLAN	04-Dec-2012	GRADING PLAN
DT946-4P	CHATEAU CRES	2001	15-Mar-2001	PROPOSED	DRAINAGE PLAN	04-Dec-2012	EROSION & SEDIMENTATION CONTROL PLAN
DT946-3	CHATEAU CRES	2001	04-Nov-2000	UNKNOWN	DRAINAGE PLAN	04-Dec-2012	SANITARY DRAINAGE AREA PLAN
A979-1	CHATEAU CRES	2001	20-Aug-2001	AS BUILT	PLAN AND PROFILE	13-Feb-2008	
A979-2	CHATEAU CRES	2001	20-Aug-2001	AS BUILT	PLAN AND PROFILE	13-Feb-2008	

Infrastructure Assets Acquired through Subdivision Development @ RS28385 CHATEAU CRES : TRICO DR - TRICO DR

	TCA Class / Category	Qty	Ownership	Physical Status	Install Year	Replacement Value *	# of Physical Assets	Life Cycle Funding	TCA Status	FIR Code
Consolidated Asset	**14 1027 - Road - Urban**	**0.52 lane*km**	**CAMBRIDGE**	**IN SERVICE**	**2001**	**$232,410**	**18**	**CAPITAL**	**1**	**D**
Components	*RC12327 PAVEMENT EDGE*	*231.6 M*		*4 blvd width (m)*	*CONCRETE CURB*	*$32,660*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-2*	
	RC17064 PAVEMENT EDGE	*261.7 M*		*0 blvd width (m)*	*CONCRETE CURB*	*$37,205*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-1*	
	RK8123 SIDEWALK	*216.0 M*		*1.2 width (m)*	*CONCRETE*	*$35,100*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-2*	
	RL19151 STREET LIGHT	*1.0 Each*		*100 Bulb Size*	*HPS*	*$4,000*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-1*	
	RL27351 STREET LIGHT	*1.0 Each*		*100 Bulb Size*	*HPS*	*$4,000*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-1*	
	RL19152 STREET LIGHT	*1.0 Each*		*100 Bulb Size*	*HPS*	*$4,000*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-1*	
	RL22173 STREET LIGHT	*1.0 Each*		*100 Bulb Size*	*HPS*	*$4,000*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-2*	
	RL28118 STREET LIGHT	*1.0 Each*		*100 Bulb Size*	*HPS*	*$4,000*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-2*	
	RL23000 STREET LIGHT	*1.0 Each*		*150 Bulb Size*	*HPS*	*$4,000*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-2*	
	RS28385 PAVEMENT	*0.5 lane-km*		*2373 m^2*		*$99,946*	*CHATEAU CRES : TRICO DR - TRICO DR*			
	RT13453 SIGN	*1.0 EACH*		*Sign Category*	*U CHANNEL*	*$438*	*103 CHATEAU CRES*		*A979-1*	
	RT13454 SIGN	*1.0 EACH*		*Sign Category*	*U CHANNEL*	*$438*	*103 CHATEAU CRES*		*A979-1*	
	RT1154 SIGN	*1.0 EACH*		*REGULATORY Sign Category*	*U CHANNEL*	*$438*	*124 CHATEAU CRES*		*A979-1*	
	RT1153 SIGN	*1.0 EACH*		*GUIDE AND INFORMATION Sign Category*	*UTILITY POLE*	*$438*	*125 CHATEAU CRES*		*A979-1*	
	RT13455 SIGN	*1.0 EACH*		*REGULATORY Sign Category*	*UTILITY POLE*	*$438*	*23 CHATEAU CRES*		*A979-1*	
	RT13456 SIGN	*1.0 EACH*		*REGULATORY Sign Category*	*UTILITY POLE*	*$438*	*23 CHATEAU CRES*		*A979-2*	
	RT1152 SIGN	*1.0 EACH*		*REGULATORY Sign Category*	*UTILITY POLE*	*$438*	*5 CHATEAU CRES*		*A979-2*	
	RT1151 SIGN	*1.0 EACH*		*GUIDE AND INFORMATION Sign Category*	*UTILITY POLE*	*$438*	*5 CHATEAU CRES*		*A979-2*	
Consolidated Asset	**19 1043 - Sewer - Plastic**	**233.90 m**	**CAMBRIDGE**	**IN SERVICE**	**2001**	**$179,341**	**56**	**CAPITAL**	**1**	**D**
Components	*SM12331 SANITARY MANHOLE*	*1.0 EACH*		*2.901 x 1200 depth(m) x width(mm)*	*CONCRETE SEGMENTS*	*$6,691*	*103 CHATEAU CRES*		*A979-1*	
	SM12327 SANITARY MANHOLE	*1.0 EACH*		*2.75 x 1200 depth(m) x width(mm)*	*CONCRETE SEGMENTS*	*$6,390*	*30 CHATEAU CRES*		*A979-2*	
	SM12328 SANITARY MANHOLE	*1.0 EACH*		*3 x 1200 depth(m) x width(mm)*	*CONCRETE SEGMENTS*	*$6,891*	*50 CHATEAU CRES*		*A979-2*	
	SM12326 SANITARY MANHOLE	*1.0 EACH*		*2.15 x 1200 depth(m) x width(mm)*		*$5,186*	*6 CHATEAU CRES*		*A979-2*	
	SM12330 SANITARY MANHOLE	*1.0 EACH*		*2.8 x 1200 depth(m) x width(mm)*	*CONCRETE SEGMENTS*	*$6,490*	*78 CHATEAU CRES*		*A979-1*	
	SP10927 SANITARY PIPE	*58.3 M*		*200*	*PVC*	*$17,321*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-2*	
	SP10931 SANITARY PIPE	*13.4 M*		*200*	*PVC*	*$3,981*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-1*	
	SP10929 SANITARY PIPE	*67.3 M*		*200*	*PVC*	*$19,995*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-2*	
	SP10928 SANITARY PIPE	*12.6 M*		*200*	*PVC*	*$3,744*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-2*	
	SP10930 SANITARY PIPE	*82.3 M*		*200*	*PVC*	*$24,452*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-1*	
	SS56029 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*	*$1,700*	*10 CHATEAU CRES*		*A979-2*	
	SS56050 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*	*$1,700*	*102 CHATEAU CRES*		*A979-1*	
	SS56037 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*	*$1,700*	*103 CHATEAU CRES*		*A979-1*	
	SS56051 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*	*$1,700*	*106 CHATEAU CRES*		*A979-1*	
	SS56028 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*	*$1,700*	*11 CHATEAU CRES*		*A979-2*	
	SS56053 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*	*$1,700*	*110 CHATEAU CRES*		*A979-1*	
	SS56054 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*	*$1,700*	*114 CHATEAU CRES*		*A979-1*	
	SS56055 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*	*$1,700*	*115 CHATEAU CRES*		*A979-1*	
	SS56056 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*	*$1,700*	*118 CHATEAU CRES*		*A979-1*	
	SS56057 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*	*$1,700*	*119 CHATEAU CRES*		*A979-1*	

	SS56059 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*122 CHATEAU CRES*		*A979-1*	
	SS56058 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*123 CHATEAU CRES*		*A979-1*	
	SS56061 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*124 CHATEAU CRES*		*A979-1*	
	SS56060 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*125 CHATEAU CRES*		*A979-1*	
	SS56027 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*14 CHATEAU CRES*		*A979-2*	
	SS56026 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*15 CHATEAU CRES*		*A979-2*	
	SS56025 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*18 CHATEAU CRES*		*A979-2*	
	SS56024 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*22 CHATEAU CRES*		*A979-2*	
	SS56046 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*23 CHATEAU CRES*		*A979-2*	
	SS56023 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*26 CHATEAU CRES*		*A979-2*	
	SS56022 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*30 CHATEAU CRES*		*A979-2*	
	SS56067 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*34 CHATEAU CRES*		*A979-2*	
	SS56033 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*38 CHATEAU CRES*		*A979-2*	
	SS56069 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*4 CHATEAU CRES*		*A979-2*	
	SS56032 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*42 CHATEAU CRES*		*A979-2*	
	SS56066 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*46 CHATEAU CRES*		*A979-2*	
	SS56068 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*5 CHATEAU CRES*		*A979-2*	
	SS56048 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*50 CHATEAU CRES*		*A979-2*	
	SS56047 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*54 CHATEAU CRES*		*A979-2*	
	SS56045 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*57 CHATEAU CRES*		*A979-2*	
	SS56044 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*58 CHATEAU CRES*		*A979-2*	
	SS56031 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*6 CHATEAU CRES*		*A979-2*	
	SS56043 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*61 CHATEAU CRES*		*A979-2*	
	SS56042 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*62 CHATEAU CRES*		*A979-2*	
	SS56041 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*65 CHATEAU CRES*		*A979-1*	
	SS56040 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*66 CHATEAU CRES*		*A979-1*	
	SS56038 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*69 CHATEAU CRES*		*A979-1*	
	SS56030 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*7 CHATEAU CRES*		*A979-2*	
	SS56039 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*70 CHATEAU CRES*		*A979-1*	
	SS56036 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*74 CHATEAU CRES*		*A979-1*	
	SS56035 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*78 CHATEAU CRES*		*A979-1*	
	SS56065 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*82 CHATEAU CRES*		*A979-1*	
	SS56062 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*86 CHATEAU CRES*		*A979-1*	
	SS56063 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*90 CHATEAU CRES*		*A979-1*	
	SS56064 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*94 CHATEAU CRES*		*A979-1*	
	SS56049 SANITARY SERVICE	*1.0 EACH*		*100 mm*	*PVC*		*$1,700*	*98 CHATEAU CRES*		*A979-1*	
Consolidated Asset	**20 1046 - Storm - Plastic**	**212.40 m**	**CAMBRIDGE**	**IN SERVICE**		**2001**	**$148,476**	**31**	**CAPITAL**	**1**	**D**
Components	*DC13477 STORM CATCHBASIN*	*1.0 EACH*					*$3,015*	*103 CHATEAU CRES*		*A979-1*	
	DC13468 STORM CATCHBASIN	*1.0 EACH*					*$3,015*	*124 CHATEAU CRES*		*A979-1*	
	DC13469 STORM CATCHBASIN	*1.0 EACH*					*$3,015*	*125 CHATEAU CRES*		*A979-1*	
	DC13478 STORM CATCHBASIN	*1.0 EACH*					*$3,015*	*23 CHATEAU CRES*		*A979-2*	
	DC13472 STORM CATCHBASIN	*1.0 EACH*					*$3,015*	*4 CHATEAU CRES*		*A979-2*	
	DC13470 STORM CATCHBASIN	*1.0 EACH*					*$3,015*	*5 CHATEAU CRES*		*A979-2*	
	DC13479 STORM CATCHBASIN	*1.0 EACH*					*$3,015*	*50 CHATEAU CRES*		*A979-2*	
	DC13476 STORM CATCHBASIN	*1.0 EACH*					*$3,015*	*98 CHATEAU CRES*		*A979-1*	

	DL11812 STORM LEAD	*6.3 M*					*$1,166*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-2*	
	DL11810 STORM LEAD	*20.1 M*					*$3,719*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-2*	
	DL11742 STORM LEAD	*5.8 M*					*$1,073*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-1*	
	DL11811 STORM LEAD	*18.9 M*					*$3,497*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-2*	
	DL16028 STORM LEAD	*2.0 M*					*$688*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-1*	
	DL16027 STORM LEAD	*1.4 M*					*$577*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-2*	
	DL16332 STORM LEAD	*6.5 M*					*$1,520*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-1*	
	DL11741 STORM LEAD	*2.7 M*					*$500*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-1*	
	DM12517 STORM MANHOLE	*1.0 EACH*					*$5,031*	*125 CHATEAU CRES*		*A979-1*	
	DM12516 STORM MANHOLE	*1.0 EACH*					*$5,031*	*125 CHATEAU CRES*		*A979-1*	
	DM12525 STORM MANHOLE	*1.0 EACH*					*$5,448*	*23 CHATEAU CRES*		*A979-2*	
	DM12524 STORM MANHOLE	*1.0 EACH*					*$5,272*	*23 CHATEAU CRES*		*A979-2*	
	DM12523 STORM MANHOLE	*1.0 EACH*					*$5,412*	*69 CHATEAU CRES*		*A979-1*	
	DM12519 STORM MANHOLE	*1.0 EACH*					*$5,025*	*7 CHATEAU CRES*		*A979-2*	
	DM12522 STORM MANHOLE	*1.0 EACH*					*$5,345*	*86 CHATEAU CRES*		*A979-1*	
	DM12521 STORM MANHOLE	*1.0 EACH*					*$5,495*	*98 CHATEAU CRES*		*A979-1*	
	DP11827 STORM PIPE	*19.5 M*		*450*	*PVC*		*$6,731*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-1*	
	DP11823 STORM PIPE	*10.4 M*		*300*	*PVC*		*$3,096*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-2*	
	DP11822 STORM PIPE	*53.7 M*		*300*	*PVC*		*$15,986*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-2*	
	DP11829 STORM PIPE	*10.6 M*		*450*	*PVC*		*$3,659*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-1*	
	DP11826 STORM PIPE	*2.1 M*		*525*	*PVC*		*$777*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-1*	
	DP11828 STORM PIPE	*69.0 M*		*450*	*PVC*		*$23,818*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-1*	
	DP11824 STORM PIPE	*47.1 M*		*375*	*PVC*		*$15,493*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-1*	
Consolidated Asset	**21 1049 - Water - Plastic**	**258.20 m**	**CAMBRIDGE**	**IN SERVICE**		**2001**	**$209,517**	**55**	**CAPITAL**	**1**	**D**
Components	*WH12251 WATER HYDRANT*	*1.0 EACH*					*$7,118*	*124 CHATEAU CRES*		*A979-1*	
	WH13206 WATER HYDRANT	*1.0 EACH*					*$7,118*	*14 CHATEAU CRES*		*A979-2*	
	WH13205 WATER HYDRANT	*1.0 EACH*					*$7,118*	*62 CHATEAU CRES*		*A979-1*	
	WJ12170 WATER JUNCTION	*1.0 EACH*					*$1,011*	*700 TRICO DR*		*A979-2*	
	WP37541 WATER PIPE	*1.4 m*		*150*	*PVC*		*$558*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-2*	
	WP37540 WATER PIPE	*250.1 m*		*150*	*PVC*		*$99,668*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-1*	
	WP37539 WATER PIPE	*6.7 m*		*150*	*PVC*		*$2,670*	*CHATEAU CRES : TRICO DR - TRICO DR*		*A979-1*	
	WS3058263 WATER SERVICE	*5.6 m*					*$1,695*	*10 CHATEAU CRES*		*A979-2*	
	WS3006935 WATER SERVICE	*2.4 m*					*$1,655*	*102 CHATEAU CRES*		*A979-1*	
	WS3058251 WATER SERVICE	*12.7 m*					*$1,784*	*103 CHATEAU CRES*		*A979-1*	
	WS3006936 WATER SERVICE	*6.9 m*					*$1,711*	*106 CHATEAU CRES*		*A979-1*	
	WS3006921 WATER SERVICE	*13.1 m*					*$1,789*	*11 CHATEAU CRES*		*A979-2*	
	WS3006937 WATER SERVICE	*7.5 m*					*$1,719*	*110 CHATEAU CRES*		*A979-1*	
	WS3006938 WATER SERVICE	*15.8 m*					*$2,135*	*114 CHATEAU CRES*		*A979-1*	
	WS3006942 WATER SERVICE	*8.2 m*					*$1,728*	*115 CHATEAU CRES*		*A979-1*	
	WS3006939 WATER SERVICE	*6.7 m*					*$1,709*	*118 CHATEAU CRES*		*A979-1*	
	WS3007066 WATER SERVICE	*13.9 m*					*$1,799*	*119 CHATEAU CRES*		*A979-1*	
	WS3006940 WATER SERVICE	*6.3 m*					*$1,704*	*122 CHATEAU CRES*		*A979-1*	
	WS3058252 WATER SERVICE	*13.2 m*					*$1,790*	*123 CHATEAU CRES*		*A979-1*	
	WS3006941 WATER SERVICE	*3.0 m*					*$1,663*	*124 CHATEAU CRES*		*A979-1*	
	WS3058253 WATER SERVICE	*13.7 m*					*$1,796*	*125 CHATEAU CRES*		*A979-1*	

WS3058262 WATER SERVICE	*5.5 m*	*$1,694*	*14 CHATEAU CRES*	*A979-2*
WS3066005 WATER SERVICE	*13.8 m*	*$1,798*	*15 CHATEAU CRES*	*A979-2*
WS3058261 WATER SERVICE	*5.7 m*	*$1,696*	*18 CHATEAU CRES*	*A979-2*
WS3058260 WATER SERVICE	*5.8 m*	*$1,698*	*22 CHATEAU CRES*	*A979-2*
WS3058246 WATER SERVICE	*13.2 m*	*$1,790*	*23 CHATEAU CRES*	*A979-2*
WS3006922 WATER SERVICE	*1.3 m*	*$1,641*	*26 CHATEAU CRES*	*A979-2*
WS3006923 WATER SERVICE	*7.9 m*	*$1,724*	*30 CHATEAU CRES*	*A979-2*
WS3006924 WATER SERVICE	*7.3 m*	*$1,716*	*34 CHATEAU CRES*	*A979-2*
WS3006925 WATER SERVICE	*10.0 m*	*$1,750*	*38 CHATEAU CRES*	*A979-2*
WS3058265 WATER SERVICE	*5.5 m*	*$1,694*	*4 CHATEAU CRES*	*A979-2*
WS3006926 WATER SERVICE	*10.2 m*	*$1,753*	*42 CHATEAU CRES*	*A979-2*
WS3006927 WATER SERVICE	*8.0 m*	*$1,725*	*46 CHATEAU CRES*	*A979-2*
WS3058244 WATER SERVICE	*13.7 m*	*$1,796*	*5 CHATEAU CRES*	*A979-2*
WS3058259 WATER SERVICE	*6.8 m*	*$1,710*	*50 CHATEAU CRES*	*A979-2*
WS3006928 WATER SERVICE	*7.0 m*	*$1,713*	*54 CHATEAU CRES*	*A979-2*
WS3058247 WATER SERVICE	*13.3 m*	*$1,791*	*57 CHATEAU CRES*	*A979-2*
WS3058258 WATER SERVICE	*7.6 m*	*$1,720*	*58 CHATEAU CRES*	*A979-2*
WS3058264 WATER SERVICE	*5.4 m*	*$1,693*	*6 CHATEAU CRES*	*A979-2*
WS3058248 WATER SERVICE	*12.9 m*	*$1,786*	*61 CHATEAU CRES*	*A979-1*
WS3058257 WATER SERVICE	*7.5 m*	*$1,719*	*62 CHATEAU CRES*	*A979-1*
WS3058249 WATER SERVICE	*12.9 m*	*$1,786*	*65 CHATEAU CRES*	*A979-1*
WS3058256 WATER SERVICE	*7.6 m*	*$1,720*	*66 CHATEAU CRES*	*A979-1*
WS3058250 WATER SERVICE	*13.1 m*	*$1,789*	*69 CHATEAU CRES*	*A979-1*
WS3058245 WATER SERVICE	*13.6 m*	*$1,795*	*7 CHATEAU CRES*	*A979-2*
WS3058255 WATER SERVICE	*7.9 m*	*$1,724*	*70 CHATEAU CRES*	*A979-1*
WS3006929 WATER SERVICE	*7.5 m*	*$1,719*	*74 CHATEAU CRES*	*A979-1*
WS3058254 WATER SERVICE	*7.0 m*	*$1,713*	*78 CHATEAU CRES*	*A979-1*
WS3006930 WATER SERVICE	*7.6 m*	*$1,720*	*82 CHATEAU CRES*	*A979-1*
WS3006931 WATER SERVICE	*10.8 m*	*$1,760*	*86 CHATEAU CRES*	*A979-1*
WS3006932 WATER SERVICE	*11.0 m*	*$1,763*	*90 CHATEAU CRES*	*A979-1*
WS3006933 WATER SERVICE	*10.1 m*	*$1,751*	*94 CHATEAU CRES*	*A979-1*
WS3006934 WATER SERVICE	*6.5 m*	*$1,706*	*98 CHATEAU CRES*	*A979-1*
WV12768 WATER VALVE	*1.0 EACH*	*$2,016*	*124 CHATEAU CRES*	*A979-1*
WV13842 WATER VALVE	*1.0 EACH*	*$2,016*	*4 CHATEAU CRES*	*A979-2*

*** Replacement Value: Estimated using avg unit costs of recent tenders assuming current standard materials and replacement of same asset in same location in same position. Actual replacement costs will vary according to specific site conditions and scenarios**

Infrastructure Assets Acquired through Subdivision Development @ UC2030 30 - 34 CHATEAU CRES

	TCA Class / Category	Qty	Ownership	Physical Status	Install Year	Replacement Value *	# of Physical Assets	Life Cycle Funding	TCA Status	FIR Code
Consolidated Asset	**20 1046 - Storm - Plastic**	**0.00 m**	**CAMBRIDGE**	**IN SERVICE**	**2001**	**$13,016**	**2**	**OPERATING**	**1**	**D**
Components	*DC20261 STORM CATCHBASIN*	*1.0 EACH*				*$4,445*	*UC2030 30 - 34 CHATEAU CRES*		*A979-2*	
	DL19581 STORM LEAD	*40.1 M*				*$8,571*	*UC2030 30 - 34 CHATEAU CRES*		*A979-2*	

*** Replacement Value: Estimated using avg unit costs of recent tenders assuming current standard materials and replacement of same asset in same location in same position. Actual replacement costs will vary according to specific site conditions and scenarios**

Infrastructure Assets Acquired through Subdivision Development @ UC2031 70-74 CHATEAU CRES

	TCA Class / Category	Qty	Ownership	Physical Status	Install Year	Replacement Value *	# of Physical Assets	Life Cycle Funding	TCA Status	FIR Code
Consolidated Asset	**20 1046 - Storm - Plastic**	**0.00 m**	**CAMBRIDGE**	**IN SERVICE**	**2001**	**$13,871**	**2**	**OPERATING**	**1**	**D**
Components	*DC20260 STORM CATCHBASIN*	*1.0 EACH*				*$4,445*	*UC2031 70-74 CHATEAU CRES*		*A979-1*	
	DL19580 STORM LEAD	*44.1 M*				*$9,426*	*UC2031 70-74 CHATEAU CRES*		*A979-1*	

*** Replacement Value: Estimated using avg unit costs of recent tenders assuming current standard materials and replacement of same asset in same location in same position. Actual replacement costs will vary according to specific site conditions and scenarios**

REFERENCES & DEFINITIONS

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[ii] Cambridge Corporate Sustainability Plan
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[iii] City of Cambridge Asset Managment Needs Study 2005 – http://www.cambridge.ca/relatedDocs/Cambridge_AMS-Final_-Needs_Study_Report.pdf

[iv] Infraguide http://fcm.ca/home/programs/past-programs/infraguide.htm

[v] Pipeline Assessment & Certification Program (PACP ®) Canadian Edition :
http://www.csa.ca/cm/ca/en/standards/products/infrastructure-and-public-works?tn=training-partners

[vi] Cambridge State of Infrastructure Report 2007: http://www.cambridge.ca/relatedDocs/rptsotirfinal010507.pdf

[vii] Ontario Government Places to Grow program https://www.placestogrow.ca/index.php

[ix] The Canadian Infrastructure Report Card: http://www.canadainfrastructure.ca/en/index.html

[x] Cambridge report on use of Gas Tax Funding (2012): http://www.cambridge.ca/relatedDocs/TPW-10-12%20Gas%20Tax%20%20Expenditure%20Update%202011.2.pdf

[x] **Poor Condition Assets**
Poor condition assets are those that have exceeded serviceable life and have had failures or at elevated probability of failure where assets of same material and vintage have already experienced repeated failures. Renewal of these assets are either backlogged or in need of replacement/renewal within 10 years.
Fair Condition Assets
Fair condition assets are those that based on condition have an estimated remaining service life between 10 and 30 years.
Good Condition Assets
Good condition assets are those that based on condition have an estimated remaining service life of more then 30 years. Where condition assessments are not available, (i.e. newer sanitary/storm/water pipes) life expectancy has been applied based on construction materials.