

City of Barrie

Corporate Asset Management Plan

November 2011

Final

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1. Introduction

1.1 Corporate Asset Status Report

This Asset Management Plan (AM Plan) is summarized in the attached Corporate Asset Status Report. This AM Plan should be read in conjunction with the Corporate Asset Status Report.

1.2 What is an Asset Management Plan

This AM Plan is a long range planning document that can be used to provide a rational framework for managing the City of Barrie's assets. It outlines the asset activities for each service within the City and provides a guide to understanding key items such as:

- ▶ The City's organizational strategic goals;
- ▶ The City wide asset portfolio;
- ▶ Levels of service and performance standards;
- ▶ Demand forecasting;
- ▶ Management techniques to assist in making long term funding decisions and prolonging asset life;
- ▶ The lifecycle activities used to operate, maintain, renew, develop and dispose of assets;
- ▶ Cash flow forecasting; and
- ▶ Key asset management practice improvement actions.

This AM Plan has consolidated information that is currently available for the City's service areas to provide both a short term (10 years) and a long term (100 years) focus. The short term focus sits within the long term period which is required to capture the full lifecycle of the assets. This AM Plan is a written representation of proposed risk reduction programs and strategies for the City of Barrie's assets based on understanding of customer requirements, regulatory compliance and the ability of the assets to meet required performance levels (levels of service).

1.3 Purpose of this Asset Management Plan

This AM Plan is intended to improve the City of Barrie's ability to meet its corporate goals and objectives in a way that best services its customers. It provides a rational framework enabling systematic and repeatable processes to manage costs, risks and levels of service for the City's assets. The AM Plan should enable identification of future costs and assist in predicting future problems that may hinder service delivery. This will create opportunities for the City's asset managers and operators to remove physical, financial and political barriers before they negatively impact customer levels of service.

Note that this is the City of Barrie's second AM Plan and has incorporated several recommendations for improvements from the first plan but will therefore not meet all of the long term goals of a fully developed AM Plan. Details regarding the specific improvements are furnished in the final section under Recommendations. It is intended that the continual improvement of asset management practices within the City of Barrie will result in annual updates to this document. As such, this AM Plan is a living document that will require ongoing refinement to reflect the evolution of asset management maturity within the City of Barrie over time.

1.4 Content of this Asset Management Plan

This AM Plan includes assets owned and operated by the City of Barrie including environmental services, transportation, recreation and culture, facilities and fleet.

This AM Plan excludes assets associated with the City of Barrie's airport and railway network, information and communication technology assets, and facility furnishings, as well as future expansion of the City outside current boundaries.

The body of the AM Plan details the approach and methodology taken in determining the framework for the AM Plan, and discusses the City of Barrie's assets at a corporate level only. The details of each asset service area are included in sub AM Plans in the appendices. These are as follows.

Appendix A: Environmental Services

(Water, wastewater, storm drainage, storm facilities and solid waste)

Appendix B: Transportation

(Roads, bridges, parking and street lights)

Appendix C: Recreation and Culture

(Parks, active recreation facilities, horticulture, park amenities and furniture, parks vehicle and pedestrian network)

Appendix D: Facilities

(Environmental, corporate, protection, transportation, recreation and culture)

Appendix E: Fleet

(Vehicles for environmental, corporate, protection, transportation, recreation and culture)

The body of the AM Plan and each Appendix are presented in a consistent framework, summarized below.

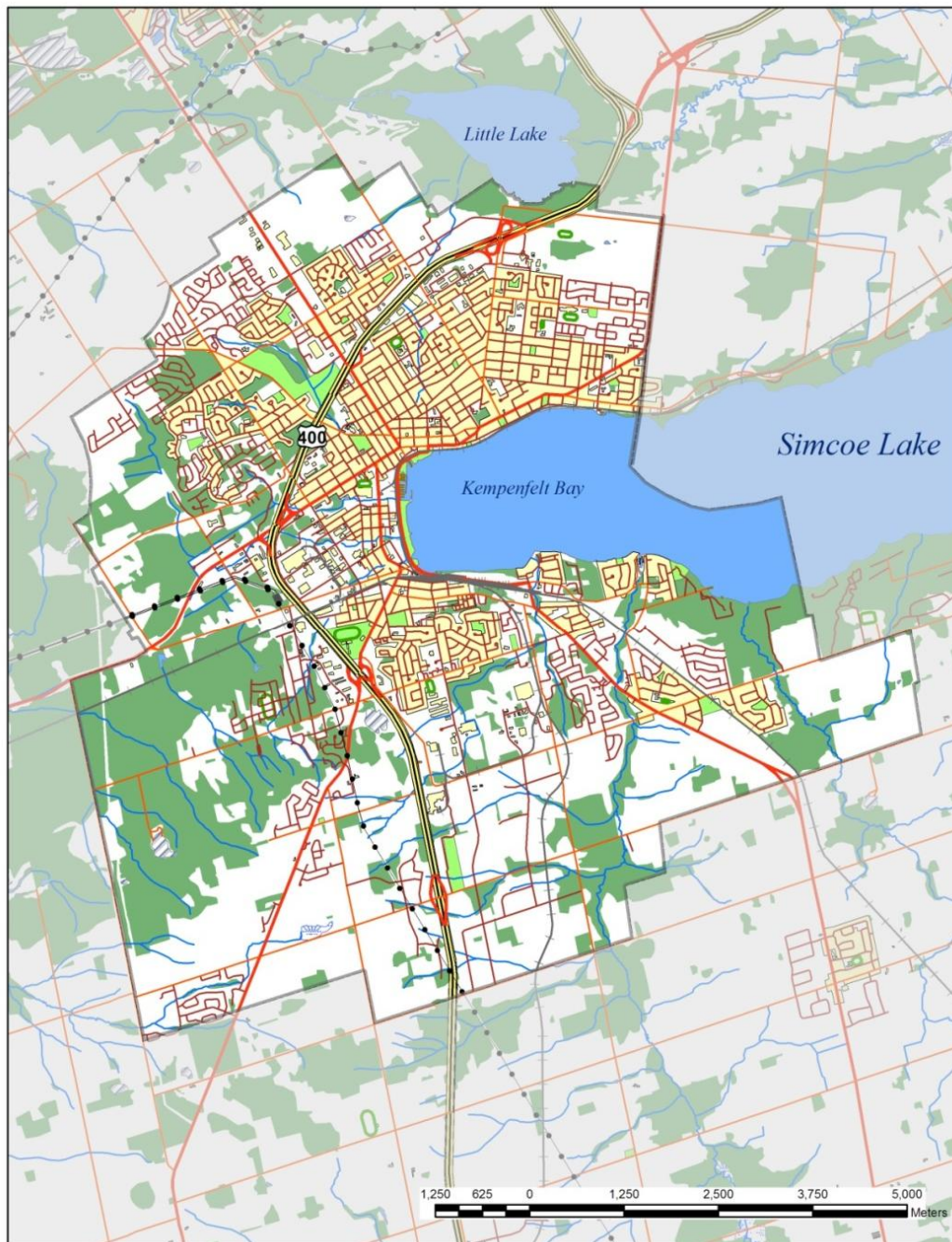
Table 1-1 Appendix Table of Contents

Section	Content
1) Introduction	Context and overview
2) Asset Portfolio	Service delivery requirements Hierarchy of Assets Cost/Value of inventory
3) Levels of Service	Goals and objectives Customer feedback (surveys) Current levels of service Future levels of service
4) Growth and Demand	Future demand of services related to growth of the City
5) Lifecycle Analysis	Failure mode predictions Risk assessments and business risk exposure by asset type Asset consumption
6) Lifecycle Management Strategies	By asset type
7) Long Term funding Analysis	Over 100 year period

Section	Content
8) Short Term Investment Needs	Over a 10 year period
9) Confidence Level Rating	Confidence level of the AM Plan Recommendations for continuous improvement

The geographical extent of the assets included in this AM Plan is illustrated in Figure 1-1 below.

Figure 1-1 Geographical Extent of this AM Plan



The relationship this AM Plan has with other City Documents and planning outputs is illustrated in the figure below. The AM Plan is the base framework or tool to assist the City in developing appropriate direction and inputs to budget forecasts, master plans and associated studies/outputs.

The diagram illustrates the Asset Management Planning Process, showing the flow from Master Plans and Current Asset Portfolio to various reporting and planning documents.

```

graph TD
    MP[Master Plans  
(Updated every 5 yrs)] --> AMPlan[AM Plan  
(Annual)]
    CAP[Current Asset Portfolio] --> AMPlan
    CAP --> PSAB[PSAB Tangible Capital Assets Reporting  
(Annual)]
    AMPlan --> PSAB
    AMPlan --> LRF[Long Range Financial Plan  
(Annual)]
    AMPlan --> C10[10-Yr Capital Program  
(Annual)]
    AMPlan --> C3[3-Yr Operating Program  
(Annual)]
    AMPlan --> CASR[Corporate Asset Status Report]
  
```

Master Plans
(Updated every 5 yrs)

- Water (25 yr)
- Wastewater (25 yr)
- Storm Drainage (25 yr)
- Transportation (25 yr)
- Parks & Rec'n (10 yr)
- Library
- Fire
- Accommodation

Current Asset Portfolio

AM Plan
(Annual)

- Transportation
- Environmental
- Rec & Culture
- Facilities
- Fleet

PSAB Tangible Capital Assets Reporting
(Annual)

10-Yr Capital Program
(Annual)

3-Yr Operating Program
(Annual)

Long Range Financial Plan
(Annual)

Corporate Asset Status Report

2. Asset Portfolio

2.1 Overview of the City of Barrie Service Delivery

The City of Barrie is responsible for a broad portfolio of assets that support goals of service delivery. To achieve these goals, the City has determined key elements that form the foundation of service delivery through the Strategic Plan consultation process. These elements are as follows.

Vision

The City of Barrie will be progressive, diverse and prosperous with opportunities for all citizens to build a healthy and vibrant community.

Direct & Manage Economic Development

- Attract and promote sector clustering
- Engage businesses, institutions and all levels of government to establish a competitive local economy
- Establish Barrie as a centre for excellence in innovation and entrepreneurship
- Develop the Lake Simcoe Regional Airport as an employment hub

Manage Growth & Protect the Environment

- Complete the secondary plan for the annexed lands
- Bring new employment lands to market
- Explore partnerships for joint servicing arrangements
- Expand transportation choices, including active transportation
- Advance intensification projects in accordance with existing policies

Strengthen Barrie's Financial Condition

- Balance service demands with financial resources
- Develop affordable long range plans that reflect changes in our community's growth and/or economy
- Diversify revenues
- Pursue innovation through our Journey of Excellence

Create a Vibrant & Healthy City Centre

- Improve integration between the downtown and the waterfront
- Actively promote the downtown and waterfront to residents and visitors
- Encourage a mix of land uses in the downtown
- Enhance safety in the downtown

Improve & Expand Community Involvement & City Interactions

- Develop a customer service strategy and enhance customer experiences
- Improve and enhance communications with the public
- Increase opportunities for public input/feedback on City initiatives

2.2 Hierarchy of Assets

Asset information is needed to support decision-making. The asset hierarchy provides the framework for segmenting the City asset portfolio into appropriate classifications with appropriate linkages between like assets. The asset hierarchy is illustrated in this AM Plan as a parent – child type relationship, to 4 levels (service, level 1, level 2, and level 3). Note the hierarchy presented below is a summary only. The asset hierarchy is illustrated in more detail (beyond level 3) for asset types in Section 2 of Appendices A to E.

The asset hierarchy for Environmental, Recreation and Culture, and Fleet assets is detailed in Table 2-1. Due to the additional level of complexity in the asset hierarchy for Facilities assets, the Facilities hierarchy has been separated in Table 2-2. Over 31,000 assets are included in the asset register against the asset hierarchy.

Table 2-1 Asset Hierarchy – Environmental

Level 1	Level 2	Level 3
Wastewater Facilities	ORO Bio-Solids Facility	Process Area, Component
	SPS	Component
	WPCC	Process Area, Component
Wastewater Linear	Sanitary Sewers	Type, Size, Material
Water Facilities	Booster Stations	Component
	SWTP	Process Area, Component
	Underground Reservoirs	Component
	Water Towers	Component
	WPS & Wells	Component
Water Linear	Hydrants & Valves	Purpose, Size
	Mains	Type, Size, Material
	Service Meters	Size
Storm Facilities	Mechanical Devices	
	Natural Ponds	Watershed
	Storm Detention Ponds	Watershed
Storm Linear	Culverts	Watershed, Size, Material
	Storm Sewers	Type, Size, Material
Waste Management	Collection	
	Disposal	
	Resource Recovery	

Table 2-2 Asset Hierarchy – Transportation

Level 1	Level 2	Level 3
Roads	Base Pavement	Arterial
		Collector
		Local
	Bridges & Major Culverts	Navigable Water
		Non Navigable Water
		Pedestrian
		Rail
	Retaining Walls	Cast In Place Concrete
		Masonry
		Pre-Cast Concrete
		Wood
		Wood (Creosote)
	Sidewalks	Material (Concrete)
	Signs	Pooled signs
	Surface Pavement	Arterial
		Collector
		Local
	Traffic Signals	Full Signals 3-Way
		Full Signals 4-Way
		Full Signals Major
		IPS
		Speed Board Advisory
		Temporary Signals
		Variable Time Flashing 40's
Street Lights	Street Lights with Pole	
	Street Lights no Pole	
Parking	Parking Lots	Active
		Declared Surplus
	Parking Meters	Pooled Electronic Guardian Mechanisms 1.4 Units
		Pooled Electronic Guardian Mechanisms XLE Units
		Pooled Parking Meter Housing Singles
		Pooled Parking Meter Housings Twins
	Pay & Display Machines	Coin
		Credit/Coin
Transit	Bus Shelters	
	Fare Boxes	

Table 2-3 Asset Hierarchy – Recreation & Culture

Level 1	Level 2	Level 3	Level 4
Parks	Active Recreation Facilities	Baseball	Major Lit
		Baseball	Major Unlit
		Baseball	Minor Lit
		Baseball	Minor Unlit
		Basketball	Free Throw Area
		Basketball	Full Court
		Basketball	Half Court
		Misc Active Rec Facilities	Beach Volleyball
		Misc Active Rec Facilities	Community Tennis Lit
		Misc Active Rec Facilities	Football Lit
		Misc Active Rec Facilities	Football Unlit
		Misc Active Rec Facilities	Lacrosse
		Misc Active Rec Facilities	Neighbourhood Tennis Lit
		Misc Active Rec Facilities	Splash Pads
		Misc Active Rec Facilities	Skate Park
		Play Spaces	Play Equipment
		Play Spaces	Play Equipment Accessible
		Soccer	Junior Unlit
		Soccer	Mini Unlit
		Soccer	Senior Unlit
		Soccer	Senior Lit
		Soccer	Senior Unlit
	Park Amenities & Furniture	Fences	
		Gazebo	
		Yard Hydrants	
		Misc Park Furniture	
	Park Veh & Ped Network	Access Drives/Roadways	
		Park Bridges	Pedestrian Only
		Park Bridges	Pedestrian Vehicle
		Parking Lots	Asphalt
		Parking Lots	Gravel
		Sidewalks, Paths & Trails	Asphalt
		Sidewalks, Paths & Trails	Concrete
		Sidewalks, Paths & Trails	Gravel
		Sidewalks, Paths & Trails	Boardwalks
		Sidewalks, Paths & Trails	Other
	Horticulture	Plantings	Floral
		Plantings	Herbaceous
		Plantings	Shrubs
		Plantings	Trees
		Topsoil, Fine Grading & Sodding	

Table 2-4 Asset Hierarchy – Facilities

Level 0 Simple Facilities	Level 1 Minor Facilities	Level 2 Major Facilities
Whole Facility	1 Site	1.1 Decommissioning
		1.2 Hardscape
		1.3 Landscape
		1.4 Site Furnishings
		1.5 Site Electrical
		1.6 Site Services
	2 Structure	2.1 Footings & Foundations
		2.2 Structural Steel
	3 Building Envelope	3.1 Air Vapour Barrier & Waterproofing
		3.2 Exterior Cladding
		3.3 Windows & Doors
		3.4 Roofing
	4 Occupied Space	4.1 Pools
		4.2 Arenas
		4.3 Interior Doors, Glass & Glazing
		4.4 Partitions
		4.5 Millwork
		4.6 Painting & Finishes
		4.7 Flooring
		4.8 Furnishings
	5 Building Services	5.1 Electrical
		5.2 Mechanical
		5.3 HVAC
		5.4 Building Automation & Controls
		5.5 Security
		5.6 Voice & Data Comms & Audio Visual
		5.7 Refrigeration & Specialized Equipment

Table 2-5 Asset Hierarchy – Fleet

Level 1	Level 2	Level 3
Fleet	General	Corporate
		Other
	Protection	Fire
	Transportation	Roads
		Transit
	Environmental	Waste Management
		Wastewater Facilities
		Water Facilities
	Recreation & Culture	Parks
		Recreation

2.3 Replacement Cost of Asset Inventory

To focus needs for investments, it is helpful to understand the number of assets and replacement value of assets against the hierarchy. The following figures illustrate the replacement value of the City's asset portfolio at both a corporate level and an asset service level for Environment Services, Transportation, Recreation and Culture, Facilities and Fleet.

Replacement costs included in these figures are based on 2007 Public Sector Accounting Board (PSAB) data. These costs have been inflated to 2011 dollars by applying appropriate indices.

These graphs illustrate the value of the City's asset portfolio is dominated by Environmental and Transportation assets. Of these assets, roads (pavement), wastewater facilities, water linear, wastewater linear and storm linear have the highest replacement cost value.

Figure 2-1 Total Asset Portfolio Replacement Cost, 2011\$

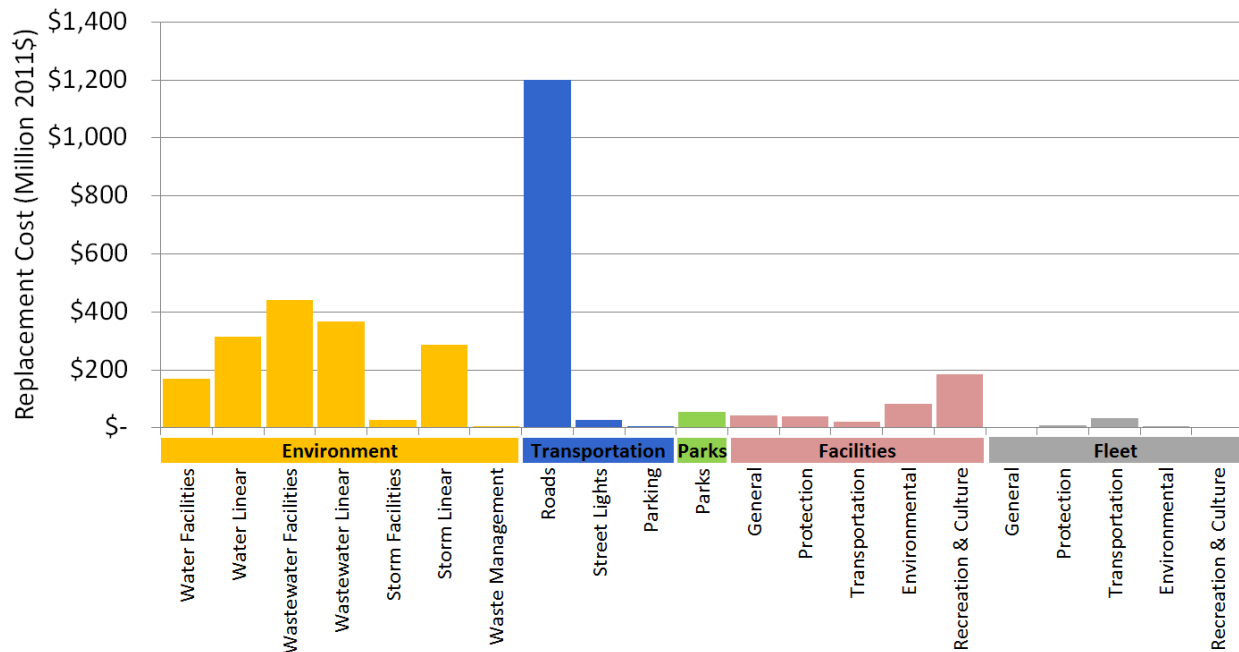


Figure 2-2 Environmental Asset Portfolio Replacement Cost, 2011\$

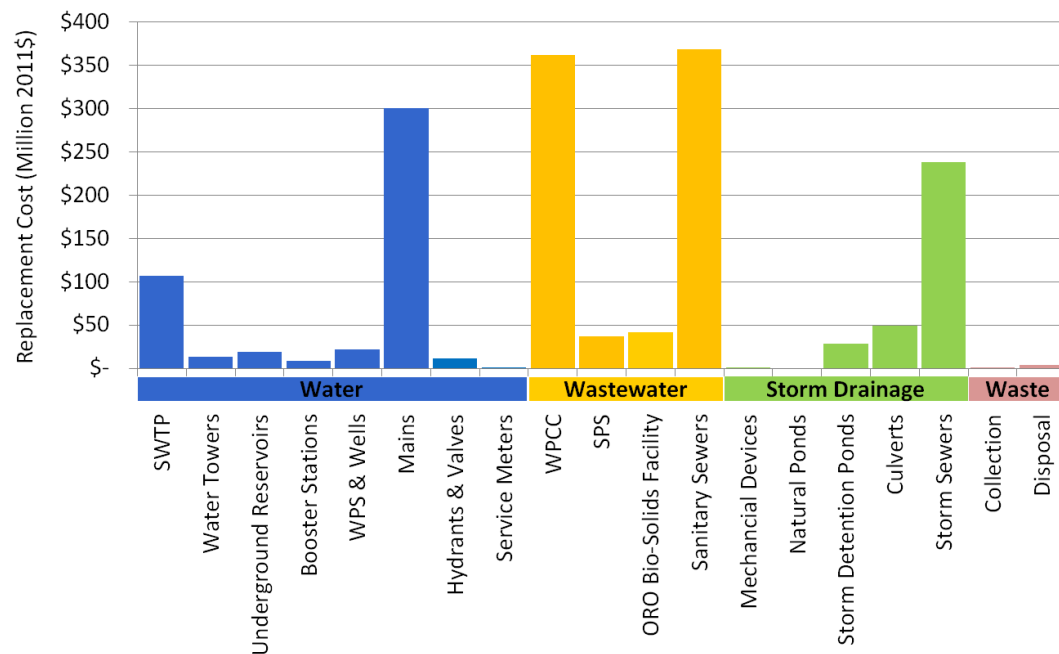


Figure 2-3 Transportation Asset Portfolio Replacement Cost, 2011\$

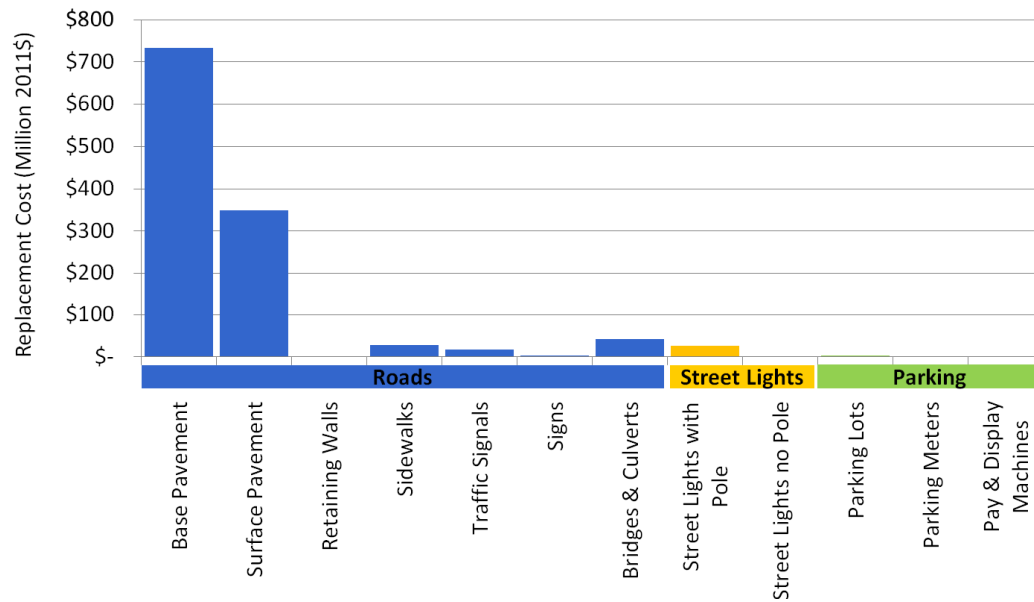


Figure 2-4 Recreation and Culture Asset Portfolio Replacement Cost, 2011\$

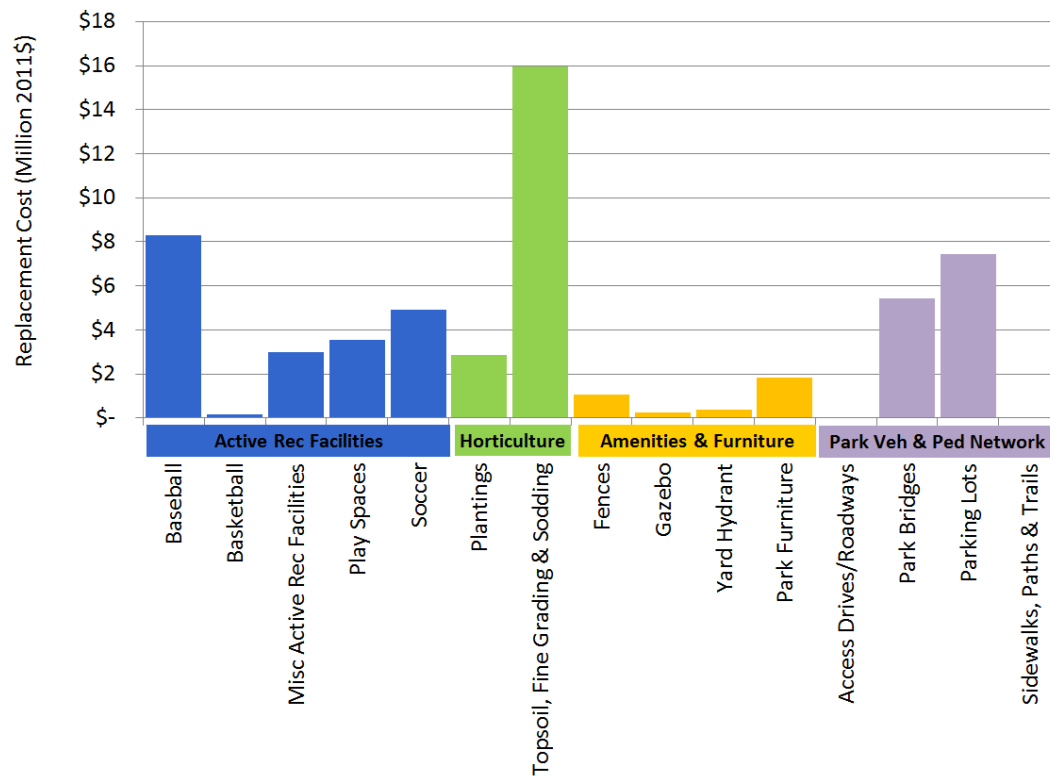


Figure 2-5 Facilities Asset Portfolio Replacement Cost, 2011\$

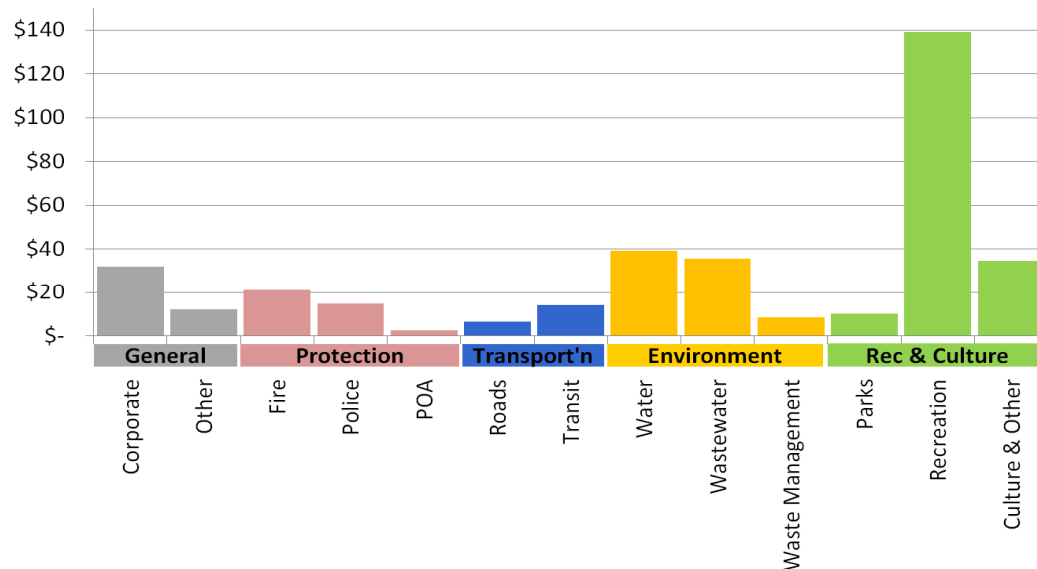
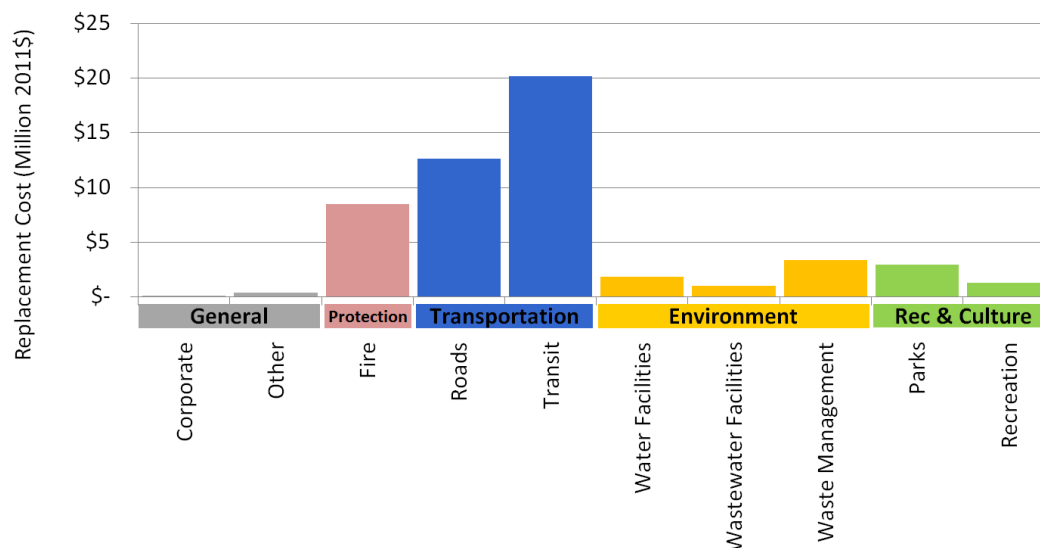


Figure 2-6 Fleet Asset Portfolio Replacement Cost, 2011\$



2.4 Installation Profile of Assets

To assist the City with future funding needs analysis, it is helpful to understand the installation profile of the asset profile portfolio and the weighted average age of the assets. The following graphs show the replacement value of the assets by year of installation. The installation profile is illustrated for the City's total asset portfolio as well as for individual services areas (Environmental Services, Transportation, Recreation and Culture, Facilities and Fleet).

The story these graphs tell is that the majority of City assets were installed between 1980 and 2005. Within this time frame, the graphs represent two main periods of growth where a significant quantity of assets were installed. The first being in the mid to late 1980's, and the second being around 1995 to 2005. These relatively recent growth periods have resulted in reducing the average age of the total asset portfolio.

Figure 2-7 Asset Installation Profile – Total

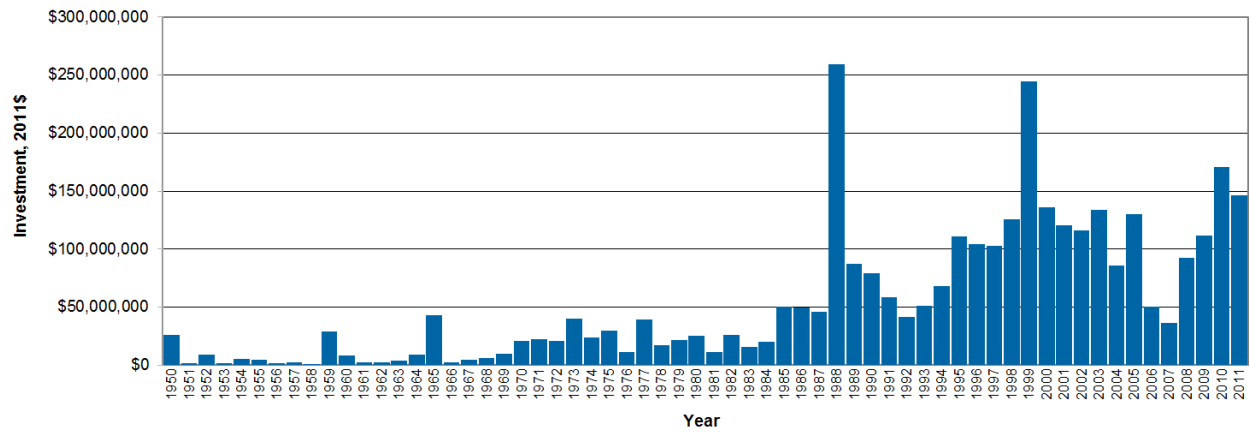


Figure 2-8 Asset Installation Profile – Environmental

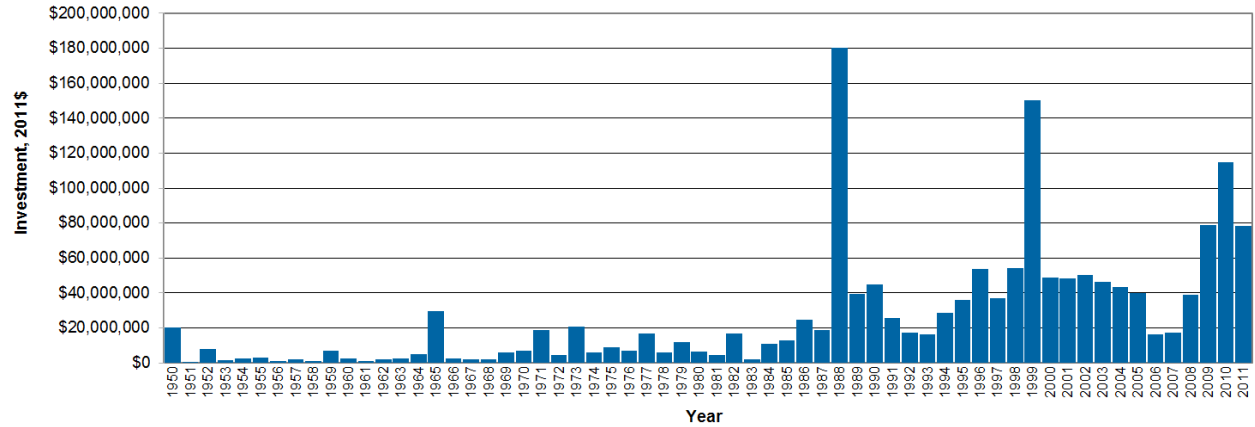


Figure 2-9 Asset Installation Profile – Transportation

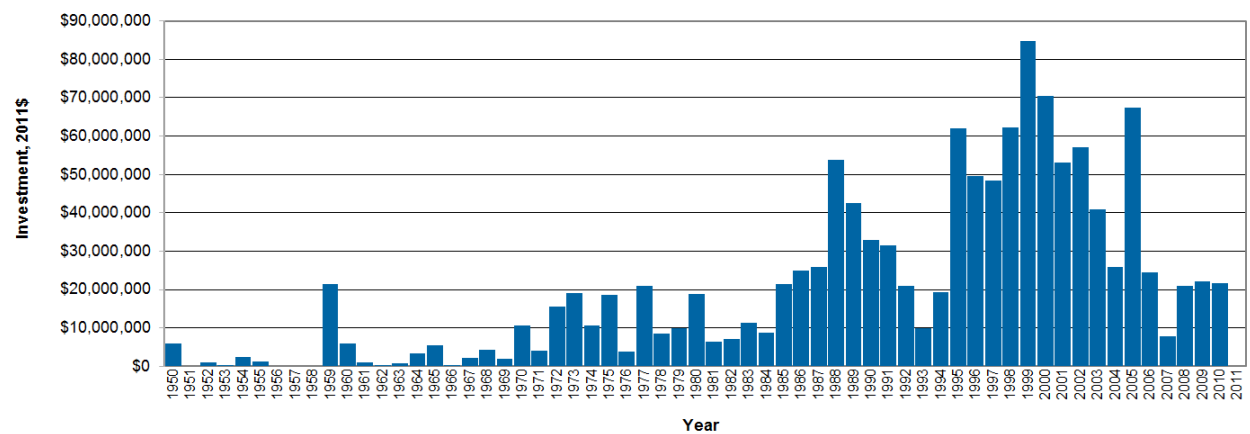


Figure 2-10 Asset Installation Profile – Recreation and Culture

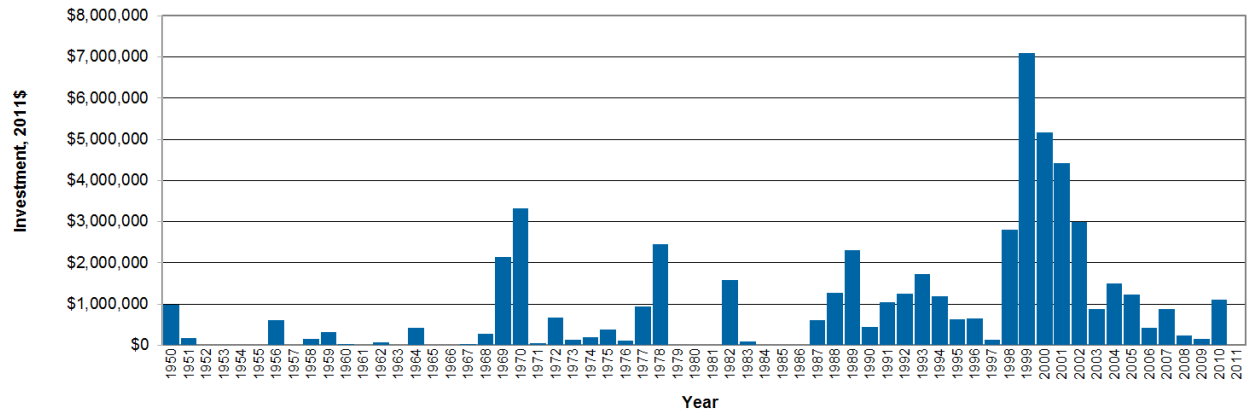


Figure 2-11 Asset Installation Profile – Facilities

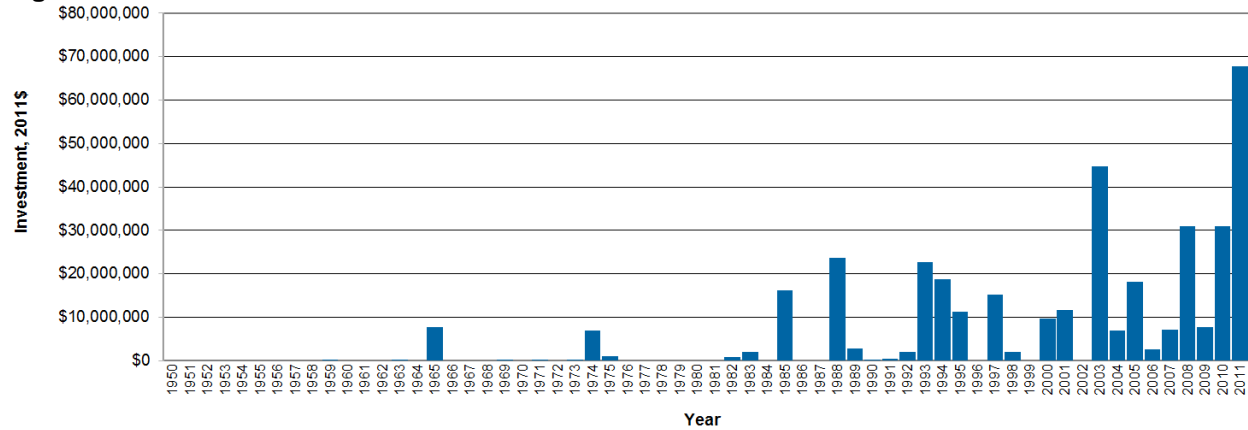
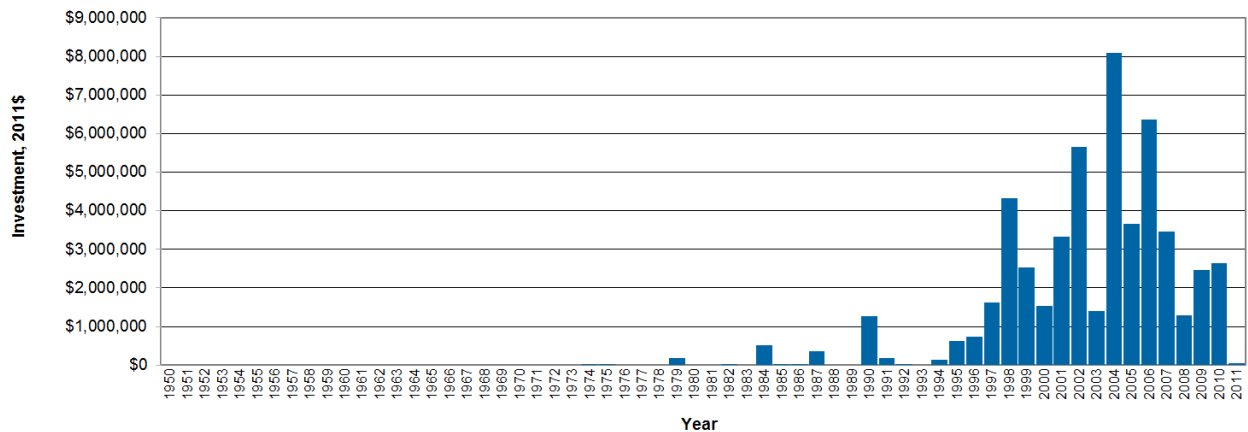


Figure 2-12 Asset Installation Profile – Fleet



3. Levels of Service

3.1 Customer Surveys

3.1.1 Corporate Citizenship Satisfaction Survey

The City gathers information on customer expectations and satisfaction through customer surveys – the most recent corporate-wide survey being conducted from November 17 to 25, 2008. Information on the results of this City of Barrie 2008 Citizen Satisfaction Report was summarized in the AM Plan 2009, and are not repeated in this Plan.

3.2 Current Levels of Service – Performance Measures

3.2.1 Corporate Balanced Scorecard

The City of Barrie Balanced Scorecard includes four quadrants: Community Services, Finance, Process, and People. The scorecard reports Target, Previous Year, and Current Year for a number of indicators, including the following indicators, among others:

Table 3-1 Corporate Balanced Scorecard – Environmental

Key Result Area	Performance Indicator	Year		
		2008	2009	2010
Finance	Capital Expenditures	\$232,370,000	\$173,880,000	\$116,300,000
	Corporate City Expenditures (Net \$)	\$102,444,433	\$85,258,313	\$92,874,335
	Corporate Revenues	\$182,454,472	\$161,170,286	\$168,922,938
	Water Operations (Net \$)	\$8,864,951	\$8,859,666	\$9,441,206
	Wastewater Operations (Net \$)	\$3,205,922	\$3,878,093	\$3,795,045
	Parking (Net \$)	\$842,374	\$500,637	-\$340,022
	Insurance Cost per Claim	\$1,928	\$2,274	\$4,060
People	PEOPLE Indicators	2008 Actual	2009 Actual	2010 Actual
	Permanent Full-Time Employees	640	672	699
	Permanent Full-Time Vacancies	39	38	45
	Permanent Part-Time Employees	33	31	30
	Permanent Part-Time Vacancies	3	2	2
	Turnover Rate	5.20%	2.96%	3.70%
	Sick Leave	30,415	33,297	34,735
	Short-Term Disability	10,304	11,339	12,545
	WSIB	4,628	2,153	3,167
	Long-Term Disability	2,035	5,880	4,884

Key	Performance Indicator		Year	
	Total Lost Time	47,382	52,669	55,331
	Average # of Absences per Employee (days)	8.80	9.79	9.70
	Number of Lost Time Accidents	18	19	17
	Cost - Lost Time Accidents	\$121,835	\$61,406	\$84,439
	Cost - Total Lost Time	\$1,403,765	\$1,495,779	\$1,657,064
Community	COMMUNITY SERVICE Indicators	2008 Actual	2009 Actual	2010 Actual
	10 FF on scene within 10 mins. - 90% of the time/structure & fire alarm	80.70%	86.58%	88.66%
	Less than 6 min. road response - 90% of the time/structure & fire alarm	90.81%	93.36%	92.01%
	Number of Conventional Transit Trips per Capita	17.50	19.82	19.50
	Transit In-Service Vehicle Hours per Capita	1.20	1.13	1.10
	Winter Control Service Level Compliance	93.40%	97.00%	98.50%
	# of Registered Program Participants Visits per Capita	1.80	1.74	1.59
	# of Drop-in Participants Visits per Capita	3.30	3.06	2.83
	Site Plans Issued	33	30	24
	Permits Issued - Residential	1,366	893	960
	Permits Issued - Commercial & Industrial	255	178	227
	Permits Issued - Institutional	39	32	34
	Attendance at Barrie Cultural events (per 1,000)	458	563	611
	Number of cultural events	431	279	252
	Total Participant Utiliz'n Rate (Directly Provided Rec. Prog)		69.00%	64.00%
	Properties on pre-authorized payment (%)	17.80%	21.51%	22.58%
	PROCESS Indicator	2008 Actual	2009 Actual	2010 Actual
Process	Emergency Response Call Volumes for Barrie (per 1,000)	7	7	6
	# of Res'l Insp Site Visits per 1,000 Households	0	0	11.39
	# of C&I Insp Site Visits per 1,000 C&I Properties	0	0	14.89
	Water - Total # of Systems Adverse	17	10	12
	Operational Spending Per Lane KM (Road, Sanitary, Traffic, Lights)	\$10,252	\$8,942	\$9,047
	Transit - Revenue to Cost Ratio	46.00%	52.00%	51.20%
	Residential Waste Diversion Rate	45.00%	49.00%	48.00%
	Facility Electrical KWh Consumption/ft2	0.00	18.92	19.16
	Facility Gas Consumption m3/ft2	0.00	1.76	1.73
	Rate of Tenders received that are greater than 10% over budget	26.70%	21.10%	24.00%

Key	Performance Indicator		Year	
	Site Plan Delegated (% of 8 weeks)	43.00%	95.00%	83.00%
	ICI Permits reviewed within mandatory time frames	95.0%	97.0%	87.0%
	Recruitment Life Cycle (Business Days)	38.30	30.60	32.60
	Avg # Applications / Posting	29.00	30.00	31.00
	Average Number of Bids per Bid Call	0.00	3.49	5.65
	% of Unbilled Water to Water Produced	0.00%	-8.51%	-12.97%
	Billings Outstanding over 90 days (%)	0.00%	49.16%	42.93%

These metrics can be plotted over time to provide a better picture of trends.

Figure 3-1 Corporate Balanced Scorecard – Water & Wastewater Operations (Net\$)

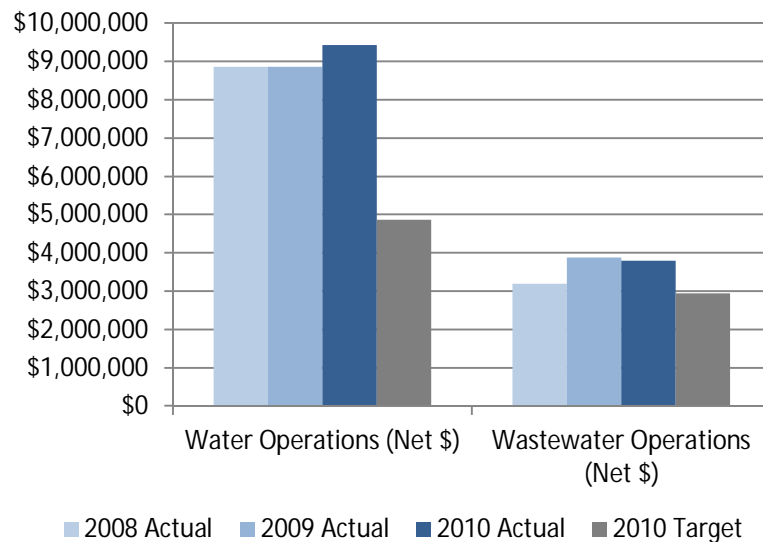


Figure 3-2 Corporate Balanced Scorecard – Water: Total # of Systems Adverse

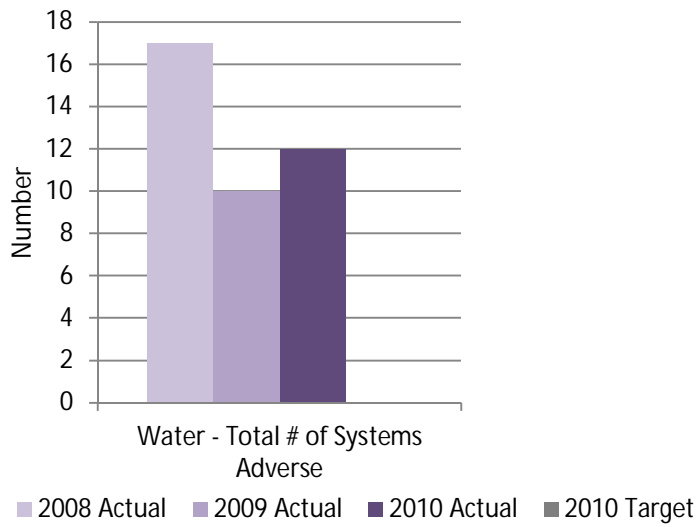


Figure 3-3 Corporate Balanced Scorecard – Residential Waste Diversion Rate (%)

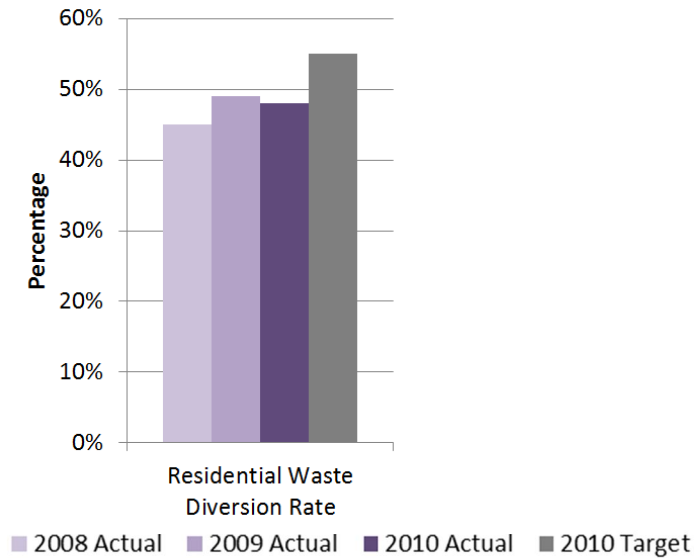


Figure 3-4 Corporate Balanced Scorecard – % of Unbilled Water to Water Produced

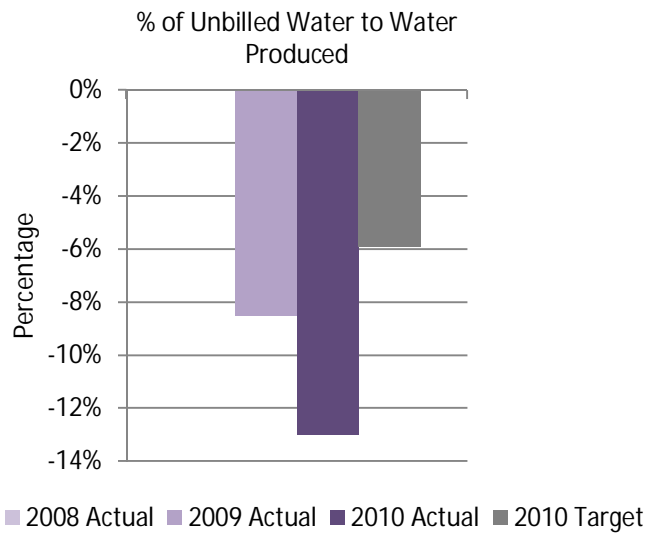


Figure 3-5 Corporate Balanced Scorecard – (Parking Net \$)

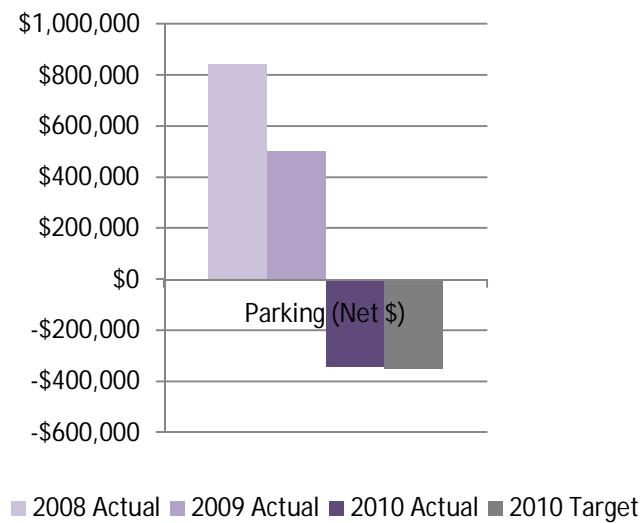


Figure 3-6 Corporate Balanced Scorecard – (Operational Spending Per Lane KM)

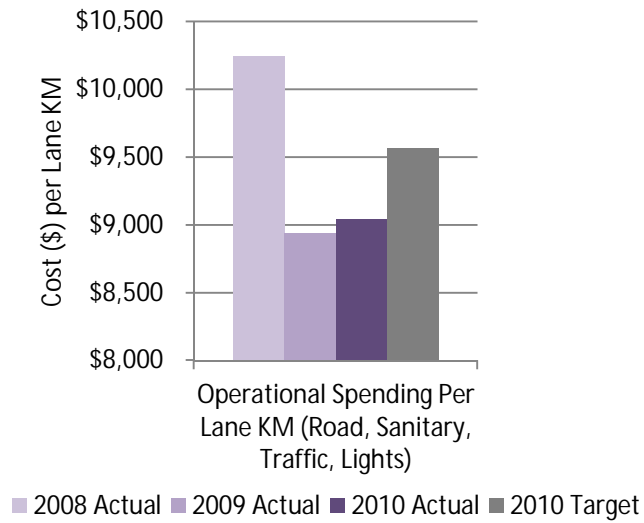


Figure 3-7 Corporate Balanced Scorecard – (Winter Control Service Level Compliance)

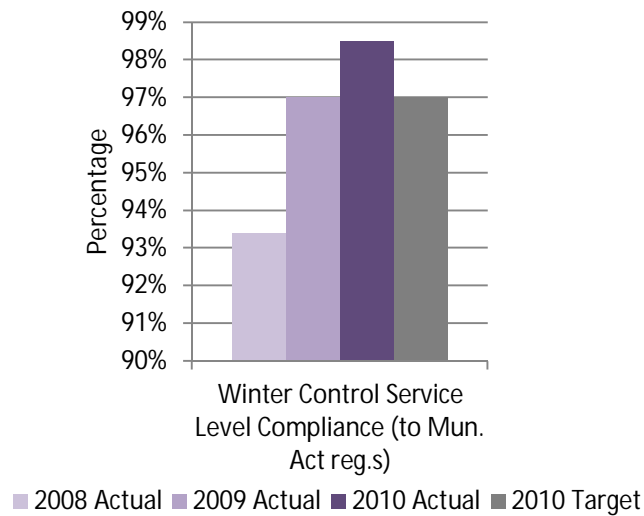


Figure 3-8 Corporate Balanced Scorecard – (Transit Use)

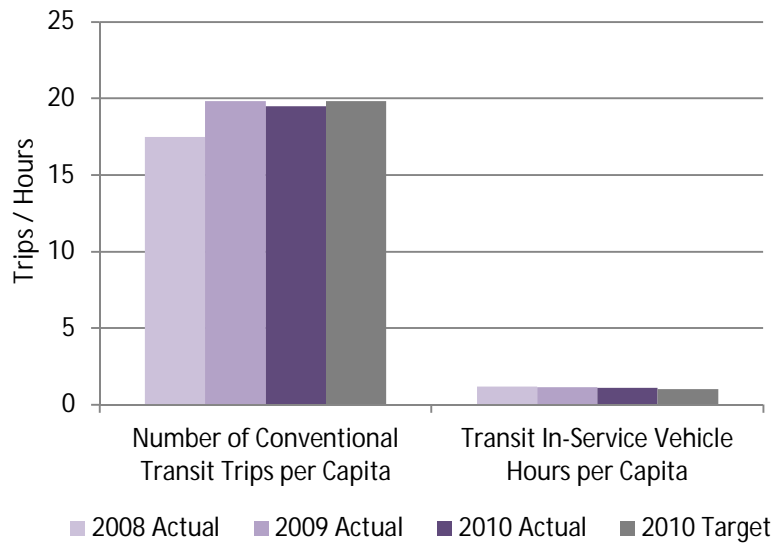


Figure 3-9 Corporate Balanced Scorecard – Facilities Services

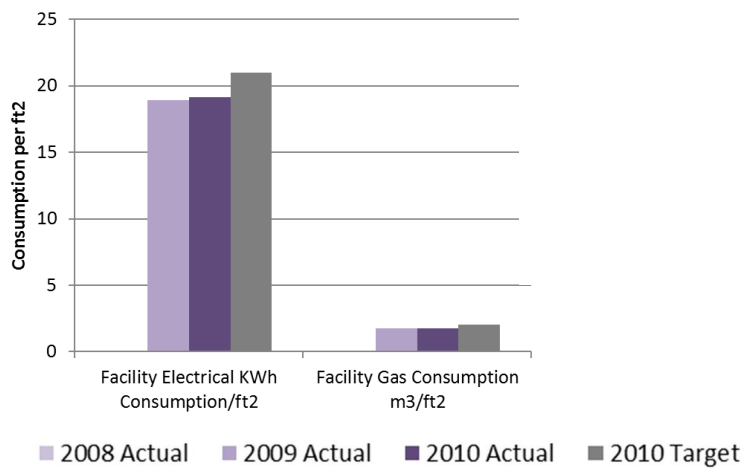


Figure 3-10 Community Service Indicators, Corporate Balanced Scorecard

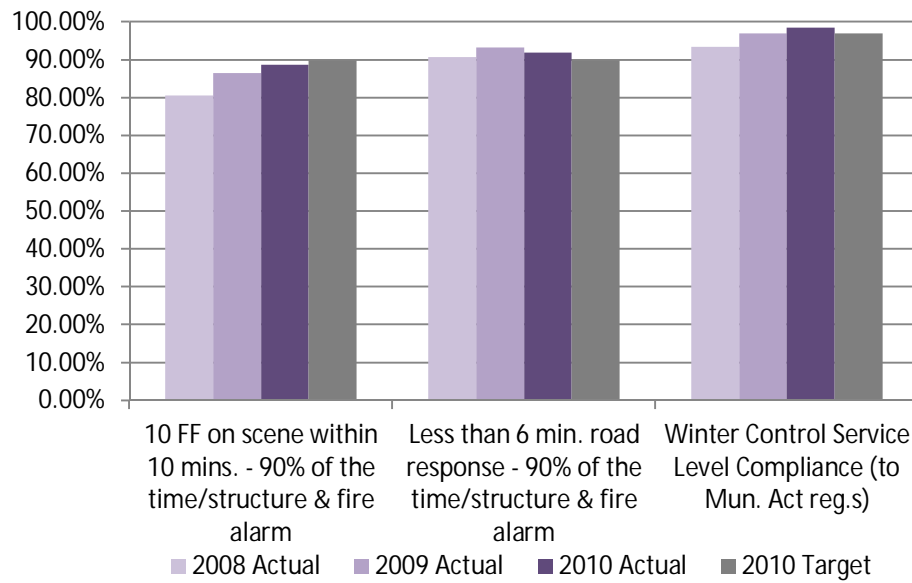
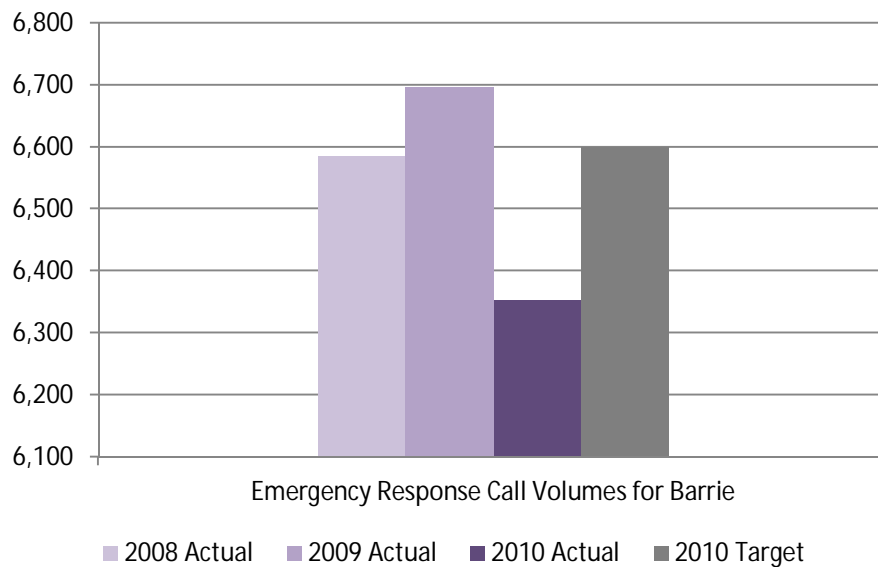


Figure 3-11 Process Indicators, Corporate Balanced Scorecard



3.2.2 OMBI Benchmarking

The Ontario Municipal Benchmarking initiative (OMBI) is a collaboration of 15 Ontario municipalities that represent 9.3 million citizens or 73% of the population of Ontario. This initiative is led by the Chief Administrative Officers (CAOs) and City Managers in each participating municipality. OMBI is intended to foster a culture of service excellence in municipal government by creating new ways to measure, share and compare performance statistics and allow experts in participating municipalities to share ideas on operational practices.

The City of Barrie recently joined the OMBI initiative. Information on the performance measures monitored and reported is provided in the 2009 AM Plan and are not repeated in this Plan.

3.2.3 Legislative Requirements

The procedures, policies, guidelines, and regulations used for inventory control and maintenance of assets that support transportation services are provided in the AM Plan 2009, and are not repeated in this Plan.

4. Growth & Demand

4.1 Overview

Both the 20-year Community Strategic Plan (Foundation for our Future 2003 – 2023) and Council's Strategic Priorities recognize the importance of the City's growth and the need to plan for it. Goals and priorities relevant to growth planning include:

- ▶ 20-Year Community Plan – Foundation for our Future (2003 to 2023)

Plan for Our Future: In future planning initiatives, employ the principles of promoting and managing growth to sustain a strong economy, build a strong community and promote a healthy environment.

- ▶ Council's Strategic Priorities (2007 to 2010)

Ensure a Balanced Approach to Growth Management

- Boundary expansion to ensure a live/work community
- Intensification to build a Complete Community

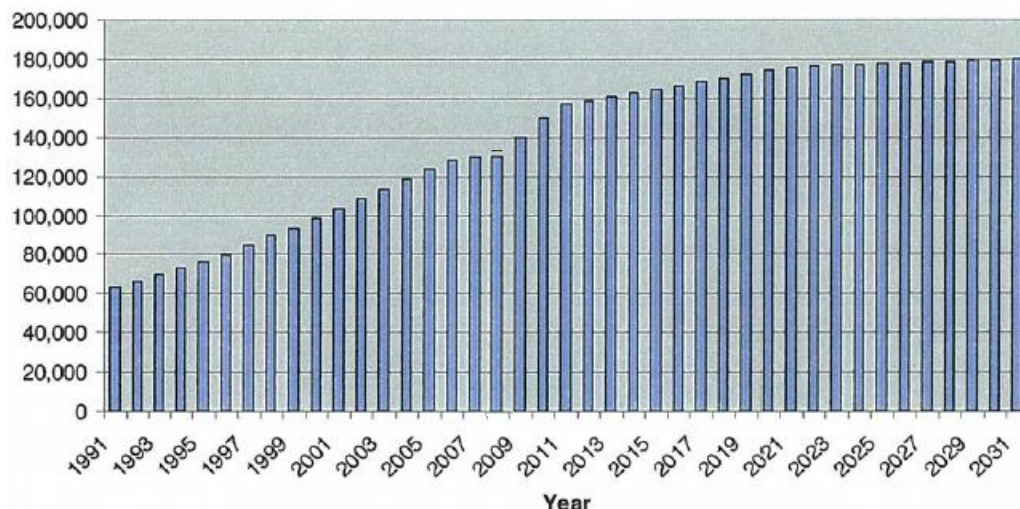
Knowledge of the demand for services and the assets that support that service delivery is important to informed decision-making, including answers to the following questions:

- ▶ How much will the demand for City services and the networks that support these services grow over time and how will this growth influence the need for subsequent lifecycle investment (i.e. operations, maintenance, refurbishment and ultimately disposal and replacement)?
- ▶ Is the imminent failure mode “demand exceeds capacity”? (refer to section 5.2 for further discussion on failure modes).

4.2 Future Population Growth

Between 1996 and 2006, Barrie grew a rate of 4.9% annually, making it the fastest growing area in Canada over the span of ten years. This historic growth and future projections are shown in Figure 4-1 below.

Figure 4-1 Barrie Population Growth – Historic and Projections



The recorded growth rates experienced by Barrie throughout the 1990's have decreased only slightly since 2001. The City is now approaching build-out within the City boundaries, and focus will shift from greenfield development to “intensification” growth or brownfield development.

The City is currently exploring opportunities for expanding its boundaries. Any annexation of surrounding lands will bring increased population and an asset portfolio spread over a much larger geographic area, through long term greenfield development.

4.3 Future Demand for Environmental Services

Future demand for Environmental Services, Transportation Services, Recreation and Culture Services, Facilities and Fleet are included in Appendix A to E respectively, Sections 4.

4.4 Exclusions

This asset management plan does not include any forecasts or projections for expansion of the City's boundaries. If such an expansion does occur in 2012, this should be considered in the next AM Plan developed by the City.

5. Lifecycle Analysis

5.1 Overview

The intention of asset management is to deliver the intended level of service from an infrastructure portfolio, at the least lifecycle cost and at an acceptable level of risk. To increase confidence in its infrastructure decision-making, the City must understand the performance of its assets. This includes understanding how the assets might fail and when, and which assets are most critical. To assist with this understanding, this AM Plan addresses lifecycle analysis processes such as failure modes, remaining life and business risk.

5.2 Failure Mode Prediction

5.2.1 Failure Modes

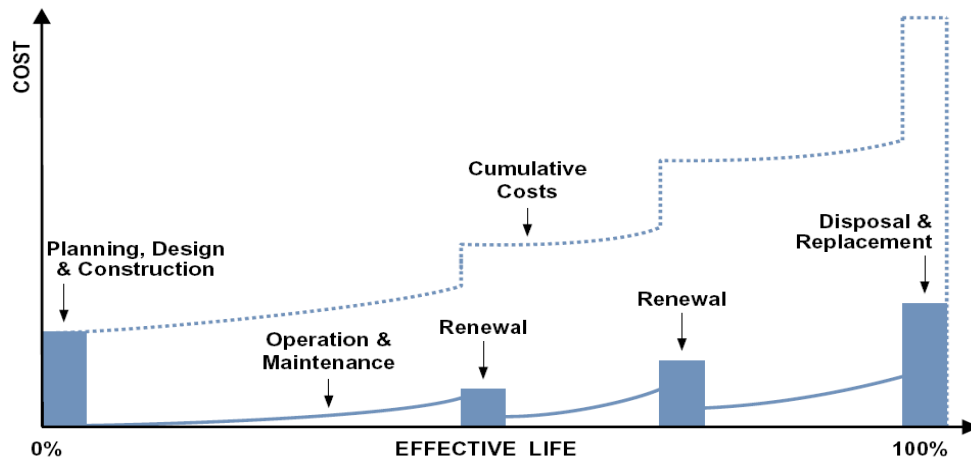
There are several different ways that an asset can fail to provide its required level of service. These are known as the failure modes of an asset. The job of each asset manager in the City is to know how each asset is likely to fail next (the imminent failure mode) and deploy the correct management strategy at the appropriate time in the life of the asset. Decisions about the refurbishment and replacement of an asset and the timing of these activities should be based on a sound determination of assets' critical failure modes. Most asset failures can be classified under one of the following four failure modes:

- ▶ **Capacity:** the demand exceeds the capacity of the existing asset or network of assets.
- ▶ **Physical Mortality:** the structural condition of the asset is such that it has reached the end of its effective life.
- ▶ **Level of Service:** the asset no longer performs reliably.
- ▶ **Financial Efficiency:** the cost of the asset exceeds the economic return necessary to justify retention of the asset.

5.2.2 Remaining Life Prediction

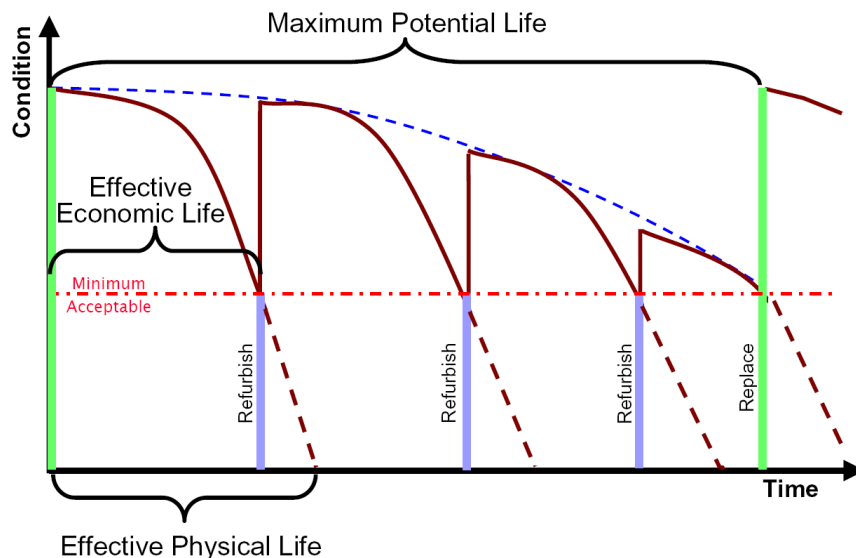
The remaining life of an asset is the period from the current point in time to the time that an asset is renewed. The lifecycle of an asset can generally be described as shown in Figure 5-1 below.

Figure 5-1 Generic Life Cycle Cost Model



There are several definitions for the life of an asset used in developing the management strategies in the lifecycle model for this Asset Management Plan. Figure 5-2 shows the definitions of the various lifecycle “intervention” points for an asset. Some assets may have no intervention points and are simply “run to failure” at the maximum potential life. Other assets may have several technically/economically feasible interventions prior to replacement at the end of the assets life. The economic life of an asset is defined as the time from when the asset is new until the first technically/economically feasible intervention point. The physical effective life is defined as the time from when an asset is new until the asset physically fails with no interventions.

Figure 5-2 Definition of Asset Lives



5.2.3 Failure Mode Prediction

Discussion on the failure mode prediction for Environmental Services, Transportation Services, Recreation and Culture Services, Facilities and Fleet are included in Appendix A to E respectively, Sections 4. For the vast majority of assets included in this AM Plan however, the failure mode utilized in

lifecycle analysis processes is Physical Mortality only. This is due to limited information being available on capacity, levels of service and financial efficiency.

Capacity has been used to predict failure in some solid waste and recreation facilities; however these are generally exceptions in this AM Plan. Where condition data is available (for some linear assets), condition has been used to determine the remaining life. For all remaining assets, remaining life for the physical mortality failure mode is based on the Maximum Potential Life (MPL) and install date. As the City begins to capture more data on its asset portfolio, this data can be used to predict failure modes around other criteria such as capacity, levels of service and efficiency in future AM Plans.

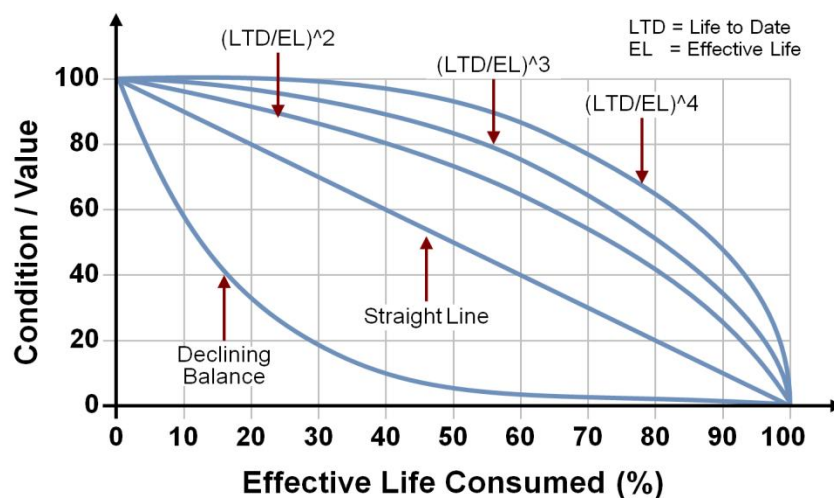
5.3 Remaining Life

The condition and performance of an infrastructure asset does not typically deteriorate in direct relationship with its age, but varies with the:

- Construction techniques, materials, etc.
- Operating environment
- Use to which the asset has been subjected
- Maintenance applied to the asset.

For maintenance and renewal planning of a new asset, initial assumptions must be made about the asset's effective life. As an asset progresses through its lifecycle, these assumptions should be revised through condition monitoring and assessment. The condition assessment of the asset is used, in conjunction with the decay curve, to predict the remaining life of the asset. This can be shown in an asset deterioration model or decay profile, for any particular asset type, as shown Figure 5-3 below.

Figure 5-3 Decay Profile



In the majority of cases, long-life passive assets will have a deterioration that starts slowly, and then accelerates over time (i.e. the gradient of the line will become steeper the older the asset becomes).

To properly address the true deterioration of assets, a software system that records and predicts the actual condition of an asset over time is required, where the user can define or develop the shape of the deterioration curve. As more information about the asset is obtained, the curve's shape is then matched to the actual decay of the asset.

In the interim however, organizations can mathematically mimic condition-based asset depreciation in a relatively quick and simple way by using the year installed or purchased and the effective (design) life of assets to generate condition based curves.

The equation: $1 - (\text{Life to Date} / \text{Effective Life})^n$ will produce a depreciation curve that bows outwards and hence increases depreciation over time, when $n > 1$. Increasing “n” will produce a parabolic curve of steeper gradient. This method allows an approximation of condition-based depreciation if the true decay of the asset is unknown. With appropriate recording of information over time, the theoretical curves can be “tweaked” to suit the assets. This is an appropriate interim method that has been used for this AM Plan until full decay curves or condition based ratings are developed.

Typical values for n are shown below:

- ▶ Major passive civil assets, $n = 4$
- ▶ Architectural passive assets, $n = 3$
- ▶ Mechanical and electrical assets, $n = 2$

5.4 Asset Consumption by Asset Type

Based on the failure modes and remaining life predictions described above, the consumption of each asset in the hierarchy has been calculated. Figures 5-4 to 5-9 illustrate where the City assets are within their lifecycle and how much they have been consumed based on the percentage of maximum potential life consumed and condition of the asset (asset consumption graphs). These figures illustrate the total City asset portfolio as well as a summary of assets specific to Environmental Services, Transportation, Recreation and Culture, Facilities and Fleet.

The asset consumption graphs illustrate the value of assets that are new (0% consumed) through to assets that have reached their maximum potential life (100% consumed). These graphs provide a good indication of which assets are at the end or nearing the end of their life and will, therefore, require replacement in the near future.

As the failure modes for assets are predominately based on install dates and maximum potential life, the consumption of the assets generally reflect the age of the assets only. As additional data becomes available (such as condition data), consumption will directly reflect the maximum potential life based on factors such as condition, capacity and service levels, as opposed to just age.

Figure 5-4 Asset Consumption – Total

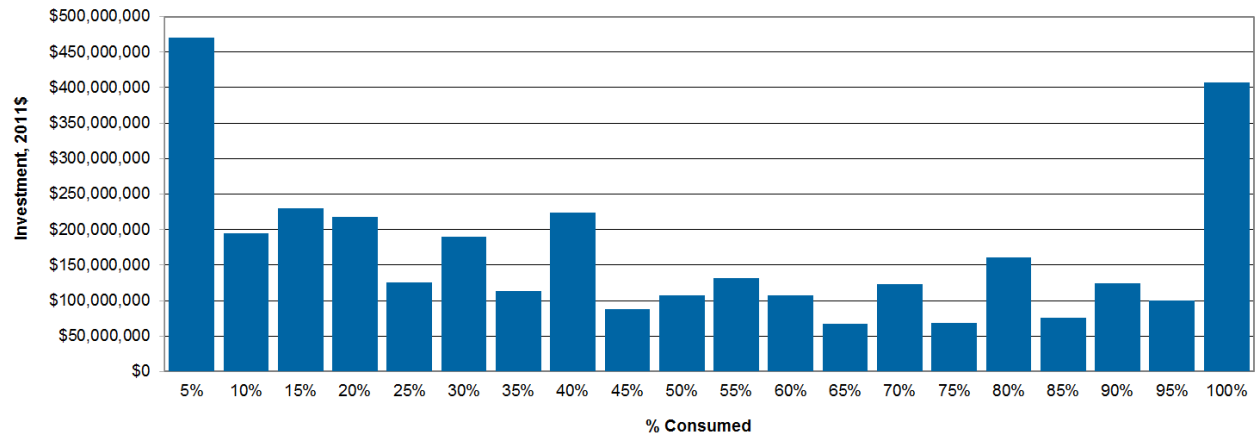


Figure 5-5 Asset Consumption – Environmental

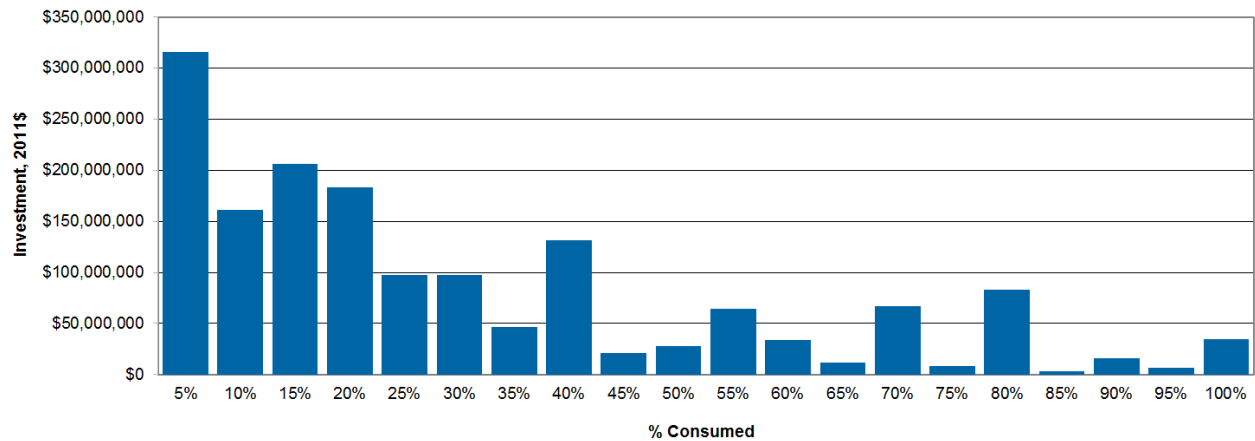


Figure 5-6 Asset Consumption – Transportation

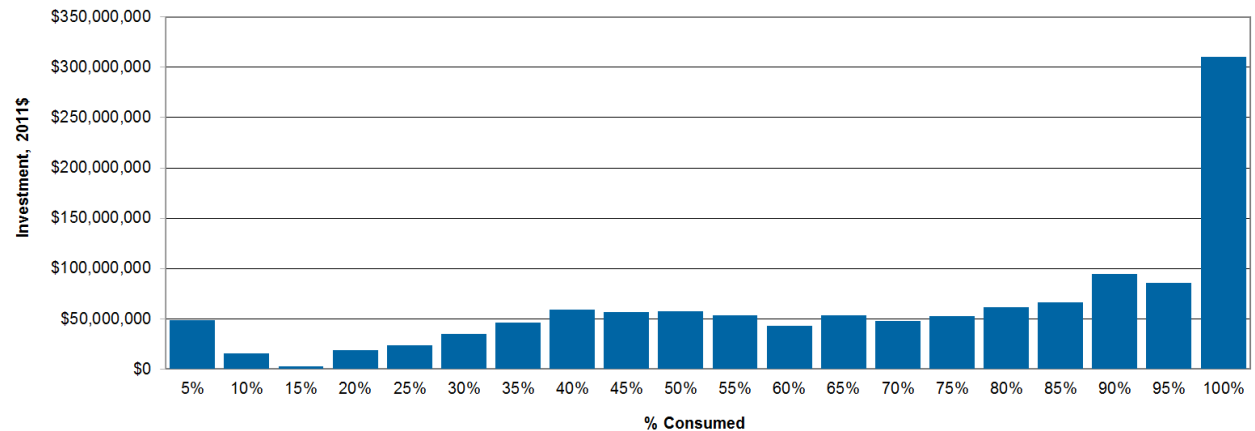


Figure 5-7 Asset Consumption – Recreation and Culture

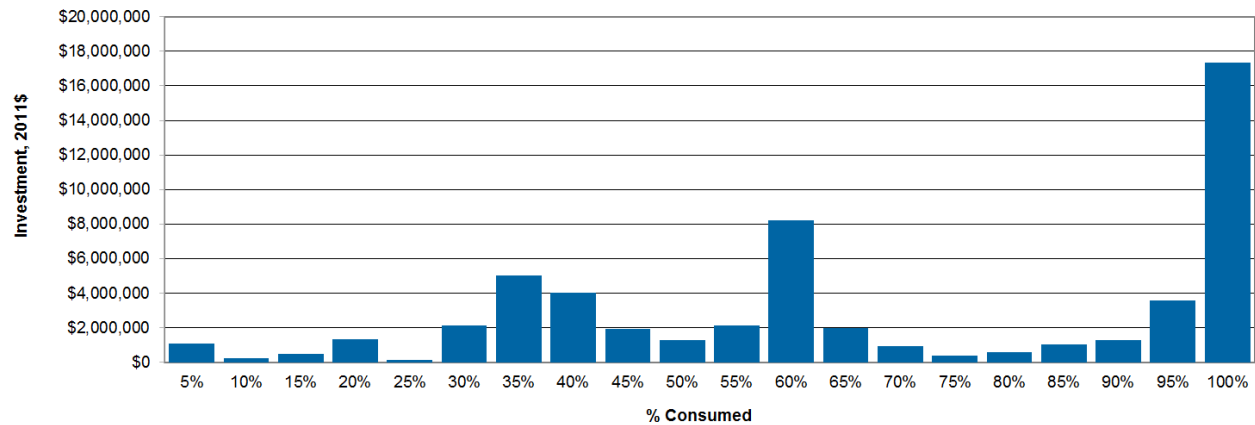


Figure 5-8 Asset Consumption – Facilities

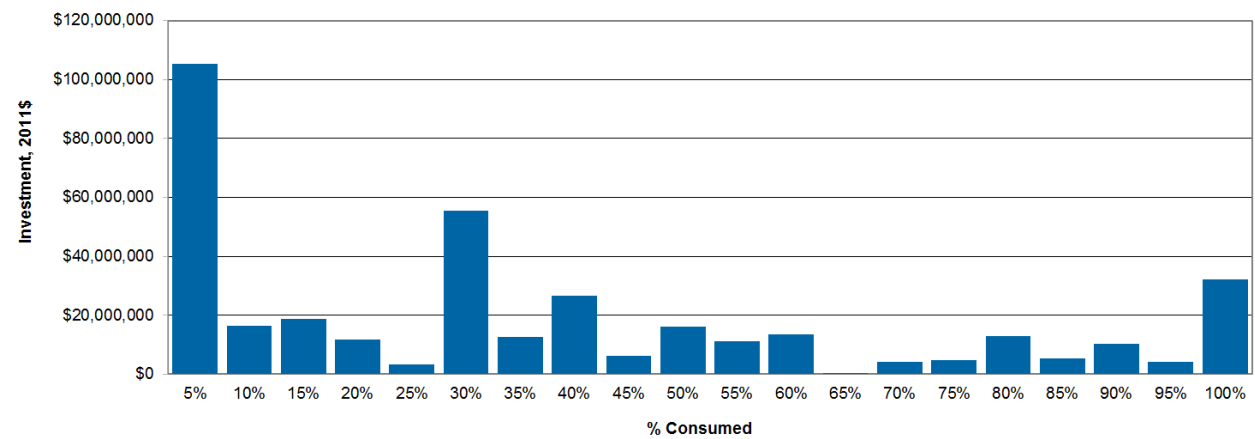
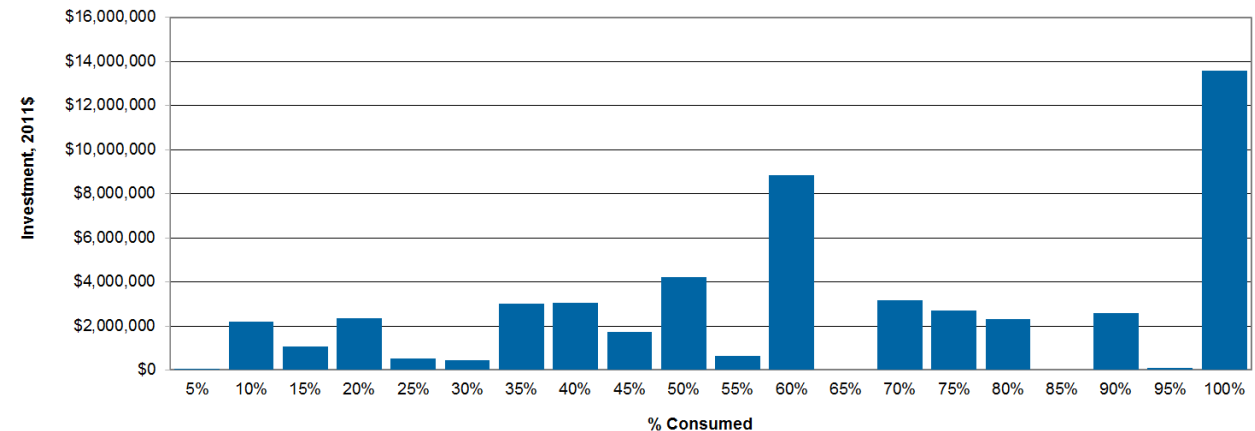


Figure 5-9 Asset Consumption – Fleet



5.5 Risk Assessment

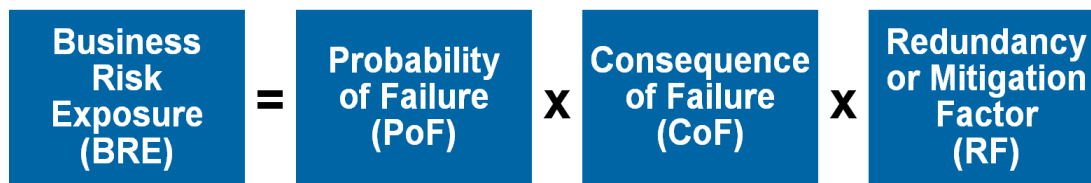
5.5.1 Overview

Risk management is integral part of managing the lifecycle of major infrastructure assets. Any approach that the City takes to the management and maintenance of its assets involves the acceptance of an inherent level of risk. There is typically not enough money in an organization to eliminate all risks. Risk management entails understanding the inherent risk profile in the asset portfolio and establishing strategies to manage the risk to acceptable levels. It is common for municipalities to keep costs low or constant and unwittingly assume more and more risk over time. Risk assessment is a valuable tool for asset investment prioritization and optimized renewal decision-making.

Asset risk arises from the potential for events or failures to occur, and will vary depending on the location, capacity, age and condition of the asset, and other factors. Mitigation of risk occurs primarily through the level of initial investment and putting processes in place to ensure that maintenance and renewals (i.e. interventions) occur in an appropriate and timely manner.

Business risk exposure is derived from the multiplication of three factors. The first is the probability of failure, which is the likelihood or chance that an asset failure may occur within the period of a year. The second is the consequence of failure, which is the direct and indirect impact on the City if such an asset failure were to occur. The third is the redundancy that may be available in the asset portfolio or other form of mitigation such as a contingency plan. This calculation is shown in Figure 5-10 below:

Figure 5-10 Business Risk Exposure Calculation



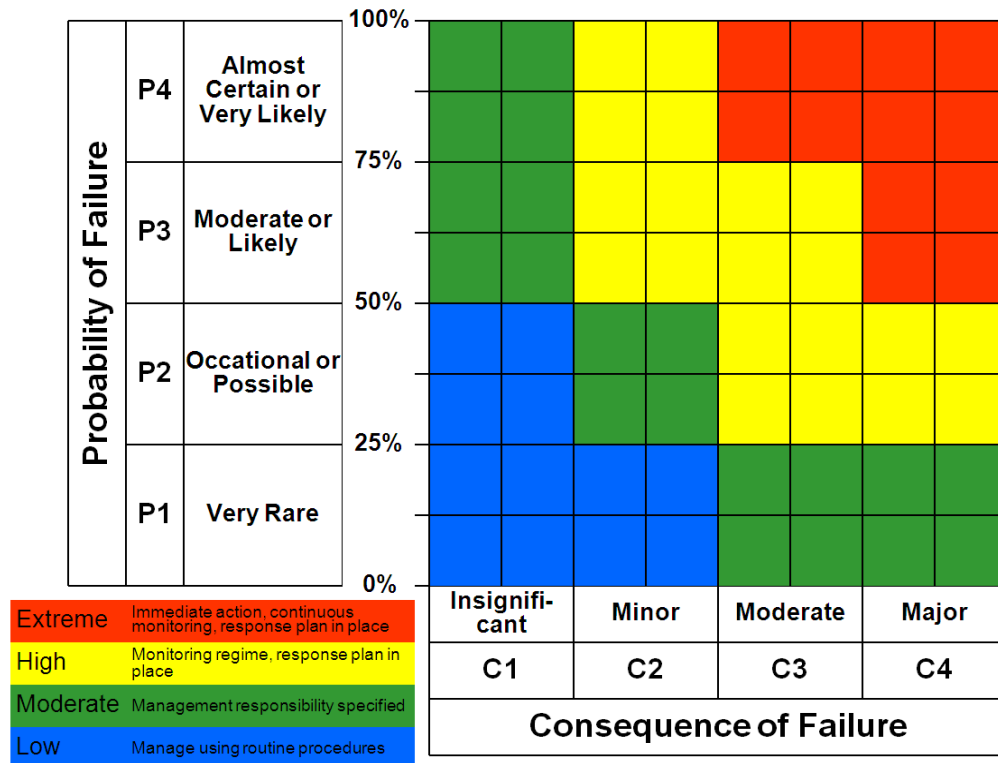
5.5.2 Risk Mapping

A risk map is a graphic representation of probability and consequence of one or more risks related to a similar objective (shown in Figure 5-11). After assessing the impact and likelihood of each risk, they are plotted on a matrix. Different colours on the map help to prioritize where and how to focus City resources, time, effort, and/or dollars.

- ▶ Risks that appear in the red zones are significant to the City and therefore need to be actively managed and monitored in a more comprehensive manner than other risks
- ▶ Risks that appear in the yellow or green zones will also be actively managed depending on their nature
- ▶ Risks that appear in the blue zone are generally acceptable without significant mitigation strategies being implemented, although monitoring may still occur in some form.

Note that this risk mapping and the assessment of probability and consequence is based on the City of Barrie's "Hazard Identification Risk Assessment" (HIRA).

Figure 5-11 Risk Assessment Matrix



Specific risk profiles for each asset portfolio were generally defined during the AM Plan workshops with City staff. The methodology for defining the probability and consequence of failures for assets is described below.

5.5.3 Risk Scores – Probability of Failure

Probability of Failure (PoF) was estimated using a 1 to 4 scale relating to frequency of occurrence, impact on capacity and impact on physical condition, as outlined in Tables 5-1, 5-2 and 5-3 respectively.

Where more than one criteria was applicable to an asset, the highest probability of failure of the three criteria was used. This ensures the greatest impact to the asset was taken into account for prioritisation of the risk.

Table 5-1 Probability of Failure (PoF) Frequency

Level	Title	Probability	Description
P1	Very Rare	< 0.25	Event could occur very infrequently or only in exceptional circumstances, but is not expected
P2	Occasional or Possible	> 0.25 & < 0.5	Event should occur at some time
P3	Moderate or Likely	> 0.5 & < 0.75	Event will probably occur regularly or in most circumstances
P4	Almost Certain or Very Likely	< 0.75	Event is expected to occur very frequently or in most circumstances

Table 5-2 Probability of Failure – Capacity

Level	Status	Description
P1	Very Good	Demand corresponds well with design capacity and no operational problems experienced.
	Good	Demand is within design capacity and occasional operational problems experienced. Demand is approaching design capacity and/or operational problems occur frequently.
P2	Fair	Demand exceeds design capacity and/or significant operational problems are evident.
	Poor	Demand corresponds well with design capacity and no operational problems experienced. Demand is within design capacity and occasional operational problems experienced.
P3	Critical	Demand is approaching design capacity and/or operational problems occur frequently.
	Critical	Demand is approaching design capacity and/or operational problems occur frequently.

Table 5-3 Probability of Failure – Physical Condition

Level	Description
P1	Asset is physically sound and is performing its function as originally intended. Required maintenance costs are well within standards & norms. Typically, asset is new or recently rehabilitated.
	Asset is physically sound and is performing its function as originally intended. Required maintenance costs are within acceptable standards and norms but are increasing. Typically, asset has been used for some time but is within mid-stage of its expected life.
P2	Asset is showing signs of deterioration and is performing at a lower level than originally intended. Some components of the asset are becoming physically deficient. Required maintenance costs exceed acceptable standards and norms and are increasing. Typically, asset has been used for a long time and is within the later stage of its expected life.
	Asset is showing significant signs of deterioration and is performing to a much lower level than originally intended. A major portion of the asset is physically deficient. Required maintenance costs significantly exceed acceptable standards and norms. Typically, asset is approaching the end of its expected life.
P3	Asset is physically unsound and/or not performing as originally intended. Asset has higher probability of failure or failure is imminent. Maintenance costs are unacceptable and rehabilitation is not cost effective. Replacement / major refurbishment is required.

5.5.4 Risk Scores – Consequence of Failure

Consequence of Failure (CoF) was estimated using a 1 to 4 scale against criteria of economic, social, environmental, and service delivery factors, as defined in Table 5-4. Where more than one criterion was

applicable to an asset, the highest probability of failure of the four criteria was used. This ensures the greatest impact to the asset was taken into account for prioritisation of the risk.

Table 5-4 Consequence of Failure (CoF) Levels

Level	Title	Economic	Social	Environmental	Service Delivery
C1	Insignificant	Loss of replaceable asset <<\$1M	No injuries No media interest	Non-lasting damage	No or few disruptions (<10%)
C2	Minor	Damages, losses or fines < \$1M	Minor injuries Local media coverage	Short-term, repairable damage	Minor (isolated) disruption in non-essential service
C3	Moderate	Damages, losses or fines \$1M to \$10M	Serious injuries, multiple minor injuries Some prov/national media coverage	Long-term damage, with repairable consequences	Major disruption in non-essential service Minor (isolated) disruption in essential service
C4	Major	Damages, losses or fines > \$10M	Loss of life, serious injuries Extensive prov/national media coverage	Long-term damage, with lasting consequences	Some essential services unavailable

5.5.5 Risk Scores - Redundancy

A redundancy or mitigation reduction factor was calculated as a percentage of the consequence of failure score for each asset assessed. Redundancy was applied if there was some form of back up system or contingency available for the assets assessed. The minimum redundancy reduction factor applied was 1.0. Redundancy factors are defined in Table 5-5.

Table 5-5 Redundancy Factors

Level of Redundancy	Reduction Factor
No backup	1.0
20% backup	0.8
50% backup	0.5
75% backup	0.2
100% backup	0.1
200% backup	0.02

5.5.6 Business Risk Exposure

The business risk exposure score was determined for all assets as the product of PoF, CoF, and the redundancy/mitigation reduction factor, as illustrated in Figure 5-10.

5.6 Business Risk Exposure (BRE) by Asset Type

Asset management involves understanding and balancing levels of service, cost, risk, and customer expectations. Understanding which assets or asset components are critical and why helps an organization focus efforts and investments on critical investments. Business risk exposure is a measure used to estimate the relative risks that individual assets present to the City of Barrie.

Using the risk methodology described above, risk maps have been produced for asset areas which show the value of assets, in 2011 dollars, at extreme, high, moderate, or low risks of failure. Assets falling in the extreme and high categories will generally be those assets that are most consumed, as illustrated in the consumption graphs, and therefore have a high probability of failure, and those that have a high consequence.

The risk maps have enabled the identification and prioritization of high risk assets that require closer inspection (to verify if they truly are high risk), and possible renewal or replacement.

5.6.1 Corporate Business Risk Exposure

The risk map for all City assets is as follows. Approximately 26% of the City's assets are an extreme business risk, with a further 19% of assets being a high business risk.

Table 5-12 Asset Business Risk Exposure – Corporate (\$2011)

PoF	P4	\$142,684,375	\$53,993,816	\$244,104,710	\$427,415,719
	P3	\$193,977,587	\$23,015,090	\$95,649,317	\$186,362,330
	P2	\$245,723,311	\$30,800,627	\$247,471,912	\$198,688,373
	P1	\$59,830,370	\$40,605,006	\$517,257,979	\$619,421,210
		C1	C2	C3	C 4

CoF

Table 5-13 Asset Business Risk Exposure – Corporate (%)

PoF	P4	4%	2%	7%	13%
	P3	6%	1%	3%	6%
	P2	7%	1%	7%	6%
	P1	2%	1%	16%	19%
		C1	C2	C3	C 4

CoF

The assets that comprise the extreme BRE for the City of Barrie are provided in detail below and in the appendices.

5.6.2 Environmental Business Risk Exposure

The risk map for environment assets is as follows. Approximately 5% of environment assets are an extreme business risk, with a further 18% of assets being a high business risk.

Table 5-14 Asset Business Risk Exposure – Environment

PoF	P4	\$646,641	\$1,850,229	\$34,318,340	\$105,726,226
	P3	\$1,839,963	\$7,884,522	\$62,315,993	\$112,774,513
	P2	\$783,782	\$20,249,708	\$195,269,492	\$106,806,239
	P1	\$1,817,807	\$16,877,739	\$440,767,710	\$503,368,181
		C1	C2	C3	C 4
		CoF			

The assets that comprise the extreme/high BRE for these assets are:

- ORO Bio-Solids Facility, Storage Tanks
- Sewage Pumping Stations (Grove Street, Pumping Station, Holly, Huronia Road, Little Lake, Lockhart Road, and Minets Point Pumping Stations), both Instrumentation & Sewage Pumps
- WPCC including:
 - SCADA & Power Generation, Co-gen facility
 - Secondary Process, Aeration Mixers
 - Tertiary Process, Filter Beds #1 & #2
 - Preliminary Process, Raw Sewage Pumps and Screen Grinders
- Sanitary Sewers, Local - VC
- Booster Stations, all, various asset types
- U/G Reservoirs (Anne Street and Harvie Road), various asset types
- Water Towers (Bayfield Street and Maplevue Drive)
- Mains, Cast Iron
- Storm Culverts, Concrete and Corrugated Steel
- Storm Sewers, Local - Various Materials (mostly concrete).

5.6.3 Transportation Business Risk Exposure

The risk map for transportation assets is as follows. Approximately 3% of transportation assets are an extreme business risk, with a further 12% of assets being a high business risk.

Table 5-15 Asset Business Risk Exposure – Transportation

PoF	P4	\$123,532,990	\$42,389,427	\$153,164,226	\$299,246,679
	P3	\$186,479,101	\$8,297,454	\$15,304,593	\$41,082,331
	P2	\$239,481,540	\$7,035,701	\$3,401,193	\$5,478,582
	P1	\$56,163,148	\$16,007,558	\$22,230,304	\$14,996,286
		C1	C2	C3	C 4

CoF

Approximately 40% of transportation assets are an extreme business risk, with a further 6% of assets being a high business risk. This is a very significant change from the 2009 AM Plan, as a result of the updated condition data from the Road Condition Assessment Study. In addition to the Surface and Base Pavement, the following assets have extreme BRE:

- Culvert 02: Big Bay Point Road (0.35km E of Pine Drive)
- Traffic signals (full signals 4 way).

5.6.4 Recreation and Culture Business Risk Exposure

The risk map for recreation and culture assets is as follows. Approximately 10% of recreation and culture assets are an extreme business risk, with a further 11% of assets being a high business risk.

Table 5-16 Asset Business Risk Exposure – Recreation and Culture

PoF	P4	\$12,609,772	\$4,439,480	\$6,866,242	\$0
	P3	\$3,559,164	\$4,146,354	\$5,968,218	\$0
	P2	\$2,357,445	\$703,625	\$11,354,404	\$0
	P1	\$417,011	\$1,282,441	\$1,658,598	\$0
		C1	C2	C3	C 4

CoF

The assets classes that comprise the extreme/high BRE for recreation and culture assets are:

- Baseball fields (minor lit, major unlit, minor unlit)
- Miscellaneous Active Rec Facilities (community tennis lit, neighbourhood tennis lit, lacrosse)
- Play spaces (play equipment large, play equipment medium, play equipment small)
- Soccer (senior unlit, junior unlit, senior lit)
- Park bridges
- Parking lots (gravel and paved).

5.6.5 Facilities Business Risk Exposure

The risk map for facilities assets is as follows. Approximately 14% of facility assets are an extreme business risk, with a further 7% of assets being a high business risk.

Table 5-17 Asset Business Risk Exposure – Facilities

PoF	P4	\$52,076	\$5,314,680	\$44,793,652	\$14,990,624
	P3	\$0	\$2,686,760	\$9,357,703	\$21,975,189
	P2	\$0	\$2,811,593	\$33,235,427	\$81,277,642
	P1	\$100,000	\$6,437,268	\$51,545,398	\$97,306,379
		C1	C2	C3	C 4

CoF

The assets that comprise the high BRE for facilities assets are:

- ▶ Components of City Hall and other smaller, older facilities
- ▶ Components of Fire Station #1, #2 and #3, and Police (Sperling)
- ▶ The building envelope of the Operations Centre and Transit Terminal
- ▶ Components of Parks facilities

5.6.6 Fleet Business Risk Exposure

The risk map for fleet assets is as follows. Approximately 40% of fleet assets are an extreme business risk, with a further 33% of assets being a high business risk.

Table 5-18 Asset Business Risk Exposure – Fleet

PoF	P4	\$5,842,896	\$0	\$4,962,250	\$7,452,190
	P3	\$2,099,359	\$0	\$2,702,810	\$10,530,297
	P2	\$3,100,544	\$0	\$4,211,396	\$5,125,910
	P1	\$1,332,404	\$0	\$1,055,969	\$3,750,364
		C1	C2	C3	C 4

CoF

The assets that comprise the extreme/high BRE for fleet assets are as follows. These are discussed in more detailed in Appendix E, Section 5.

- ▶ Plated Fire (9) Unplated Fire (2)
- ▶ Plated Environmental (1) Unplated Environmental (2)
- ▶ Plated Recreation and Culture (1) and Unplated Recreation and Culture (2)
- ▶ Plated Transportation (44) and Unplated Transportation (4).

6. Lifecycle Activities

6.1 Overview

This section describes the lifecycle activities used in the development of this AM Plan and what should be used in the development of future AM Plans. Lifecycle activities are strategies implemented by the City to enable assets to achieve the required levels of service and to prolong the economic effective life and maximum potential life of the assets beyond the initial physical failure. Lifecycle activities may include maintenance strategies, renewal works and capital improvements or other similar interventions/treatments that are required over the life of an asset.

The following sections describe the lifecycle activities for each asset type that were developed in the AM Plan workshops with City staff. The fundamental lifecycle activities available to the City include:

- ▶ Do nothing (“Zero-based” strategy)
- ▶ Status quo
- ▶ Operate differently
- ▶ Maintain differently
- ▶ Run-to-failure
- ▶ Preventive-based maintenance
- ▶ Condition/usage (predictive)-based
- ▶ Repair
- ▶ Refurbish/Rehabilitate
- ▶ Replace
- ▶ Decommission
- ▶ Non-asset based solutions (e.g. applying water restrictions).

Lifecycle activities are the combination of the appropriate intervention activities, such as maintenance or replacements. Intervention is the individual event or set of events that comprise the strategy over the life of the asset. The major question for each asset manager is which strategy or combination of strategies gives the longest life extension to the asset at the least lifecycle cost (lowest total cost of ownership).

An asset-based organization should understand how its assets are performing in relation to the assets’ rate of consumption and condition. Condition assessment provides insight into the remaining physical effective life of the asset and the probability of failure. Failure to fully understand an asset’s current condition, remaining life and probability of failure, may lead to its premature failure or to the misdirection or mistiming of reinvestment in the asset. Unanticipated failure of an asset often leaves the asset manager with only one option – to replace the asset, and this option is often the most costly of all options. The associated failure can unduly expose the organization to potentially severe undesired consequences depending on the nature and context of the failed asset.

The City budget available to implement lifecycle activities often restricts the strategies that can be implemented at any point in time. The following table lists the budgets assumed to be available for each of the asset types for 2011, as defined by the 2011 Operating Budget.

Table 6-1 Annual Budget – Assumed Available for Capital Renewal Funding for 2011

Asset Type			Budget (\$M)	% of Total
Environmental	Water Linear		\$989,958	3.33
Environmental	Wastewater Facilities		\$543,847	1.83
Environmental	Wastewater Linear		\$821,826	2.76
Environmental	Storm Facilities		\$4,622,463	15.55
Environmental	Waste Management		\$3,415,687	11.49
Transportation	Roads	Pavement	\$8,354,041	28.10
Transportation	Roads	Bridges & Major Culverts	\$16,450	0.06
Transportation	Roads	Sidewalks	\$455,167	1.53
Transportation	Roads	Traffic Signals	\$565,773	1.90
Transportation	Street Lights		\$29,297	0.10
Transportation	Parking		\$99,054	0.33
Facilities	General	Corporate	\$252,236	0.85
Facilities	General	Other	\$3,378,247	11.36
Facilities	Protection	Fire	\$4,415,199	14.84
Facilities	Protection	POA	\$52,182	0.18
Facilities	Protection	Police	\$4,566	0.02
Facilities	Recreation & Culture	Culture & Other	\$35,390	0.12
Facilities	Recreation & Culture	Parks	\$465,554	1.57
Facilities	Transportation	Roads	\$262,983	0.87
Fleet			\$151,000	0.51
Parks			\$801,851	2.70

6.2 Lifecycle Activities by Asset Type

During the AM Plan workshops, City staff discussed “preferred” lifecycle activities for each asset type. Preferred lifecycle activities are the desired practices prescribed by City staff and assumed to provide the intended level of service, at the least lifecycle cost, and at an acceptable level of risk.

These strategies answer the questions: “What will I do to my assets? When? At what cost?” For many asset types, this strategy is “run to failure” but, for other asset types, a maintenance regime and a series of rehabilitation “interventions” are applied to reduce the overall cost of owning the asset over its life.

Due to the limited information available on most City assets, the dominate lifecycle activity is to replace the asset at the end of the maximum potential life (MPL). Additional lifecycle activities are discussed in Appendices A to E, Sections 6.

7. Long-Term Funding Analysis

7.1 Overview

This section of the AM Plan describes the results of the forecast modelling of the lifecycle activities described in the previous section. The results shown are for a 100 year period. The 100 year forecast encompasses the longest projected life of any of the City's assets, thereby allowing the full lifecycle of the assets to be modelled, which decreases the chance of a future event that has not been considered.

This section forecasts the future investments required to sustain the City's current asset portfolio to enable the City to deliver current levels of service to the community – the forecast renewal capital investment. Then, the overall funding required to deliver the required services into the future was forecast. This forecast includes estimates for growth-related capital investment, renewal capital investment, and operating expenditures including administration, operations and maintenance. This funding forecast is then compared to recent capital investments and operating budgets.

7.2 Sustaining the Existing Asset Portfolio

Figures 7-1 to 7-6 illustrate the estimated long term investment needs to sustain the City's existing asset portfolio. That is, the estimated amount of money the City needs to reinvest on in its existing asset portfolio on an annual basis to sustain the current level of service to the City's citizens. The dollar amounts in these figures are in 2011 dollars.

These figures only represent investment needed to replace these assets – they do not include the cost to maintain or rehabilitate them throughout their lives (these costs are addressed in Section 7.3). All costs are order of magnitude estimates only and are based on cost data provided by the City of Barrie. The figures illustrate the long term funding needs at a corporate level (all City assets) and for each service department including Environmental, Transportation, Recreation and Culture, Facilities and Fleet. The figures indicate that the City needs to be reinvesting the following amounts on an annual basis to sustain its existing asset portfolio.

Figure 7-1 Forecast Asset Renewal Investment – Corporate

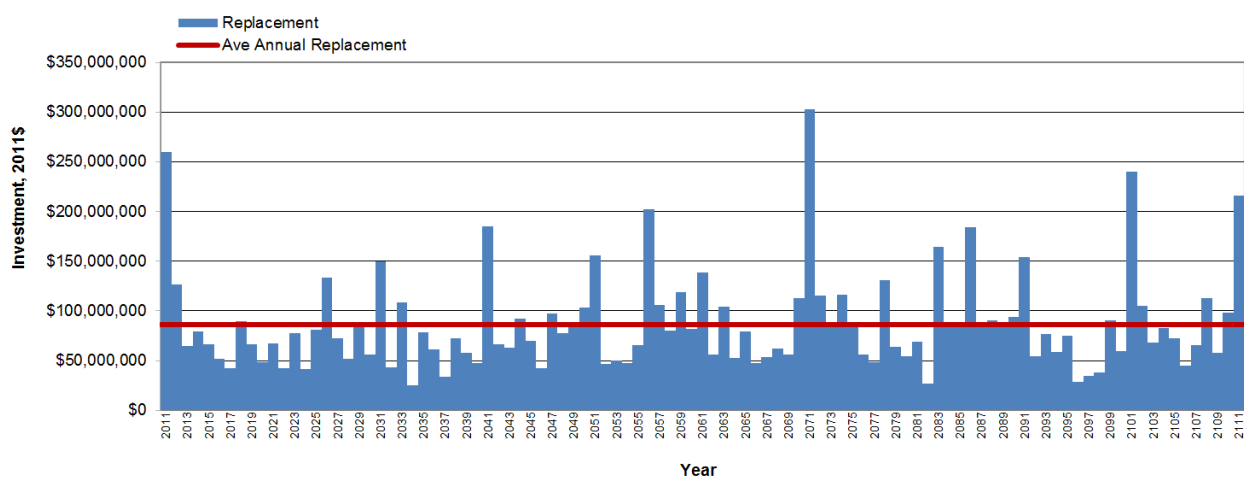


Figure 7-2 Forecast Asset Renewal Investment – Environmental

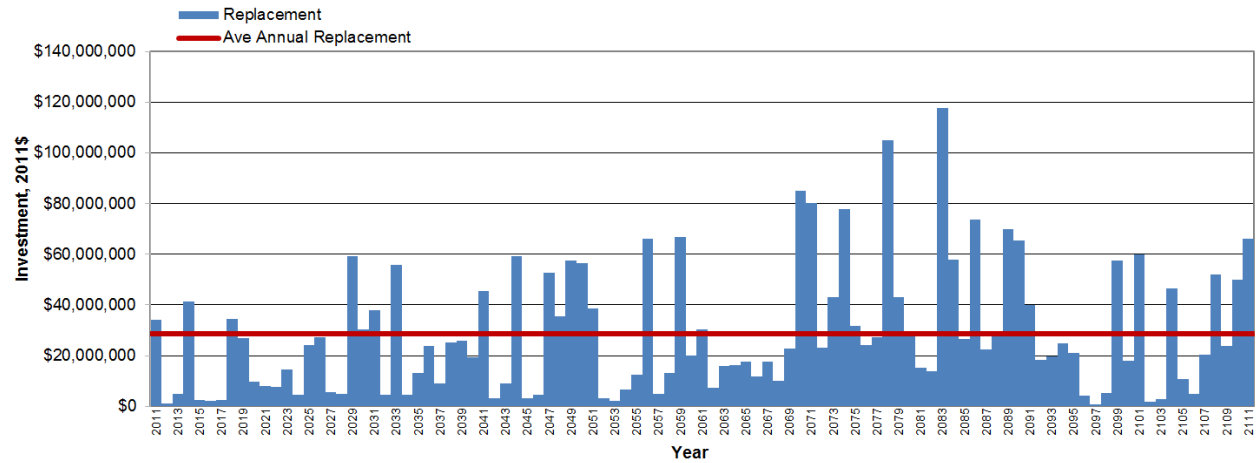


Figure 7-3 Forecast Asset Renewal Investment – Transportation

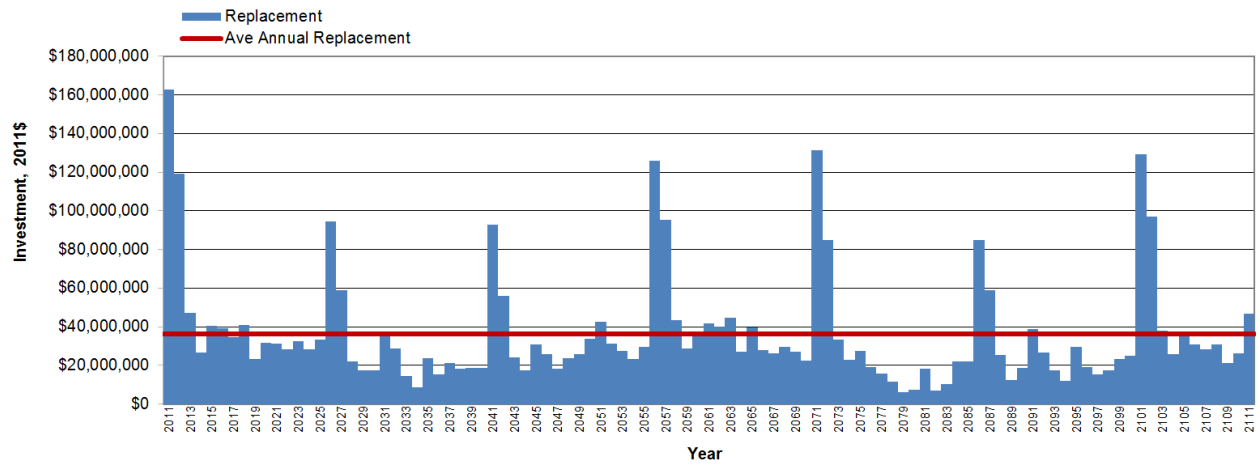


Figure 7-4 Forecast Asset Renewal Investment – Recreation and Culture

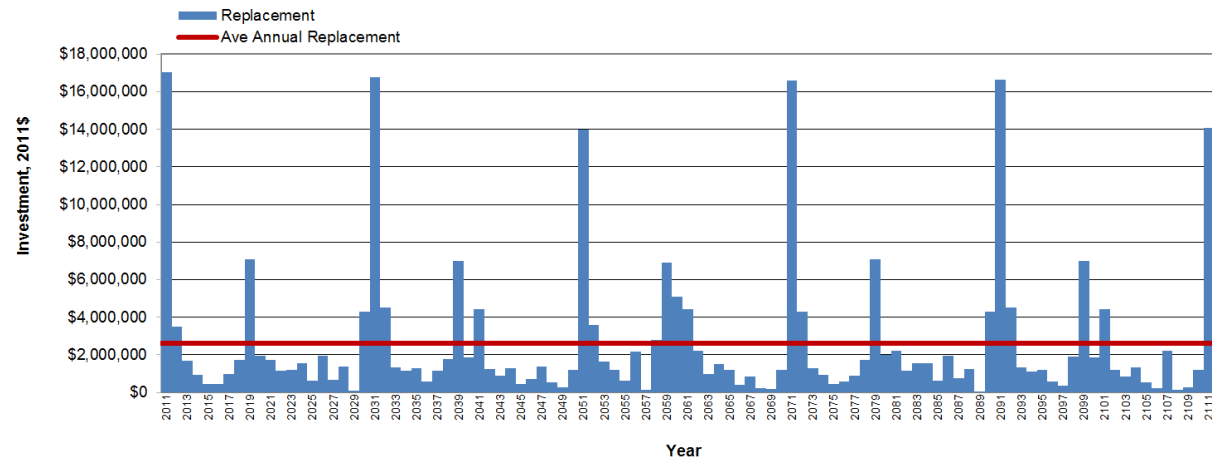


Figure 7-5 Forecast Asset Renewal Investment – Facilities

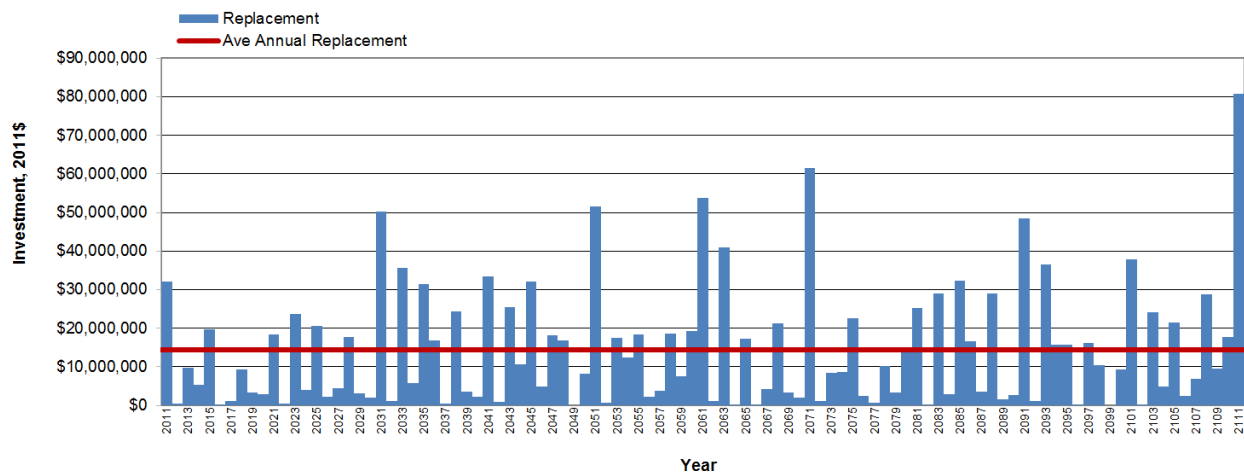
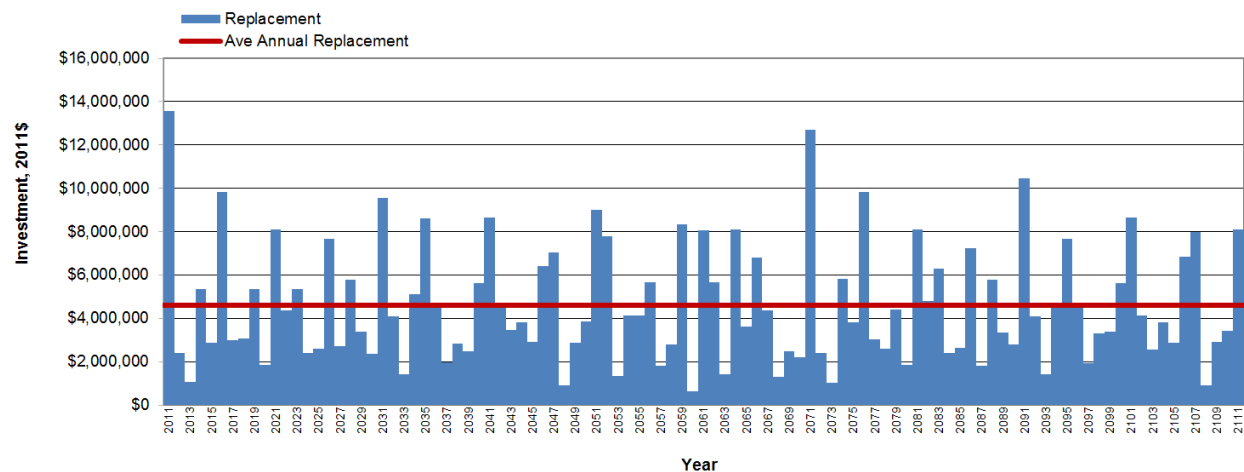


Figure 7-6 Forecast Asset Renewal Investment – Fleet



The City reinvested approximately \$33 million to replace assets within the portfolio in 2008, \$44 million in 2009, \$36 million in 2010, and approximately \$30 million in 2011 (all in 2011\$). The average reinvestment over the past four years is \$36 million, which is only 41% of the forecast average annual sustainable renewal amount of \$28.6 million. **Thus the historic rate of replacement is not sustainable.**

If the City continues to defer needed replacement of its infrastructure, the City's assets will continue to deteriorate, service levels will be negatively impacted and/or the City will continue to assume more risk.

Note that the \$260 million forecast asset replacement investment in 2011 includes a “backlog” of investment that has not taken place in the past and is now “due”. **The City's estimated asset deficit is \$146 million in 2011** (which equals \$260 million 2011 replacement investment, less the \$86 million average annual replacement investment and less the \$28 million 2011 estimated budget), up from \$140 million in 2009. Each year that the City does not reinvest adequately to replace its assets, this deficit will continue to grow and compound. If this deficit is allowed to grow, the result will be a reduction in service levels or an increase in risk related to the assets that comprise the deficit.

Table 7-1 below shows the level of expenditures over the past three years and the estimated budget for 2011 compared to the forecast average annual sustainable renewal amount (all in millions of 2011\$).

Table 7-1 Comparison of Past Expenditures to Sustainable Renewal Amounts

	Expenditures (in 2011\$)			Estimate 2011	Forecast Sustainable Renewal Amount
	2008	2009	2010		
City (Total)	\$32.9	\$44.2	\$35.9	\$29.7	\$86.6
Environmental	\$16.5	\$32.8	\$14.9	\$10.4	\$28.6
Transportation	\$14.8	\$8.1	\$11.4	\$9.5	\$36.3
Rec & Culture	\$0.3	\$0.6	\$0.5	\$0.8	\$2.6
Facilities	\$1.4	\$2.2	\$9.1	\$8.9	\$14.5
Fleet	\$0.0	\$0.4	\$0.1	\$0.2	\$4.6

8. Short-Term Investments

8.1 Corporate 10-Year Capital Program Needs

An important part of the City asset management decision-making is developing specific work or projects in the short term. Much of the City's investment in assets should be to reduce risk. The City's highest risk (BRE) assets are shown in more detail along with the short term capital needs, with replacement cost in 2011 dollars, in the Appendices for each of the asset types. The City should confirm if these assets do indeed represent a high/extreme business risk to the City and, if they do, develop business cases to include them in the 10-year capital program.

9. Confidence Level Rating & Recommendations

9.1 Overview

The underpinning premise of asset management is that an organization will seldom have perfect processes and perfect data with which to manage the asset portfolio. Asset management is a process of continuous improvement – start with what is known today and improve over time. The City expects that this AM Plan will be developed and improved on a one or two year cycle to match City business planning. These improvements will be taken on a step-by-step basis in line with the resources the organization has available to complete this work. The Confidence Level Rating approach will be used to identify the greatest benefit / cost areas for improvement to enable the City to identify the most appropriate improvements to employ.

9.2 Confidence Level Rating

In simple terms, the Confidence Level Rating is based on the following principles:

- ▶ That the AM Plan is produced following a best practice guideline and process
- ▶ That the production of the AM Plan involves 15 elements
- ▶ That the practice undertaken is reviewed and assessed in terms of the quality applied to that process element
- ▶ That the data used in the process is assessed for accuracy and quality perspective
- ▶ That the product of process effectiveness and data quality develops a confidence level rating;
- ▶ That depending on the asset condition, performance and the business environment / viability, a business value chain (weighting) is applied to each quality element based its value to the businesses, or service delivery
- ▶ This then equates to the Confidence Level Rating for that particular quality element
- ▶ The sum of these elements then equates to the Confidence Level Rating for the Asset Management Plan as a whole.

Figure 9-1 Confidence Level Rating Methodology (CLR)

$$\frac{\text{Effectiveness of Process Used} + \text{Quality of Data Used}}{2} \times \text{Business Merit Weighting} = \text{Confidence Level Rating CLR}$$

The confidence level of an AM Plan varies over the planning horizon. As the planning period extends up to 100 years, the accuracy of the predictions is less in terms of clearly identifying the timing of the works and more around the appropriate renewal or replace decisions. As time progresses and this AM Plan is improved, the expectation is the CLR will improve to be commensurate with the City's maturity and commitment to asset management best practices.

9.3 Asset Management Plan 2009 Confidence Level Rating Assessment

Based on the quality elements and weighting allocated in Table 9-1 below, the City's overall confidence level rating, for all five asset service areas, is 43% (up from 42% in 2009). Although this is a low score, it is appropriate considering this is the second asset management plan completed by the City. The score is reflective of the quality and type of data available (or lack thereof), current processes and management strategies. The following table summarises the scores for asset type.

Table 9-1 Confidence Level Rating Assessment Summary

#	Quality Element	CLR Env	CLR Transport	CLR Parks	CLR Fac	CLR Fleet	CLR Ave
1	Existing Standards of Service	1.7	1.6	1.8	1.6	2.0	1.7
2	Knowledge of Existing Assets / Portfolio	6.4	7.1	4.7	6.7	7.8	6.6
3	Current Demands	1.5	1.6	1.5	2.0	1.5	1.6
4	Future Demands / Changes in LOS	2.5	2.5	2.5	3.3	3.5	2.7
5	Prediction of Failure Mode	2.9	2.9	3.7	3.1	3.5	3.1
6	Timing of Failure	2.9	3.2	2.9	2.4	2.4	2.8
7	Consequence of Failure	6.7	6.3	6.5	7.0	6.9	6.6
8	Quality of Proposed Maintenance Program	5.2	5.2	5.2	5.2	7.0	5.4
9	Appropriateness of Recurrent Budgets / Costs	3.4	3.0	3.0	3.0	3.8	3.2
10	Appropriateness of Renewal Solutions	2.3	2.5	2.4	2.4	3.5	2.5
11	Appropriateness of New Asset Solutions	1.6	1.6	1.6	1.6	1.7	1.6
12	Appropriateness of Economic Evaluation Processes	1.4	1.5	1.4	1.4	1.5	1.5
13	Plan and Customer Expectations	1.6	1.6	1.6	1.6	1.6	1.6
14	Ability to Modify Plan	0.8	0.8	0.8	0.8	0.8	0.8
15	Links to Business Goals	0.8	0.8	0.8	0.8	0.8	0.8
TOTAL							43%

Confidence level ratings for each asset type are summarized in Table 9-2 below. Observations that have driven the outcome of this confidence level rating are discussed in Appendices A to E, Sections 9.

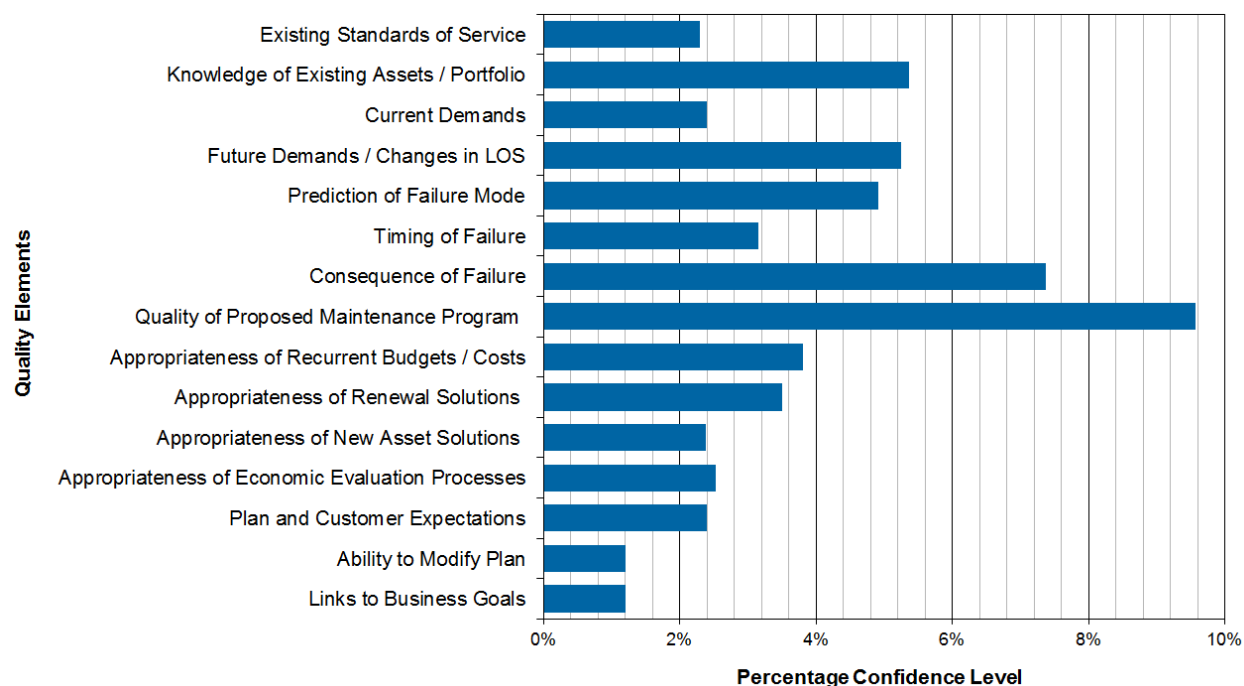
Table 9-2 Confidence Level Rating for each Asset Type

Asset	CLR 2009	CLR 2011
Environmental	41%	42%
Transportation	41%	42%
Recreation & Culture	40%	40%
Facilities	43%	43%
Fleet	47%	48%

9.4 Proposed Improvement Program

The confidence level rating assessment process allows us to identify the most critical elements and target these for a future improvement program. The following figure illustrates the gap in confidence based on the quality elements. The greater the percentage gap, the greater the improvement required.

Figure 9-2 Confidence Level Gap for each Quality Element



9.5 Recommendations for Future Improvements

To assist in the improvement of this asset management plan's confidence level rating, it is recommended that the City of Barrie focus on the key findings from the above gap analysis. Key recommendations are summarised in the table below.

Table 9-3 Recommendations for Future Improvement

	CLR	Comments	Recommendations for Next AM Plan
1	Existing Standards of Service	Service standards are listed in the AM Plan, but service performance was not included in the AM Plan analysis. The AMPs were updated to reflect the 2010 to 2014 Strategic Plan.	As the City incorporates performance management processes and indicators into its business practice, the AM Plan can include level of service performance.
2	Knowledge of Existing Assets / Portfolio	The City has good attribute data on many of its assets, with most linear networks disaggregated into "segments" between "nodes", and wastewater facility (i.e., plant) and community facility assets disaggregated to the level that they are maintained. Water and solid waste facility assets and park assets are held at a low level of disaggregation developed for PSAB PS 3150	The City should continue to expand the asset hierarchy for those service areas where it does not exist at the level at which the assets are maintained. The City should develop data standards for all assets, particularly for condition, performance, and utilization rates. The City should develop condition assessment protocols.

	CLR	Comments	Recommendations for Next AM Plan
		<p>compliance. The hierarchy of facility assets was reorganized to better fit with the way the City manages facilities.</p> <p>Data on condition exists and is recorded at the asset level for some service areas. The 2011 AMPs include updated condition data on pavement, and condition data on some environmental facility assets. Utilization data exists, but is not typically recorded at the asset level. Data standards do not exist.</p>	
3	Current Demands	<p>The City's assessment of the demand for services is on a network or facility level not an asset or process level and based on existing Master Plans. Demand /capacity were not included in the AM Plan analysis. The 2011 AMPs include assets added after 2009.</p>	<p>Once the master plans are complete, the City should estimate the demand for asset services and include it in the AM Plan, including issues such as capacity/availability (quantity), asset levels of service (quality), other associated levels of service (appearance, odour, etc), and reliability of service. The City should continue to distinguish drivers of needs (i.e., additional capacity/ capability, corporate need, legislated requirement, renewal)</p>
4	Future Demands / Changes in LOS	<p>Forecasts for future demand and levels of service are based on Delphi workshop input by City staff and a list of future projects.</p>	<p>Once the master plans are complete, the City should project future demand and levels of service against the assets.</p>
5	Prediction of Failure Mode	<p>The only failure mode used to develop the AM Plan was physical mortality.</p>	<p>The City should include the capacity failure mode and other failure modes, as available, in the next AM Plan.</p>
6	Timing of Failure	<p>Timing of failure for most assets was based on date of creation and standard useful life. For some assets such as pavement and linear underground infrastructure, failure timing was based on condition data (approximately xx% of assets, based on \$2011 replacement cost)</p>	<p>For high consequence of failure assets where condition is a predictor of remaining life, the City should continue to update or determine condition and include this data in development of the probability of failure timing (i.e., the date of failure).</p>
7	Consequence of Failure	<p>Consequence of failure was included in AM Plan analysis using a granular 4 point CoF risk matrix based on Delphi workshop input by City staff. The consequence of failure included the triple bottom line (i.e., economic, social, environmental) plus level of service. An 8 point CoF risk matrix was developed and included in the AMP, but not used to determine CoF. Refinements to the methods to determine CoF were made for some assets.</p>	<p>The City should implement the 8 point CoF risk matrix including the triple bottom line (i.e., economic, social, environmental) plus level of service. For future AM Plans, consequence of failure should be based on dollars, not points.</p>
8	Quality of Proposed Maintenance Program	<p>The maintenance program included in the AM Plan is based on current maintenance budgets, inflated to reflect the growth of the asset portfolio.</p>	<p>As the City incorporates maintenance management processes and implements the CMMS into its business practice, the AM Plan can include causal, activity based cost, and consequence of failure analysis for differing blends of planned and unplanned maintenance,</p>

	CLR	Comments	Recommendations for Next AM Plan
9	Appropriateness of Recurrent Budgets / Costs	Most recurrent costs are not tracked against assets (except WPCC & Fleet). Future forecast recurrent costs are not included in the AM.	As the City incorporates maintenance management processes and implements the CMMS into its business practice, the AM Plan can include more accurate forecasts for recurrent costs, based on actual labour, materials and services recorded against assets, and on the prediction of maintenance costs with usage and age of the asset.
10	Appropriateness of Renewal Solutions	The AM Plan is based on the replacement option. "Lifecycle activities" (i.e. rehabilitation options) are considered for those assets disaggregated to a low level (e.g., an individual pavement "asset" is a block to block segment of surface pavement, with base pavement for the same block being a separate "asset". Asset lifecycle management strategies were investigated and discussed for pavement and fleet.	The City should continue to explore alternative options for renewal of assets for the next AM Plans, including "do nothing", asset (replace, rehabilitate, maintain/operate differently) and non-asset (failure management plan, rebate for failure, different level of service).
11	Appropriateness of New Asset Solutions	The AM Plan does not include growth of the asset portfolio. For all service areas, master plans are under development to support annexation.	Once master plans are updated , the City should include alternative options for new assets for the next AM Plan, including "do nothing", asset (replace, rehabilitate, maintain/operate differently) and non-asset (failure management plan, rebate for failure, different level of service).
12	Appropriateness of Economic Evaluation Processes	The AM Plan is based on constant dollars, with the analysis covering a 100 year period. Asset lifecycle management strategies were investigated and discussed for fleet using Present Value (PV) analysis.	The City should expand the use of analysis of capital investments using more sophisticated modelling processes including lifecycle cost analysis, optimized decision making, and economic indicators such as net present value, internal rate of return, annuities and residual risk cost.
13	Plan and Customer Expectations	The AM Plan is based on the physical mortality failure mode, rather than on customer and other stakeholder requirements such as demand, levels of service, and cost of service (i.e., financial efficiency).	As the City incorporates demand and levels of service processes and performance indicators into its business practice, the AM Plan can include a clearer relationship between customer and other stakeholder requirements and the AM Plan recommendations.
14	Ability to Modify Plan	The AM Plan does not include rationalizing capital and operating programs to suit the customer and stakeholder expectations and willingness to pay.	As the City incorporates verification of projects and use of business cases, the City will develop the ability to identify the implications of not spending money originally requested and passing that information back through the stakeholder framework.
15	Links to Business Goals	There is no clear link between current business goals and objectives of the City and the AM Plan. The Consequence of Failure considered the triple bottom line, which generally relates to City objectives. The AMPs were updated to reflect the 2010 to 2014 Strategic Plan.	As the City incorporates demand and levels of service processes and performance indicators into its business practice, the AM Plan can more clearly link to current business goals and objectives of the city as a whole.

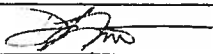
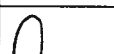
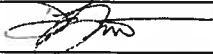
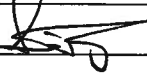
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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
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