City of Hamilton
Water and Wastewater Master Plan
Class Environmental Assessment Report

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1. INTRODUCTION

This Water and Wastewater Master Plan for the lake-based systems is a critical component in the integrated GRIDS process and provides the framework and vision for the water and wastewater servicing needs for the City into the future.

The purpose of the Integrated Water and Wastewater Master Plan for the Lake Based Systems is to provide the City with a water and wastewater servicing strategy in support of the preferred growth option identified by GRIDS Growth Related Integrated Development Strategy) and adopted by Council on May 24, 2006.

The Water and Wastewater Master Plan for the Lake Based System is comprised of three documents, namely:

- **Baseline and Optimization Report**: completed a review of the existing infrastructure and identified opportunities and constraints with respect to optimizing and servicing of future growth. This was a technical study that was used as one of the key inputs into the Integrated Water and Wastewater Master Plan for the Lake Based Systems.
- **Water and Waster Master Plan Policy Paper**: completed and endorsed by Council on May 11, 2005, provided a framework for planning water and wastewater infrastructure.
- **Integrated Water and Wastewater Master Plan for the Lake Based Systems**: followed the Municipal Class Environmental Assessment process which was integrated with the Transportation and Stormwater Master Plans through GRIDS.

This Master Plan Report, including all Appendices, is the documentation placed on public record for the Class EA review period.

1.1 STUDY AREA

The Study Area for this Master Plan consists of the existing lake-based water and wastewater servicing area, which extends to the Urban Boundary, plus any urban boundary expansion areas that are required to service the anticipated growth between the present date and 2031.

1.2 PROBLEM/OPPORTUNITY STATEMENT

The Problem/Opportunity Statement has been defined as:

- The Province, through its Place to Grow document, has identified the need to accommodate growth within the City of Hamilton.
- Water and wastewater infrastructure upgrades will be required to service areas already approved for development as well as future residential and non residential lands.
- Wastewater infrastructure upgrades will be required to address water quality concerns in Hamilton Harbour.

- Integration of planning, water/wastewater, transportation and stormwater processes will ensure implementation of a sustainable growth strategy and fulfill the City's goals identified in Vision 2020.

2. MASTER PLAN METHODOLOGIES

A number of tasks and evaluation requirements were undertaken as part of the Master Plan process unique to the City of Hamilton.

Under any Master Plan, the methodology for analyzing planning information, developing water demands and wastewater flows and modeling the systems needs to be developed to best serve the proponent.

These activities included:

- Development of a data management strategy for population projections
- Updating the City's existing water and wastewater system models for the evaluation of alternative strategies, and for on-going use by the City in the future
- Development of infrastructure unit costs to enable comparative evaluation of alternatives, and
- Evaluation of the servicing alternatives.

2.1 EVALUATION CRITERIA

Information on each of the servicing alternatives was developed to enable a comparative evaluation of impacts, and selection of a preferred alternative. The factors considered generally matched the Triple Bottom Line (TBL) evaluation approach approved for GRIDS:

- Physical and Natural Environment:
- Social, Economic, and Cultural Environment:
- Financial Factors:
- Technical Factors:

2.2 TECHNICAL CRITERIA AND GUIDELINES

Due to the nature of the City of Hamilton's water and wastewater systems and the location of the system and facilities on Lake Ontario and specifically the Hamilton Harbour, there are provincial technical guidelines relevant to the evaluation of the servicing strategies. Principle guidelines for the design criteria and water quality objectives primarily related to the wastewater system are:

- Procedure F-5-5, a supporting document for the Provincial Guideline F-5 "Levels of Treatment for Municipal and Private Sewage Treatment Works Discharging to Surface Waters"
- The Remedial Action Plan for the Hamilton Harbour (HHRAP).

These principal guidelines have been incorporated into the overall servicing evaluation being undertaken as part of the City of Hamilton Water and Wastewater Master Plan. Under the Master Plan, the goals related to strategies for wastewater servicing, wet weather control and wastewater treatment include:

- Provide capacity to service projected growth
- Maximize volume to be treated through full secondary and tertiary treatment
- Reduce discharge of untreated combined sewer overflow
- Endeavour to meet and achieve HHRAP loading targets and MOE Procedure F-5-5.

3. PLANNING PROJECTIONS

3.1 EXISTING AND FUTURE PLANNING DISTRICTS

The provincial projections under *Places to Grow* for Hamilton in 2031are as follows:

- Hamilton's residential populations will reach 660,000
- There will be 80,000 more households, with 58,400 within the existing urban boundary
- Hamilton will employ 90,000 more people
- There will be an additional 1050 gross hectares of employment land.

The preferred growth option developed through the GRIDS process is generally based on the nodes and corridors concept. The primary growth areas include the Elfrida node located in the southwest mountain and the airport lands. This option also includes selected intensification located primarily along corridors in the central mountain and downtown core.

The projected population and employment statistics are presented in Table ES-1.

Table ES-1 Growth Projections

	Population Projections		Jobs Projections	
	2001	**2031**	**2001**	**2031**
Existing Urban Boundary	471,958	594,795	195,718	286,318
Urban Boundary Expansion Areas	0	41,558	0	16,085
Total Urban	471,958	636,353	195,718	302,403
Total Rural	33,844	32,064	9,194	6,502
GRAND TOTAL HAMILTON	505,802	668,417	204,912	308,905

4. WATER TREATMENT AND DISTRIBUTION

4.1 EXISTING SYSTEM

The existing water system for the study areas consists of the Woodward Ave. WTP, a series of water pumping stations, reservoirs, elevated storage tanks and the distribution system. Based on the change in topography (including the Niagara Escarpment) and the wide geographical service area, numerous Pressure Districts have been established to maintain adequate levels of service.

The water system is set up to pump water through the Pressure Districts to the limits of the system. The transmission of water to each pumping station and reservoir is not provided through dedicated transmission mains but is conveyed through larger diameter trunk watermains. In some Pressure Districts, multiple trunk watermains distribute flow through the system.

The existing water system has two primary feedermains up the escarpment to service the Mountain areas. There is also one feedermain up the escarpment to service Waterdown.

The City water system also takes advantage of the change in topography by providing in-ground and at-grade reservoir storage to service the Pressure Districts in the central and northern areas. Based on historical City standards, the City of Hamilton water system has a large amount of storage available for supply (both floating storage and suction-side storage for pumping), equalization of system flows and pressures, and emergency conditions.

5. DEVELOPMENT AND EVALUATION OF WATER SERVICING ALTERNATIVES

5.1 DEVELOPMENT OF ALTERNATIVES

In general, the overall objectives for the development of water servicing alternatives are:

- Provide high level of service to existing users and approved growth
- Provide security of supply
- Review and mitigate impacts to natural, social and economic environments
- Best meet policy statements
- Ensure servicing meets the technical criteria
- Endeavour to optimize existing infrastructure
- Ensure the strategies are cost-effective and evaluate the life-cycle costs of the infrastructure.

The preliminary evaluation of the long list of alternatives led to the development of several water servicing alternatives. Due to the independent servicing needs in different areas of the City of Hamilton water system, the study area was divided into multiple servicing areas to more clearly evaluate the alternatives. The evaluation within each servicing area was then integrated to ensure the comprehensive preferred solution met all objectives system wide.

Four primary water servicing alternatives were developed to address the water treatment and distribution requirements for the study area. These are outlined in Table ES-2.

Table ES-2 Water Servicing Alternatives

Servicing Area	Alternative ID	Description
Waterdown	W-WS-3	Upgrade pumping capacity at the existing HD016 pumping station, and construct elevated storage
	W-WS-4a	Upgrade pumping station capacity at the existing HD016 pumping station, and construct additional storage in the Kelly Street area
	W-WS-4b	Upgrade pumping capacity at the existing HD016 pumping station and construct new reservoir and pumping station in the Kelly Street area
	W-WS-5	Upgrade HD016 pumping station and construct new reservoir on-site
	W-WS-6	Expand HD016 pumping station and construct new pumping station and reservoir southwest of Waterdown
Southeast Mountain	SEM-WS-1	Service growth area entirely from HD007 New elevated tank for storage, security and operational flexibility
	SEM-WS-2	Service growth area from HD007 and HD006B with new Pressure District 7 pumps New elevated tank for storage, security and operational flexibility
	SEM-WS-3	Service growth area from HD007 and new PD7 pumping station Provide all storage as pumped storage from suction side reservoirs
Airport Lands	AL-WS-1	Service lands from Pressure Districts 6 and 18 Minimize Pressure District 18 service area New elevated tank for storage, security and operational flexibility
	AL-WS-2	Service lands from Pressure Districts 6 and 18 Increased Pressure District 18 service area New elevated tank for storage, security and operational flexibility
Escarpment Crossing	EC-WS-1	Centennial Parkway Feedermain to HD007
	EC-WS-2	Centennial Parkway Feedermain to HD06B
	EC-WS-3	Upper Wellington Feedermain
	EC-WS-4	Beckett Drive Feedermain
	EC-WS-5	Feedermain from HDR02 to Scenic Drive

5.2 SELECTION OF THE PREFERRED ALTERNATIVES

5.2.1 Waterdown Water Servicing

Alternative W-WS-3 is preliminarily selected as the preferred servicing alternative for the Airport Lands, with the following rationale:

- It carries the lowest environmental impact of the alternatives considered;
- It carries a smaller overall land requirement;
- It is the most economical of the options considered;
- The proposed elevated tanks provide increased security of supply, operation flexibility, and efficiency.

5.2.2 Southeast Mountain Water Servicing

Alternative SEM-WS-2 is preliminarily selected as the preferred servicing alternative for the Airport Lands, with the following rationale:

- It carries the lowest capital cost of the three Southeast Mountain alternatives;
- It makes use of the available site capacity that currently exists in station HD06B; and,
- It provides security of supply through construction of a new elevated tank, and the addition of a second supply point.

5.2.3 Airport Lands Water Servicing

Alternative AL-WS-1 is preliminarily selected as the preferred servicing alternative for the Airport Lands, with the following rationale:

- Servicing the Airport Lands through District 6 eliminates the need to upgrade pumping stations servicing District 18.
- This alternative carries the lower capital cost.

5.2.4 Escarpment Crossing Water Servicing

Alternative EC-WS-2 is preliminarily selected as the preferred servicing alternative for the escarpment crossing, with the following rationale:

- There will be a need to reconstruct Centennial Parkway following completion of the Red Hill Valley Expressway. This provides an opportunity to install new trunk water and wastewater servicing while minimizing the impacts to the natural and socio-cultural environments.

5.2.5 Schedule 'B' Projects Included in the Preferred Water Servicing Alternatives

Table ES-3 presents a list of the Schedule 'B' water servicing projects, identified through the master planning process.

Table ES-3 Schedule 'B' Water Servicing Projects

Schedule 'B' Project	Location
Waterdown North Elevated Tank	Waterdown
New HD16A Pumping Station	Waterdown
Parkside Drive Watermain	Waterdown
HD12A – Governor's Rd. Pumping Station Upgrades	Dundas
Waterdown South Elevated Tank	Waterdown
New HD03B – Highland Gardens Pumping Station	Hamilton
HD007 Highland Pumping Station Upgrades and Reservoir Expansion	Hamilton Mountain
Centennial Trunk Feedermain	Hamilton/Hamilton Mountain
Pressure District 18 Elevated Tank	Ancaster
HD002 Ferguson Pumping Station Upgrades (Standby Power)	Hamilton
HD012 Lynden Ave Pumping Station Upgrades	Dundas
HD019 Binbrook/Hwy 56 Pumping Station Upgrades	Binbrook
HD06B Tunbridge Pumping Station Upgrades (New Zone 7 pumps - HD07A)	Hamilton Mountain
Pressure District 7 Elevated Tank in growth node	Hamilton Mountain
Stone Church Trunk Feedermain	Hamilton Mountain
HD016 Trunk Feedermain	Dundas to Waterdown
HD016 York/Valley Rd Pumping Station Upgrades	Dundas
HD05A Greenhill Pumping Station Upgrades	Hamilton
Binbrook Trunk Feedermain	Hamilton Mountain/Binbrook

6. WASTEWATER COLLECTION AND TREATMENT

The City of Hamilton wastewater system consists of combined sanitary/stormwater service areas and separated sanitary service areas. The combined system is generally located in the downtown core and northern sections of the Hamilton Mountain while the separated systems lie at the outer limits of the network.

There are three wastewater treatment plants; Woodward Avenue Wastewater Treatment Plant; The King Street (Dundas) Wastewater Treatment Plant; and the Main Street (Waterdown) Wastewater Treatment Plant.

The Woodward Ave. WWTP catchment area consists generally of the downtown and mountain areas of Hamilton including Ancaster and Stoney Creek. The topography of this catchment area typically falls south to north with the Niagara Escarpment as a significant topographical feature dividing the area. However, at the southern and western limits of the catchment areas, the topography begins to fall southerly and as such, there are a number of sewage pumping stations which convey flows back to the gravity system.

Within the combined sewer system, there are also numerous wet weather control devices including weirs, gates and combined sewer overflows and tanks.

Since the late 1990's, the City has systematically constructed CSO storage tanks, that collect wastewater during wet weather periods, resulting in reduced flow into the system and fewer and smaller system bypasses. CSO storage facilities in the City's system are presented in Table ES-4.

Table ES-4 CSO Storage Facilities - Existing and Under Construction

Tank	Date	Volume (m3)	System
Greenhill #1	1988	83,500	Fennell/RHCSI
Bayfront Park	1993	21,000	Western Interceptor
James Street	1993	3,200	Western Interceptor
Main/King	1997	77,100	Western Interceptor
Eastwood Park	1997	27,350	Western Interceptor
Greenhill #2	2003	66,750	Fennell/RHCSI
Royal	under construction	15,000	Western Interceptor
Ewen	Pending	5,935	Western Interceptor
Red Hill Valley	under construction	14,200 (in-line)	Red Hill Creek Sanitary Interceptor

During periods of wet weather, excess flows will enter the CSO tanks and fill the tanks. Where there are no tanks, excess flow bypasses the treatment system at CSO structures.

The weirs and gates are designed to capture as much wet weather flow as possible within the system or divert to overflow to prevent system surcharging and basement flooding.

The Dundas wastewater system consists primarily of separated service areas. The system conveys flows by gravity from the west to east to the Dundas plant. There is also provision for any excess flows beyond the plant capacity to enter a diversion structure which can convey flows to the Woodward Ave. WWTP.

The Waterdown wastewater system consists of three primary service areas: the core area which drains by gravity to the Waterdown WWTP; the western service area which drains by gravity down the Borer's Creek trunk sewer to the Dundas diversion structure and ultimately to the Woodward Ave. WWTP; the eastern service area which is pumped across to the western service area and ultimately to Borer's Creek trunk sewer.

7. DEVELOPMENT AND EVALUATION OF WASTEWATER SERVICING ALTERNATIVES

7.1 DEVELOPMENT OF ALTERNATIVES

The preliminary evaluation of the long list of alternatives led to the development of several wastewater servicing alternatives. Due to the independent servicing needs in different areas of the City of Hamilton wastewater system, the study area was divided into multiple servicing areas to more clearly evaluate the alternatives. The evaluation within each

servicing area was then integrated to ensure the comprehensive preferred solution met all objectives system wide.

A number of servicing options were developed for providing wastewater treatment capacity for the urban buildout scenario. Servicing alternatives were developed for the following key servicing issues:

- Wastewater servicing within the former Towns of Waterdown and Dundas
- Southeast Mountain urban boundary expansion area, which also includes lands already approved for development through ROPA 9
- Airport Lands urban boundary expansion area
- Combined Sewer Overflow (CSO) control.

The wastewater servicing alternatives are presented in Table ES-5.

Table ES-5 Wastewater Servicing Alternatives

Servicing Area	Alternative ID	Description
Waterdown-Dundas Servicing	WD-WWS-1	The existing servicing areas remain unchanged Central Waterdown serviced through an expanded Waterdown WWTP North and South Waterdown and all of Dundas serviced through an expanded Dundas WWTP
	WD-WWS-2	Decommission Waterdown WWTP, and send all Waterdown flows through the Dundas diversion structure to the Woodward Avenue WWTP. Do nothing at Dundas WWTP, and send excessive flows through the Dundas diversion structure to the Woodward Avenue WWTP.
	WD-WWS-3	Decommission Waterdown WWTP, and send all Waterdown flows to an expanded Dundas WWTP.
	WD-WWS-4	Decommission Waterdown and Dundas WWTPs, and send all Waterdown and Dundas flows through an expanded Dundas diversion structure to the Woodward Avenue WWTP.
Southeast Mountain	SEM-WWS-1	Pump the flows from the Southeast Mountain servicing area to the Red Hill Creek Interceptor System.
	SEM-WWS-2	Service the Southeast Mountain servicing area through a new Centennial Parkway trunk sewer to the Eastern Interceptor System.
Airport Lands	AL-WWS-1a	Collect flows at a single pumping station in the south of the Airport Lands; pump through Ancaster to the Western Interceptor System.
	AL-WWS-1b	Collect flows at a pumping station in the south of the Airport Lands and an intermediate station in the middle of the Airport Lands; pump through Ancaster to the Western Interceptor System.
	AL-WWS-2	Collect flows at a single pumping station in the south of the Airport Lands; pump along Highway 6 to the Red Hill Creek Interceptor system.
	AL-WWS-3	Collect flows at a single pumping station in the south of the Airport Lands; pump along Highway 6 to a new gravity trunk along Dickenson Road and Centennial Parkway to the Eastern Interceptor system.

Servicing Area	Alternative ID	Description
CSO Control	CSO-WWS-1	Construct additional CSO tanks at the remaining uncontrolled outfalls in order to meet Procedure F-5-5 system-wide.
	CSO-WWS-2	Construct additional conveyance capacity in order to reduce the number of CSO events, and instead treat those flows at the expanded Woodward Avenue WWTP.

7.2 SELECTION OF THE PREFERRED ALTERNATIVES

7.2.1 Waterdown/Dundas Wastewater Servicing

Alternative WD-WWS-2 is preliminarily selected as the preferred servicing alternative for Waterdown and Dundas, with the following rationale:

- This alternative addresses the existing capacity issues at the Waterdown WWTP, while minimizing the new infrastructure requirements
- This alternative makes the most effective use of existing treatment capacity, without triggering an expansion of an aging plant
- Because the peak flows to the Western Interceptor will not change, this alternative will have little downstream impacts
- Because there are no major infrastructure upgrades required, this alternative will allow for earlier development in Waterdown than the other alternatives considered
- This alternative carries the lowest capital cost of the alternatives considered.

7.2.2 Southeast Mountain Wastewater Servicing

Alternative SEM-WWS-2 is preliminarily selected as the preferred servicing alternative for the Southeast Mountain, with the following rationale:

- This alternative has the lowest potential environmental impacts.
- The need for a pumping station is eliminated.
- This alternative makes use of existing reserve capacity within the Eastern Sanitary Interceptor and the Battlefield Trunk Sewer.
- This other alternative would have added the wastewater flows from a separated system to existing combined systems (the Red Hill Creek Sanitary Interceptor).
- This alternative presents an opportunity to remove additional separated sewer flow from the Red Hill Creek Sanitary Interceptor, mitigating some of the existing capacity limitations. It would also be able to service future development of the South Mountain, such as the existing business park or a future expansion of the urban boundary outside of the current planning horizon.

- This alternative carries a 33 percent lower capital cost than Alternative SEM-WWS-1, and eliminates the annual operational costs associated with the sewage pumping station.

7.2.3 Airport Lands Wastewater Servicing

Alternative AL-WWS-3 is preliminarily selected as the preferred servicing alternative for the Airport Lands, with the following rationale:

- This alternative has the lowest potential environmental impacts.
- The total forcemain length is minimized
- This alternative makes use of existing reserve capacity within the Eastern Sanitary Interceptor.
- The other alternatives would have added the wastewater flows from a separated system to existing combined systems (either the Western Sanitary Interceptor or the Red Hill Creek Sanitary Interceptor), which the City wishes to avoid.
- This alternative presents an opportunity to remove additional separated sewer flow from the RHCSI, mitigating some of the existing capacity limitations. It would also be able to service future development of the South Mountain, such as the existing business park or a future expansion of the urban boundary outside of the current planning horizon.
- While the capital cost of Alternative AL-WWS-3 is approximately 20 percent higher than the Ancaster alternatives, this should be mitigated by the decreased annual pumping costs.

7.2.4 Combined Sewer Overflow Control

Based on the City's commitment to F-5-5, and the results of the modelling exercises to date, the preferred solution will incorporate the optimum balance of collection system and treatment plant upgrades.

The range of collection system upgrades should consider, but not be limited to, the following CSO control options:

- Local improvements to control structures
- Construction of additional CSO tanks
- Constructing additional conveyance capacity.

The analysis of the collection system upgrades is being coordinated with the analysis of upgrade requirements at the Woodward Ave. WWTP for capacity and level of treatment.

Given that the wastewater treatment plant upgrades and some of the potential collection system upgrades are subject to further requirements of the Class EA process, it is determined that the optimum balance of system upgrades be established through the follow on Phases 3 and 4.

7.2.5 Schedule 'B' Projects included in the Preferred Wastewater Servicing Alternatives

Table ES-6 presents a list of the Schedule 'B' wastewater servicing projects, identified through the master planning process.

Table ES-6 Schedule 'B' Wastewater Servicing Projects

Schedule 'B' Project	Location
HC018 - Twenty Road SPS Upgrade and Twin Forcemain	Hamilton Mountain
Mountain Brow Trunk Sewer	Waterdown
DC014 - First Street SPS	Waterdown
Hwy 403 Trunk Sewer Twinning - Royal to Main-King	Hamilton
Ancaster-to-Fennell Trunk Sewer Twinning	Hamilton Mountain
Centennial Trunk Sewer	Hamilton/Hamilton Mountain
HC058 - Binbrook SPS Upgrade	Binbrook
HC056 - Green Road SPS Upgrade and Twin Forcemain	Stoney Creek
Decommission Waterdown WWTP	Waterdown
New Waterdown SPS and Forcemain at WWTP	Waterdown
Airport Lands SPS and Hwy 6 Forcemain	Hamilton Mountain
Hwy 6 Trunk sewer	Hamilton Mountain
Decommission Harmony Hall SPS	Ancaster
Dickenson Road trunk sewer	Hamilton Mountain
Dickenson Road SPS and Forcemain	Hamilton Mountain
HC053 – New Shaver Road SPS	Ancaster
HC002 – Scenic SPS Upgrade	Hamilton Mountain
HC011 – Calvin Street SPS Upgrade	Ancaster

8. IMPLEMENTATION

The preferred servicing strategies will support the short and long term servicing needs of the approved growth areas as well as addressing Hamilton Harbour water quality and provide flexibility for servicing potential growth areas in the future.

Under the Municipal Class EA, the Schedule A projects are pre-approved and may proceed to implementation. Upon completion of the master plan or Phase 2 of the EA process, Schedule B may proceed to Phase 5, Implementation, subject to finalization of the 30 day review period and assuming no Part II Orders (bump ups) are received. Schedule C projects must complete Phases 3 & 4 of the EA process prior to proceeding to implementation.

City Staff have discussed the interdependencies of the work at the Woodward Avenue WWTP and the proposed CSO and conveyance upgrades with primary equivalency treatment at either the Woodward Avenue WWTP or at a remote location with Ministry of Environment (MOE) staff. There has been consensus reached with MOE during the Master Plan process to allow the City to proceed beyond Phase 1 and 2 based on the preferred servicing solution for the combined sewer overflow control. The preferred solution will be developed through fulfilling the Class EA Phase 3 and 4 requirements for both undertakings. This study process will include the review and selection of a preferred design alternative.

CITY OF HAMILTON WATER AND WASTEWATER MASTER PLAN
CLASS ENVIRONMENTAL ASSESSMENT REPORT

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1. INTRODUCTION

1.1 BACKGROUND

The City of Hamilton is one of a number of Municipalities in the Greater Golden Horseshoe Area situated around the south western end of Lake Ontario and one of the fastest growing regions in North America. By 2031, the population of this area is forecasted to grow by an additional 3.7 million (from 2001) to 11.5 million people, accounting for over 80 percent of Ontario's population growth. This new growth will require 1.75 million new homes and 1.7 million additional jobs.

Ready and accessible public infrastructure is essential to the viability of existing and growing communities. Infrastructure planning, land use planning and infrastructure investment require close integration to ensure efficient, safe and economically achievable solutions to providing the required water and wastewater infrastructure.

The City of Hamilton has developed goals to blend the economic and social activities of a growing City with the preservation and protection of natural areas and resources through a sustainable approach to land management. This approach was initiated by the former Regional Municipality of Hamilton-Wentworth, now the City of Hamilton through strategic policies generated through VISION 2020, "Building A Strong Foundation" (BASF) and its Growth Related Integrated Development Strategy (GRIDS).

GRIDS brings together into one process, all of the activities related to development. This enables a more coordinated, time efficient and cost efficient investment process for the public and private sectors.

This Water and Wastewater Master Plan for the lake-based systems is a critical component in the integrated GRIDS process and provides the framework and vision for the water and wastewater servicing needs for the City into the future.

1.2 GRIDS PROCESS

In 2003, the City of Hamilton initiated the Growth Related Integrated Development Strategy study, known as GRIDS.

The Growth Related Integrated Development Strategy, or GRIDS, is a made-in-Hamilton balanced growth strategy. The purpose of GRIDS is to identify the most ideal places for growth and the type of growth based on environmental priorities, social issues, economic opportunities and population studies as well as to identify strategies to fund the servicing of these areas.

The City of Hamilton has undertaken GRIDS to help determine where the future growth of the City will take place over the next thirty years. This unique approach integrates land use, transportation, water/wastewater and stormwater planning into one project. GRIDS is intended to reflect the principles of Smart Growth, creating compact, affordable and liveable communities. GRIDS was developed concurrently with the Province's "Places to Grow" initiative, and reflects the requirements contained in that document.

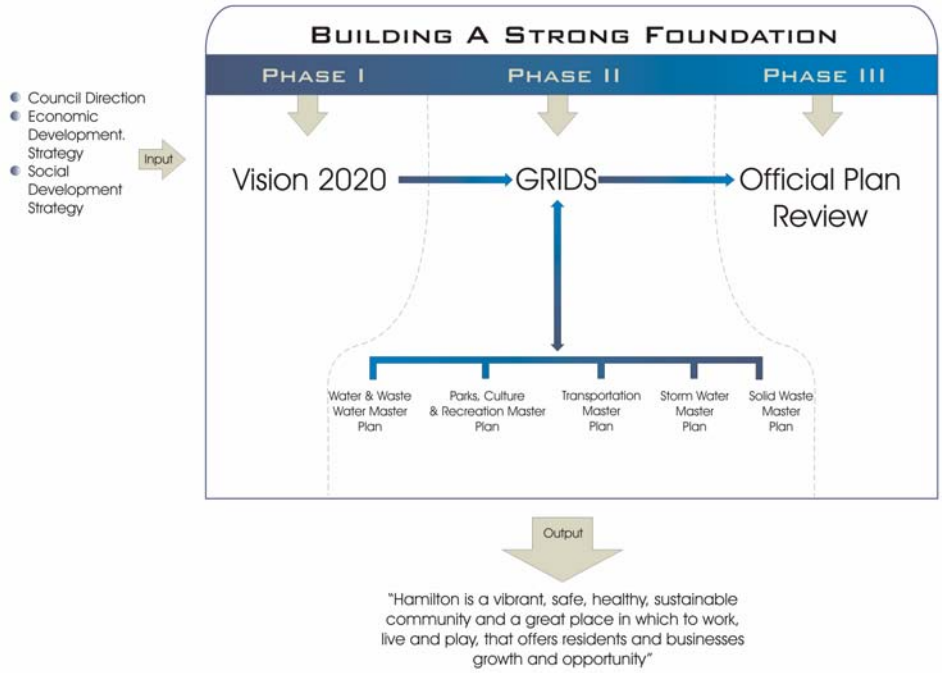
GRIDS is being co-ordinated under "Building A Strong Foundation", to ensure that sustainable thinking prevails in decisions. Citizens of Hamilton helped to establish an interrelated set of directions for accommodating new people and jobs in a way that supports the City's Vision. These directions are the starting point for Hamilton's 30-year growth strategy, GRIDS.

GRIDS is focused on the urban areas of the City of Hamilton. A parallel process for the rural areas is also being undertaken as part of the development of a new Official Plan. These processes recognize that rural and urban land use planning are not mutually exclusive, but rather both are interrelated. Both urban and rural areas are part of this water and wastewater master plan study.

The GRIDS process involved three distinct steps:

- Development and evaluation of growth concepts
- Development and evaluation of growth options
- Refinement of the preferred growth option.

Three comprehensive infrastructure Master Plans including this Water and Wastewater Master Plan Study provided critical input to the identification and evaluation of growth options to enable the full understanding and consideration of infrastructure requirements, costs and impacts associated with growth.



1.3 MASTER PLAN GOALS AND OBJECTIVES

The approach and goals of the City of Hamilton's Master Planning process is summarized in the following steps:

1. Complete a baseline review of the existing water and wastewater systems

   "Where Are We Now"

2. Develop water and wastewater policies to provide guidelines to the process and to the development/evaluation of servicing strategies

   "What We Should Plan For"

3. Complete and document the study and selection of the preferred solutions within the Class Environmental Assessment process for Water and Wastewater Master Plans

   "Presenting the Details of our Recommendations"

4. Develop sound water and wastewater servicing strategies which are cost effective, optimize existing infrastructure, minimize impact to or enhance the natural, social and economic environments, and meet the technical service requirements

In completing this approach, key objectives to be satisfied include:

- Develop several alternatives for servicing
- Evaluate the servicing alternatives against environmental and technical criteria
- Establish preferred long-term servicing strategies to meet the servicing needs of the existing system and approved growth
- Complete the process with extensive public and agency participation
- Document the process and provide sufficient technical information for the City to move forward and implement the system improvements
- Clearly identify the needed water and wastewater infrastructure and detail the capital and implementation plan.

1.4 MASTER PLAN REPORT OUTLINE

This Master Plan Class EA Report documents the planning and design process followed and conclusions reached for the City of Hamilton Water and Wastewater Master Plan Class Environmental Assessment.

This Master Plan Class EA Report forms part of the overall deliverables for the Master Plan project. Based on the approach followed, the documentation has been prepared as described below:

Report 1 Baseline Conditions (under separate cover)

The Baseline Conditions Report summarizes the inventory and evaluation of the current water and wastewater systems. The Baseline Conditions tasks included:

- Defining design criteria for the water and wastewater systems
- Identification of opportunity and constraint areas in the systems such as facilities with available capacity or identification of service areas with lower levels of service
- Computer modelling of the systems

Report 2 Policy Paper (under separate cover)

The Policy Paper Report summarizes the process completed for developing and endorsing water and wastewater policies which provide direction and guidelines for development, evaluation and implementation of servicing strategies.

Report 3 Water and Wastewater Master Plan Class EA Report

The Water and Wastewater Master Plan Class EA Report, including all Appendices, forms part of the comprehensive Report 3. Report 3, including Appendices, is the documentation placed on public record for the Class EA review period.

This report contains and describes all required phases of the planning process and incorporates the procedure considered essential for compliance with the Environmental Act.

This Report contains the following sections:

1. Introduction and Background – provision of relevant information leading to the initiation of this study
2. Master Planning Process – description of the Class EA Master Planning process
3. Problem/Opportunity Statement – definition of the problem/opportunity needing to be addressed under this study and presentation of baseline planning information
4. Master Plan Methodologies – description of the approach, specific tasks and relevant background information unique to the completion of the City of Hamilton Master Plan
5. Existing Conditions – description of the natural and social environments within the City of Hamilton
6. Planning Scenarios – description of the preferred growth option and relation to existing service areas

Water

7. Existing Water System – description of the existing water system operating philosophy and trunk infrastructure

8. Water Design Criteria – definition of the design criteria used for the water system

9. Development of Water Servicing Alternatives – description of the rationale and methodology for developing and evaluating water servicing alternatives

10. Evaluation of Water Servicing Alternatives – presentation of the evaluation process for the short listed water servicing alternatives

Wastewater

11. Existing Wastewater System – description of the existing wastewater system operating philosophy and trunk infrastructure

12. Wastewater Design Criteria – definition of the design criteria used for the wastewater system including plants, conveyance and analysis approaches

13. Development of Wastewater Servicing Alternatives – description of the rationale and methodology for developing and evaluating wastewater servicing alternatives

14. Evaluation of Wastewater Servicing Alternatives – presentation of the evaluation process for the short listed wastewater servicing alternatives

15. Preferred Servicing Strategies – description of the preferred water and wastewater servicing strategies

16. Implementation – description of overall implementation considerations and closing

17. Implementation – description of general implementation requirements

18. References

Appendix A – Project and Implementation Data (attached to this report)

Contains relevant project , implementation and analysis information

Appendix B – Public Consultation (under separate cover)

Contains all relevant documentation of the public consultation process including notices, comments and responses and distributed information

Appendix C – PIC Documentation (under separate cover)

Contains all presentation material from all Public Information Centres (PICs) held during the process

Appendix D – Agency Consultation (under separate cover)

Contains all presentation material and discussion information from topical workshops held with relevant agency and approval bodies

Report 4 Master Plan Implementation Report (under separate cover)

This report provides additional project information including project data sheets and schedules to support City staff in implementing the preferred servicing strategies.

2. MASTER PLANNING PROCESS

The Municipal Class Environmental Assessment process clearly defines approaches for completion of Master Plans within the Class Ea context. The City of Hamilton has prepared this Master Plan based on Approach 2 which involves preparing a Master Plan document at the conclusion of Phases 1 and 2 in order to fulfil the requirements for Schedule B projects. Any Schedule C projects identified would continue to fulfil Phases 3 and 4.

2.1 CLASS ENVIRONMENTAL ASSESSMENT PROCESS

This section describes the environmental assessment process and the specific requirements for the preparation of master plans.

2.1.1 Environmental Assessment Act

Ontario's *Environmental Assessment Act (EA Act)* was passed in 1975 and proclaimed in 1976. The EA Act requires proponents to examine and document the environmental effects which might result from major projects or activities and their alternatives. Municipal undertakings became subject to the *Act* in 1981.

The *Act* defines the environment broadly as:

1. Air, land or water
2. Plant and animal life, including man
3. The social, economic and cultural conditions that influence the life of man or a community
4. Any building, structure, machine or other device or thing made by man
5. Any solid, liquid, gas odour, heat, sound, vibration or radiation resulting directly or indirect from activities of man
6. Any part or combination of the foregoing and the interrelationships between any two or more of them.

The purpose of the EA Act is the betterment of the people of the whole or any part of Ontario by providing for the protection, conservation and wise management of the environment in Ontario (RSO1990, c. 18, s.2).

As set out in Section 5(3) of the *EA Act*, an EA document must include the following:

a) a description of the purpose of the undertaking

   i The undertaking

   ii The alternative methods of carrying out the undertaking

   iii Alternatives to the undertaking.

b) a description of:

i The environment that will be affected or that might reasonably be expected to be affected, directly or indirectly, by the undertaking or alternatives to the undertaking.

ii The effects that will be caused or that might reasonably be expected to be caused to the environment by the undertaking or alternatives to the undertaking.

iii The actions necessary or that may reasonably be expected to be necessary to prevent, change, mitigate or remedy the effects upon or the effects that might reasonably be expected upon the environment by the undertaking or alternatives to the undertaking.

c) an evaluation of the advantages and disadvantages to the environment of the undertaking, the alternative methods of carrying out the undertaking and the alternatives to the undertaking (RSO 1990, c. 18, s.2).

2.1.2 Principles of Environmental Planning

The Act sets a framework for a systematic, rationale and replicable environmental planning process that is based on five key principles, as follows:

1. *Consultation with affected parties.* Consultation with the public and government review agencies is an integral part of the planning process. Consultation allows the proponent to identify and address concerns cooperatively before final decisions are made. Consultation should begin as early as possible in the planning process.

2. *Consideration of a reasonable range of alternatives.* Alternatives include functionally different solutions, "alternatives to" the proposed undertaking and "alternative methods" of implementing the preferred solution. The do nothing alternative must also be considered.

3. *Identification and consideration of the effects of each alternative on all aspects of the environment.* This includes the natural, social, cultural, technical, and economic environments.

4. *Systematic evaluation of alternatives in terms of their advantages and disadvantages, to determine their net environmental effects.* The evaluation shall increase in the level of detail as the study moves from the evaluation of "alternatives to" to the evaluation of "alternative methods".

5. *Provision of clean and complete documentation of the planning process followed, to allow "traceability" of decision-making with respect to the project.* The planning process must be documented in such a way that is may be repeated with similar results.

2.1.3 Class Environmental Assessment

"Class" Environmental Assessments (Class EAs) were approved by the Minister of the Environment in 1987 for municipal projects having predictable and mitigatable impacts. The municipal Class EAs were revised and updated in 1993 and again in 2000. The Class EA approach streamlines the planning and approvals process for municipal projects which have the following characteristics:

- Recurring
- Similar in nature
- Usually limited in scale
- Predictable range of environmental impacts
- Responsive to mitigation.

The Municipal Class Environmental Assessment, prepared by the Municipal Engineers Association (June 2000), outlines the procedures to be followed to satisfy EA requirements for water, wastewater and road projects. The process includes five phases:

- Phase 1: Problem Definition
- Phase 2: Identification and Evaluation of Alternative Solutions to Determine a Preferred Solution
- Phase 3: Examination of Alternative Methods of Implementation of the Preferred Solution
- Phase 4: Documentation of the Planning, Design and Consultation Process
- Phase 5: Implementation and Monitoring.

Public and agency consultation are integral to the Class EA planning process.

Projects subject to the Class EA process are classified into three possible "schedules", depending on the degree of expected impacts. Schedule A projects are minor, operational and maintenance activities and are approved without the need for further assessment. Schedule B projects require a screening of alternatives for their environmental impacts and Phases 1 and 2 of the planning process must be completed.

Provided no significant impacts are identified and no requests for a Part II order to a Schedule C or Individual Environmental Assessment are received, Schedule B projects are approved and may proceed directly to implementation. If outstanding issues remain after the public review period, any party may request that the Minister of the Environment consider bumping-up the project to an Individual EA.

Schedule C projects must satisfy all five phases of the Class EA planning process. These projects have the potential for greater environmental impacts. Phase 3 involves the assessment of alternative methods of carrying out the project, as well as public consultation on the preferred conceptual design. Phase 4 normally includes the preparation of an Environmental Study Report which is filed for public review. Provided no significant impacts are identified and no requests for "bump-up" to an Individual Environmental Assessment are

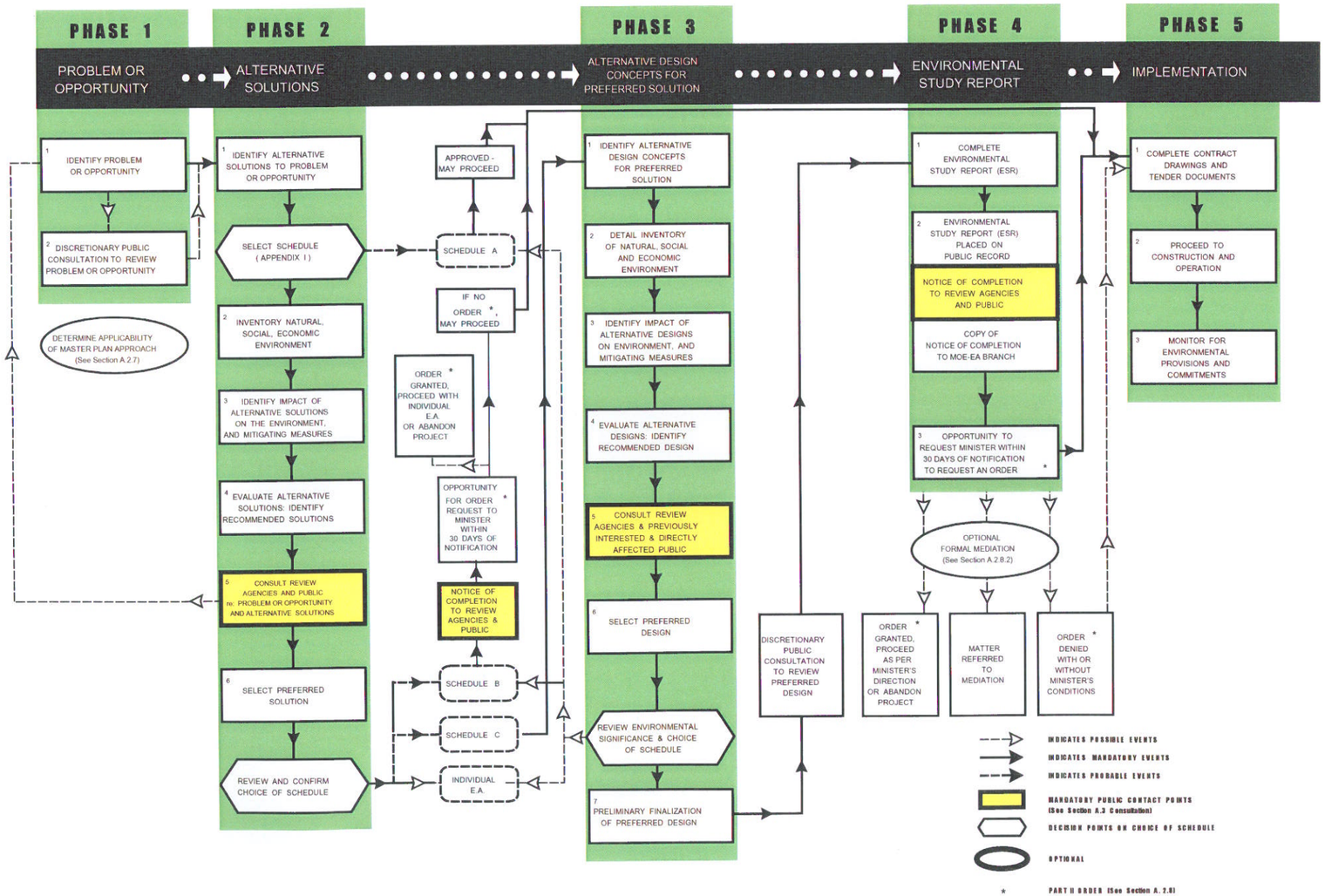
received, Schedule C projects are then approved and may proceed directly to implementation.

The Class EA process flowchart is provided in Figure 1.

EXHIBIT A.2

MUNICIPAL CLASS EA PLANNING AND DESIGN PROCESS

NOTE: This flow chart is to be read in conjunction with Part A of the Municipal Class EA



Hamilton

BUILDING A STRONG FOUNDATION HAMILTON

Integrated Water & Wastewater Master Plan

Municipal Class EA
Planning and Design Process

KMK Consultants Limited

Figure 1

Nov 10, 2006
N/A
2590-D-70

Master Planning Process

Municipalities recognize the benefits of comprehensive, long-range planning exercises that examine problems and solutions for an overall system of municipal services. The Municipal Class EA for Water and Wastewater Projects recognizes the importance of master plans as the basis for sound environmental planning. The Class EA defines master plans as:

> "*Long range plans which integrate infrastructure requirements for existing and future land use with environmental assessment planning principles. These plans examine an infrastructure system(s) or group of related projects in order to outline a framework for planning for subsequent projects and/or developments.*"

Master plans have distinguishing features that set them apart from project specific studies. These features include the following:

- Master plans are broad in scope and focus on the analysis of a system for the purpose of outlining a framework for the provision of future works and developments.
- Specific projects recommended in a master plan are part of a larger management system and are distributed geographically throughout the study area. The implementation of specific projects may occur over an extended time frame.

According to the Class EA document, a master plan must <u>at least</u> satisfy the requirements of Phases 1 and 2 of the Class EA process and incorporate the five key principles of environmental planning, as identified in Section 2.1. It is intended that the Hamilton Water/Wastewater Master Plan meet these requirements. The master plan must document public and agency consultation at each phase of the process and a reasonable range of alternative solutions must be identified and systematically evaluated.

2.2 CONSULTATION AND COMMUNICATION

At the outset of the Master Plan process, a Public Consultation Plan was developed. The activities that were undertaken as part of the process are described in the following sections and are considered critical and required under the Class EA Master Planning process.

Full documentation of the consultation and communication program is contained in the appendices to this report.

2.2.1 Public Access to Information

At the onset of the project, the City developed a website (www.gridsmasterplans.com), where all project publications, presentation materials and other documentation has been made available to the general public. Notices of upcoming Public Information Centres (PICs) and other project milestones were also posted on this website.

For those without Internet access, the City also maintained a Contact List, and sent relevant project materials to all who had expressed interest in the process.

2.2.2 Public Information Centres

Through Phases 1 and 2 of a Municipal Class EA, the study proponent (in this case, the City of Hamilton) is required to consult the public only once the alternative solutions to the problem being addressed have been evaluated, and a preferred option selected. The City of Hamilton, however, decided to consult the public more often than was required by the Class EA process, and instead consulted with the public on six (6) occasions:

- GRIDS PIC #1: May 30th 2005
- GRIDS PIC #2: May 16th, 17th, and 18th 2006
- Water/Wastewater PIC #1: June 20th, 21st, and 23rd 2005
- Water/Wastewater PIC #2: November 28th, 30th, and December 5th 2005
- Water/Wastewater PIC #3: July 6th and 10th 2006
- Stormwater/Transportation PIC #3: September 25th and 26th, 2006.

Each of these PICs was advertised in the local media and on the City's website such that any concerned parties would be aware of the opportunities to become involved in the Master Planning process.

All of the materials presented at these PICs are included in the PIC Documentation binder that is appended to this report.

2.2.3 Stakeholder Workshops

In addition to the project information disseminated through the mandatory contact distribution and public information centres, stakeholder workshops were held to provide opportunity for detailed discussion on the development and evaluation of the servicing strategies and for detailed discussion on specific technical topics related to Hamilton's systems.

The Stakeholder Workshops included:

- Wet Weather Workshop #1: May 2004
- Policy Workshop: November 2004
- Phase 1 Workshops: June 2005
- Wet Weather Workshop #2: May 2006
- Wet Weather Workshop #3: June 2006.

The stakeholders included representatives from various agencies including, but not limited to:

- City Departments (Planning and Economic Development, Public Health, Community Services, Public Works, City Manager's Office)
- Conservation Authorities

- Ministry of the Environment
- Environment Canada including the Hamilton Harbour Remedial Action Plan Office
- Bay Area Restoration Council.

2.3 ABORIGINAL DIALOGUE

The project communications approach also included specific dialogue with aboriginal agencies.

Three contacts including Hamilton Executive Directors Aboriginal Coalition (HEDAC), Six Nations and Ontario Secretariat for Aboriginal Affairs were part of the mandatory contact list and received all project notices and communications.

The City of Hamilton undertook additional communications with the aboriginal agencies during the project. These communications are appended in Appendix D.

3. PROBLEM/OPPORTUNITY STATEMENT

3.1 STUDY AREA

In 2001, the City of Hamilton was amalgamated with the former municipalities of Ancaster, Dundas, Flamborough, Glanbrook and Stoney Creek. Hamilton is now the 10th-largest municipality in Canada, and covers an area of over 112,000 ha. The City of Hamilton currently includes both urban and rural areas, and encompasses a number of hamlets.

The Study area is currently governed by the land use policies set forth in seven former Official Plans (the Region and the six former municipalities). A new Official Plan is being created which will update and consolidate the policies of the seven former Official Plans into one Plan to apply to the entire City. Several ongoing Corporate Projects are integrated with the development of the new Official Plan: Vision 2020, the GRIDS project, Social Development Strategy, Master Plans and Secondary Plans. All programs are linked through an initiative called "Building a Strong Foundation", (BASF) is an initiative coordinated by the City that takes a cross-disciplinary, integrative and community-based approach to implementing Hamilton's Vision for a sustainable future. Hamilton has not yet adopted its new Official Plan. In accordance with the City of Hamilton Act, the by-laws of the 6 former municipalities remain in effect until new ones are established.

The Study Area for this Master Plan consists of the existing lake-based water and wastewater servicing area, which extends to the Urban Boundary, plus any urban boundary expansion areas that are required to service the anticipated growth between the present date and 2031. A map of the Study Area is included in Figure 2.

Initially, the community of Greensville, due to its close proximity to Dundas, was included in the Study Area. However, the City has initiated the Mid Spencer Creek/Greensville Rural Settlement Area Subwatershed study to determine the servicing needs and, as such, assessment of this area has been deferred.

Carlisle, due to the recommendations in a recent Class Environmental Assessment, was also included in the study area to assess long term water supply. Subsequently, an addendum to the Carlisle Water Supply Master Plan and Class Environmental Assessment was completed and identified an adequate water supply scheme which addresses the water demand projections included in the April 2004 project file report.

City of Burlington

Lake Ontario

Haldimand County

Region of Niagara

KING ST.

MAIN ST.

GORTH ST.

UPPER JAMES ST.

UPPER WELLINGTON ST.

UPPER WENTWORTH ST.

UPPER SHERMAN AVE.

UPPER GAGE ST.

UPPER OTTAWA ST.

Legend

- Study Area Boundary
- Urban Boundary
- Rural Settlement Area
- Niagara Escarpment
- Greenbelt

Hamilton

Integrated Water & Wastewater Master Plan

Map of Study Area

KMK Consultants Limited

Figure 2

Nov 22, 2006

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3.2 PLANNING CONTEXT

The City of Hamilton, like all municipalities in Ontario must operate within the administrative, legislative and financial framework established by senior levels of government. Subsequent to the adoption of the GRIDS study process, the Province has adopted a more proactive role in growth management and planning issues. The key provincial initiatives that provided directives and were considered under the Master Plan process include the following:

- Provincial Policy Statement 2005
- Greenbelt Plan
- Places to Grow Plan
- Niagara Escarpment Plan
- Parkway Belt West Plan
- Greater Golden Horseshoe Growth Plan
- Planning Act Reform.

The results of these initiatives directly affect future growth in Hamilton and the City's policies to accommodate growth.

3.2.1 Provincial Policy Statement 2005

The Provincial Policy Statement (PPS) provides policy direction on matters of provincial interest related to land use planning and development. As a key part of Ontario's policy-led planning system, the Provincial Policy Statement sets the policy foundation for regulating the development and use of land. It also supports the provincial goal to enhance the quality of life for citizens of Ontario.

The Provincial Policy Statement provides for appropriate development while protecting resources of provincial interest, public health and safety, and the quality of the natural environment. The Provincial Policy Statement supports improved land use planning and management, which contributes to a more effective and efficient land use planning system.

PPS compliance and factors considered in the preparation of the Water and Wastewater Master Plan:

- The PPS focuses growth within settlement areas and away from significant or sensitive resources and areas. Land use must be carefully managed to accommodate appropriate development to meet the full range of current and future needs, while achieving efficient development patterns.
- Efficient development patterns optimize the use of land, resources and public investment in infrastructure and public service facilities
- Supports the financial well-being of the Province and municipalities over the long term, minimizes the undesirable effects of development, including impacts on air, water and other resources

- The Province's natural heritage resources, water, agricultural lands, mineral resources and cultural heritage and archaeological resources provide important environmental, economic and social benefits. The wise use and management of these resources are managed in a sustainable way to protect essential ecological processes and public health and safety, minimize environmental and social impacts, and meet its long-term needs.

3.2.2 Greenbelt Plan

In 2005 the Province released its Greenbelt Plan. The Greenbelt identifies areas around the Greater Golden Horseshoe where urbanization should not occur to provide permanent protection to the agricultural land base and the ecological features and functions occurring on this landscape. The Greenbelt Plan includes the areas of the Oak Ridges Moraine Conservation Plan, Niagara Escarpment Plan and the Parkway Belt West Secondary Plan. Areas within the Greenbelt Plan are considered to not be suitable for future development. The Greenbelt Plan is considered to be the foundation upon which the Province's growth strategy, Places to Grow, is built.

Greenbelt Plan policies were considered in the preparation of the Water and Wastewater Master Plan with specific policy compliance and factors considered as follows:

Natural Heritage System Policies (Policy 3.2.2)

New development or site alteration in the Natural Heritage System shall demonstrate that there will be no negative effects on key natural heritage features or key hydrological features or their functions.

Water Resource System Policies (Policy 3.2.3)

All Planning authorities shall provide for a comprehensive, integrated and long-term approach for the protection, improvement or restoration of the quality and quantity of water. Such an approach will consider all hydrologic features and functions and include a systems approach to the inter-relationships between and/or among recharge/discharge areas, aquifers, headwaters and surface waters (e.g. lakes as well as rivers and streams, including intermittent streams).

Watersheds are the most meaningful scale of hydrological planning, and municipalities, together with conservation authorities, should ensure that watershed plans are completed and used to guide planning and development decisions within the protected countryside.

Municipalities shall, in accordance with provincial direction related to the protection of source water, protect vulnerable surface and groundwater areas, such as wellhead protection areas, from development that may adversely affect the quality and quantity of ground and surface water.

Sewage and Water Infrastructure Policies (Policies 4.2.2)

Sewage and water servicing can be provided in a manner that does not negatively impact ecological features and functions, quality and quantity of ground and surface water, including stream baseflow, and is sufficient to accommodate the proposed use(s). *(The Greenbelt Plan , Ministry of Municipal Affairs and Housing February 28, 2005)*

3.2.3 The Niagara Escarpment Plan

In 1990, the United Nations Educational, Scientific and Cultural Organization (UNESCO) named Ontario's Niagara Escarpment a World Biosphere Reserve. This designation recognizes the natural features and ecological importance of the Escarpment.

The Plan is a large scale environmental land use plan with aims of balancing protection, conservation and sustainable development to ensure that the Escarpment remains mainly a natural environment.

The policies of the Niagara Escarpment Plan are the policies of the Greenbelt Plan for the Niagara Escarpment Plan Area.

Niagara Escarpment Plan policies were considered in the preparation of the Water and Wastewater Master Plan with specific objective compliance and factors considered as follows:

New Development Affecting Water Resources

The objective is to ensure that new development that might affect streams, watercourses, lakes, wetlands, and groundwater systems will have minimum individual and cumulative effect on water quality and quantity, and on the Escarpment environment.

Transportation and Utilities

The objective is to design and locate new and expanded transportation and utility facilities so the least possible change occurs in the environment and the natural and cultural landscape.

All new and reconstructed transportation and utility facilities shall be designed and located to minimize the impact on the Escarpment environment and be consistent with the Plan.

New transportation and utilities facilities should avoid Escarpment Natural Areas. *(The Niagara Escarpment Plan, Niagara Escarpment Commission, Office Consolidation September 26, 2006)*

3.2.4 Parkway Belt West Secondary Plan

The Parkway Belt West Plan provides a system of linked natural areas and protected utility corridors which originates in Dundas and runs through the Regions of Halton, Peel and York. The Secondary Plan was reviewed and taken into consideration during the preparation of the Water and Wastewater Master Plan.

3.2.5 Places to Grow Growth Plan for the Greater Golden Horseshoe

The Growth Plan for the Greater Golden Horseshoe (GGH) has been prepared under the Places to Grow Act, 2005. It is a framework for implementing the Government of Ontario's vision for building stronger, more prosperous communities by better managing growth in this region to 2031.

The Plan provides the framework for infrastructure investments in the GGH, so that existing infrastructure and future investments are optimized to serve growth to 2031 and beyond.

Growth Plan policies were considered in the preparation of the Water and Wastewater Master Plan with specific objective compliance and factors considered as follows:

Water and Wastewater Systems

Municipalities are encouraged to plan and design municipal water and wastewater systems that return water to the Great Lake watershed from which the withdrawal originates.

Construction of new, or expansion of existing, municipal or private communal water and wastewater systems should only be considered where the following conditions are met:

a) Strategies for water conservation and other water demand management initiatives are being implemented in the existing area.

b) Plans for expansion or for new services are to serve growth in a manner that supports achievement of the intensification target and density targets.

Municipalities that share an inland water source and/or receiving water body, should co-ordinate their planning for potable water, stormwater, and wastewater systems to ensure that water quality and quantity is maintained or improved.

Municipalities, in conjunction with conservation authorities, are encouraged to prepare watershed plans, and use plans to guide development decisions and water and wastewater servicing decisions.

Population, Household and Employment Forecasts

In addition, the Places to Grow Plan states that the population, household and employment forecasts contained in the Places to Grow Plan will be used as the basis for planning and managing growth in the Greater Golden Horseshoe which includes Hamilton.

The Places to Grow Plan defines that by the year 2015 and for each year thereafter, a minimum of 40 percent of all residential development occurring annually within upper and single-tier municipalities will be within the built-up area including areas of intensification of existing urban areas. Hamilton also contains a designated urban growth centre, and as such specific minimum gross density targets are defined for numbers of residents and jobs combined.

Municipal planning decisions must be "consistent with" the Provincial Policy Statement and must "conform to" the Places to Grow Plan. Therefore, the recommendations of GRIDS must be consistent with the Provincial Policy Statement and must also conform to the Places to Grow Plan.

Provincial projections for Hamilton in 2031

- Hamilton's residential populations will reach 660,000
- There will be 80,000 more households, with 58,400 within the existing urban boundary
- Hamilton will employ 90,000 more people
- There will be an additional 1050 gross hectares of employment land.

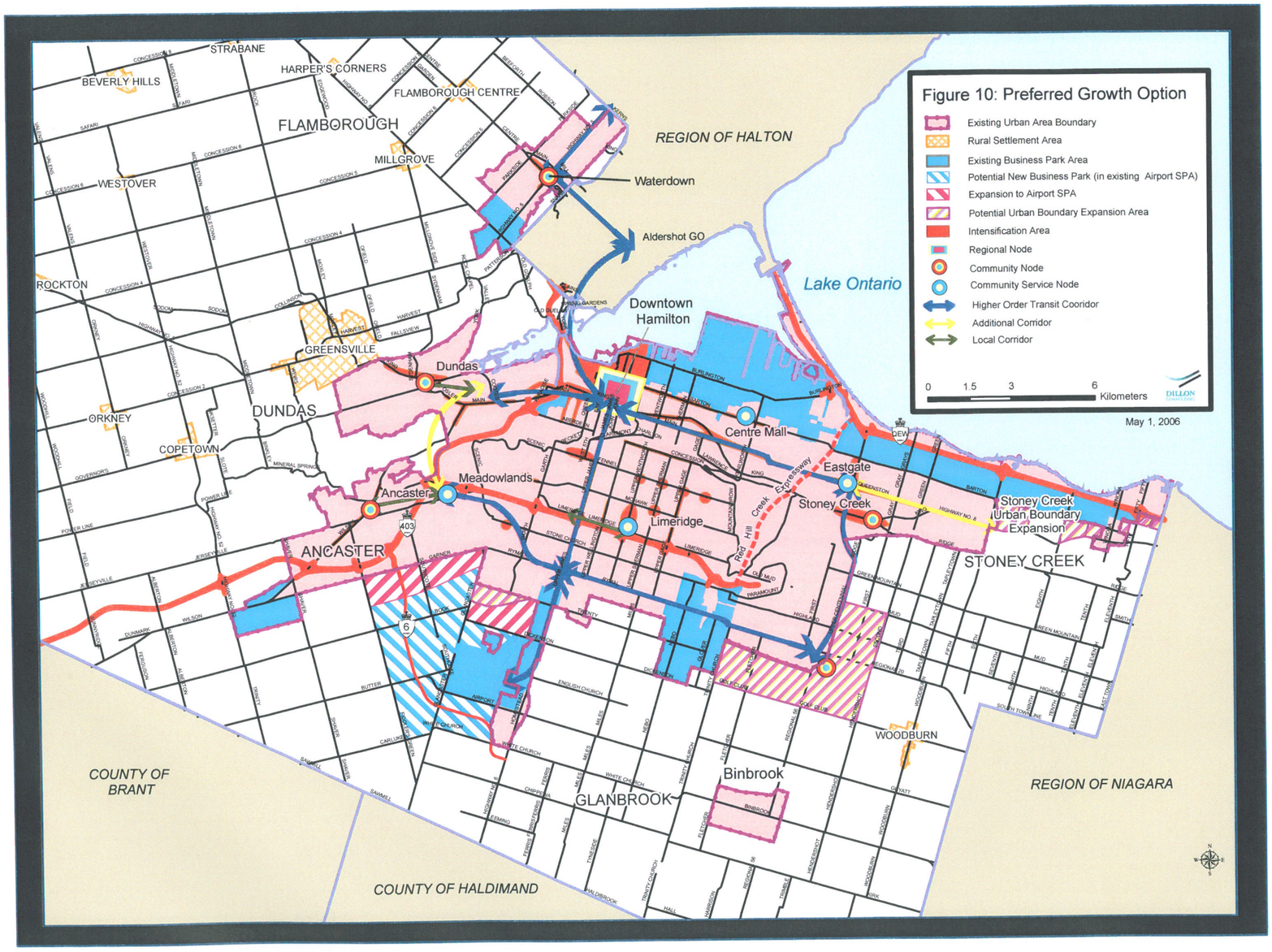
3.3 PREFERRED GROWTH OPTION

The preferred growth option selected through the GRIDS evaluation process was adopted by Council in May, 2006. Council gave direction to implement Growth Strategy through the new Official Plan, Infrastructure Master Plans and Development Charges By-law.

The preferred growth option is depicted in Figure 3. This option is generally based on the nodes and corridors concept. The primary growth areas include the Elfrida node located in the southwest mountain and the airport lands. This option also includes selected intensification located primarily along corridors in the central mountain and downtown core.

As described through the GRIDS process, the preferred growth option achieves the following objectives:

- Creates complete communities in keeping with Vision 2020 and Provincial Plans, such as Places to Grow and the Greenbelt Plan
- Provides reasonable intensification
- Supports a vibrant Downtown
- Focuses growth around transit infrastructure
- Develops compact, complete communities – Not "more of the same" but rather creates livable, walk-able communities
- Directs development to areas with full servicing
- Avoids and protects local natural features and green space
- Identifies and protects the movement of goods along defined corridors
- Reinforces importance of Hamilton International Airport.



Hamilton

BUILDING A STRONG FOUNDATION HAMILTON

Integrated Water & Wastewater Master Plan

Preferred Growth Option

KMK Consultants Limited

Figure 3

Nov 22, 2006
N/A
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3.4 PLANNING PROJECTIONS

The growth options developed through the GRIDS process were developed concurrently with Places to Grow. As the growth options were being developed, the Provincial process was also being updated. As such, preliminary planning projections ranged from 660,000 persons to over 700,000 persons for population in 2031 and ranged from 290,000 employees to over 310,000 employees for employment in 2031.

Once the Places to Grow Growth Plan finalized and the GRIDS process finalized, the preferred growth option and the long term planning projections to year 2031 were established. The distribution of population and employment growth among the primary geographic regions of the City of Hamilton are presented in Tables 1 and 2.

Table 1 Projected Population Statistics – 2001 through 2031

	Serviced Population			
	2001	**2011**	**2021**	**2031**
Lower Hamilton	191,499	202,588	207,843	217,419
Upper Hamilton	143,100	147,473	158,531	164,719
Stoney Creek	59,783	65,464	80,818	89,109
Glanbrook	8,132	10,119	18,938	26,794
Dundas	23,817	24,874	25,575	25,708
Ancaster	29,920	33,066	39,453	39,692
Flamborough	15,707	16,066	21,976	31,354
EXISTING URBAN BOUNDARY	**471,958**	**499,650**	**553,134**	**594,795**
Airport Lands UBE	0	0	0	0
Southeast Mountain UBE	0	946	4,559	41,558
URBAN BOUNDARY EXPANSION AREAS	**0**	**946**	**4,559**	**41,558**
TOTAL URBAN	**471,958**	**500,596**	**557,693**	**636,353**
TOTAL RURAL	33,844	33,893	32,669	32,064
GRAND TOTAL HAMILTON	**505,802**	**534,489**	**590,362**	**668,417**

Table 2 Projected Employment Statistics – 2001 through 2031

	Number of Jobs			
	2001	**2011**	**2021**	**2031**
Lower Hamilton	115,497	126,302	139,100	154,931
Upper Hamilton	31,540	34,491	38,662	43,112
Stoney Creek	27,463	31,815	36,999	41,971
Glanbrook	4,022	5,404	8,477	15,374
Dundas	6,067	6,748	7,136	7,878
Ancaster	6,115	7,506	9,349	13,358
Flamborough	5,015	5,911	8,752	9,694
EXISTING URBAN BOUNDARY	**195,718**	**218,177**	**248,475**	**286,318**
Airport Lands UBE	0	0	4,482	12,560
Southeast Mountain UBE	0	0	3,140	3,525
URBAN BOUNDARY EXPANSION AREAS	**0**	**0**	**7,622**	**16,085**
TOTAL URBAN	**195,718**	**218,177**	**256,097**	**302,403**
TOTAL RURAL	**9,194**	**10,116**	**6,079**	**6,502**
GRAND TOTAL HAMILTON	**204,912**	**228,293**	**262,176**	**308,905**

3.5 PROBLEM/OPPORTUNITY STATEMENT

The purpose of the Problem/Opportunity Statement is to define the principal starting point in the undertaking of the Master Plan Class EA and assist in defining the scope of the project.

As such, the Problem/Opportunity Statement has been defined as:

- The Province, through its Place to Grow document, has identified the need to accommodate growth within the City of Hamilton.
- Water and wastewater infrastructure upgrades will be required to service areas already approved for development as well as future residential and non residential lands.
- Wastewater infrastructure upgrades will be required to address water quality concerns in Hamilton Harbour.
- Integration of planning, water/wastewater, transportation and stormwater processes will ensure implementation of a sustainable growth strategy and fulfill the City's goals identified in Vision 2020.

4. MASTER PLAN METHODOLOGIES

4.1 OVERVIEW

A number of tasks and evaluation requirements were undertaken as part of the Master Plan process unique to the City of Hamilton.

Under any Master Plan, the methodology for analyzing planning information, developing water demands and wastewater flows and modelling the systems needs to be developed to best serve the proponent.

In addition to analysis processes, the City of Hamilton is subject to unique provincial guidelines designed to ensure optimal water quality in Lake Ontario and the Hamilton Harbour. Plus, the City developed a policy process to augment the directives and guideline for the Master Plan study.

4.2 POPULATION AND EMPLOYMENT DATA

This Master Plan makes use of the planning information derived through the GRIDS process in order to assess growth areas and allocate future water demands and wastewater flows.

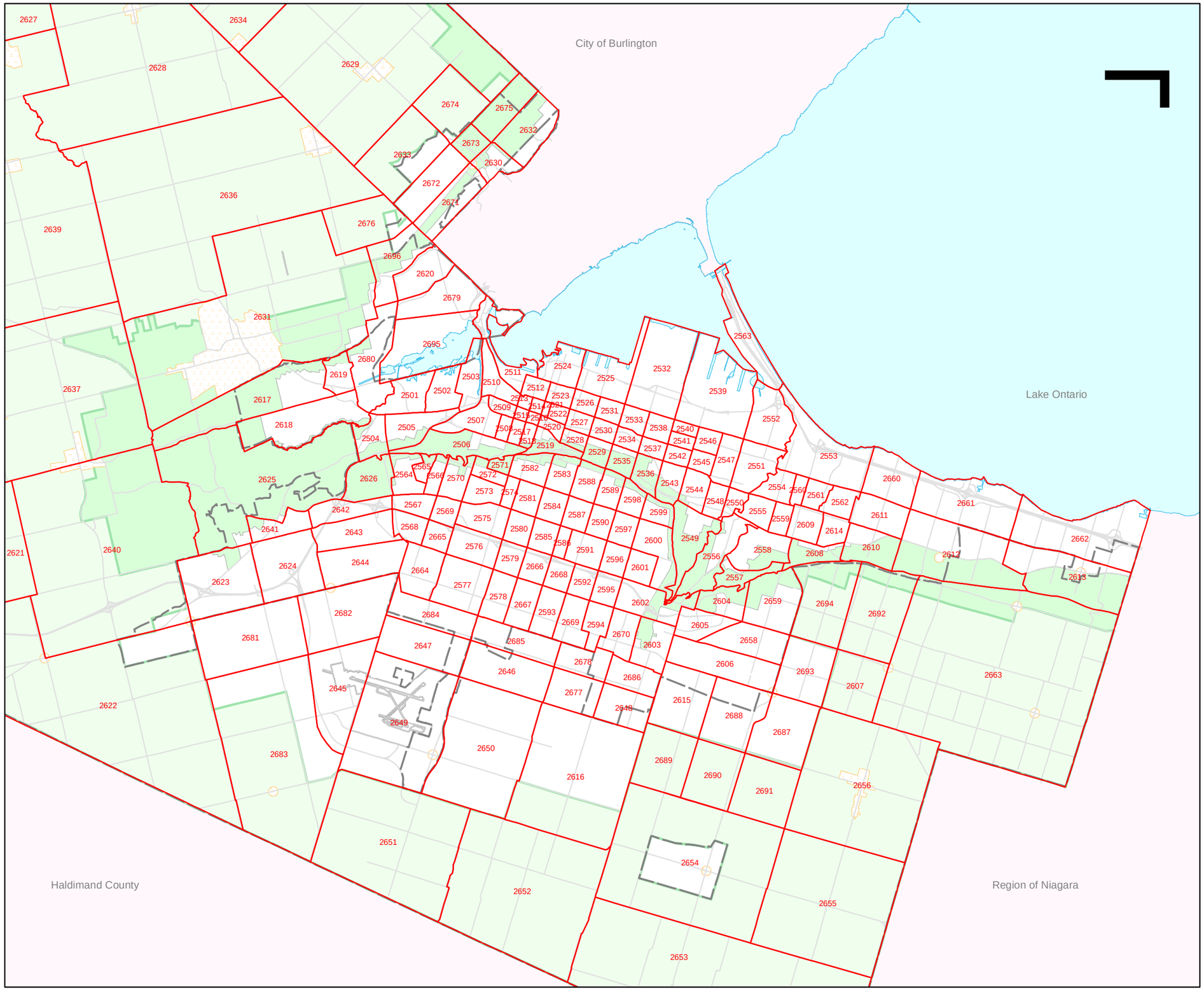
The planning data was developed by the City of Hamilton whereby City-wide projections were geographically allocated by traffic survey zone (TSZ). The planning projections including population and employment data, were developed through analysis of vacant lands, intensification opportunities and boundary expansion requirements. The data was provided to the Master Plan team in 10-year intervals for 195 separate traffic zones covering the entire City, as shown in Figure 4. Many of these traffic zones cover areas that lie outside of the study area (rural areas outside of the lake-based water and wastewater servicing area). Only the traffic zones that overlap the existing servicing area, the existing urban boundary, or identified urban boundary expansion areas were considered in this Master Plan.

In order to further allocate the planning data for modelling purposes, additional GIS processing was completed to allocate the TSZ data to model node polygons. This process used the GRIDS planning data in TSZ, the City's land use data, the wastewater model catchments (wastewater node polygons) and the water node polygons.

For areas within the existing urban boundary, the population and employment increases were distributed according to existing land uses. This assumes that existing residential areas will remain residential, with an increased population density. For urban boundary expansion areas, population and job growth was assumed to be evenly distributed across the traffic zones. A geographic overlay was used to transfer the population and job data to individual land parcels, and then to the wastewater catchments and water node polygons.

4.3 WATER AND WASTEWATER SYSTEM MODELS

Analysis of the infrastructure requirements for this Master Plan was undertaken utilizing the computerized water and wastewater models for the City systems.



Legend

- Traffic Zone Boundary
- Urban Boundary
- Rural Settlement Area
- Niagara Escarpment
- Greenbelt

Hamilton

Integrated Water & Wastewater Master Plan

Traffic Zone Map

Nov 22, 2006
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2590-D-75

4.3.1 Water Model

WaterCAD, from Haestad Methods/Bentley was selected as the preferred water model software package. The water system model was developed in 2004 by the City of Hamilton and it includes all pumping stations, reservoirs, elevated tanks, valves and the existing watermains. The model is a skeletonized network consisting generally of watermains larger than 200 mm diameter with some smaller watermains included for connectivity.

The entire water system was divided into 3,076 individual geographic areas or water node polygons. These geographic areas covered the existing serviced areas of the City as well as areas that were under development or that could potentially be developed by the year 2031. The water demands were calculated for each water node polygon based on residential and employment projections.

4.3.2 Wastewater Model

MOUSE, from DHI Software, was selected as the preferred wastewater model software package. The wastewater system model was developed in 2004 by AWS Engineers & Planners Corp, and includes all of the sewage pumping stations and the main trunk infrastructure. Within the separated sewer system (SSS), the trunk sewers were generally defined as any pipe having a diameter of 300 mm and greater. Within the combined sewer system, the trunk sewers were generally defined as any pipe having a diameter of 600 mm and greater.

The entire drainage area for the three wastewater treatment plants (WWTPs): Woodward Avenue, Dundas and Waterdown; was divided into 610 individual sewer catchments (wastewater node polygons), each with an average area of approximately 155 ha. These catchments cover the existing serviced areas of the City as well as areas that are currently under development or that might potentially be developed by the year 2031.

The model was calibrated based on sewer flow data that was measured at 59 locations during the City's 2004 flow monitoring program. As well, ten temporary rain gauges were installed to augment the City's nine permanent rain gauges. In general, the calibrated model achieves a reasonably good match to the measured flows when using the 2004 rainfall data as the model input.

4.4 EVALUATION CRITERIA

Information on each of the servicing alternatives was developed to enable a comparative evaluation of impacts, and selection of a preferred alternative. The factors considered generally matched the Triple Bottom Line (TBL) evaluation approach approved for GRIDS:

- Physical and Natural Environment:
  - Impact on vegetation, fish and wildlife; surface drainage and groundwater; soil and geology
  - Impact on areas of natural and scientific interest, and environmentally-sensitive areas
  - Disruption of topographical features.

- Social, Economic, and Cultural Environment:
  - Impact on existing and proposed development
  - Impact on archaeological and historic sites
  - Impact on agricultural resources
  - Impact on recreational areas
  - Impact on other utilities
  - Coordination with proposed roadway development.
- Financial Factors:
  - Construction, operation and maintenance (life-cycle) costs
  - Best use of existing infrastructure
  - Flexibility for scheduling works.
- Technical Factors:
  - Level of service
  - Security and reliability
  - Impact on existing infrastructure
  - Constructability
  - Impact on operations and maintenance
  - Meeting legislated criteria and regulations.

4.5 RELEVANT TECHNICAL CRITERIA AND GUIDELINES

Due to the nature of the City of Hamilton's water and wastewater systems and the location of the system and facilities on Lake Ontario and specifically the Hamilton Harbour, there are provincial technical guidelines relevant to the evaluation of the servicing strategies. Principal guidelines for the design criteria and water quality objectives primarily related to the wastewater system are:

- Procedure F-5-5, a supporting document for the Provincial Guideline F-5 "Levels of Treatment for Municipal and Private Sewage Treatment Works Discharging to Surface Waters"
- The Remedial Action Plan for the Hamilton Harbour (HHRAP).

These principal guidelines have been incorporated into the overall servicing evaluation being undertaken as part of the City of Hamilton Water and Wastewater Master Plan. Under the Master Plan, the goals related to strategies for wastewater servicing, wet weather control and wastewater treatment include:

- Provide capacity to service projected growth
- Maximize volume to be treated through full secondary and tertiary treatment

- Reduce discharge of untreated combined sewer overflow
- Endeavour to meet and achieve HHRAP loading targets and MOE Procedure F-5-5.

In addition to the provincial policies and guidelines, the City undertook a Water and Wastewater Policy exercise to develop specific guidelines for the Master Plan process and for future use in implementing the strategies.

4.5.1 Procedure F-5-5

The key goals and objectives identified under Procedure F-5-5 and as interpreted for the Master Plan address:

- Generally:
  - Eliminate the occurrence of dry weather overflows
  - Minimize the potential for impacts on human health and aquatic life resulting from CSOs
  - Achieve as a minimum, compliance with body contact recreational water quality objectives.
- CSO events and discharges to the City's receiving waters
- Capture and Level of Treatment for wet weather flows across the City's wastewater system.

The F-5-5 goals and objectives as they relate to the Master Plan design criteria are further detailed in Section 12.

4.5.2 The Remedial Action Plan for the Hamilton Harbour (HHRAP)

The key goals and objectives identified under HHRAP for the City of Hamilton related to Woodward Ave. WWTP effluent loading targets to the Hamilton Harbour, Dundas WWTP effluent loading targets to the Cootes Paradise and system wide CSO effluent loading targets.

Further discussion and interpretation of these goals was refined as part of the wet weather workshops documented in the appendices.

The HHRAP goals and objectives as they relate to the Master Plan design criteria are further detailed in Section 12.

4.5.3 Water and Wastewater Servicing Policies

As part of the overall master planning process, the City of Hamilton has developed a series of water and wastewater servicing policies to provide guidelines and directions for developing and evaluating servicing alternatives cognizant of provincial legislation, regulations and Vision 2020. The Policies have been endorsed by City Council.

These policies are explained in detail in Report #2: City of Hamilton Water and Wastewater Policy Paper. The General, Water, and Wastewater Policy Statements are summarized in Tables 3, 4 and 5 respectively.

Table 3 General Servicing Policies

Policy	Policy Statement
G.01	The City of Hamilton shall harmonize planning and servicing policies and processes within the City of Hamilton Planning and Public Works Departments.
G.02	The City of Hamilton shall not permit partial servicing for new development.
G.03	Growth areas within the City of Hamilton shall be designated based on the provision of municipal water and wastewater.
G.04	The City of Hamilton shall ensure that the design of water and wastewater infrastructure recognizes the potential for growth beyond the time horizon of the Official Plan.
G.05	The City of Hamilton shall maximize the use of existing capacity, prior to the upgrading or expansion of infrastructure.
G.06	The City of Hamilton shall maintain sufficient reserve capacity in its water and wastewater infrastructure and facilities to provide operational flexibility and meet potential changes in servicing conditions.
G.07	The City of Hamilton shall adopt city-wide development standards, design standards, and by-laws.
G.08	The City of Hamilton shall implement best practices and standards to ensure system efficiency and optimization through infrastructure planning, design, operation, and maintenance.
G.09	The City of Hamilton shall maintain Operating procedures that support open communications between the public, review agencies, and City Departments.
G.10	The City of Hamilton shall locate all of its services and facilities on public property or on municipally-owned easements.
G.11	The City of Hamilton shall continue to monitor water and wastewater system conditions and water production/wastewater collection flow information.

Table 4 Water Servicing Policies

Policy	Policy Statement
W.01	The City of Hamilton shall endeavour to protect its raw water sources.
W.02	The City of Hamilton shall meet or exceed legislated water quality criteria.
W.03	The City of Hamilton shall provide potable water at adequate pressure and flow to its customers.
W.04	The City of Hamilton shall provide reliability and security throughout the water distribution system.
W.05	The City of Hamilton shall ensure that acceptable water quality is maintained throughout the distribution system.
W.06	The City of Hamilton shall consider the Ministry of the Environment Guidelines and the Insurance Underwriters Guidelines for establishing the acceptable level of fire flow.
W.07	The City of Hamilton shall adopt the Ministry of the Environment Guidelines as the minimum acceptable level of water storage.
W.08	The City of Hamilton shall have an adequate combination of reservoir capacity, pumping capacity, and stand-by power to meet the desired level of service under emergency conditions.
W.09	The City of Hamilton shall encourage and promote water conservation.
W.10	The City of Hamilton shall utilize reasonable design and costing criteria for establishing and evaluating servicing scenarios.

Table 5 Wastewater Servicing Policies

Policy	Policy Statement
WW.01	Provision of separate sanitary and storm sewer systems shall be considered a priority for all new growth areas.
WW.02	The City of Hamilton shall implement a sewer use bylaw that will set the maximum permissible limits on the criteria for discharge into municipal sewers.
WW.03	The City of Hamilton shall provide adequate reliability and security in wastewater pumping systems.
WW.04	The City of Hamilton shall endeavour to meet or exceed the Ministry of Environment Procedure F-5-5 and HH-RAP for CSO control.
WW.05	The City of Hamilton shall meet the Hamilton Harbour Remedial Action Plan (RAP) initial loading objectives and work towards the refinement and achievement of the final stage loading objectives.
WW.06	The City of Hamilton shall meet or exceed the requirements of the C of A and the appropriate legislated treatment criteria.
WW.07	The City of Hamilton shall utilize reasonable design and costing criteria for establishing and evaluating servicing scenarios.
WW.08	The City of Hamilton shall ensure that there is a Biosolids Management Plan that addresses the needs of all residents within the City boundary.

5. EXISTING CONDITIONS

The City of Hamilton has many areas valued for their natural heritage and resource functions, as shown in Figure 5. These areas are not highly suitable for new growth and development. The Province provides guidance for the identification of areas to be protected from urban uses/growth through the Provincial Policy Statement (PPS 2005) as outlined in an earlier section. With the PPS guidelines in mind the following areas were identified as constraint areas for development.

Identification of Constraint Areas for Development:

- The Greenbelt Plan (which incorporates The Niagara Escarpment Plan and The Parkway Belt West Plan)
- Aggregate Resource Areas
- Provincially Significant Wetlands
- Areas of Natural and Scientific Interest
- Prime Agricultural Lands, as defined by Hamilton's Land Evaluation and Area Review (LEAR) Study
- Significant Woodlands (significance defined by the City)
- Regionally and / or locally significant wetlands (defined by the City)
- Environmentally Significant Areas
- Land potentially impacted by aircraft noise as identified by Airport Noise Contours (25-28 NEF/NEP in Year 2011).

The depiction of these constraint areas and description below have been referenced from the GRIDS Final Report, May 2006 as prepared by Dillon Consulting.

5.1 NATURAL ENVIRONMENT

There exists a system of natural areas of varying significance. These interdependent areas are described as the Regional Natural Heritage System and are the focus of resource protection policies.

The City of Hamilton's diverse natural features perform numerous ecological functions, essential to life processes including the conservation of biological diversity. These functions include: maintaining and improving air and water quality; controlling and mitigating the effects of erosion, sedimentation and flooding; and, providing habitat for a wide variety of plant and animal species. Natural features also provide many recreational, aesthetic and economic benefits to our human communities.

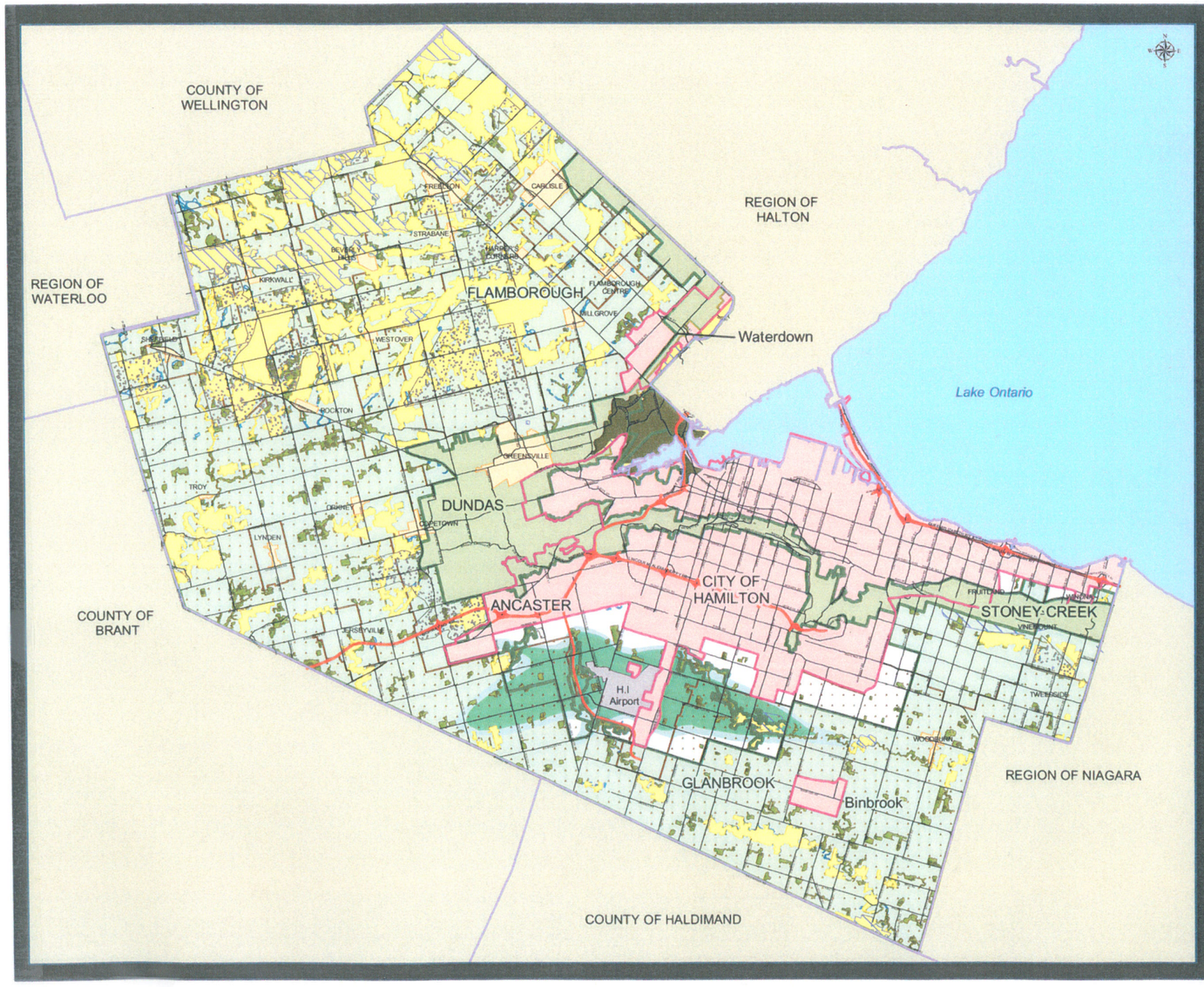

Figure 3:Growth Considerations

Map Features

- Municipal Boundary
- Urban Area
- Settlement Area
- Greenbelt Plan Area[1]
- Parkway Belt West Secondary Plan Area[2]
- Niagara Escarpment Commission Regulated Area[3]
- ANSI[4]
- Aggregate Resource Area[5]
- Prime Agricultural Land[6]
- Significant Wetland[7]
- Significant Woodland[8]
- ESA[9]
- Hamilton Airport NEF/NEP Noise Contours[10]
  - 28 NEF/NEP, 1996
  - 25 NEF/NEP, 1996

Scale

0 1.25 2.5 5 7.5 Kilometers

Map Notes

[1]Greenbelt layer derived from mapping found on Ministry of Municipal Affairs and Housing website.
[2]Parkway Belt West layer provided by City of Hamilton.
[3]Niagara Escarpment Commission layer provided by City of Hamilton.
[4]ANSI layer provided by City of Hamilton. Derived from MNR.
[5]Aggregate Resource Area provided by City of Hamilton (Regional Offical Plan).
[6] The Prime Ag layer was derived from the LEAR study.
[7]THIS LAYER IS DRAFT. Significant Wetlands are a combination of Provincially Significant Wetlands (MNR) and locally significant wetlands. Please refer to City of Hamilton for more detail.
[8] THIS LAYER IS DRAFT. Significant Woodlands layer provided by City of Hamilton. Please refer to City for more details.
[9]ESAs provided by City of Hamilton.
[10] NEF/NEP noise contours derived from City of Hamilton's Airport Master Plan.

March 2006

DILLON CONSULTING

Hamilton

BUILDING A STRONG FOUNDATION HAMILTON

Integrated Water & Wastewater Master Plan

Growth Considerations

KMK Consultants Limited

Figure 5
Nov 22, 2006
N/A
2590-D-71

The City's natural areas include such major landscape features as the Niagara Escarpment, Lake Ontario, Hamilton Harbour and Cootes Paradise, as well as a network of streams, wetlands, water bodies, forests, woodlots and other identified areas of natural and scientific interest. The Niagara Escarpment's designation as a World Biosphere Reserve by UNESCO in 1990 gives it international prominence.

There are 81 Environmentally Significant Areas identified in the City of Hamilton (including the Escarpment and other areas of provincial level significance).

The areas where policy and designation determines growth cannot occur and those areas where growth is discouraged were put together on one map to provide a better understanding of where new growth could occur, which in turn steered the Water and Wastewater Master Plan.

5.1.1 Watersheds

The shoreline of Lake Ontario and Hamilton Harbour has ecological, economic, aesthetic, recreational, historical and cultural importance. Many of these features must be protected to ensure that impacts are minimized upon the natural ecosystems and protect the shoreline, water quality and aquatic ecosystems.

Hamilton Harbour is a 2,150 ha embayment of Lake Ontario connected to the lake by a single ship canal across the sandbar that forms the bay. The conditions in the Harbour reflect natural inputs, human activities, land uses and drainage from the watershed of 49,400 hectares.

This watershed is drained by three main tributaries: Grindstone Creek draining the north central area of the watershed (9,000 hectares), Red Hill Creek draining the southeast sector of the basin (6,640 hectares) and Spencer Creek draining the northwest and western parts of the watershed (28,452 hectares). There are also minor tributaries that drain parts of the shore of Cootes Paradise and the north shore of Hamilton Harbour.

The urban runoff from a major portion of the City of Hamilton is currently collected in a combined sewer system (sanitary and storm) that has combined sewer overflow (CSO) outfalls discharging directly into the Harbour.

Spencer Creek reaches the main part of the Harbour through a 250 hectare, shallow area of both marsh and open water called Cootes Paradise Marsh, discharging at an artificial opening into the west end of the Harbour called the Desjardins Canal.

There are four wastewater treatment plants (WWTP) that discharge to the Harbour. The Regional Municipality of Halton operates the Skyway WWTP, which discharges into the northeast end of the Harbour. The City of Hamilton operates the other three plants. The largest plant, the Woodward WWTP, discharges into Red Hill Creek. The Main Street WWTP (also known as the Waterdown WWTP) discharges into Grindstone Creek. The King Street WWTP (also known as Dundas WWTP) discharges into Cootes Paradise.

The Harbour also receives the treated wastewater from all of Stoney Creek (via the Woodward WWTP) and Burlington (via the Skyway WWTP).

5.1.2 Topography and Geology

The Niagara Escarpment is the most outstanding physiographic feature of the area, dividing the area of the watershed in half. The area above the escarpment is generally very flat (typical gradients of 1 in 2,000). The escarpment itself gives rise to stream gradients of up to 1 to 20 with several waterfalls. Below the escarpment, with stream gradients in the order of 1 in 100, streams move across plains of clay and sand, or down the Dundas Valley.

Changes in urban, rural and industrial activities have resulted in destruction of sustainable natural ecosystems. This has taken the form of increased erosion, increasing demands on wastewater and treatment plants, increased number and volume of toxic substances entering the watershed, and loss of access to the Harbour for the general public.

5.1.3 Physical Setting

The City of Hamilton encompasses a diverse landscape that includes parts of seven distinct physiographic regions. The physical setting is dominated by three prominent landform features:

- The western Lake Ontario shoreline; including the Hamilton embayment
- The Niagara Escarpment cuesta that runs roughly parallel to the shoreline, but is some 2 km inland
- The Dundas Valley, a major, partially-buried bedrock gorge that forms a major indentation in both the shoreline and escarpment.

Representative physiographic features above the Niagara Escarpment consist of bedrock, sand and clay plains in the former municipalities of Flamborough, Ancaster, and Glanbrook respectively. Shoreline processes associated with the fluctuating level of Lake Ontario have shaped the surface features in the area along the Lake Ontario shoreline.

5.1.4 Aggregates Resources Areas

The planning responsibility for aggregate resources is shared between the Province and the City of Hamilton. The Provincial interest is to protect the aggregate resources for long term use and ensure that as much as possible is made available to the aggregate industry. The task of the City of Hamilton is to establish comprehensive mineral aggregate policies for the protection and use of mineral aggregate resources. These areas of protection as shown in Figure 5 were accounted for in the preparation of the Water and Wastewater Master Plan.

5.1.5 Prime Agricultural Lands

The preservation and enhancement of farming and agricultural land, are vital components of the sustainable future envisioned for the City of Hamilton and were considered in the preparation of the Water and Wastewater Master Plan.

5.1.6 Significant Woodlands

The City of Hamilton recognizes the importance of woodlands and trees to the health and quality of life in the community. The City's policies encourage the protection and

restoration of forests, including trees, hedge rows, wooded areas, significant woodlands. Where the City is undertaking infrastructure work, the City will, where feasible, protect and preserve existing woodland resources.

5.1.7 Hamilton Natural Heritage System

The system includes provincially, regionally and locally significant features that have been included because of their ecological, or potentially ecological characteristics and functions. The Natural Heritage System has two components including the core natural areas and linkages (existing natural features). The Master Plan has reviewed the natural heritage system and taken account of the many protected areas found within the City of Hamilton to avoid or minimize any impact associated with the proposed Water and Wastewater Master Plan.

5.1.8 Hamilton Airport

Hamilton Airport located in the Township of Glanbrook is recognized as a valued transportation facility and an important link in the movement of goods and people. The City has existing policies to minimize future conflicts between the operation of the airport and surrounding land uses. Regulations apply noise exposure forecast contours (Transport Canada) and guidelines for development in the vicinity of airports (Provincial Ministry of Municipal Affairs and Housing) so that no new residential uses are developed within areas exposed to set noise disturbance levels.

5.2 SOCIAL ENVIRONMENT

Hamilton has a long history of human settlement and development. Due to the combination of favourable climate conditions and productive soils, Hamilton includes some of the best agricultural lands in Canada, including specialty croplands used for growing tender fruits. The area continues to support an important agricultural industry.

Due to its strategic geographic location at the apex of the Ontario's Golden Horseshoe much of the area's landscape has been strongly influenced by human settlements and land use activity. Non-agricultural development in the area was initially concentrated in small clusters wherever streams could provide a source of hydraulic power. Following the construction of shipping canals in the 1800s, urban centres began to develop around the Harbour facilities at Hamilton and Dundas. Industrial, commercial, and residential developments subsequently spread out along the system of railways that radiated out from the head of the lake.

The City of Hamilton spans 110,000 hectares along the Niagara Escarpment and south western shores of Lake Ontario. It is home to approximately 510,000 people and millions of annual visitors. Hamilton's geography is distinctive, with the Escarpment (the Mountain) acting as a dividing line between the waterfront / core area and other parts of the City.

Hamilton has a diversity of neighbourhoods. The core area along with parts of Dundas, Flamborough, Ancaster and Stoney Creek has well established, mature neighbourhoods defined by older homes, mature trees and heritage properties. The core area is also where much of Hamilton's higher density neighbourhoods are located. Suburban parts of former Hamilton, Flamborough, Ancaster and Stoney Creek have modern residential and

commercial development. Glanbrook typifies the more rural parts of the City that blend old with new homes.

The south and east shores of the Harbour have been filled over time and developed for industrial and commercial activities (primarily the iron and steel industries), marine terminals, railway and highway construction, institutional uses, and recreational uses. Twenty-five percent of the area of the original bay has been filled, eliminating 65 percent of the wetlands, protected inlets and shallow areas.

The eastern shore is comprised of the highway, the canal, institutional lands, as well as commercial activities that prevent significant general public access. However, increasing public access in the south eastern end is one of the tasks of the Hamilton Harbour RAP.

The north shore of the Harbour in the Aldershot district of the City of Burlington consists largely of private homes, private golf course, two cemeteries and public park.

The western shore is shared between railway land and the Hamilton Waterfront Trail, a public walking trail.

The western end of the south shore includes Bayfront Park and Pier 4 Park, both with public beaches.

6. PLANNING SCENARIOS

6.1 EXISTING AND FUTURE PLANNING DISTRICTS

The City's general planning philosophy is to grow to the limits of the existing urban boundary before expanding it. Naturally, as shown in Table 6 the majority of the growth until 2011 is expected to occur on currently vacant land within the existing urban boundary. Planning projections indicate that the extent of the existing urban boundary will be reached after 2011 – likely closer to 2014 – at which point there will be pressure to expand.

Table 6 Growth Split Between Existing and Future Urban Boundaries

	2001-2011	2011-2021	2021-2031
Population Growth – Existing Urban Boundary	27,692	53,484	41,661
Population Growth – Urban Boundary Expansion	0	3,613	36,999
Employment Growth – Existing Urban Boundary	22,459	30,298	37,843
Employment Growth – Urban Boundary Expansion	0	7,622	8,463

Growth within the existing urban boundary from 2011 through 2031 will occur primarily through re-development and intensification of existing developed areas. Full build-out is anticipated by about 2031.

While there is expected to be significant growth outside of the existing urban boundary commencing in 2014, the City has an opportunity to upgrade its existing infrastructure over the next five to ten years in order to address existing constraints and shortfalls, as well as to accommodate these additional growth centres.

6.2 EXISTING AND FUTURE PRESSURE ZONES

Table 7 provides a summary of projected demands in relation to the existing urban boundary and urban boundary expansion.

Table 7 Projected Demands Expected for Existing and Future Urban Boundaries

	2011	2021	2031
Projected Demands – Existing Urban Boundary (ML/d)	414	466	496
Projected Demands – Urban Boundary Expansion (ML/d)	10	20	92
Total Projected Demands (ML/d)	424	486	588

The water system design criteria has been utilized in the calculation of the future projected demands. However, it was noted that the employment areas could have varying water uses and possibly require additional capacity should these uses be water-intensive. Also, based on the direction of the Master Plan Policy Paper, provision for servicing beyond the Master Plan planning horizon should be considered. As such, during the evaluation of key trunk

infrastructure such as the Woodward Ave. WTP and escarpment crossing transmission and pumping capacity, potential water demands beyond 588 ML/d were considered.

Based on the topography of the proposed growth areas, it is anticipated that no additional Pressure Districts will be required to provide sufficient levels of service.

Growth due to intensification or re-development will impact primarily Pressure Districts 1, 2, 10 and 23. These correspond to the areas of downtown Hamilton, Stoney Creek and Binbrook. Growth that will occur outside the urban boundary will impact Pressure Districts 7, 6 and 18, which are in the areas in Glanbrook and Elfrida (Southeast Mountain) and the Airport Lands.

Evaluation of the growth in the Airport Lands will need to consider potential upgrades to the infrastructure of Pressure Districts 6 and 18. Based on topography of the area, it is estimated that a large percentage of the Airport Lands could be serviced from Pressure District 6. Also, there is a natural divide in the Airport Lands, the existing utility corridor, which could provide a logical Pressure District boundary between PD 6 and 18.

6.3 EXISTING AND FUTURE DRAINAGE AREAS

Table 8 provides a breakdown of what the future flows are expected to be at each of the wastewater treatment plants based on the future development scenarios.

Table 8 Future Wastewater Flows – By Plant Location

	2001	2011	2021	2031
Woodward Avenue WWTP				
Serviced Population [1]	442,417	469,797	525,802	604,336
Per-Capita Flow (Lpcd)	769	769	769	769
Design Average Flow (ML/d)	338	359	402	462
Dundas WWTP				
Serviced Population	23,817	24,874	25,575	25,708
Per-Capita Flow (Lpcd)	653	653	653	653
Design Average Flow (ML/d)	15.6	16.2	16.7	16.8
Waterdown WWTP				
Serviced Population	5,724	5,925	6,316	6,309
Per-Capita Flow (Lpcd)	653	653	653	653
Design Average Flow (ML/d)	3.7	3.9	4.1	4.1

1. Includes Urban Boundary Expansion Areas

The above wastewater flow breakdown recognizes that the majority of the growth is within the Woodward Ave. WWTP catchment area. The limited growth within the Dundas WWTP catchment area is not expected to require expansion to the facility while the growth projected for the Waterdown WWTP will exceed the plant capacity which is already approaching and exceeding rated capacity.

Based on the location of the growth areas within the Woodward Ave. WWTP catchment area, evaluation of the conveyance strategy will be required given the limitations of the existing escarpment trunk sewers. With growth areas in the Southwest (Airport Lands) and the Southeast (Elfrida node) Mountain, determination whether to direct flow to the west or east trunk system and the corresponding downstream impacts will need to be considered. Also, based on the location of the growth in the southern limits, new and additional pumping capacity is anticipated.

Similar to the water trunk infrastructure, based on the direction of the Master Plan Policy Paper, provision for servicing beyond the Master Plan planning horizon should be considered for the key wastewater trunk infrastructure. As such, during the evaluation of key trunk infrastructure such as the Woodward Ave. WWTP and escarpment crossing conveyance capacity, potential wastewater flows beyond 462 ML/d were considered.

From review of the alternative growth options developed during the GRIDS process as well as the provincial scenarios presented during the Places To Grow process, it is estimated that a future population exceeding 700,000 persons could need to be serviced by the key wastewater infrastructure. As such, for planning purposes, a design flow rate of 553 ML/d (718,000 persons at 769 Lpcd) was established for the Woodward Ave. WWTP. This design flow rate is consistent with analysis completed under the Woodward Ave. WWTP Scoping Study by CH2MHILL in February 2005.

7. EXISTING WATER SYSTEM

The urban area of the City of Hamilton is provided with Lake Ontario-based potable water. The entire service area is supplied treated potable water from the Woodward Ave. Water Treatment Plant.

The City is also responsible for the supply and treatment of water in four rural communities, including Carlisle, Freelton, Greensville, and Lynden, however they do not fall within the current study area.

The existing water system for the study areas consists of the Woodward Ave. WTP, a series of water pumping stations, reservoirs, elevated storage tanks and the distribution system. Based on the change in topography (including the Niagara Escarpment) and the wide geographical service area, numerous Pressure Districts have been established to maintain adequate levels of service.

The water system is set up to pump water through the Pressure Districts to the limits of the system. The transmission of water to each pumping station and reservoir is not provided through dedicated transmission mains but is conveyed through larger diameter trunk watermains. In some Pressure Districts, multiple trunk watermains distribute flow through the system.

The existing water system has two primary feedermains up the escarpment to service the Mountain areas. There is also one feedermain up the escarpment to service Waterdown.

The City water system also takes advantage of the change in topography by providing in-ground and at-grade reservoir storage to service the Pressure Districts in the central and northern areas. Based on historical City standards, the City of Hamilton water system has a large amount of storage available for supply (both floating storage and suction-side storage for pumping), equalization of system flows and pressures, and emergency conditions.

Figure 6 shows the extents of the lake-based water system for the City including key supply and distribution facilities such as the Woodward Avenue Water Treatment Plant.

7.1.1 Woodward Avenue Water Treatment Plant

Treated water within the City of Hamilton Water/Wastewater Master Plan study area is provided through the Woodward Avenue Water Treatment Plant.

The plant is currently permitted to take up to 909 ML/d from Lake Ontario, and has an existing firm high-lift pumping station capacity of 569 ML/d. The capacity of the raw water intakes is approximately 1,150 ML/d. Based on typical maximum day flows of over 300 ML/d, the plant is currently operating within its rated capacity. Notwithstanding, the major unit processes are meeting the current needs but each have unique performance rated capacities.

Pre-treatment consists of two modules of process tanks. Each module has a raw water inlet well, four rapid mixing tanks, six sets of primary and secondary flocculation tanks, and two sedimentation tanks. Raw water enters each module at a centrally located raw water inlet well and splits into a two stage rapid mixing tank on each side of the raw water inlet well.

City of Burlington

Lake Ontario

Haldimand County

Region of Niagara

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Legend

- Pump
- Reservoir
- Plant
- Watermain
- Rural Settlement Area
- Intensification Area
- Niagara Escarpment
- Greenbelt
- Urban Boundary

Hamilton

Integrated Water & Wastewater Master Plan

Water Servicing

Water Distribution System

Nov 22, 2006
1:125,000
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The plant regularly undergoes asset and process upgrades based on condition and performance of the equipment. Aging infrastructure is replaced in order to maintain a high level of service and performance from the facility.

Extensive study on the Water Treatment Plant has been undertaken, including the Hargrave and Burdick studies in 2004, which has also provided recommendations on major and minor unit process upgrades and advanced technology implementation to address emerging water quality issues on the Great Lakes and evolving Federal and Provincial water quality guidelines and standards.

7.1.2 Water Distribution System

The Lake-Based System is currently divided into 20 Pressure Districts. A map of the Pressure Districts is presented in Figure 6. The Woodward Avenue Water Treatment Plant provides potable water to all of the Pressure Districts through Pressure District 1.

The following paragraphs provide a brief description of the system components and the servicing of the primary geographic regions of the City of Hamilton.

Downtown

The Downtown area is serviced from Pressure Districts 1, 2 and 3. Pressure District 1 is serviced directly from the hi-lift pumps located at the Woodward Avenue Water Treatment Plant, then HD002 pumps water up to the higher areas of Downtown Hamilton. There are three reservoirs with a top water level of 133.35 m, which provide security and operational equalization of the system.

Pressure District 2 is also equipped with two storage facilities with a top water level of 147.8 m. Pumping stations HD002/HD03A are located at the same site at Ferguson Avenue. This facility is aging and ongoing upgrades have been recently undertaken.

Pressure District 3 is fed by gravity via Pressure District 5, which is located on top of the escarpment as well as through existing PD3 pumping stations. Equalization, emergency, and fire storage for Pressure District 3 is also provided through Pressure District 5.

If the water supply from Pressure District 5 is interrupted, water can be pumped into Pressure District 3 through two backup pumping stations. The primary backup pumps from Pressure District 1 can supply adequate volumes and pressures. The secondary backup pumps from Pressure District 2 (HD03A), cannot supply sufficient water to meet the demands. The pumps in these stations are controlled manually.

Stoney Creek

Stoney Creek is also serviced through Pressure District 1, and also has areas located within Pressure Districts 4 and 8. There are two pumping stations, HD04B and HD08A which feed Pressure Districts 4 and 8 respectively. There is currently no elevated storage in either District, though there is pumped storage at HD04B.

Pressure Districts 9 and 10 are located at the east end of Stoney Creek, they are serviced through Pressure District 1 but there is also an interconnection with the Grimsby Water

system maintained. Currently, there is elevated storage in Pressure District 10, though with limited capacity.

Dundas

Dundas is serviced through Pressure Districts 11 and 12, and is adjacent to and supplied through Pressure District 2. The storage located in Pressure District 11 is sufficient for both Pressure Districts.

Pressure District 12 is supplied from Pressure District 11 through Pumping Station HD12A. This district is also supplied through Pressure District 22, which receives its supply through a PRV from District 18. The elevated tank within Pressure District 12 provides equalization but has limited capacity to provide security in an event of an emergency.

The properties located south of the Spring Creek Conservation Area are fed by a single 300 mm diameter watermain located on Bridlewood Drive. In the event that this supply is interrupted, pumping station HD012 can be used to service this area from Pressure District 11. Station HD012 has to be operated manually, and it does not have sufficient capacity to supply the required fire flows.

Pressure District 22, which services the higher lands in north west Dundas, is supplied through a single connection from Pressure District 18. The elevated tank within Pressure District 22 provides equalization but has limited capacity to provide security in an event of an emergency.

Waterdown

Waterdown is located within Pressure District 16, which has an elevation range from 210 m to 250 m. District 16 is supplied through Pressure District 2. The Pleasantview neighbourhood is serviced through pressure-relief valves from District 16.

Local pressure for the Waterdown area is provided by Pumping Station HD016 located below the escarpment at York and Valley Road in Dundas. Water is distributed from Pump Station HD016 up the escarpment through a single 600 mm trunk watermain. There is limited storage capacity within Waterdown, and there is some limited capacity for an emergency supply through a maintained interconnection with the Region of Halton.

Mountain

The Mountain area is located above the Niagara Escarpment, within Pressure Districts 5 and 6. Pressure District 5 is fed from Pressure District 1 through two pumping stations, HD005 and HD05A. Pressure District 6 is in turn fed from District 5 through two additional pumping stations, HD006 and HD06A.

Currently, there are two supply feedermains up the Escarpment, and approximately half of the City's population resides on the Mountain.

There is sufficient pumped storage for the area, and operational equalization is provided from the reservoir located in Pressure District 18.

Glanbrook and Binbrook

Glanbrook is located within Pressure District 7, which is supplied through District 5. From this area, a watermain feeds the Town of Binbrook.

While there is no floating storage within Pressure District 7, there is currently pumped storage at Pumping Station HD007.

There is an new elevated tank, HDT23, located west of the Binbrook Fairgrounds, which provides security and storage to this small community.

Ancaster

Ancaster is located to the west of the mountain lands and is within Pressure Districts 18, 13 and 14. Pressure District 18 is supplied through Pressure District 6, then there are pressure reducing valves that allow servicing to the small areas in Pressure Districts 13 and 14.

While there is no floating storage within Pressure District 18, there is pumped storage at Pumping Station HD018.

8. WATER DESIGN CRITERIA

8.1 UNIT WATER DEMAND CRITERIA

The water demand criteria were developed using actual consumption data through billing records. Peaking factors were developed using actual production data from supply/pump/storage facilities. The information provided contained daily average, maximum and minimum flows by month for the period from 1996 up to 2002.

The existing system conditions were analyzed and noted that unique consumption rates were observed for residential and employment users in each local municipality. However, for Master Planning purposes, overall residential and employment rates were established based on the historical data.

Criteria	Value
Average Day Residential Consumption	300 Lpcd
Average Day Employment Consumption	260 L/employee/d
Maximum Day Factor	1.9
Peak Hour Factor	3.0

Through the historical data analysis, it was noted that localized areas and users can exceed the above criteria. As such, it is recommended that for area-specific analyses, the tradition City of Hamilton criteria of 360 Lpcd for residential and 125 equivalent persons/ha for employment be used.

Fire flow rate criteria generally follows the MOE Guidelines with most Pressure Districts being planned for 250 L/s.

8.2 DESIGN CRITERIA FOR SYSTEM COMPONENTS AND OPERATION

Pumping Capacity

Pumping stations are rated on their firm capacity to supply water. For the City of Hamilton, given that, in some cases, multiple stations could supply a particular pressure district, firm capacity is based on the largest pump out of service between the stations servicing a determined pressure district.

For each pressure district, the pumping stations must provide local peak demands if there is no storage in that pressure district, or maximum day demands if there is sufficient storage, and have sufficient capacity to transfer maximum day demands for the subsequent Pressure Districts.

Storage Capacity

Historical City of Hamilton storage criteria is based on providing a full maximum day demand needs in storage plus fire flow storage for each pressure district. This criteria

provides a higher level of storage than typical MOE criteria. Where possible and where water quality is not adversely impacted, this criteria was maintained.

This criteria would satisfy the objectives of system storage including:

- Providing equalization storage to meet peak instantaneous demands
- Supplying water for fire fighting
- Providing emergency storage for instances of system failures, power outages or other emergency interruptions of supply
- Assisting in controlling pressure in each pressure district.

Distribution Capacity

The distribution system is sized to convey the greater of peak hour flows or maximum day plus fire flows. In addition, given that the City of Hamilton water distribution network serves as transmission between Pressure Districts, it is essential that the trunk watermains can transfer maximum day flows through the Pressure Districts to the outer most Pressure Districts.

Within each pressure district in the distribution system, the range of acceptable pressures under normal conditions are approximately 40 psi (275 kPa) to 100 psi (690 kPa). Under fire flow conditions, it is acceptable for pressures to drop to 20 psi (140 kPa)

Treatment Capacity

The water treatment facilities are designed to provide the maximum day demands for the system.

The treated water must, and has continually, met all existing water treatment regulations.

8.3 WATER UNIT COSTS

For the development and evaluation of alternative solutions as well as for the development of the preferred solution capital program, financial analysis has been required. To facilitate this financial analysis, unit costing for the horizontal and vertical works have been derived.

These unit costs have been used as a benchmark tool to approximate the total project costs. However, where applicable, the cost estimates for each project have been refined based on unique aspects of the implementation or construction of the project.

The water infrastructure capital cost estimates were developed using historical construction information for the City of Hamilton as well as recent project delivery costs trends.

Table 9 Benchmark Unit Capital Costs for Water Facilities

Infrastructure	Unit	Unit Cost – Urban	Unit Cost – Rural
Pumping Capacity	per L/s of capacity	$ 17,000	$ 17,000
Reservoir Capacity	per m^3 of volume	$ 420	$ 420
Water Treatment Capacity (new or expansion)	per L/d	$ 525	$ 525

Table 10 Benchmark Unit Capital Costs for Watermains

Infrastructure	Unit	Unit Cost – Urban	Unit Cost – Rural
300 mm diameter	per m of length	$ 711	$ 569
400 mm diameter	per m of length	$ 961	$ 769
450 mm diameter	per m of length	$ 1,100	$ 880
500 mm diameter	per m of length	$ 1,210	$ 968
600 mm diameter	per m of length	$ 1,463	$ 1,170
750 mm diameter	per m of length	$ 1,853	$ 1,482
900 mm diameter	per m of length	$ 2,178	$ 1,742
1050 mm diameter	per m of length	$ 2,591	$ 2,073
1200 mm diameter	per m of length	$ 2,953	$ 2,362
1350 mm diameter	per m of length	$ 3,758	$ 3,006
1500 mm diameter	per m of length	$ 4,360	$ 3,488
1650 mm diameter	per m of length	$ 4,763	$ 3,810
1800 mm diameter	per m of length	$ 5,287	$ 4,230

Notes:

1. Watermain costs include total project delivery allowances including engineering and contingency plus account for installation, restoration and appurtenances.

9. DEVELOPMENT OF WATER SERVICING ALTERNATIVES

In general, the overall objectives for the development of water servicing alternatives are:

- Provide high level of service to existing users and approved growth
- Provide security of supply
- Review and mitigate impacts to natural, social and economic environments
- Best meet policy statements
- Ensure servicing meets the technical criteria
- Endeavour to optimize existing infrastructure
- Ensure the strategies are cost-effective and evaluate the life-cycle costs of the infrastructure.

9.1 WATER TREATMENT CONSIDERATIONS

The existing Woodward Avenue WTP has a rated capacity of 909 ML/d, which will be sufficient to meet the water treatment needs for the 2031 growth scenario.

Some individual process will need upgrades including:

- The high-lift pumping station
- The sedimentation tanks
- The pre-chlorination system.

9.2 WATER DISTRIBUTION

A WaterCAD hydraulic model of the water distribution system was developed. The model was used to evaluate the system capacities and constraints for the current population, and also for the benchmark years of 2011, 2021, and 2031.

Based on a review of the modelling results for the existing conditions, the following system limitations and constraints were identified:

- There is a need for a third Escarpment crossing on order to provide additional capacity and security of supply to the Pressure Districts on the Mountain.
- There is no security of supply for Waterdown, and in particular the lands within OPA 28, as the area is serviced through a single watermain, and there is insufficient storage for Pressure District 16.

Any proposed water distribution system upgrades will be based on maintaining water pressures throughout the system in the range of 40 to 100 psi.

9.3 CONCEPTS FOR SERVICING NEW GROWTH

The long list of alternative solutions were developed based on the following concepts for servicing new growth:

- "Do nothing"
- Limit community growth
- Maximize capacity at existing treatment plant sites
- Construct a new water treatment plant (potentially on the mountain or east Hamilton/Stoney Creek
- Utilize and/or build treatment capacity in coordination with neighbouring municipalities
- Construct new trunk watermains up the escarpment
- Construct new and/or expand existing water pumping station and reservoir facilities
- Construct new elevated storage
- Upgrade and/or rehabilitate existing trunk main infrastructure within existing urban area
- Alternative servicing arrangements for Greensville and Carlisle.

Through preliminary evaluation of the long list of alternatives, a number of themes were established.

9.3.1 "Do Nothing"

This alternative is traditionally carried forward as a benchmark. This alternative would not address current limitations in the water system. It would also not provide for additional capacity needed to service approved growth. This would ultimately lead to significant drop in level of service, water distribution and transmission issues, insufficient system security. This option would also not meet the goals and objectives of the GRIDS process and Vision 2020 including servicing approved growth, providing sustainable water systems, or providing high level of service to existing water service areas. This is not carried forward for evaluation because it is not reasonable and feasible and does not address the problem/opportunity statement.

9.3.2 Limit Community Growth

This alternative would generally consist of limiting growth to within the existing system capacities. Under this alternative, however, existing system deficiencies, including limited system security, areas with insufficient storage and transmission capacity, would not be addressed. Under Places to Grow, the City is required to plan for future residential and employment growth. This growth and the goals and objectives of the GRIDS process and Vision 2020 would not be met. Plus the preferred growth option under GRIDS was approved

by City of Hamilton Council and does require additional servicing capacity. This is not considered a viable option.

9.3.3 Treatment Plant Capacity

Based on the current available capacity at the Woodward Ave. Water Treatment Plant, there is no other cost effective alternative to provide water treatment capacity to the new growth areas other than to utilize and maximize the use of existing infrastructure. As such, consideration to a new water treatment plant and coordination with neighbouring municipalities was not further pursued.

9.3.4 Greensville and Carlisle

The community of Greensville, due to its close proximity to Dundas, was included in the study area. However, the City has initiated the Mid Spencer Creek/Greensville Rural Settlement Area Subwatershed study to determine needs and, as such, assessment of this area has been deferred. Carlisle, due to the recommendations in a recent Class Environmental Assessment, was also included in the study area to assess long term water supply. Subsequently, an addendum to the Carlisle Water Supply Master Plan and Class Environmental Assessment was completed (Spring 2006) and identified an adequate water supply scheme which addresses the water demand projections included in the April 2004 project file report.

9.4 OVERVIEW OF WATER SERVICING ALTERNATIVES

The preliminary evaluation of the long list of alternatives led to the development of several water servicing alternatives. Due to the independent servicing needs in different areas of the City of Hamilton water system, the study area was divided into multiple servicing areas to more clearly evaluate the alternatives. The evaluation within each servicing area was then integrated to ensure the comprehensive preferred solution met all objectives system wide.

Three primary water servicing (WS) alternatives were developed to address the water treatment and distribution requirements for the study area. These are outlined in Table 11.

Table 11 Water Servicing Alternatives

Servicing Area	Alternative ID	Description
Waterdown	W-WS-3	Upgrade pumping capacity at the existing HD016 pumping station, and construct elevated storage
	W-WS-4a	Upgrade pumping station capacity at the existing HD016 pumping station, and construct additional storage in the Kelly Street area
	W-WS-4b	Upgrade pumping capacity at the existing HD016 pumping station and construct new reservoir and pumping station in the Kelly Street area
	W-WS-5	Upgrade HD016 pumping station and construct new reservoir on-site

Servicing Area	Alternative ID	Description
	W-WS-6	Expand HD016 pumping station and construct new pumping station and reservoir southwest of Waterdown
Southeast Mountain	SEM-WS-1	Service growth area entirely from HD007 New elevated tank for storage, security and operational flexibility
	SEM-WS-2	Service growth area from HD007 and HD006B with new Pressure District 7 pumps New elevated tank for storage, security and operational flexibility
	SEM-WS-3	Service growth area from HD007 and new PD7 pumping station Provide all storage as pumped storage from suction side reservoirs
Airport Lands	AL-WS-1	Service lands from Pressure Districts 6 and 18 Minimize Pressure District 18 service area New elevated tank for storage, security and operational flexibility
	AL-WS-2	Service lands from Pressure Districts 6 and 18 Increased Pressure District 18 service area New elevated tank for storage, security and operational flexibility
Escarpment Crossing	EC-WS-1	Centennial Parkway Feedermain to HD007
	EC-WS-2	Centennial Parkway Feedermain to HD06B
	EC-WS-3	Upper Wellington Feedermain
	EC-WS-4	Beckett Drive Feedermain
	EC-WS-5	Feedermain from HDR02 to Scenic Drive

10. DESCRIPTION AND EVALUATION OF WATER SERVICING ALTERNATIVES

The following sections present a full review of the water servicing options.

10.1 WATERDOWN WATER SERVICING

The City of Hamilton is preparing Secondary Plans for the Waterdown North and South study areas. The plans identify the growth requirements, development limits, land uses, and the water, wastewater, stormwater and transportation servicing requirements. Accordingly, the City is concurrently planning to provide a water and wastewater servicing system for the existing Waterdown area including infill and the designated growth areas of Waterdown North, Waterdown South and UpCountry.

The identification and evaluation of alternatives for Waterdown water servicing has been undertaken through a separate Class EA process (Waterdown Water and Wastewater Class EA; KMK, 2006). The following paragraphs provide a summary of the water distribution and storage requirements for the Waterdown area, and describes the preferred solution.

The full evaluation of the water servicing alternatives has not been repeated in this study. Rather, the evaluation matrix have been included as a summary of the alternatives considered. Alternative 1 ("Do nothing"), and Alternative 2 ("Limit growth") were deemed not feasible, and were not carried through to the detailed alternative evaluation.

Watermain Alignments

With the future development in Waterdown South and UpCountry, there will be a need to extend the water distribution network. Key issues related to the extension of the watermains are:

- Construct a trunk watermain to service growth in Waterdown
- Connect with the water storage facilities
- Evaluate the crossing of Grindstone Creek and railway line on Parkside Drive.

The existing trunk watermain runs east-west on Parkside Drive. In order to service UpCountry an extension of the trunk watermain along Parkside Drive is necessary. This requires the crossing of Grindstone Creek and the railway line.

Water Storage

With the future development in Waterdown North, Waterdown South and UpCountry, there will be a need to construct additional water storage facilities in Waterdown.

The Waterdown Class EA examined three alternative sites for at-grade water reservoirs, and nine alternative sites for elevated storage tanks. These sites were short-listed based locations within the settlement boundary and not within designated or candidate Environmentally Significant Areas (ESAs), Areas of Natural and Scientific Interest (ANSI), or designated as Greenbelt Areas.

Booster Pumping

Because the Waterdown South and UpCountry lands lie at a higher elevation than is currently serviceable through the existing Pressure District 16, a second Waterdown Pressure District (PD-16A) will need to be created. Creating this additional pressure district will require construction of a new booster pumping station.

The combined requirements of the new pressure district plus the requirements of the existing district (which will also include new development in Waterdown North) will also result in the need for additional supply to the existing serviced areas of Waterdown. As such, upgrades to existing Pumping Station HD016 will be required. The extent of the upgrades to the station were coordinated with the various storage alternatives, as these would result in different pumping requirements.

10.1.1 Preferred Waterdown Water Servicing Alternative

The key alternatives evaluated to address the distribution, storage and pumping requirements for the existing service area and new growth in Waterdown North, South and UpCountry were:

Alternative 3:	Upgrade pumping capacity at existing HD016 pumping station and construct new elevated tanks.
Alternative 4A:	Upgrade pumping capacity at the existing HD016 pumping station and construct a new reservoir and pumping station in the Kelly Street Area.
Alternative 4B:	Upgrade pumping capacity at the existing HD016 pumping station and construct a new reservoir and pumping station in the Kelly Street Area (Coordinated with Waterdown South and UpCountry Alternative 4B).
Alternative 5:	Construct new reservoir at HD016 site and extend HD016 pumping station.
Alternative 6:	Expand HD016 Pumping Station and construct new pumping station and reservoir south west of Waterdown.

The detailed evaluation of these alternatives is summarized in Table 13.

As noted, Alternative 3 has been identified as the preferred alternative.

Recommended Pressure Districts

The preferred solution requires the construction of an elevated tank in Waterdown South, a further tank in Waterdown North and the creation of a new Pressure District H16A

The H16 and H16A storage requirements are summarized in Table 12.

Table 12 Zone H16 and Zone H16A Storage Requirements

	MOE Guidelines Storage (m^3)	Equivalent Population
Zone H16 (1)	8,017.14	18,086.06
Zone H16A (2)	6,338.72	16,238.49
Total OPA 28 + Existing and Zoned	**14,355.85**	**34,324.56**

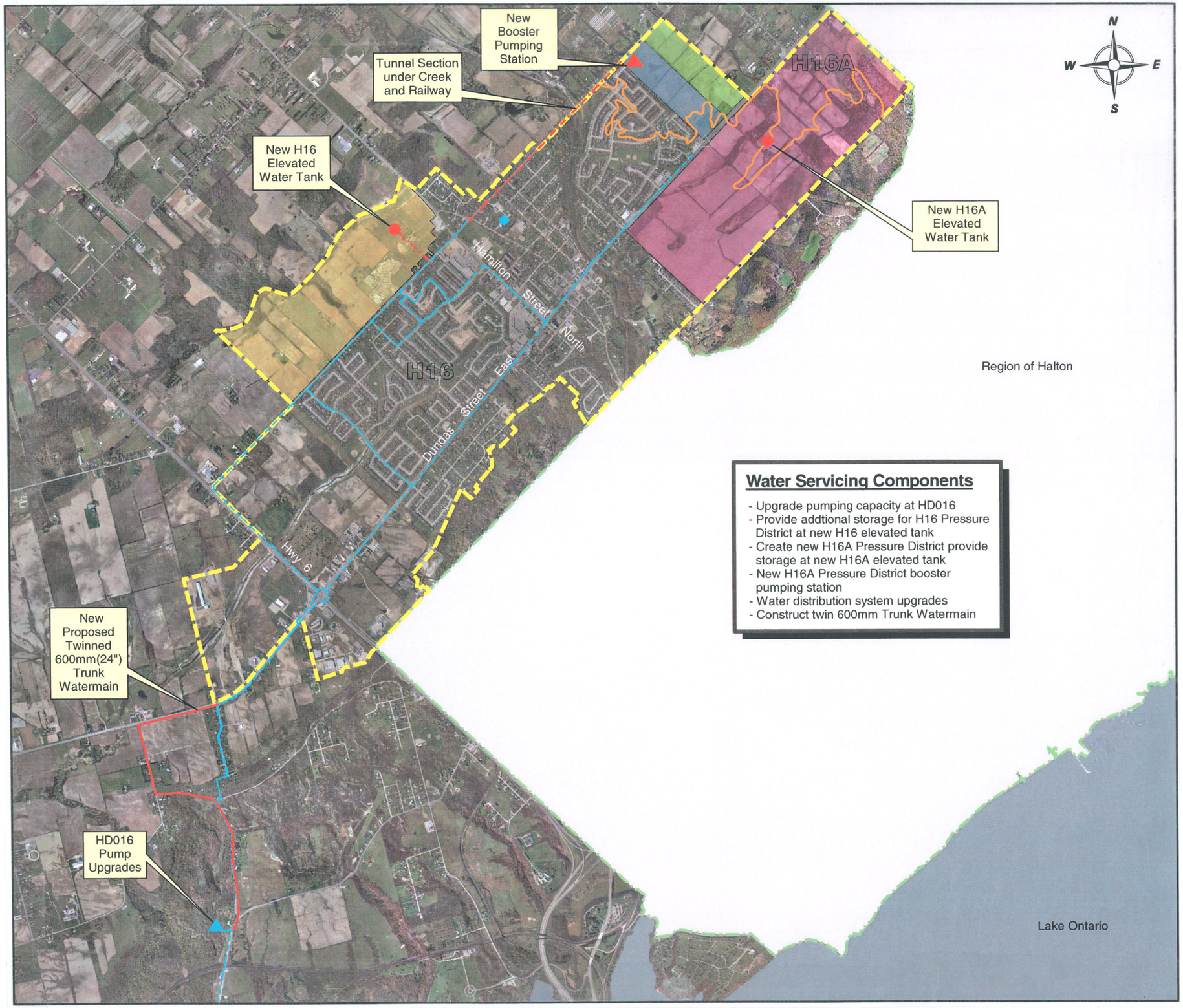
1. Waterdown North and 83% of Existing and Zoned Waterdown
2. Waterdown South, UpCountry and 17% of Existing and Zoned Waterdown

After a detailed evaluation of the alternatives, a preferred solution has been recommended as follows:

Water Servicing

- Upgrade pumping capacity at HD016 Pumping Station to supply Waterdown – 20.59 ML/D
- Provide standby power at HD016
- Provide additional storage for H16 Pressure District at new H16 elevated tank (Site 5 Waterdown North within proposed park) - 8 ML Tank Size
- Create a new H16A Pressure District to provide storage at new H16A elevated tank (Site WS 1 Waterdown South) – 6.3 ML Tank Size
- Construct new H16A Pressure District booster pumping station – Maximum Day Standards 9.743 ML/D
- Water distribution system upgrades
- Construct twin 600 mm Trunk Watermain from the HD016 Pumping Station

The preferred solution is depicted in Figure 7.



Water Servicing Components

- Upgrade pumping capacity at HD016
- Provide addtional storage for H16 Pressure District at new H16 elevated tank
- Create new H16A Pressure District provide storage at new H16A elevated tank
- New H16A Pressure District booster pumping station
- Water distribution system upgrades
- Construct twin 600mm Trunk Watermain

LEGEND

- Existing Water Standpipe
- Existing Pumping Station
- Booster Pumping Station
- Water Tower Preferred
- Existing Trunk Watermain
- New 400mm Watermain
- New 600mm Trunk Watermain
- Theoretic 245m Elevation Contour
- Waterdown North
- Waterdown South
- Upcountry Phase 1
- Upcountry Phase 2
- Urban Boundary
- City Boundary

Note:
The proposed infrastructure has been depicted approximately for Master Planning purposes. The exact location of the proposed infrastructure will be determined in the subsequent project detailed phases.

Hamilton

BUILDING A STRONG FOUNDATION HAMILTON

Integrated Water & Wastewater Master Plan

Waterdown Water and Wastewater Servicing Class EA

Preferred Water Servicing Strategy

KMK Consultants Limited

Figure 7

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N/A

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Table 13 Information Matrix of Waterdown Water Servicing Alternatives

EVALUATION CRITERIA	ALTERNATIVE 3	ALTERNATIVE 4A	ALTERNATIVE 4B	ALTERNATIVE 5	ALTERNATIVE 6
	Upgrade pumping capacity at the existing HD016 pumping station and construct elevated storage	Upgrade pumping capacity at the existing HD016 pumping station and construct new reservoir and pumping station in Kelly Street area	Upgrade pumping capacity at the existing HD016 pumping station and construct new reservoir and pumping station in Kelly Street area	Upgrade HD016 pumping station and construct new reservoir on site	Expand HD016 pumping station and construct new pumping station and reservoir south west of Waterdown
NATURAL ENVIRONMENT FACTORS	**HD016 Site** The existing pumping station is not in a designated ESA or ANSI site but is adjacent to Borer's Falls Conservation Area and Borer's Falls – Rock Chapel ESA The existing pumping station has some vegetation. Site clearance will involve minor removal/disturbance of vegetation. Disturbed areas will be restored to its original or to an improved condition **Elevated Tanks** Study area has a good range of potential sites outside of designated ESA and ANSI areas that meet elevation requirements for the construction of elevated tanks. This will ensure there will be no impact on designated ESA or ANSI.	**HD16 Site** The existing pumping station is not in a designated ESA or ANSI site but is adjacent to Borer's Falls Conservation Area and Borer's Falls – Rock Chapel ESA The existing pumping station has some vegetation. Site clearance will involve minor removal/disturbance of vegetation. Disturbed areas will be restored to its original or to an improved condition **Reservoir – Kelly Street Area** The existing Water Standpipe site has some mature vegetation. Site clearance will involve removal/disturbance of vegetation The existing Waterdown Memorial Park is public green recreational space	**HD016 Site** The existing pumping station is not in a designated ESA or ANSI site but is adjacent to Borer's Falls Conservation Area and Borer's Falls – Rock Chapel ESA The existing pumping station has some vegetation. Site clearance will involve minor removal/disturbance of vegetation. Disturbed areas will be restored to its original or to an improved condition **Reservoir – Kelly Street Area** The existing Water Standpipe site has some mature vegetation. Site clearance will involve removal/disturbance of vegetation The existing Waterdown Memorial Park is public green recreational space	**HD016 Site** The existing pumping station is not in a designated ESA or ANSI site but is adjacent to Borer's Falls Conservation Area and Borer's Fall – Rock Chapel ESA **Reservoir** Current site is not large enough for new reservoir and extended pumping station. Construction would require expansion into Conservation Area causing negative impact	**HD016 Site** The existing pumping station is not in a designated ESA or ANSI site but is adjacent to Borer's Falls Conservation Area and Borer's Fall – Rock Chapel ESA **Reservoir** Area south west of Waterdown is not a designated ESA or ANSI site.
SOCIO-CULTURAL FACTORS	**HD016 Pumping Station Site** Site is adjacent to York Road in a rural setting **Elevated Tank Sites** Study Area is currently comprised of mostly vacant/agricultural land The Secondary Plan is being prepared concurrently with this Class EA Study. As Zoning Standards have yet to be developed for the Study Area there is low potential for requirements for amendments Elevated towers could cause potential aesthetic impact, although impact could be mitigated with appropriate location	**HD016 Pumping Station Site** Site is adjacent to York Road in a rural setting **Reservoir – Potential Sites** Kelly Street Site is currently used as a Water Stand Pipe site (0.36 ha) and is adjacent to existing residential area and school. The Waterdown Memorial Park is opposite the Water Stand Pipe Site and is public green recreational space Zoning conflict for Park due to loss of current land use. Ingress and egress of the construction vehicles will cause minor disruption of traffic. There will be temporary impact on the adjacent landowners during construction. Noise disturbance will be limited by ensuring construction takes place during normal working hours. Dust will be controlled through construction contract obligations. Potential aesthetic impact caused by new pumping station	**HD016 Pumping Station Site** Site is adjacent to York Road in a rural setting **Reservoir – Potential Sites** Kelly Street Site is currently used as a Water Standpipe site (0.36 ha) and is adjacent to existing residential area and school. The Waterdown Memorial Park is opposite the Water Standpipe Site and is public green recreational space Zoning conflict for Park due to loss of current land use. Site is currently accommodated in ROW and neighbours Conservation Area which may limit expansion opportunities Ingress and egress of the construction vehicles will cause minor disruption of traffic. There will be temporary impact on the adjacent landowners during construction. Noise disturbance will be limited by ensuring construction takes place during normal working hours. Dust will be controlled through construction contract obligations. Potential aesthetic impact caused by new pumping station	**HD016 Pumping Station Site** Site is adjacent to York Road in a rural setting **Reservoir** Land is currently a conservation area high potential for land use planning conflict Ingress and egress of the construction vehicles will cause minor disruption of traffic. There will be temporary impact on the adjacent landowners during construction. Noise disturbance will be limited by ensuring construction takes place during normal working hours. Dust will be controlled through construction contract obligations.	**HD016 Pumping Station Site** Site is adjacent to York Road in a rural setting **Reservoir Site** Land is currently comprised of vacant/agricultural land Potential zoning conflict Potential aesthetic impact to existing residential area although impact could be mitigated with appropriate location Ingress and egress of the construction vehicles will cause minor disruption of traffic. There will be temporary impact on the adjacent landowners during construction. Noise disturbance will be limited by ensuring construction takes place during normal working hours. Dust will be controlled through construction contract obligations. Potential aesthetic impact caused by new pumping station
LEGAL/JURISDICTIONAL FACTORS	HD016 Pumping Station upgrade will be carried out within the property limits Property acquisition (0.5 ha/tank) required for elevated tank sites	Stand Pipe Site does not meet the required size for the construction of a reservoir Property acquisition (approx 2 ha) required for reservoir site Implementation risk due to limited property availability	Stand Pipe Site does not meet the required size for the construction of a reservoir. Property acquisition (approx 2–3 ha) required for reservoir site Implementation risk due to constrained site	Property acquisition (approx 2–3 ha) required for reservoir site Implementation risk due to constrained site	Property acquisition (approx 2–3 ha) required for reservoir site
TECHNICAL FACTORS	Currently Greenfield construction Low potential for conflict with utilities Adequate land availability within OPA28 area and Flamborough Power Centre General topography of the Waterdown area is high, providing a good range of potential sites that meet elevation requirements for the construction of elevated tanks Elevated tanks provide the following benefits: ♦ Improved security during main break or power failure ♦ Improved operational factors – reliable pressures and increased operational flexibility ♦ Improved efficiency as pumps are not working constantly ♦ Lower O & M costs for tanks and pumps	Construction would occur in existing developed area Potential for conflict with utilities due to site falling within built urban area Limited property availability	Construction would occur in existing developed area Potential for conflict with utilities due to site falling within built urban area Limited property availability	High risk that land is unavailable Currently Greenfield construction Potentially constrained site Upgrades could address existing and future capacity and security	Currently Greenfield construction Low potential for conflict with utilities Requires change in operating philosophy and overall system hydraulics
ECONOMIC FACTORS	Smaller land requirement than Reservoir Alternatives More efficient, lower O & M costs than Reservoir Alternatives	Larger land requirement than Elevated Tank Alternatives Less efficient, higher O & M costs than Tank Alternative	Larger land requirement than Elevated Tank Alternatives Less efficient, higher O & M costs than Tank Alternative	Larger land requirement than Elevated Tank Alternative Less efficient, higher O & M costs than Tank Alternative	Larger land requirement than Elevated Tank Alternative Less efficient, higher O & M costs than Tank Alternative
OVERALL ALTERNATIVE RANK	●	◔	◔	◕	◐
RECOMMENDED ALTERNATIVE	ALTERNATIVE 3				
LEGEND	Most Preferred ● ◔ ◐ ◕ ○ Least Preferred				

10.2 SOUTHEAST MOUNTAIN WATER SERVICING ALTERNATIVES

The growth areas within the Southeast Mountain urban boundary expansion are located primarily within Pressure District 7, which can service elevations between 195 m and 219 m. District 7 is currently being serviced through pumping station HD007, which pumps water from District 5.

Under the 2031 growth scenario, the population is expected to increase to 109,151, and the total number of jobs to 8,953. This will increase the maximum day demand in Pressure District 7 to 70.1 ML/d.

The HD007 pumping station which currently supplies water to District 7 does not have sufficient capacity to meet this growth, and there is limited site capacity available to expand the existing station.

Three water servicing alternatives have been developed for the Southeast Mountain, and these are further described in the following sections. The following considerations are consistent for all servicing alternatives:

- Additional supply, pumping capacity, and storage capacity will be required
- Additional storage requirements for the southern Pressure Districts could be met through pumped reservoir storage or new elevated tanks
- Key supply stations should be provided with standby power, particularly for Pressure Districts without floating storage.

The individual alternatives are described in the following sections.

10.2.1 Water Servicing Alternative SEM-WS-1

Description and Infrastructure Requirements

Alternative SEM-WS-1 is based on providing all of the required water servicing to the Southeast Mountain from an expanded HD007 pumping station, as shown in Figure 8.

This alternative would include a new elevated storage tank, that would also provide system security and operational flexibility.

Capital Cost

The capital cost estimate for infrastructure required for the 2031 development scenario for Alternative SEM-WS-1 is presented in Table 14.

Table 14 Capital Cost of Servicing Alternative SEM-WS-1

Description	Cost (Millions)
Pumping Station and Reservoir	$ 20.00
Elevated Tank	$ 4.00
Total for Alternative SEM-WS-1 (excluding engineering and contingencies)	**$ 24.00**

Timing and Phasing Issues

This project will be triggered by growth within the Southeast Mountain area, but is dependant on additional supply capacity to the top of the escarpment. This additional supply could be provided through an expansion of pumping station HD05A.

Aside from installing individual pumps as required, this project provides little opportunity for phasing based on development.

Impact Assessment

The potential for impacts associated with Alternative SEM-WS-1 was assessed, and options for mitigation of these impacts were reviewed. Details on the assessment are included in the following paragraphs.

Natural Environment Factors:

While construction activities associated expanding the pumping station will be contained within an existing developed area, construction of local watermains might require crossing environmental features.

Socio-Cultural Factors:

Expanding a pumping station within an existing built-up area will result in significant construction noise, and will likely cause traffic disruptions.

The elevated storage tank would be constructed within a currently undeveloped area, allowing the exact siting of the tank to be within a compatible land use.

Legal-Jurisdictional Factors:

As sufficient site capacity for the proposed pumping station and reservoir expansion is not available, the City would need to obtain an adjacent property. At this time, there are no suitable properties within the immediate vicinity of the pumping station.

Technical Factors:

Providing all of the servicing requirements through the existing pumping station HD007 is somewhat limiting in that all of District 7 will be provided through a single location. This alternative therefore does not provide security of supply that is desirable for a District with demands as high as those currently projected for District 7.

Also, the lack of an available property adjacent to the existing pumping station limits the feasibility of this alternative.

10.2.2 Water Servicing Alternative SEM-WS-2

Description and Infrastructure Requirements

Alternative SEM-WS-2 is based on providing water servicing to the Southeast Mountain from two separate pumping stations:

- An expanded Pumping Station HD007

- Through the addition of District 7 pumps within existing Station HD006B.

This alternative would also include a new elevated storage tank. With the two sources of supply, this alternative provides system security and operational flexibility. The infrastructure requirements for this alternative are shown in Figure 9.

Capital Cost

The capital cost estimate for infrastructure required for the 2031 development scenario for Alternative SEM-WS-2 is presented in Table 15.

Table 15 Capital Cost of Servicing Alternative SEM-WS-2

Description	Cost (Millions)
Pumping Station and Reservoir	$ 12.00
Elevated Tank	$ 4.00
Pumping Station Upgrades	$ 3.00
Pressure District 7 Feedermain	$ 4.00
Total for Alternative SEM-WS-2 (excluding engineering and contingencies)	**$ 23.00**

Timing and Phasing Issues

This project will be triggered by growth within the Southeast Mountain area, but is dependant on additional supply capacity to the top of the escarpment. This additional supply could be provided through an expansion of pumping station HD05A.

Because the supply will be provided from two distinct pumping stations, there would be an opportunity to service early development with the Southeast Mountain area through a single station upgrade, and schedule the second station upgrade for a later time.

Impact Assessment

The potential for impacts associated with Alternative SEM-WS-2 was assessed, and options for mitigation of these impacts were reviewed. Details on the assessment are included in the following paragraphs.

Natural Environment Factors:

While construction activities associated expanding the pumping station will be contained within an existing developed area, construction of local watermains might require crossing environmental features.

There is no site expansion required at HD06B, but a new feedermain will be required from this station to District 7. Pumping station HD06B is located within the Niagara Escarpment, and construction practices will need to mitigate any potential environmental impacts.

Socio-Cultural Factors:

Station HD007 is located within an existing built-up area, so expansion of the station will result in significant construction noise, and will likely cause traffic disruptions.

Construction of the District 7 feedermain from station HD06B will also take place in currently-developed areas, and will also cause traffic disruptions.

The elevated storage tank would be constructed within a currently undeveloped area, allowing the exact siting of the tank to be within a compatible land use.

Legal-Jurisdictional Factors:

This alternative does not require acquisition of a property within an existing developed area.

It is anticipated that an appropriate site for the new elevated storage tank could be acquired.

Technical Factors:

From a technical standpoint, there are several positive aspects to this alternative:

- It provides security of supply, as District 7 would be fed from 2 sources
- It utilizes available space and infrastructure within existing station HD06B
- It utilizes additional suction side storage for supply to the growth area
- The new elevated tank provides storage, security and operational flexibility.

10.2.3 Water Servicing Alternative SEM-WS-3

Description and Infrastructure Requirements

Alternative SEM-WS-3 is based on providing water servicing to the Southeast Mountain from pumping station HD007 and a new District 7 pumping station, as shown in Figure 10.

This alternative would not include a new elevated storage tank, as all of the storage requirements would be provided from the suction side reservoirs.

Capital Cost

The capital cost estimate for infrastructure required for the 2031 development scenario for Alternative SEM-WWS-3 is presented in Table 16.

Table 16 Capital Cost of Servicing Alternative SEM-WWS-3

Description	Cost (Millions)
Pumping Station Upgrades	$ 2.00
New Pumping Station and Reservoir	$ 25.00
Total for Alternative SEM-WS-3 (excluding engineering and contingencies)	**$ 27.00**

Timing and Phasing Issues

This project will be triggered by growth within the Southeast Mountain area, but is dependant on additional supply capacity to the top of the escarpment. This additional supply could be provided through an expansion of pumping station HD05A.

Because the supply will be provided from two distinct pumping stations, there would be an opportunity to service early development with the Southeast Mountain area through the upgrading of HD007, and delay construction of the new pumping station such that it comes into service as HD007 reaches its capacity.

Impact Assessment

The potential for impacts associated with Alternative SEM-WS-3 was assessed, and options for mitigation of these impacts were reviewed. Details on the assessment are included in the following paragraphs.

Natural Environment Factors:

While construction activities associated expanding the pumping station will be contained within an existing developed area, construction of local watermains might require crossing environmental features.

The new pumping station would be constructed within a currently-undeveloped area, and it's exact site could potentially be coordinated such that construction of the station would have minimal potential environmental impact.

Socio-Cultural Factors:

Station HD007 is located within an existing built-up area, so expansion of the station will result in significant construction noise, and will likely cause traffic disruptions.

The new pumping station would be constructed within a currently undeveloped area, allowing its exact siting to be within a compatible land use.

Legal-Jurisdictional Factors:

This alternative does not require acquisition of a property within an existing developed area.

It is anticipated that an appropriate site for the new pumping station could be acquired.

Technical Factors:

While this alternative provides security of supply in that District 7 would be serviced through two pumping stations, there will be increased operational and maintenance costs associated with the new station.

Also, the lack of elevated storage in this alternative will require a standby power supply to be installed at the new station. The absence of elevated storage also limits the operational flexibility somewhat.

10.2.4 Information Matrix for Southeast Mountain Water Servicing Alternatives

Table 17 presents a comparison of the costs and impacts of the Southeast Mountain Water Servicing Alternatives.

Alternative SEM-WS-2 is preliminarily selected as the preferred servicing alternative for the Airport Lands, with the following rationale:

- It carries the lowest capital cost of the three Southeast Mountain alternatives
- It makes use of the available site capacity that currently exists in station HD06B
- It provides security of supply through construction of a new elevated tank, and the addition of a second supply point.

City of Burlington

Lake Ontario

Haldimand County

Region of Niagara

Legend

- Pump
- Reservoir
- Plant
- Watermain
- Rural Settlement Area
- Potential Urban Boundary Expansion
- Potential New Business Park
- Intensification Area
- Niagara Escarpment
- Greenbelt
- Urban Boundary

Hamilton

Integrated Water & Wastewater Master Plan

South-East Mountain
Water Servicing

Alternative 2

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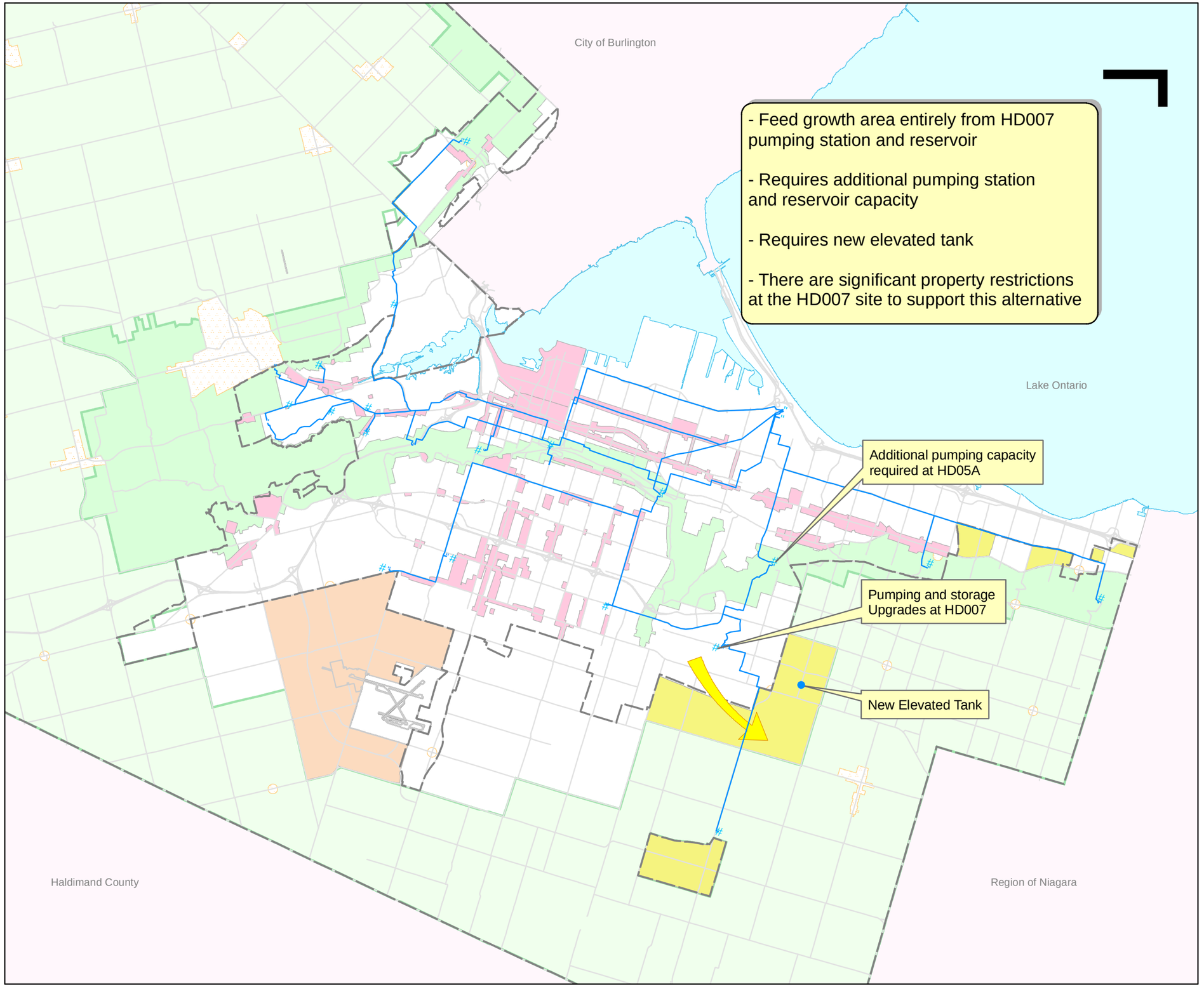

Legend

- Pump
- Reservoir
- Plant
- Watermain
- Rural Settlement Area
- Potential Urban Boundary Expansion
- Potential New Business Park
- Intensification Area
- Niagara Escarpment
- Greenbelt
- Urban Boundary

Hamilton

Integrated Water & Wastewater Master Plan

South-East Mountain
Water Servicing

Alternative 1

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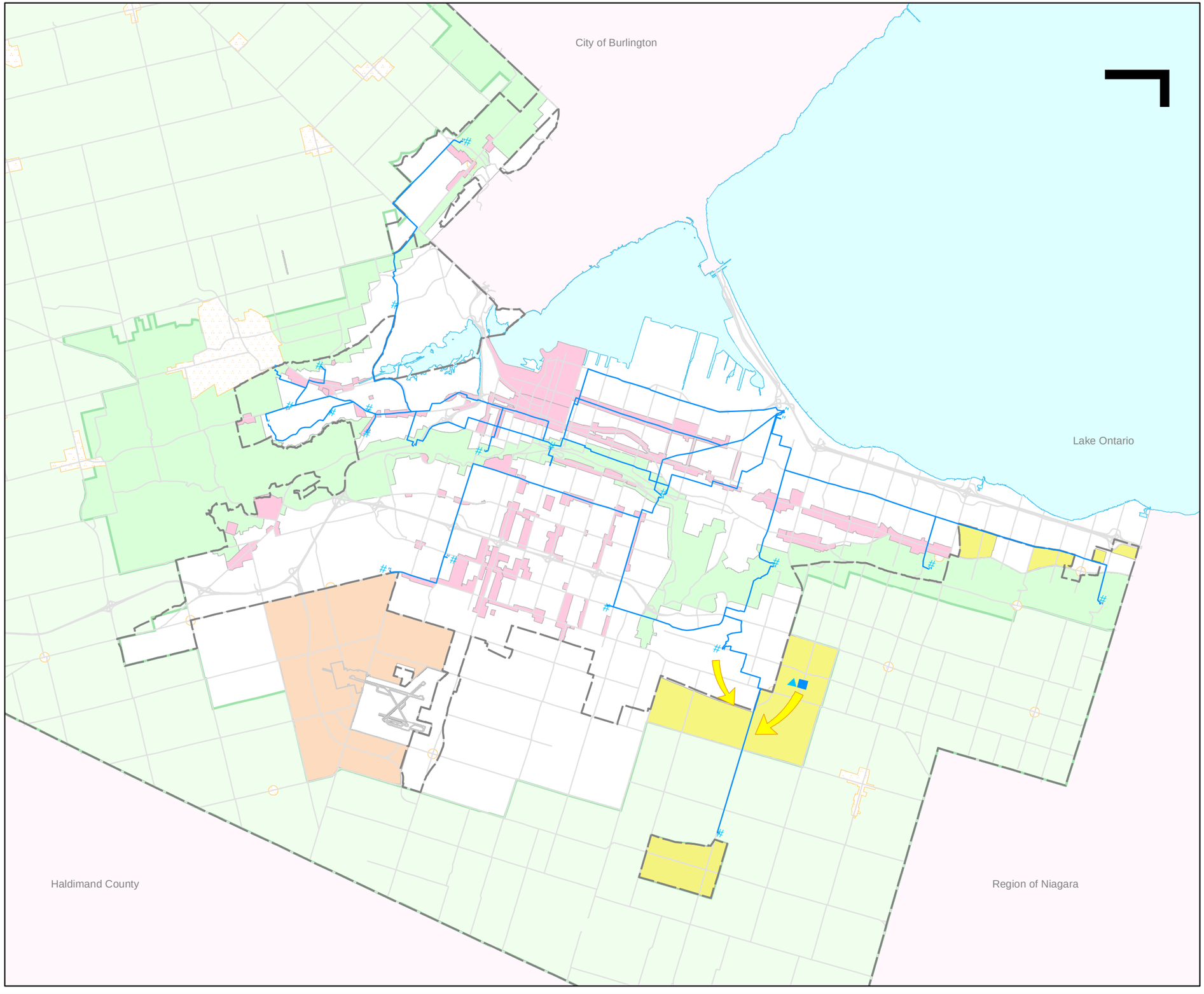

Legend

- Pump
- Reservoir
- Plant
- Watermain
- Rural Settlement Area
- Potential Urban Boundary Expansion
- Potential New Business Park
- Intensification Area
- Niagara Escarpment
- Greenbelt
- Urban Boundary

Hamilton

Integrated Water & Wastewater Master Plan

South-East Mountain
Water Servicing

Alternative 3

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Table 17 Information Matrix of Southeast Mountain Water Servicing Alternatives

Evaluation Criteria	SOUTHEAST MOUNTAIN WATER SERVICING ALTERNATIVE 1	SOUTHEAST MOUNTAIN WATER SERVICING ALTERNATIVE 2	SOUTHEAST MOUNTAIN WATER SERVICING ALTERNATIVE 3
Description	♦ Service growth area entirely from HD007 ♦ New elevated tank for storage, security and operational flexibility	♦ Service growth area from HD007 and HD006B with new Pressure District 7 pumps ♦ New elevated tank for storage, security and operational flexibility	♦ Service growth area from HD007 and new PD7 pumping station ♦ Provide all storage as pumped storage from suction side reservoirs
Natural Environment Factors	♦ Will require expansion at the HD007 site ♦ There is significant property restrictions at the HD007 site to support the full reservoir capacity needed for this alternative. Additional property would be required. ♦ Local watermains will be required which may require environmental feature crossings	♦ Will require expansion at the HD007 site ♦ No site expansion required at HD06B ♦ New feedermain alignment will need to mitigate any environmental feature crossings ♦ Local watermains will be required which may require environmental feature crossings	♦ Will avoid expansion at the HD007 site ♦ Will also require new pumping station and reservoir. However, this station will be located within growth area. ♦ Local watermains will be required which may require environmental feature crossings
Socio-Cultural Factors	♦ Expansion at HD007 is within existing builtup area ♦ Elevated tank will be located within suitable land uses	♦ Expansion at HD007 is within existing builtup area ♦ Feedermain alignment will require construction through existing builtup area and will have temporary disruption ♦ Elevated tank will be located within suitable land uses	♦ Expansion at HD007 is within existing builtup area ♦ New pumping station and reservoir will be located within suitable land uses
Legal-Jurisdictional Factors	♦ There is no suitable additional property in the vicinity to support the reservoir capacity needed for this alternative ♦ Property will need to be coordinated for the elevated tank	♦ There is sufficient property at HD007 to support this alternative ♦ Property will need to be coordinated for the elevated tank	♦ There is sufficient property at HD007 to support this alternative ♦ Property will need to be coordinated for the pumping station and reservoir
Technical Factors	♦ Only provides single supply feed to the area ♦ Property restrictions impact the feasibility of this alternative	♦ Provides secure supply feed to the area from 2 sources ♦ Utilizes available space and infrastructure in HD06B ♦ Utilizes additional suction side storage for supply to the growth area ♦ New elevated tank provides storage, security and operational flexibility	♦ Provides secure supply feed to the area from 2 sources ♦ No elevated storage for security and operational flexibility ♦ Adds a new station for maintenance
Economic Factors	♦ PS and Reservoir approximate costs : $20M ♦ New elevated tank approximate cost: $4M	♦ PS and Reservoir approximate costs : $12M ♦ New elevated tank approximate cost: $4M ♦ Pumping station upgrades approximate costs: $3M ♦ PD7 feedermain approximate cost: $4M	♦ PS upgrades approximate costs : $2M ♦ New pumping station and reservoir approximate costs: $25M
Overall Alternative Rank	○	●	◐

Most Preferred ● ◔ ◐ ◕ ○ Least Preferred

10.3 AIRPORT LANDS WATER SERVICING ALTERNATIVES

The topography of the Airport Lands allows for potential servicing from either District 6 or District 18. As neither District 6 nor District 18 can supply the full water demands of the Airport Lands, the area will be serviced from both districts. Establishing the pressure district boundary within the Airport Lands is based on topography, and optimizing the expansion needs between the District 6 and 18 pumping stations and reservoirs.

Two wastewater servicing alternatives have been developed for the Airport Lands, and these are further described in the following sections. The following considerations are consistent for all servicing alternatives:

- Additional supply, pumping capacity, and storage capacity will be required
- Additional storage requirements for the southern Pressure Districts could be met through pumped reservoir storage or new elevated tanks
- Key supply stations should be provided with standby power, particularly for Pressure Districts without floating storage.
- There is an opportunity to include, as part of the alternatives, a new elevated tank in Pressure District 18 to provide system security.

The individual alternatives are described in the following sections.

10.3.1 Water Servicing Alternative AL-WS-1

Description and Infrastructure Requirements

Alternative AL-WS-1 is based on providing water servicing to the Airport Lands from Districts 6 and 18, with the supply from District 18 kept to a minimum. Doing so will eliminate the need for pumping station upgrades at either HD06A or HD018.

This alternative would include a new elevated storage tank, that would also provide system security and operational flexibility. The infrastructure requirements for this alternative are shown in Figure 11.

Capital Cost

Alternative AL-WS-1 would carry no additional capital costs at existing pumping stations. The main capital requirement would be the new elevated storage tank in District 18, which carries an approximate cost of $4M.

This alternative would result in increased operation and maintenance costs associated with the increased pumping requirements associated with servicing the Airport Lands.

Timing and Phasing Issues

The only major infrastructure requirement under this alternative is a new elevated tank, the construction of which will be triggered by growth within the Airport Lands.

While sufficient pumping capacity currently exists within Stations HD06A and HD018, full buildout of the Airport Lands will require additional supply to Districts 6 and 18 through an upgrade to pumping station HD05A.

Impact Assessment

The potential for impacts associated with Alternative AL-WS-1 was assessed, and options for mitigation of these impacts were reviewed. Details on the assessment are included in the following paragraphs.

Natural Environment Factors:

As there are no facility expansion projects associated with this project, major construction activities will be kept to a minimum. A new elevated storage tank will be constructed on a compatible site within an existing developed area, which will limit the potential environmental impact.

Construction of local watermains might require crossing environmental features, which would require mitigative construction practices.

Socio-Cultural Factors:

Most of the construction activities associated with this alternative will take place within currently-undeveloped areas, which will limit traffic-related impacts.

Locating the new elevated tank within an existing business park will minimize aesthetic concerns.

Legal-Jurisdictional Factors:

Under this alternative, the City would need to secure a property for the new elevated tank.

Technical Factors:

By minimizing the area of District 18, this alternative makes optimum use of the existing infrastructure.

The new elevated tank will provide additional storage, security and operational flexibility.

10.3.2 Water Servicing Alternative AL-WS-2

Description and Infrastructure Requirements

Alternative AL-WS-2 is also based on providing water servicing to the Airport Lands from Districts 6 and 18, only with an increased supply from District 18.

This alternative would include a new elevated storage tank, that would also provide system security and operational flexibility. This servicing alternative is presented in Figure 12.

Capital Cost

Alternative AL-WS-2 would carry an additional capital costs of $1M to upgrade existing pumping station HD018.

Like Alternative AL-WS-1, this alternative would also require a new storage tank, which carries an approximate cost of $4M.

This alternative would result in increased operation and maintenance costs associated with the increased pumping requirements associated with servicing the Airport Lands.

Timing and Phasing Issues

While additional pumping capacity will ultimately be required at Station HD018, development could proceed within the Airport lands based in the availability of supply through Pressure District 6 initially.

Full build-out of the Airport Lands will require the HD018 upgrade, and also an increased supply to Districts 6 and 18 through expansion of pumping station HD05A.

Impact Assessment

The potential for impacts associated with Alternative AL-WS-2 was assessed, and options for mitigation of these impacts were reviewed. Details on the assessment are included in the following paragraphs.

Natural Environment Factors:

As there are no facility expansion projects associated with this project, major construction activities will be kept to a minimum. A new elevated storage tank will be constructed on a compatible site within an existing developed area, which will limit the potential environmental impact.

Socio-Cultural Factors:

Most of the construction activities associated with this alternative will take place within currently-undeveloped areas, which will limit traffic-related impacts.

Locating the new elevated tank within an existing business park will minimize aesthetic concerns.

Legal-Jurisdictional Factors:

Under this alternative, the City would need to secure a property for the new elevated tank.

Technical Factors:

This alternative makes optimum use of the existing infrastructure.

The new elevated tank will provide additional storage, security and operational flexibility.

10.3.3 Information Matrix for Airport Lands Water Servicing Alternatives

Table 18 presents a comparison of the costs and impacts of the Airport Lands Water Servicing Alternatives.

10.3.4 Preliminary Selection of the Preferred Airport Lands Servicing Alternative

Alternative AL-WS-1 is preliminarily selected as the preferred servicing alternative for the Airport Lands, with the following rationale:

- Servicing the Airport Lands through District 6 eliminates the need to upgrade pumping stations servicing District 18.
- This alternative carries the lower capital cost.

City of Burlington

Lake Ontario

Haldimand County

Region of Niagara

- Topography of the Aerotropolis area requires feeds from Pressure Districts 6 and 18

- Through minimizing District 18 area, the service area can be met without any pumping capacity upgrades at HD018 and HD06A

- Additional Pressure District 18 Storage is required

Legend

- Pump
- Reservoir
- Plant
- Existing Watermain
- Rural Settlement Area
- Potential Urban Boundary Expansion
- Intensification Area
- Niagara Escarpment
- Greenbelt
- Urban Boundary

Hamilton

Integrated Water & Wastewater Master Plan

Airport Lands Water Servicing

Alternative 1

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City of Burlington

Lake Ontario

Haldimand County

Region of Niagara

- Topography of the Aerotropolis area requires feeds from Pressure Districts 6 and 18

- A larger District 18 area will trigger additional pumping capacity requirements at HD018

- Additional Pressure District 18 Storage is required

Additional pumping capacity required at HD018

Legend

- Pump
- Reservoir
- Plant
- Watermain
- Rural Settlement Area
- Potential Urban Boundary Expansion
- Intensification Area
- Niagara Escarpment
- Greenbelt
- Urban Boundary

Hamilton

Integrated Water & Wastewater Master Plan

Airport Lands Water Servicing

Alternative 2

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Table 18 Information Matrix of Airport Lands Water Servicing Alternatives

Evaluation Criteria	AIRPORT LANDS WATER SERVICING ALTERNATIVE 1	AIRPORT LANDS WATER SERVICING ALTERNATIVE 2
Description	♦ Service lands from Pressure Districts 6 and 18 ♦ Minimize Pressure District 18 service area ♦ New elevated tank for storage, security and operational flexibility	♦ Service lands from Pressure Districts 6 and 18 ♦ Increased Pressure District 18 service area ♦ New elevated tank for storage, security and operational flexibility
Natural Environment Factors	♦ No site expansions required ♦ Local watermains will be required which may require environmental feature crossings ♦ Elevated tank located within urbanized area	♦ Additional pumping capacity required at HD018 ♦ Upgrades anticipated to be within building envelope – no site impacts ♦ Local watermains will be required which may require environmental feature crossings ♦ Elevated tank located within urbanized area
Socio-Cultural Factors	♦ Construction will be contained to new growth areas only ♦ There will be no disruption to existing servicing ♦ Elevated tank located within business park to minimize aesthetic concerns	♦ Construction will be contained to new growth areas only ♦ There will be no disruption to existing servicing ♦ Elevated tank located within business park to minimize aesthetic concerns ♦ Minor disruption for pumping station upgrades
Legal-Jurisdictional Factors	♦ No property required for stations ♦ Local watermains will need to be coordinated with future road rights of way ♦ Property will be required for the elevated tank	♦ No property required for stations ♦ Local watermains will need to be coordinated with future road rights of way ♦ Property will be required for the elevated tank
Technical Factors	♦ Maximizes the available capacity in existing infrastructure ♦ Service areas are easily phased ♦ Elevated tank will provide additional storage, security and operational flexibility	♦ Utilizes the available capacity in existing infrastructure ♦ Service areas are easily phased ♦ Elevated tank will provide additional storage, security and operational flexibility
Economic Factors	♦ No additional capital costs at the stations ♦ Elevated tank approximate costs: $4M ♦ Increase pumping requirements will moderately increase operation and maintenance costs ♦ Local watermain costs	♦ No additional capital costs at the stations ♦ Elevated tank approximate costs: $4M ♦ Pumping station upgrades approximate costs: $1M ♦ Increase pumping requirements will moderately increase operation and maintenance costs ♦ Local watermain costs
Overall Alternative Rank	●	○

Most Preferred ● ◔ ◑ ◕ ○ **Least Preferred**

10.4 ESCARPMENT CROSSING WATER SERVICING ALTERNATIVES

While much of the anticipated growth will be located on Hamilton Mountain, additional transmission and pumping capacity to the top of the Escarpment will be required to meet the future water demands of Pressure Districts 5, 6, 7, 13, 14, 18, and 22.

Under the 2031 growth scenario, the projected demands throughout the service areas at the top of the escarpment are expected to reach 259 ML/d, based on existing water use statistics. The water demands from future businesses or industries within the Airport Lands could be significant, resulting in even greater water demands from the Pressure Districts that service the Mountain.

Constructing a new feedermain across the Escarpment will provide the required supply to the Mountain, provide additional security of supply, and ensure that the two existing feedermains are operated within an acceptable range of pressures and velocities.

There were five alternative locations identified for the construction of an additional Feedermain, and these are presented in Figure 13.

10.4.1 Escarpment Crossing Alternative EC-WS-1

Description and Infrastructure Requirements

Alternative EC-WS-1 is based on providing another escarpment crossing along Centennial Parkway to HD007. The proposed alignment is as follows:

- Along Barton Street from Nash Road to Centennial Parkway
- South along Centennial Parkway from Barton Street, up the Escarpment to Highland Road
- West along Highland Road to existing Pumping Station HD007.

Capital Cost

The capital cost estimate for infrastructure required for the 2031 development scenario for Alternative EC-WS-1 is $40M.

Timing and Phasing Issues

There is currently not enough reserve capacity within the two existing feedermains that cross the Escarpment to service the 2031 development projections. This project will be triggered by development on the Mountain, within both the Airport Lands and the Southeast Mountain area.

Construction of this Feedermain could be coordinated with the proposed road improvements along Centennial Parkway.

Impact Assessment

The potential for impacts associated with Alternative EC-WS-1 was assessed, and options for mitigation of these impacts were reviewed. Details on the assessment are included in the following paragraphs.

Natural Environment Factors:

While construction activities will be required along the Niagara Escarpment, the impacts of that construction will be mitigated since the feedermain will be located within the existing Centennial Parkway right-of-way.

Socio-Cultural Factors:

Installation of the feedermain along Centennial Parkway would be coordinated with road improvements that are already being planned along Centennial Parkway, and possibly also the construction of a new trunk sewer. While this will cause significant traffic disruptions, this alternative provides an opportunity to combine three infrastructure upgrades into one major construction project.

The overall impact of the construction activities will also be lessened as they would not commence until the Red Hill Valley Expressway is completed. It is expected that much of the traffic that currently uses Centennial Parkway will migrate to the Red Hill Valley Expressway once it is completed.

Legal-Jurisdictional Factors:

- Will require extensive approvals with review agencies particularly the NEC.

Technical Factors:

- Alignment is well integrated with the pumping supply point at HD05A
- Supports servicing strategies for the south east mountain growth area
- Location is near existing escarpment crossings.

10.4.2 Water Servicing Alternative EC-WS-2

Description and Infrastructure Requirements

Alternative EC-WS-2 is based on providing another escarpment crossing along Centennial Parkway to pumping station HD006B. The proposed alignment is as follows:

- Along Barton Street from Nash Road to Centennial Parkway
- South along Centennial Parkway from Barton Street, up the Escarpment to just south of Mud Street
- West to Paramount Drive
- West along Paramount Drive and Stone Church Road to Pumping Station HD06B at Upper Ottawa Street.

Capital Cost

The capital cost estimate for infrastructure required for the 2031 development scenario for Alternative EC-WS-2 is $45M.

Timing and Phasing Issues

There is currently not enough reserve capacity within the two existing feedermains that cross the Escarpment to service the 2031 development projections. This project will be triggered by development on the Mountain, within both the Airport Lands and the Southeast Mountain area.

Construction of this feedermain could be coordinated with the proposed road improvements along Centennial Parkway.

Impact Assessment

The potential for impacts associated with Alternative SEM-WS-2 was assessed, and options for mitigation of these impacts were reviewed. Details on the assessment are included in the following paragraphs.

Natural Environment Factors:

While construction activities will be required along the Niagara Escarpment, the impacts of that construction will be mitigated since the feedermain will be located within the existing Centennial Parkway right-of-way.

Socio-Cultural Factors:

Installation of the Feedermain along Centennial Parkway would be coordinated with road improvements that are already being planned along Centennial Parkway, and possibly also the construction of a new trunk sewer. While this will cause significant traffic disruptions, this alternative provides an opportunity to combine three infrastructure upgrades into one major construction project.

The overall impact of the construction activities will also be lessened as they wouldn't commence until the Red Hill Valley Expressway is completed. It is expected that much of the traffic that currently uses Centennial Parkway will migrate to the Red Hill Valley Expressway once it is completed.

Legal-Jurisdictional Factors:

- Will require extensive approvals with review agencies particularly the NEC.

Technical Factors:

- Alignment is well integrated with the pumping supply point at HD05A
- Supports servicing strategies for the south east mountain growth area
- Provides added capacity to Pressure District 6 sources
- Location is near existing escarpment crossings.

10.4.3 Water Servicing Alternative EC-WS-3

Description and Infrastructure Requirements

Alternative EC-WS-3 is based on providing another escarpment crossing from Pumping Station HD002 at Ferguson Avenue and Charlton Avenue to the Intersection of Upper Wellington Street and Fennell Avenue.

Capital Cost

The capital cost estimate for infrastructure required for the 2031 development scenario for Alternative EC-WS-3 is $20M.

This alternative will also require additional pumping station expansion costs.

Timing and Phasing Issues

There is currently not enough reserve capacity within the two existing feedermains that cross the Escarpment to service the 2031 development projections. This project will be triggered by development on the Mountain, within both the Airport Lands and the Southeast Mountain area.

Impact Assessment

The potential for impacts associated with Alternative SEM-WS-3 was assessed, and options for mitigation of these impacts were reviewed. Details on the assessment are included in the following paragraphs.

Natural Environment Factors:

As there is no existing road allowance up the Escarpment along the alignment presented in this alternative, a tunnel or shaft would need to be constructed within the Escarpment itself.

The extension of the Feedermain along Upper Wellington to Fennel Avenue would be within the existing road allowance, which would minimize the impacts of construction on the natural environment.

Socio-Cultural Factors:

The construction activities required under this alternative would result in construction noise for the residential area below the Escarpment, and noise and traffic disruptions for the residential and commercial areas on the Mountain.

Legal-Jurisdictional Factors:

- Will require extensive approvals with review agencies particularly the NEC.

Technical Factors:

- Alignment would utilize the pumping supply point at HD002 which would require a new PD5 pumps
- Limited expansion capability at HD002
- Location is centralized

- Does not provide direct feed to pumping stations.

10.4.4 Water Servicing Alternative EC-WS-4

Description and Infrastructure Requirements

Alternative EC-WS-4 is based on providing another escarpment crossing along Beckett Drive. The proposed alignment is as follows:

- From the existing pumping station and reservoir at the intersection of Hillcrest Avenue and Mountain Avenue, up the Escarpment to Beckett Drive
- Along Beckett Drive to the intersection of Garth Street and Fennell Avenue.

Capital Cost

The capital cost estimate for infrastructure required for the 2031 development scenario for Alternative EC-WS-4 is $15M.

This alternative will also require additional pumping station expansion costs.

Timing and Phasing Issues

There is currently not enough reserve capacity within the two existing feedermains that cross the Escarpment to service the 2031 development projections. This project will be triggered by development on the Mountain, within both the Airport Lands and the Southeast Mountain area.

Impact Assessment

The potential for impacts associated with Alternative EC-WS-4 was assessed, and options for mitigation of these impacts were reviewed. Details on the assessment are included in the following paragraphs.

Natural Environment Factors:

There is no existing road allowance along the portion of the proposed alignment from the pumping station to Beckett Drive. A tunnel or shaft would need to be constructed to cross the Escarpment.

The extension of the feedermain along Beckett Drive and Garth Street would be within the existing road allowances, which would minimize the impacts of construction on the natural environment.

Socio-Cultural Factors:

The construction activities required under this alternative would result in construction noise for the residential area below the Escarpment, and noise and traffic disruptions for the residential and commercial areas on the Mountain.

Construction of the portion of the Feedermain along Beckett Drive will cause significant traffic disruptions, as it will take one of the Escarpment crossings out of service.

Legal-Jurisdictional Factors:

- Will require extensive approvals with review agencies particularly the NEC.

Technical Factors:

- Alignment would require integration of new PD5 pumps at the proposed HD003 station
- Location is centralized
- Does not provide direct feed to pumping stations
- Concurrent Class EA has identified that there is insufficient space for the added capacity plus the Beckett Drive alignment has constructability issues.

10.4.5 Water Servicing Alternative EC-WS-5

Description and Infrastructure Requirements

Alternative EC-WS-5 is based on providing another escarpment crossing in the vicinity of Scenic Drive and Goulding Avenue. The proposed alignment would be from existing reservoir HDR02 up the escarpment to Scenic Drive.

Capital Cost

The capital cost estimate for infrastructure required for the 2031 development scenario for Alternative EC-WS-5 is $15M.

This alternative will also require additional pumping station expansion costs.

Timing and Phasing Issues

There is currently not enough reserve capacity within the two existing feedermains that cross the Escarpment to service the 2031 development projections. This project will be triggered by development on the Mountain, within both the Airport Lands and the Southeast Mountain area.

Impact Assessment

The potential for impacts associated with Alternative EC-WS-5 was assessed, and options for mitigation of these impacts were reviewed. Details on the assessment are included in the following paragraphs.

Natural Environment Factors:

While the new Feedermain alignment would utilize the existing trunk sewer corridor, all construction activities will take place within the Escarpment. The required infrastructure would consist of a tunnel or shaft to house the feedermain, as well as a new pumping station at the reservoir site.

Socio-Cultural Factors:

The construction activities required under this alternative would result in construction noise and traffic disruptions for the residential areas above and below the Escarpment.

Legal-Jurisdictional Factors:

- Will require extensive approvals with review agencies particularly the NEC.

Technical Factors:

- Alignment would utilize existing trunk sewer easement
- A new pumping station at HDR02 would be required
- Location provides a western feed to the mountain area
- Does not provide direct feed to pumping stations.

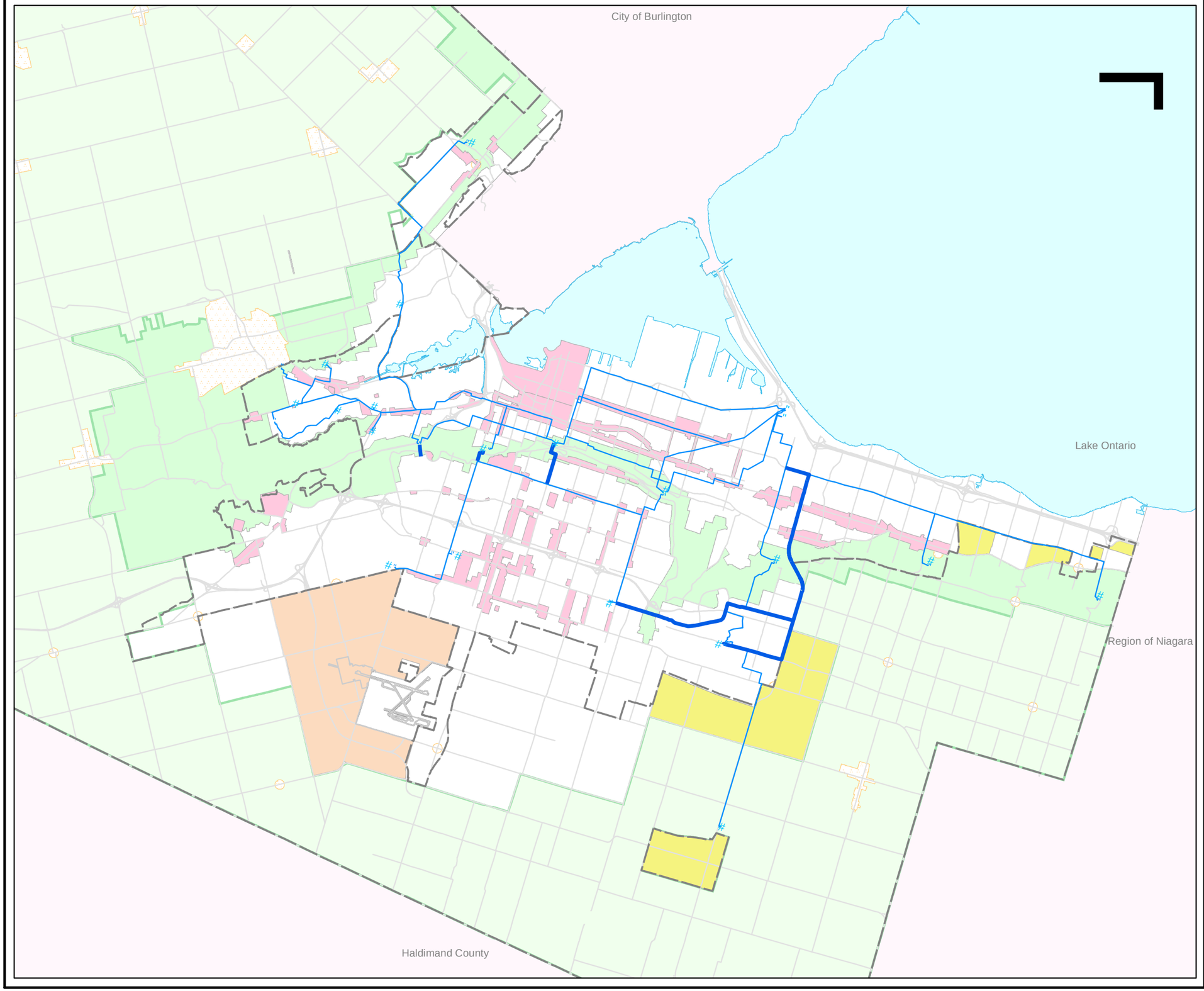
10.4.6 Information Matrix for Escarpment Crossing Water Servicing Alternatives

Table 19 presents a comparison of the costs and impacts of the Escarpment Crossing Water Servicing Alternatives.

10.4.7 Preliminary Selection of the Preferred Escarpment Crossing Servicing Alternative

Alternative EC-WS-2 is preliminarily selected as the preferred servicing alternative for the escarpment crossing, with the following rationale:

- There will be a need to reconstruct Centennial Parkway following completion of the Red Hill Valley Expressway. This provides an opportunity to install new trunk water and wastewater servicing while minimizing the impacts to the natural and socio-cultural environments.



Legend

- Pump
- Reservoir
- Plant
- Watermain
- Watermain Options
- Rural Settlement Area
- Potential Urban Boundary Expansion
- Potential New Business Park
- Intensification Area
- Niagara Escarpment
- Greenbelt
- Urban Boundary

Hamilton

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Escarpment Water Servicing

Alternatives

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Table 19 Information Matrix of Escarpment Crossing Water Servicing Alternatives

EVALUATION CRITERIA	ESCARPMENT CROSSING WATER SERVICING ALTERNATIVE 1	ESCARPMENT CROSSING WATER SERVICING ALTERNATIVE 2	ESCARPMENT CROSSING WATER SERVICING ALTERNATIVE 3	ESCARPMENT CROSSING WATER SERVICING ALTERNATIVE 4	ESCARPMENT CROSSING WATER SERVICING ALTERNATIVE 5
DESCRIPTION	♦ Centennial Parkway Feedermain to HD007	♦ Centennial Parkway Feedermain to HD06B	♦ Upper Wellington Feedermain	♦ Beckett Drive Feedermain	♦ Centennial Parkway Feedermain to HD007
NATURAL ENVIRONMENT FACTORS	♦ Requires escarpment crossing ♦ Feedermain alignment within existing Centennial Parkway right of way	♦ Requires escarpment crossing ♦ Feedermain alignment within existing Centennial Parkway right of way	♦ Requires escarpment crossing ♦ Crossing would require tunnel/shaft	♦ Requires escarpment crossing ♦ Crossing would require tunnel/shaft as well as alignment along Beckett Drive	♦ Requires escarpment crossing ♦ Crossing would require tunnel/shaft ♦ Would require construction of a new pumping station within the escarpment lands
SOCIO-CULTURAL FACTORS	♦ Disruption to road use during construction however construction would be coordinated with other road and infrastructure improvements	♦ Disruption to road use during construction however construction would be coordinated with other road and infrastructure improvements	♦ Disruption within existing residential and commercial areas above and below mountain ♦ Disruption to road use during construction however construction would be coordinated with other road and infrastructure improvements	♦ Disruption to road use during construction ♦ Disruption to parkland and residential areas during construction	♦ Minimal disruption to existing urban areas ♦ Some parkland disruption during construction
LEGAL-JURISDICTIONAL FACTORS	♦ Will require extensive approvals	♦ Will require extensive approvals	♦ Will require extensive approvals	♦ Will require extensive approvals	♦ Will require extensive approvals
TECHNICAL FACTORS	♦ Alignment is well integrated with the pumping supply point at HD05A ♦ Supports servicing strategies for the south east mountain growth area ♦ Location is near existing escarpment crossings	♦ Alignment is well integrated with the pumping supply point at HD05A ♦ Supports servicing strategies for the south east mountain growth area ♦ Provides added capacity to Pressure District 6 sources ♦ Location is near existing escarpment crossings	♦ Alignment would utilize the pumping supply point at HD002 which would require a new PD5 pump ♦ Limited expansion capability at HD002 ♦ Location is centralized ♦ Does not provide direct feed to pumping stations	♦ Alignment would require integration of new PD5 pumps at the proposed HD003 station ♦ Location is centralized ♦ Does not provide direct feed to pumping stations ♦ Concurrent Class EA has identified that there is insufficient space for the added capacity plus the Beckett Drive alignment has constructability issues	♦ Alignment would utilize existing trunk sewer easement ♦ A new pumping station at HDR02 would be required ♦ Location provides a western feed to the mountain area ♦ Does not provide direct feed to pumping stations
ECONOMIC FACTORS	♦ Feedermain approximate costs: $40M	♦ Feedermain approximate costs: $45M	♦ Feedermain approximate costs: $20M ♦ This alternative would also require pumping station expansion costs	♦ Feedermain approximate costs: $15M ♦ This alternative would also require new pumping station costs	♦ Feedermain approximate costs: $15M ♦ This alternative would also require new pumping station costs
OVERALL ALTERNATIVE RANK	◔	●	◐	○	○

Most Preferred ● ◔ ◐ ◕ ○ **Least Preferred**

10.5 INTENSIFICATION AND DEVELOPMENT RELATED WATER SYSTEM IMPROVEMENTS

This section describes projects related to existing capacity limitations or needed to service future intensification of development within the existing service area or needed for local servicing of new growth areas. There are generally more limited available servicing alternatives for these projects based on the extent and current location of the existing infrastructure.

Additional servicing requirements were reviewed from the 2004 Development Charges Study. This study identified a number of local servicing projects that would not normally be included in the scope of a Master Planning exercise. However, because these projects meet the DC criteria, their validity within the context of the Master Plan was reviewed, and they have been included in the capital program where applicable.

The projects related to intensification and/or development in local service areas can be categorized as follows:

- Existing system upgrades or new projects which would be applicable to the Class EA process and usually are considered Schedule B projects
- Local servicing requirements that are implemented under the Planning Act as Schedule A activities given that their need and location is typically refined subject to plan of subdivision and are located to service a new development or site only

Additional project details for these projects is provided in Appendix A-1. The capital program and timing is detailed in Appendix A-3.

10.5.1 System Upgrades – Schedule B Projects

10.5.1.1 Waterdown North Elevated Tank

Currently there is limited storage in the Waterdown area. The Waterdown North Elevated Tank would provide emergency, equalization and fire storage to Pressure District 16, which includes Waterdown North and the existing and zoned Waterdown.

The required storage for this pressure district is 8.0 ML. The City of Hamilton is currently undertaking a Class EA Study to evaluate the different alternatives for this project. The estimated capital cost carried by this project is $6.0 M and has a required in-service date of 2008.

10.5.1.2 New Pumping Station HD16A

The existing area of Waterdown is currently serviced by one pressure zone. In order to service some of the new growth area, the creation of a new pressure district (H16A) is proposed. A new booster pumping station is required to meet the servicing needs of the new Pressure District 16A.

The City of Hamilton is currently undertaking an Class EA Study to evaluate the different alternatives for this project. This project carries an estimated capital cost of $3.0 M, and has a required in-service date of 2008.

10.5.1.3 Parkside Drive Watermain

The existing trunk watermain runs east west on Parkside Drive. In order to service the UpCountry development, support connection to the future Waterdown North elevated tank and new booster pumping station, plus increase the level of service in PD16, an extension of the 400 mm watermain along Parkside Drive is necessary. This requires the crossing of Grindstone Creek and railway line.

The City of Hamilton is currently undertaking a Class EA Study to evaluate the different alternatives for this project. This project carries an estimated capital cost of $1.5 M, and has a required in-service date of 2008.

10.5.1.4 HD12A Pumping Station Upgrades

The HD12A pumping station is located at Kerr St, close to the intersection of Governor's Road and Osler Drive, in the former municipality of Dundas. The station currently has a firm pumping capacity estimated at 1.31 ML/d, and a total pumping capacity of 4.58 ML/d with both pumps in operation.

Pressure District 12 is currently being serviced only through this station, as pumping station HD012 (located on the south side of the Spring Creek Conservation Area) is used only for emergency purposes and has to be controlled manually. Modelling results show that there are existing capacity limitations at this station.

The immediate requirements for this pumping station are installation of a third pump, and upsizing of the existing 300 mm diameter watermain that feeds the station.

Based on the servicing needs for Pressure District 22, expansion of the HD12A pumping station with PD22 pumps will provide additional supply security and capacity to the area.

This project carries an estimated capital cost of $2.1M, and has a required in-service date of 2008.

10.5.1.5 Waterdown South Elevated Water Tower

As development occurs in the Waterdown South and UpCountry areas where topographical elevations are higher, new elevated storage for the new Pressure District 16A will be required. The Waterdown South Elevated Tank would provide emergency, equalization and fire storage to the new Pressure District 16A. The required storage for this Pressure District is 6.34 ML.

The City of Hamilton is currently undertaking a Class EA Study to evaluate the different alternatives for this project. The estimated capital cost carried by this project is $4.5 M and has a required in-service date of 2009.

10.5.1.6 HD03B Pumping Station

Under normal operating conditions, Pressure District 3 is fed by gravity via Pressure District 5, which is located on top of the escarpment. Equalization, emergency, and fire storage for Pressure District 3 is also provided through Pressure District 5. Pressure District 3 is also supplied through HD003, Ferguson Ave pumping station, as well as a small emergency pumping station located at the Highland Gardens park. Pumping station HD003

does not currently have sufficient capacity to supply the District's requirements. Based on the condition of the PD5 feed and the pumping stations, it is necessary to provide a secure water supply source to the area.

Therefore, in order to service Pressure District 3, a new station is proposed which should have a firm pumping capacity estimated at 7.0 ML/d. This project carries an estimated capital cost of $4.0M, and has a required in-service date of 2009. These project requirements have been confirmed through a separate Class EA Study.

10.5.1.7 HD002 Standby Power

The HD002 pumping station is located at the intersection of Ferguson Ave and Foster St. in Hamilton. The station currently has a firm pumping capacity estimated at 149.75 ML/d, and a total pumping capacity of 204.25 ML/d with all pumps in operation, but has no standby power.

In order to provide security of supply in case of a power outage, stand-by power is required at this key facility. This project carries an estimated capital cost of $1.5M, and has a required in-service date of 2011.

10.5.1.8 HD012 Pumping Station Upgrades

The HD012 pumping station is located at the intersection of Lynden Avenue and Little John Road in the former municipality of Dundas. This station is generally used only in emergency situations. It currently has a firm pumping capacity estimated at 1.91 ML/d, and a total pumping capacity of 5.18 ML/d with both pumps in operation.

The properties located south of the Spring Creek Conservation Area are fed by a single 300 mm diameter watermain located on Bridlewood Drive. In the event that this supply is interrupted, pumping station HD012 can be used to service this area from Pressure District 11. Station HD012 has to be operated manually, and it does not have sufficient capacity to supply the required fire flows.

As such, this pumping station needs to be upgraded to provide the flow required to meet demands in the event of a fire emergency in the area. The immediate requirements for this pumping station are the replacement of the existing pumps to larger ones. This project carries an estimated capital cost of $2.1M, and has a required in-service date of 2011.

10.5.1.9 HD019 Pumping Station Upgrades

The HD019 pumping station is located in Binbrook, and services Pressure District 23. The station currently has a firm pumping capacity estimated at 6.4 ML/d, and a total pumping capacity of 9.6 ML/d.

The expected future demands in Binbrook are in the order of 15 ML/d, which calls for a need to upgrade the station to be able to provide this flow. This project carries an estimated capital cost of $6.4M, and has a required in-service date of 2014.

10.5.1.10 HD016 Feedermain Extension

Water supply for the Waterdown area is provided by Pumping Station HD016 located below the escarpment, through a single 600 mm diameter watermain. The single feed provides

limited security in the event that this supply from the pumping station is interrupted although there is floating storage in Waterdown.

To provide additional security and to mitigate excessive elevated water storage needs in Waterdown, it is recommended to twin and upsize the existing feed to Waterdown. The City of Hamilton is currently undertaking a Class EA Study to evaluate the different alternatives for this project. This project carries an estimated capital cost of $6.7M, and has a required in-service date of 2019.

10.5.1.11 HD016 Pumping Station Upgrades

Pumping Station HD016 is located below the escarpment at York and Valley Road in Dundas. Water is pumped from this location to Waterdown's existing pressure zone, Pressure District H16. The HD016 Pumping Station currently has 4 pumps with a firm pumping capacity of 17.97 ML/D and total capacity of 26.86 ML/D. The HD016 pumping station also supplies the Pleasantview Area (Districts 19 and 20), with a required capacity of 0.71 ML/D.

Based on the future capacity requirements, this station will require replacement two of the existing pumps with larger pumps to increase the station's firm capacity to 21.4 ML/d. In addition, given that this pumping station is critical for the supply to Waterdown, it is recommended that standby power is provided to mitigate potential down time under emergency conditions. The City of Hamilton is currently undertaking a Class EA Study to evaluate the different alternatives for this project. This project carries an estimated capital cost of $6.0M, and has a required in-service date of 2019.

10.5.2 Local Servicing – Schedule A Projects

10.5.2.1 Garner Road Watermain

There is currently a 400 mm watermain on Garner Road that reduces to a 300 mm watermain and feeds the southern portion of Ancaster. In order to accommodate the flows required to service future growth in Ancaster and maintain adequate pressures in the Pressure District, a new watermain should be installed, parallel to the existing one.

Modelling results show that a new 500 mm watermain will be required to convey the expected flows and improve the level of service in Ancaster. This project carries an estimated capital cost of $6.2M and has a required in-service date of 2009.

10.5.2.2 Water Treatment Plant Improvements

While some of the individual treatment processes at the Woodward Avenue WTP have sufficient capacity to supply the anticipated 2031 demands, the sedimentation tanks and pre-chlorination system will require upgrades. These upgrades have been detailed under separate study completed for the City of Hamilton.

These upgrades carry a total estimated capital cost of $16.0M, and have a required in-service date of 2011.

10.5.2.3 Locke St. Watermain

The northwest area of Pressure District 2 is currently fed by several 300 mm diameter watermains ending at Locke St. Modelling results show a need to connect these watermains and provide a trunk watermain linking large diameter trunk watermains supplying the areas from the east to the south. This connection will improve pressures and flows as intensification occurs.

The requirements are the installation of a 400 mm watermain on Locke St, from Barton St. to Main St connecting to all the watermains that it intersects. This project carries an estimated capital cost of $1.4M, and has a required in-service date of 2014.

10.5.2.4 Woodward Water Treatment Plant High Lift Pumps

The Woodward Water Treatment Plant is currently permitted to take up to 909 ML/d from Lake Ontario, and has a firm high-lift pumping station capacity of 569 ML/d. The capacity of the raw water intakes is approximately 1150 ML/d.

The required future demand for the area it services will be 591.8 ML/d with potential for greater water needs depending on growth beyond this Master Plan planning horizon of 2031. As such, additional pumping capacity will need to be provided in order meet this future demand. This project carries an estimated capital cost of $2.0M, and has a required in-service date of 2023.

10.5.2.5 Binbrook Feedermain Extension

Local pressure for Binbrook is provided by Pumping Station HD019 through a single 400 mm diameter watermain. Because of the single feed, there is limited security from the existing elevated tank in the event that this supply is interrupted.

To provide this security and support the supply capacity to the area, there is a need to twin the existing feed to Binbrook. This project carries an estimated capital cost of $5.5M, and has a required in-service date of 2023.

10.5.2.6 Governor's Road Watermain Extension – PD 11

Based on the additional pumping capacity requirements from HD012A pumping station, additional distribution capacity on the suction side of the station is required. The location of the watermain will twin the existing 400 mm watermain on Governor's Road.

This project carries an estimated capital cost of $0.2M, and has a required in-service date of 2008.

10.5.2.7 Governor's Road Watermain Extension – PD 22

In order to support the strategy of pumping form HD012A to PD22 for security and capacity, a dedicated watermain extension from the station is required to the pressure district boundary. A 300 mm watermain on Governor's Road is required.

This project carries an estimated capital cost of $0.7M, and has a required in-service date of 2008.

11. EXISTING WASTEWATER SYSTEM

11.1 GENERAL

The City of Hamilton wastewater system consists of combined sanitary/stormwater service areas and separated sanitary service areas. The combined system is generally located in the downtown core and northern sections of the Hamilton Mountain while the separated systems lie at the outer limits of the network. The boundary of the combined and separated systems is depicted on Figure 14.

There are three wastewater treatment plants; Woodward Avenue Wastewater Treatment Plant; The King Street (Dundas) Wastewater Treatment Plant; and the Main Street (Waterdown) Wastewater Treatment Plant.

The Woodward Ave. WWTP catchment area consists generally of the downtown and mountain areas of Hamilton including Ancaster and Stoney Creek. The topography of this catchment area typically falls south to north with the Niagara Escarpment as a significant topographical feature dividing the area. However, at the southern and western limits of the catchment areas, the topography begins to fall southerly and as such, there are a number of sewage pumping stations which convey flows back to the gravity system.

Within the combined sewer system, there are also numerous wet weather control devices including weirs, gates and combined sewer overflows and tanks.

Since the late 1990s, the City has systematically constructed CSO storage tanks, that collect wastewater during wet weather periods, resulting in reduced flow into the system and fewer and smaller system bypasses. CSO storage facilities in the City's system are presented in Table 20.

Table 20 CSO Storage Facilities - Existing and Under Construction

Tank	Date	Volume (m^3)	System
Greenhill #1	1988	83,500	Fennell/RHCSI
Bayfront Park	1993	21,000	Western Interceptor
James Street	1993	3,200	Western Interceptor
Main/King	1997	77,100	Western Interceptor
Eastwood Park	1997	27,350	Western Interceptor
Greenhill #2	2003	66,750	Fennell/RHCSI
Royal	under construction	15,000	Western Interceptor
Ewen	Pending	5,935	Western Interceptor
Red Hill Valley	under construction	14,200 (in-line)	Red Hill Creek Sanitary Interceptor

During periods of wet weather, excess flows will enter the CSO tanks and fill the tanks. Where there are no tanks, excess flow bypasses the treatment system at CSO structures.

The weirs and gates are designed to capture as much wet weather flow as possible within the system or divert to overflow to prevent system surcharging and basement flooding.

The Dundas wastewater system consists primarily of separated service areas. The system conveys flows by gravity from the west to east to the Dundas plant. There is also provision for any excess flows beyond the plant capacity to enter a diversion structure which can convey flows to the Woodward Ave. WWTP.

The Waterdown wastewater system consists of three primary service areas: the core area which drains by gravity to the Waterdown WWTP; the western service area which drains by gravity down the Borer's Creek trunk sewer to the Dundas diversion structure and ultimately to the Woodward Ave. WWTP; the eastern service area which is pumped across to the western service area and ultimately to Borer's Creek trunk sewer.

11.2 WASTEWATER TREATMENT PLANTS

The City of Hamilton currently operates three wastewater treatment plants:

- The Woodward Avenue Wastewater Treatment Plant
- The King Street (Dundas) Wastewater Treatment Plant
- The Main Street (Waterdown) Wastewater Treatment Plant.

The location of the three plants and their existing drainage areas are also depicted on Figure 14.

Woodward Avenue Wastewater Treatment Plant

The Woodward Avenue WWTP is a secondary treatment facility that services the urban areas of the existing City of Hamilton, with the exception of the former Town of Dundas and the central portion of the former Town of Waterdown. It is the principal facility for treating wastewater flows for a significant portion of the City of Hamilton.

The flows from Ancaster, Mount Hope, the Upper Mountain, Binbrook and Stoney Creek consist of separated sanitary flows, with some rainfall-derived inflow and infiltration. There are still many combined sewers within the central core of the City, so the Woodward Avenue WWTP receives a combination of sanitary and storm flows from this area. As a result, the Woodward Avenue WWTP experiences significant wet weather flows of up to four times the average dry-weather rate. Flows are conveyed to the plant through the Western Sanitary Interceptor, and the Eastern Sanitary Interceptor. These major collection system components will be discussed in the following sections.

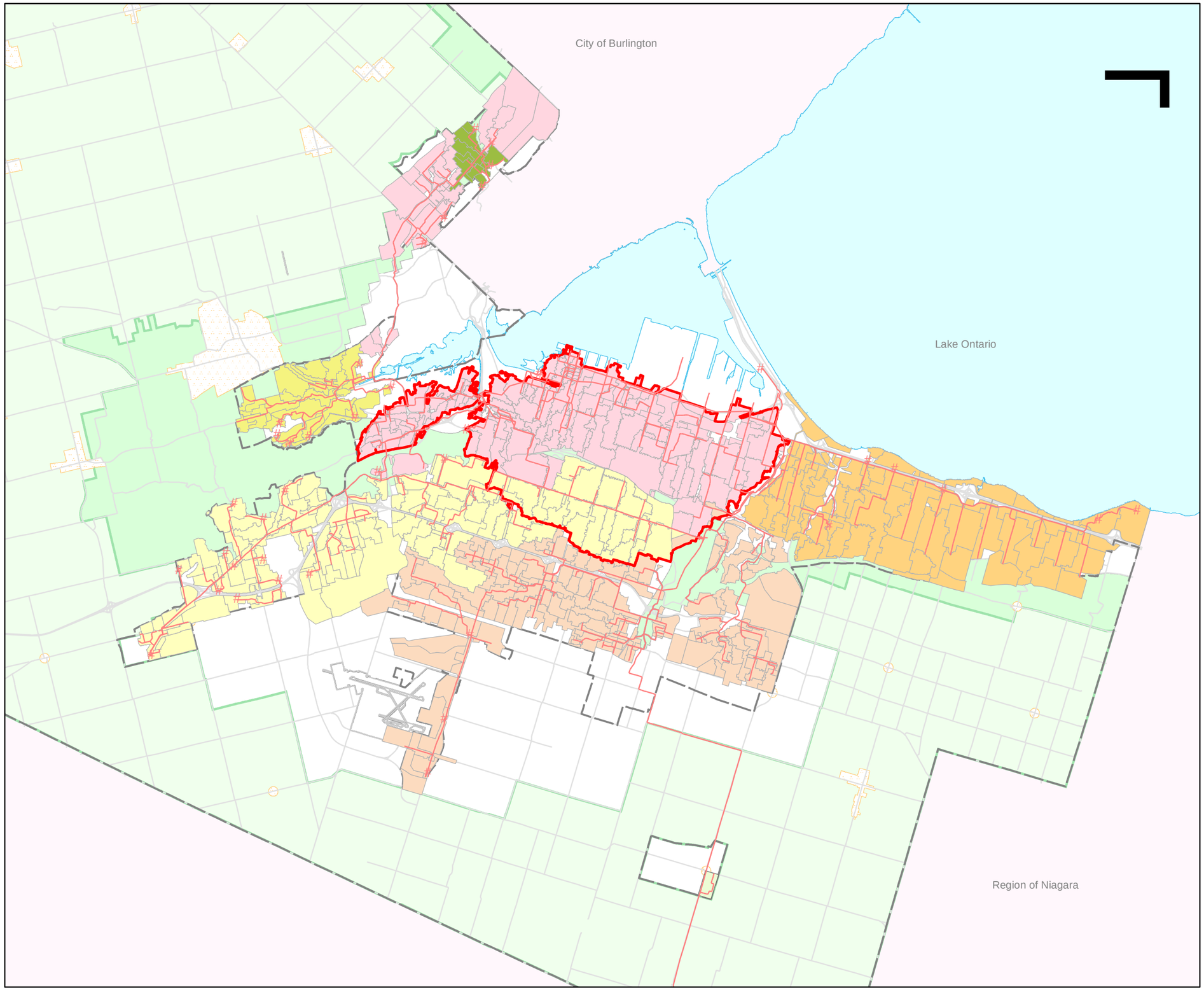
Currently, the plant has a rated capacity of 409 ML/d and is operating at approximately 85 percent of the rated capacity. Treated effluent is discharged to Hamilton Harbour via the Red Hill Creek.

The facilities at this site incorporates the low lift pumping station, primary and secondary treatment of liquid flows, and treatment of biosolids within conventional anaerobic digesters. The facility has significant methane gas storage and recently co-generation facilities have been constructed to capitalize on this asset.

The facilities have been the subject of a number of recent and on-going studies and upgrades. A comprehensive scoping study was recently competed by CH2MHill, which demonstrated, amongst other topics, that the site could accommodate the growth anticipate to 2031. Currently, the City is in the process of upgrades to achieve enhanced primary treatment to 1100 ML/d capacity and have initiated a study of membrane bioreactors as a technology that might be suitable for enhanced tertiary treatment.

A biosolids master plan is also underway and a preferred alternative is not likely to be adopted until early 2007. Recognising the inter-relationship between the biosolids process and the rest of the plant, and recognizing the scope of this master planning document, the total requirements for the Woodward Avenue Wastewater Treatment Plant will only be completed during Phases 3 and 4 of the Class EA to be initiated specifically for that purpose.

While the low lift pumping station was upgraded several years ago, limiting capacity of the original wet well continues to be problematic for operations.



Legend

- Pumping Station
- Existing Sewer
- Rural Settlement Area
- Niagara Escarpment
- Dundas WWTP Service Area
- Eastern Interceptor Service Area
- Fennell Trunk Service Area
- Red Hill Creek SI Service Area
- Waterdown WWTP Service Area
- Western Interceptor Service Area
- Greenbelt
- Urban Boundary
- Extends of Combined Sewer System

Hamilton

Integrated Water & Wastewater Master Plan

Wastewater Collection System

Nov 22, 2006
1:125,000
2590-D-76

Dundas Wastewater Treatment Plant

The Dundas WWTP is a tertiary treatment facility that services the former Town of Dundas. The plant has a rated capacity of 18 ML/d and is currently operating at approximately 91 percent of the rated capacity. The plant effluent is discharged to Cootes Paradise via the Desjardin Canal.

Waterdown Wastewater Treatment Plant

The Waterdown WWTP is a tertiary treatment facility that services the central portion of the former Town of Waterdown. The plant has a rated capacity of 2.7 ML/d and is currently operating at approximately 108 percent of the rated capacity. The plant effluent is discharged to Cootes Paradise via Grindstone Creek.

11.3 WASTEWATER COLLECTION SYSTEM

The overall Hamilton wastewater collection system is divided into five main systems:

- The Western Sanitary Interceptor System
- The Eastern Sanitary Interceptor System
- The Red Hill Creek Sanitary Interceptor System
- The Dundas System
- The Waterdown System.

The Eastern, Dundas and Waterdown systems all consist of exclusively sanitary sewers. Most of the Western Sanitary Interceptor System consists of combined sewers, as does a portion of the Red Hill Creek Sanitary Interceptor System.

In order to limit the loadings to Hamilton Harbour resulting from wet-weather events, the City has constructed six off-line CSO storage tanks since 1988, with a seventh tank and trunk sewer sections currently under construction. An eighth tank is also currently being considered. These tanks are designed to capture in excess of 90 percent of the wet-weather flows, which are pumped back into the interceptors during dry weather periods.

The overall collection system also includes 70 sewage pumping stations, which vary in size – with some servicing very local areas, to other more major stations – and have firm pumping capacities ranging from 5 L/s to 252 L/s.

Western Sanitary Interceptor

The Western Sanitary Interceptor (WSI) runs west-to-east along Hamilton Harbour, from the Main-King CSO Tank to the Woodward Avenue WWTP. It generally receives combined sewage from the downtown core, but also services some separated areas along the former Ancaster/Hamilton border, as well as a portion of the former Town of Waterdown.

Data collected during the City's 2004 Flow Monitoring Program indicate significant wet-weather inputs into the WSI. The data also indicated that certain sections of the Interceptor experienced flows exceeding 85% of its capacity, leaving limited capacity to service future growth.

There are 18 combined sewer outfalls (CSOs) within the Western Interceptor drainage area that can discharge into Hamilton Harbour during rainfall events, five of which have had CSO storage tanks installed.

Red Hill Creek Sanitary Interceptor

The Red Hill Creek Sanitary Interceptor (RHCSI) runs south-to-north, from the intersection of Rymal Road and Dartnall Road to the Woodward Avenue WWTP. It receives combined sewage from the North Mountain area via the Fennell trunk sewer, and separated sewage from the South Mountain, Ancaster, Mount Hope, Binbrook, and South Stoney Creek.

Data collected during the City's 2004 Flow Monitoring Program indicate significant wet-weather inputs into the RHCSI. The data also indicated that surcharging occurred in both the Ancaster-to-Fennell Trunk and the Red Hill Creek Sanitary Interceptor itself. Development in the catchments upstream of these locations could worsen the existing conditions.

There are four combined sewer outfalls (CSOs) within the RHCSI drainage area that can discharge into Hamilton Harbour via the Red Hill Creek during rainfall events. Two CSO storage tanks have been constructed at the eastern extremity of Greenhill Avenue, where the Fennell Trunk discharges into the RHCSI. A CSO storage tunnel that will parallel the existing RHCSI from Lawrence Road to south of Barton Street is currently being constructed. This tunnel will provide CSO control at the Lawrence Road, Queenston Road, and Melvin Avenue CSOs.

Eastern Sanitary Interceptor

The Eastern Sanitary Interceptor (ESI) runs east-to-west along Lake Ontario, from Oriole Avenue to the Woodward Avenue WWTP. It receives sanitary sewage from the former municipality of Stoney Creek only.

Data collected during the City's 2004 Flow Monitoring Program indicate moderate wet-weather inputs into the Eastern Interceptor. The data also indicated that at no point in 2004 did the flows through these trunks exceed even 35% of their capacities, indicating that the Eastern Sanitary Interceptor system is significantly oversized when considering the population that it services, and the fact that it receives no combined sewage. When the ESI was originally constructed, it included an allowance for development of the lands south of the existing service area, which are now protected by the Greenbelt Plan.

While the ESI has excess capacity at the present time, it can experience backwater conditions depending on the wet well level at the Woodward Avenue WWTP influent pumping station. When the elevation in the wet well is high, the effective conveyance capacity of the ESI is reduced.

Dundas WWTP System

The Dundas system services the entire former Town of Dundas, generally draining from west to east to the Dundas WWTP.

Dundas is serviced, for the most part, through separated sanitary and storm sewers. There is an isolated neighbourhood which is considered serviced by combined sewers under the City's sewer use bylaw.

Waterdown WWTP System

The Waterdown system services only the central core of the former Town of Waterdown, generally draining from west to east to the Waterdown WWTP. The remainder drains to the Borer's Creek Trunk Sewer to Dundas. The flow is captured in the Dundas Diversion Tank and pumped to the Woodward Avenue WWTP catchment area.

Waterdown is serviced through separated sanitary and storm sewers.

12. WASTEWATER DESIGN CRITERIA

12.1 AVERAGE DAY DRY-WEATHER FLOW

The unit flow criteria for growth were developed by comparing the calibrated dry-weather flow data from the model with the existing population and employment data developed through the GRIDS process. Historical plant flow data as well as the Woodward Ave. WWTP 2004 monitoring data was analyzed. This information allowed analysis of consecutive dry weather flow days to establish average dry weather flow criteria.

Based on review of historical data and given that the GRIDS forecasts were provided in residential persons and employees, the dry-weather flow criteria was established as follows:

Residential: 300 Lpcd

Employment including industrial, commercial, and institutional (ICI): 260 L/employee/d

For planning purposes, it is reasonable to allow for a lower rate of extraneous flow even within dry weather flow conditions. As such, a 20% allowance for flow generated by the new population or employment areas in the calculation of dry weather flows has been used.

12.2 AVERAGE PLANT FLOWS

From the dry weather flow analysis and wet weather flow analysis using historical plant flow and the Woodward Ave. WWTP 2004 monitoring data, the average dry weather flow component was able to be isolated from the total average flow. This analysis also provided estimation of the average wet weather flow component. The rationale for isolating the dry and wet weather flow criteria is based on the concept that the criteria for the wet weather flow component will remain relatively constant regardless of growth. This component can then be applied to future dry weather flow criteria to establish total average plant flows.

As such the total equivalent average plant flow rate for the combined area was determined to be 769 Lpcd.

For the separated area, the total equivalent average plant flow rate was determined to be 653 Lpcd.

This process confirmed criteria established under the Woodward Ave. WWTP Scoping Study completed by CH2MHILL in February 2006.

12.3 PEAK WET-WEATHER FLOWS

Peak wet-weather flows throughout the system were evaluated using the calibrated MOUSE model under a 5-year design storm condition. The specific storm used in the evaluation was a 24-hour SCS storm event, which was developed using intensity-frequency-duration (IDF) data collected by Environment Canada's Atmospheric Environment Service (AES) at their Mount Hope environmental monitoring station.

For existing developed catchments within the existing urban boundary, it was assumed that the storm runoff from the existing catchments would not increase through redevelopment

or intensification. While the actual hydrologic properties of the catchments likely would change, it is anticipated that stormwater control measures would also be implemented such that the post-development (i.e., future) rates of runoff would not exceed the pre-development rates (the existing conditions).

The extraneous flow rate criteria for future development, is based on a wet weather design allowance of 0.2 L/ha/s. This is consistent with the City's existing design standards.

12.4 DESIGN CRITERIA FOR SYSTEM COMPONENTS AND OPERATION

12.4.1 Pumping Capacity

Pumping stations are rated on their firm capacity to pump flows. This is based on the largest pump out of service at each station.

Each pumping station must have sufficient firm capacity to meet peak wet weather flows for its respective catchment.

12.4.2 Conveyance Capacity

The conveyance system is sized to convey the peak instantaneous flow.

For the existing infrastructure, the capacity to service future flows was assessed using the calibrated MOUSE model and a 5-year design storm event. In cases where existing sewers experienced peak flows in excess of their capacity, the resulting hydraulic grade was also examined. Moderate surcharging of sewers was deemed acceptable as long as the peak hydraulic grade line remained at least 3 m below grade.

Due to a large service area with combined sewers, it is essential to note that there is a high level of unpredictability of true wastewater flows generated in the conveyance system. The storm components are a function of rainfall, intensity and duration. The unpredictability of storm events and their magnitude can significantly impact the infrastructure costs to either separate the system or convey the largest storm event.

12.4.3 Level of Treatment and Capacity

While wastewater conveyance systems are designed and rated to deliver peak wastewater flow to the treatment facilities, the treatment plants themselves are rated for average day flows.

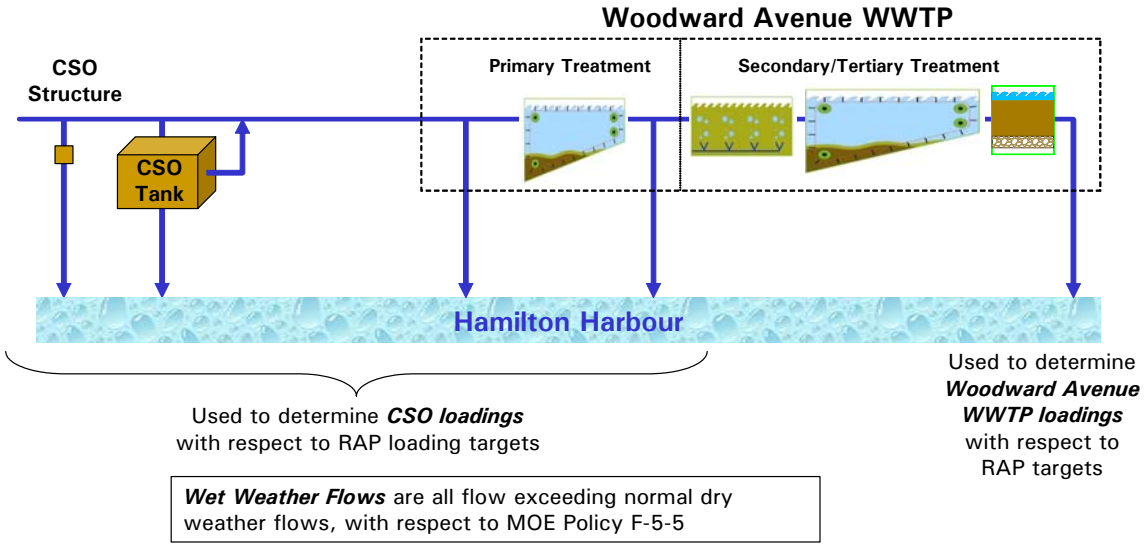
Plant effluent objectives are as set out in each Certificate of Approval for the facilities. The effluent objectives for the City of Hamilton wastewater treatment plants have been further defined under Hamilton Harbour Remedial Action Plan (HHRAP) targets.

As part of the agency workshops on the wet weather control issues, members from HHRAP and RAP technical team have participated in the technical review. These workshops have led to support of servicing strategy and general agreement on the water quality and implementation objectives for the wastewater treatment plants:

Woodward Avenue WWTP

For the purposes of evaluating loadings from Woodward Avenue WWTP to evaluate compliance with Hamilton Harbour RAP loading targets, Woodward Avenue WWTP loadings were calculated using only flow receiving full secondary (and in future) tertiary treatment.

For the purposes of evaluating CSO loadings to evaluate compliance with RAP CSO loading targets, loadings were calculated using flow receiving no treatment (i.e., system and plant bypasses) and flow receiving only primary treatment (i.e., all flow that does not receive full secondary/tertiary treatment).



For the purposes of calculating total volume of wet weather flow to evaluate compliance with Ministry of Environment (MOE) Policy F-5-5, wet weather flow is all flow in excess of normal dry weather flow volumes. Dry weather flow was determined using flow data from historical weeks with no rainfall, and prorated for the future planning population.

Dundas WWTP

All flow to the Dundas WWTP will receive full secondary/tertiary treatment, and therefore, a wet weather flow definition for this plant does not apply.

12.5 MOE PROCEDURE F-5-5 AND COMBINED SEWER OVERFLOWS

The City currently does not have a sewer separation plan in place. Separation of existing combined sewers is only considered as major road works are required, and even then only in areas where there is a viable storm sewer outlet location. Instead, the City plans to maintain its existing combined sewer system, and is committed to meeting or exceeding the requirements of Ministry of the Environment Procedure F-5-5, "*Determination of the Treatment Requirements for Municipal and Private Combined and Partially-Separated Sewer Systems*".

The following is an excerpt from Procedure F-5-5, and provides some context as to the conditions that the City has committed to achieving:

> ***6. MINIMUM COMBINED SEWER OVERFLOW (CSO) CONTROLS:***
>
> *The minimum CSO controls consist of the following:*
>
> *(a) Eliminate CSOs during dry-weather periods, except under emergency conditions.*
>
> …
>
> *(g) During a seven-month period commencing within 15 days of April 1, capture and treat for an average year all the dry-weather flow plus 90% of the volume resulting from wet weather flow that is above the dry weather flow. The volumetric control criterion is applied to the flows collected by the sewer system immediately above each overflow location unless it can be shown through modelling and on-going monitoring that the criterion is being achieved on a system-wide basis.*
>
> …
>
> ***9. BEACH PROTECTION***
>
> *Additional controls above the minimum CSO controls (section 6) are required for swimming and bathing beaches affected by CSOs and consist of the following:*
>
> *(a) There should be no violation of the body contact recreational water quality objective for E. coli of 100 E. coli per 100 mL based on a geometric mean at swimming and bathing beaches as a result of CSOs for at least 95% of the four-month season (June 1 to September 30) for an average year.*
>
> *(b) Controlling to not more that two overflow events per season (June 1 to September 30) for an average year in a combined sewer system with the combined total duration of the CSOs at any single CSO location being less than 48 hours and ensuring that the controlled combined sewage which does not overflow receives a level of treatment (as specified in section 7) plus disinfection (as specified in section 8) is deemed to satisfy section 9(a). An additional overflow event per season may be allowed if the proponent can demonstrate that section 9(a) will still be satisfied and the combined total duration of the CSOs at any single CSO location will be less than 48 hours.*

In addition to the minimum requirements of Procedure F-5-5, the City has also committed to controlling all CSOs in an average year at the following environmentally significant locations:

- The Birch Street CSO, which discharges into the Sherman Inlet aquatic habitat restoration initiative.
- The Parkdale Avenue and Dunn Avenue CSOs, which discharge into Windermere Basin.

The City has committed to no more than one CSO event per year for the combined sewer outfalls discharging to Coote's Paradise (Royal, Ewen, and Sterling CSOs).

The City has also committed to collection system upgrades to ensure there is no untreated discharge of wastewater before the full capacity of the treatment plant is reached.

In an effort to ensure the best implementation of practices aimed at achieving F-5-5, the City has held a number of workshops with regulatory personnel and water and wastewater experts from across Canada. These forums were used to discuss existing conditions within the combined sewer system and Hamilton Harbour, and the range of potential solutions that will enable the City to achieve F-5-5.

12.6 HAMILTON HARBOUR REMEDIAL ACTION PLAN (HHRAP) CRITERIA

12.6.1 Effluent Loading Criteria

The Hamilton Harbour RAP defines loading targets for the Woodward Avenue WWTP and Dundas WWTP considering what is required to improve water quality within the Harbour. Since wastewater treatment plants are designed to achieve a level of performance, as represented by effluent concentrations, the design concentration objectives, corresponding to the loading targets, needed to be determined. These concentration criteria will be used in Phases 3 and 4 of the Class EA process to develop treatment process requirements.

Woodward Avenue WWTP

It is proposed that Woodward Avenue WWTP secondary and tertiary treatment processes be designed to achieve the effluent concentrations presented in Table 21. Also shown are the effluent concentrations that would be required to achieve the RAP Final loading targets at the future design capacity of 553 ML/d.

Table 21 Proposed Woodward Avenue WWTP Effluent Design Objectives

Parameter	Proposed Design Objectives		RAP Final Loading Target	RAP Effluent Concentration at 553 ML/d
	BAT Design Objective	BAT Loadings at 553 ML/d		
Total suspended solids (TSS)	3 mg/L	1,659 kg/d	900 kg/d	1.6 mg/L
Total phosphorus	0.15 mg/L	55 kg/d	60 kg/d	0.1 mg/L
Ammonia-N	1 to 5 mg/L	550 to 2,765 kg/L	530 kg/d	1 mg/L

It is very important to note that while design is based on the concentrations presented in Table 21, it is understood that ***compliance concentrations and loadings to be defined in the Certificate of Approval will be less stringent***. This allows for routine process upsets due to maintenance, seasonal variability and industrial loadings common to municipal wastewater treatment facilities. As the design of the Woodward WWTP expansion proceeds through Phases 3 and 4 of the Class EA, and detailed design, approaches to ensure reliable performance and contingency to minimize risk of exceeding design objectives will be incorporated.

Total Suspended Solids (TSS) and Total Phosphorus (TP)

With respect to total suspended solids (TSS), the corresponding RAP concentration of 1.6 mg/L has not been demonstrated to be consistently achievable using proven best available technology (BAT) for municipal wastewater treatment. As a result, 3 mg/L as a design criterion is proposed. The removal of phosphorus is dependent on the efficiency of suspended solids removal. At 3 mg/L of suspended solids, the phosphorus concentration criterion of 0.1 mg/L, corresponding to the RAP Final loading target, is achievable using BAT.

Ammonia Nitrogen

The RAP final loading target for ammonia-nitrogen would result in a design concentration of 1 mg/L. While this concentration is achievable, at a plant the size of Woodward Avenue WWTP, with significant variability in flows and loadings, this level of treatment is difficult to achieve on a consistent basis. In addition, the level of treatment to consistently achieve 1 mg/L will significantly increase the size, capital cost, operating cost and operating complexity for a secondary treatment plant expansion, compared to designing for a concentration of about 5 mg/L.

The toxicity of ammonia is based on the portion in unionized form, which increases with both temperature and pH. Through discussion with representatives from RAP during the Master Plan, it was generally agreed that a non-toxic unionized ammonia concentration at the end-of-pipe is required, and that concentrations should be sufficiently low to avoid increasing unionized ammonia concentrations above the Provincial Water Quality Objective under ambient water quality conditions in the Harbour. At a concentration of 5 mg/L, the end-of-pipe non-toxic objectives would be easily met.

Additional review and coordination with review agencies is required to determine the design ammonia effluent concentration target for the Woodward Avenue WWTP. In moving forward, the design requirements will be based on a concentration that will be in the range of 1 to 5 mg/L. The actual design objectives will be refined in Phases 3 and 4 of the Class EA process.

Dundas WWTP

It is anticipated that the Dundas WWTP will retain its rated capacity (i.e., no expansion), and that secondary and tertiary treatment be upgraded to strive to achieve RAP Final loading targets. Table 22 presents proposed effluent design objectives for the Dundas WWTP, as well as the RAP targets.

Table 22 Proposed Dundas WWTP Effluent Design Objectives

Parameter	Proposed Design Objectives		RAP Final Loading Target	RAP Effluent Concentration at 18.6 ML/d
	BAT Design Objective	BAT Loadings at 18.6 ML/d		
Total suspended solids (TSS)	3 mg/L	55.8 kg/d	28 kg/d	1.5 mg/L
Total phosphorus	0.27 mg/L	5 kg/d	5 kg/d	0.27 mg/L
Ammonia-N	1.2 mg/L	22 kg/d	22 kg/d	1.2 mg/L

As discussed above, a total suspended solids concentration of 3 mg/L has been selected because it represents BAT for municipal wastewater treatment. For the Dundas WWTP, since it discharges directly to Cootes Paradise, a sensitive wetland and fish spawning habitat, the RAP ammonia loading objective is adopted as the design criterion.

As discussed for Woodward Avenue WWTP, compliance concentrations to be included in the Certificate of Approval for the facility would be less stringent than the design objectives.

12.6.2 Wet Weather Flows

For the purposes of evaluating compliance with RAP CSO loading targets, loadings from flow receiving no treatment or primary treatment are included. Four sources of CSO loadings are included, as follows:

- Raw wastewater either:
  - Bypassing the collection system at CSO structures
  - Overflowing a full CSO storage tank
  - Pumped to the Woodward Avenue WWTP and bypassing primary treatment
- Primary treated effluent bypassing secondary treatment.

For the purposes of evaluating loading impacts from CSOs, it was assumed that the total raw sewage loading of contaminants (total suspended solids, total phosphorus, total ammonia) generated from the service area is constant. This means that as the total system flow increases with wet weather, the raw wastewater concentrations decrease. The constant loading was based on historical recorded loadings prorated for the future population.

Table 23 presents the basis for evaluating CSO loading impacts from each source.

Table 23 Level of Treatment Basis for Wet Weather Flows

Process	TSS	TP	Ammonia-Nitrogen
Primary effluent	50% removal	50% removal	20% removal
CSO Tank Overflows	40% removal	25% removal	0% removal
Raw wastewater bypasses from CSO structures or at Woodward Avenue WWTP	0% removal	0% removal	0% removal

12.7 SIMULATION OF LOADINGS

For the purposes of the Master Plan, the options for the Woodward Avenue WWTP service area to be developed and evaluated for providing wastewater treatment capacity and wet weather flow management for the future will consider:

- Conceptual process/component sizing
- Resulting loadings to Hamilton Harbour from the Woodward Avenue WWTP and CSOs relative to the RAP loading targets

- Capital costs
- Other advantages and disadvantages.

12.7.1 Modelling

A model of the collection system was developed and calibrated to simulate hourly system flows and loadings to the collection system based on rainfall events and defined dry weather flows over the 7-month period from April to October.

The model simulations that were undertaken were performed using the MOUSE platform. The initial model was built and calibrated by AWS Engineers and Planners Corp, using flow data collected during the City of Hamilton's 2004 flow monitoring program.

The calibrated model combines the dry weather and wet weather (rainfall derived) flow components in the simulations. The dry weather flows and hourly diurnal patterns were directly entered, while the wet-weather component is calculated from the hour rainfall data that serves as model input. There are two mechanisms for rainfall to be converted into pipe flow; runoff and infiltration. Both of these are simulated in the model.

The model calibration was demonstrated by comparing results generated from 2004 rainfall data to actual measured 2004 measured flows based on the 2004 rainfall data is fairly good.

While all of the CSO tanks (existing, under construction and pending, refer to Table 20) and pumps are included in the model, the real-time control capabilities that are required to simulate the storage and draining functions have not yet been incorporated. For the purposes of the analysis, the operation of the tanks was simulated using a spreadsheet analysis of the model output.

The analysis considered all of the inputs into the various tanks and CSO outfalls, as well as the capacities of the interceptors where they discharge and the available primary and secondary/tertiary capacity at Woodward Avenue WWTP. When sufficient capacity was available in the interceptor sewer and the plant, then the tanks drain; when insufficient capacity in either the interceptor or the plant, they fill. Once the maximum CSO tank storage volume is reached, any additional flows would trigger an overflow to Hamilton Harbour. Similarly, flow to the plant would be treated up to the maximum secondary/tertiary treatment capacity, and/or the maximum primary treatment capacity, prior to bypassing into the Harbour.

The end results of the modelling are several time series (i.e., 7 months of hourly flow data), as follows:

- Total System Flows: This includes all of the flow generated from dry weather and rainfall into the Woodward Avenue WWTP collection system.
- Dry Weather Flows: This is the dry weather component of flows.
- Wet Weather Flows: This is the portion of system flows generated from rainfall.
- Into CSO Tanks: This is the flow into the CSO tanks.

- Out of CSO Tanks: This is the flow from the CSO tanks into the system (and ultimately to the Woodward Avenue WWTP).
- System CSO Into Harbour: This is the flow that overflows CSO tanks and CSO structures from the collection system into the Harbour.
- Woodward Avenue WWTP:
  - Bypass into Harbour
  - Primary effluent into Harbour
  - Secondary/tertiary effluent into Harbour.

These flow components were used with the effluent criteria to calculate hourly, monthly and annual loadings into the Harbour for each Option.

12.7.2 Rainfall Data Used in Modelling

The model was run as a continuous simulation for the seven-month period from April 1st to October 31st of both 1988 and 1989. These years were selected for the simulations as these were previously identified as "average years" in that the total rainfall volume, number of CSO events, and estimated CSO volume are all within 5% of the expected annual average.

As shown in the graphs in Appendix 1, 1988 rainfall data resulted in several smaller rainfall events and while relatively high volume, lower peak flows to system. Based on 1989 data, there were extreme rainfall events, resulting in high peak flows to system. Using years with these very different rainfall patterns ensures that 'average' years are well represented in the analysis.

12.8 WASTEWATER UNIT COSTS

For the development and evaluation of alternative solutions as well as for the development of the preferred solution capital program, financial analysis has been required. To facilitate this financial analysis, unit costing for the horizontal and vertical works have been derived.

These unit costs have been used as a benchmark tool to approximate the total project costs. However, where applicable, the cost estimates for each project have been refined based on unique aspects of the implementation or construction of the project.

The wastewater infrastructure capital cost estimates were developed using historical construction information for the City of Hamilton as well as recent project delivery costs trends.

Table 24 Unit Capital Costs for Wastewater Pumping Stations

Flow (L/s)	Unit Cost	Basis
<150	$1,250,000	Each
150-300	$17,000	Per L/s of flow capacity
300-450	$13,500	Per L/s of flow capacity
450-600	$11,000	Per L/s of flow capacity
600-750	$9,500	Per L/s of flow capacity
750-900	$8,500	Per L/s of flow capacity
>900	$7,500	Per L/s of flow capacity

Table 25 Unit Capital Costs for Wastewater Treatment Plants

Wastewater Treatment Plant	Unit Cost	Basis
New Plant and Plant Expansions	$1,300	Per m^3/d average flow capacity
Retrofits	$1,500	Per m3/d average flow capacity (allows for retrofitting into existing site

Table 26 Unit Capital Costs for Gravity Sewers

Diameter (mm)	3 m to 5 m		6 m to 10 m		11 m to 15 m	
	Urban	Rural	Urban	Rural	Urban	Rural
250	$612	$490	$1,312	$1,050	$2,312	$1,850
300	$620	$496	$1,320	$1,056	$2,320	$1,856
375	$634	$507	$1,509	$1,207	$2,759	$2,207
450	$657	$526	$1,707	$1,366	$3,207	$2,566
525	$705	$564	$1,930	$1,544	$3,680	$2,944
600	$766	$613	$2,166	$1,733	$4,166	$3,333
675	$846	$677	$2,421	$1,937	$4,671	$3,737
750	$940	$752	$2,515	$2,012	$4,765	$3,812
825	$1,157	$926	$2,907	$2,326	$5,407	$4,326
900	$1,411	$1,129	$3,161	$2,529	$5,661	$4,529
975	$1,723	$1,378	$3,648	$2,918	$6,398	$5,118
1050	$1,896	$1,517	$3,996	$3,197	$6,996	$5,597
1200	$2,155	$1,724	$4,430	$3,544	$7,680	$6,144
1350	$2,383	$1,906	$4,833	$3,866	$8,333	$6,666
1500	$2,642	$2,114	$5,267	$4,214	$9,017	$7,214
1650	$2,897	$2,318	$5,610	$4,488	$9,485	$7,588
1800	$3,152	$2,522	$5,952	$4,762	$9,952	$7,962
2100	$3,751	$3,001	$6,726	$5,381	$10,976	$8,781
2400	$4,384	$3,507	$7,534	$6,027	$12,034	$9,627
2700	$5,114	$4,091	$8,439	$6,751	$13,189	$10,551
3000	$5,844	$4,675	$9,344	$7,475	$14,344	$11,475

Table 27 Unit Capital Costs for Sanitary Forcemains

Forcemains		
Diameter (mm)	Unit Cost	
	Urban	Rural
150	$347	$277
200	$462	$370
250	$578	$462
300	$693	$555
350	$846	$677
400	$999	$800
450	$1,119	$895
500	$1,165	$932
600	$1,409	$1,127
750	$1,807	$1,445
900	$2,124	$1,699
1050	$2,574	$2,059

13. DEVELOPMENT OF WASTEWATER SERVICING ALTERNATIVES

In general, the overall objectives for the development of wastewater servicing alternatives are:

- Provide high level of service to existing users and approved growth
- Address current capacity deficiencies
- Review and mitigate impacts to natural, social and economic environments
- Best meet policy statements
- Ensure servicing meets the technical criteria
- Endeavour to optimize existing infrastructure
- Ensure the strategies are cost-effective and evaluate the life-cycle costs of the infrastructure.

13.1 WASTEWATER TREATMENT CONSIDERATIONS

There are three wastewater treatment plants in the City of Hamilton, as follows:

- Woodward Avenue Wastewater Treatment Plant
- Dundas Wastewater Treatment Plant
- Waterdown Wastewater Treatment Plant.

A review of the three wastewater treatment plants was undertaken to identify those factors that will affect the feasibility and the costs of providing capacity at each plant for new growth that will occur within the study area. The following points highlight some of the important considerations for each plant:

Woodward Avenue WWTP:

- The Woodward Avenue WWTP is the largest of the three plants with a current capacity of 409 ML/d. It typically services most of the study area, excluding only Dundas and the central portion of Waterdown.
- The plant has site capacity to expand from its existing 409 ML/d capacity.
- The plant discharges to Hamilton Harbour – a RAP Area of Concern – which poses stringent loading limits. Expansion beyond the 409 ML/d would require a higher level of treatment to meet the loading limits.
- A significant portion of the Woodward Avenue WWTP service area contains combined sewers, which results in significant peak flows to the plant, and bypasses to Hamilton Harbour through the 19 combined sewer overflows (CSOs) distributed throughout the combined sewer system.

Dundas WWTP:

- The Dundas WWTP currently has an average day rated capacity of 18 ML/d (208 L/s), and is not expected to require an expansion in order to meet the 2031 treatment requirements.
- The plant has limited site capacity for expansion based on the naturalized areas surrounding the plant.
- The plant discharges to Cootes Paradise – a RAP Area of Concern – which poses stringent loading limits. Expansion beyond its rated capacity would require a higher level of treatment to meet the loading limits.

Waterdown WWTP:

- The Waterdown SSTP currently has an average day rated capacity of 2.7 ML/d (31 L/s).
- There is no expansion capability at the plant site due to the naturalized and developed surroundings and the impact on discharges to the Grindstone Creek.
- In order to service additional development in Waterdown, either the plant will need to be expanded, or additional flows would need to be diverted to the Woodward Avenue WWTP or Dundas WWTP service areas.

13.2 WASTEWATER COLLECTION AND CONVEYANCE

Flow monitoring data collected in 2004 and baseline computer modelling have identified existing capacity limitations in some key sections of the existing collection system:

- Highway 403 trunk sewer
- Ancaster-to-Fennel trunk sewer
- Red Hill Creek Sanitary Interceptor.

These trunk sewer capacity limitations combined with the variability of peak flows under wet weather conditions for the combined sewer system indicates that system improvements are required to support conveying flows down the escarpment.

However, sections of the collection system such as the Eastern Interceptor and the Borer's Creek trunk sewer have available capacity to support wastewater servicing alternatives.

13.3 CONCEPTS FOR SERVICING NEW GROWTH

The long list of alternative solutions were developed based on the following concepts for servicing new growth:

- "Do nothing"
- Limit community growth

- Maximize capacity at existing treatment plant sites
- Construct a new wastewater treatment plant (potentially on the Mountain or east Hamilton/Stoney Creek
- Utilize and/or build treatment capacity in coordination with neighbouring municipalities
- Construct new trunk sewers down the escarpment
- Construct new west sewer interceptor
- Construct new and/or expand existing CSO (combined sewer overflow) facilities (including tanks and overflow pipes)
- Provide treatment at CSO facilities
- Construct new and/or expand existing wastewater pumping stations
- Upgrade and/or rehabilitate existing trunk sewer infrastructure within existing urban area.

Through preliminary evaluation of the long list of alternatives, a number of limiting factors and natural features that impact the analysis were established.

- Existing capacity of the WWTPs is less than the total required to service new growth
- Significant expansion capacity is available at the Woodward Avenue WWTP
- Limited expansion capacity is available at the Dundas WWTP
- No expansion capacity is available at the Waterdown WWTP
- The Airport Lands urban boundary expansion area generally slopes to the south thus requiring wastewater flows to be pumped back to the existing system. Three alternatives contemplated included:
  - pump flows along Highway 6 to the Red Hill Creek Sanitary Interceptor
  - pump flows north through Ancaster to the Western Interceptor system, or
  - pump flows east along a new sewer trunk down the escarpment ultimately to the Eastern Interceptor
- The Southeast Mountain urban boundary expansion area could be serviced through the Red Hill Creek Sanitary Interceptor system, or through a new Centennial Parkway trunk sewer to the Eastern Interceptor System
- The servicing study for the Rymal Road Planning Area (ROPA 9) identified the need for extensive upgrades to the Red Hill Creek Sanitary Interceptor prior to full build-out of ROPA 9.

13.3.1 "Do Nothing"

This alternative is traditionally carried forward as a benchmark. This alternative would not address current capacity limitations in the wastewater system. It would also not provide for additional capacity needed to service approved growth. This would ultimately lead to significant drop in level of service, wastewater conveyance issues and resulting overflows, and inability to meet water quality criteria for the Hamilton Harbour. This option would also not meet the goals and objectives of the GRIDS process and Vision 2020 including servicing approved growth, providing sustainable water systems, or providing high level of service to existing water service areas. This is not carried forward for evaluation because it is not reasonable and feasible and does not address the problem/opportunity statement.

13.3.2 Limit Community Growth

This alternative would generally consist of limiting growth to within the existing system capacities. Under this alternative, however, existing system deficiencies, including continued uncontrolled overflows, inability to meet HHRAP and F-5-5 targets, treatment and conveyance capacity limitations, would not be addressed. Under Places to Grow, the City is required to plan for future residential and employment growth. This growth and the goals and objectives of the GRIDS process and Vision 2020 would not be met. Plus the preferred growth option under GRIDS was approved by City of Hamilton Council and does require additional servicing capacity. This is not considered a viable option.

13.3.3 Construction of new Wastewater Treatment Facilities

This alternative would require the construction of new Wastewater Treatment Facilities. Locating (a) new Wastewater Treatment Plant(s) would be evaluated to optimize servicing for new growth and to achieve water quality goals for the Hamilton Harbour. Two general locations were considered:

- On the south mountain close to the planned growth area, and either discharging to local streams or have a new piped effluent to the Harbour or lake.
- East of Woodward Ave. WWTP to facilitate discharge directly to Lake Ontario.

The south mountain option has limitations given that the new plant would service primarily only areas in the south mountain and would require significant changes to the collection system (including pumping) to increase the service area. Also, being at the headwaters of the rivers in the area, there is little anticipated assimilative capacity for discharging to the either the Grand River, Welland River, Twenty Mile Creek or possibly Forty Mile Creek subwatersheds. Otherwise, discharge down the escarpment to Lake Ontario would be required which would result in a costly effluent discharge outfall.

East Stoney Creek was considered as a potential site for a new WWTP in order to facilitate effluent discharge to Lake Ontario. However, based on the current and planned development including waterfront residential, there is limited availability for sites.

Also, the current investment in infrastructure does not easily support re-direction of service to the east. All trunk infrastructure has been designed to flow to Woodward Ave. WWTP. The existing eastern interceptor, while it does have existing surplus capacity, conveys flows east to west by gravity. The eastern interceptor will also not realize its capacity needs based

on the location of growth under the preferred GRIDS growth option. This is also a function of the defined greenbelt boundary which contradicted previous servicing planning studies undertaken by the City which anticipated south Stoney Creek growth.

However, given that there is site capacity at the Woodward Ave. WWTP and all existing infrastructure is designed for conveyance to this site, this alternative does not meet the intent of maximizing the use of existing infrastructure or Policy G.06. It also does not efficiently address improvements required at the Woodward Ave. WWTP to meet capacity and water quality goals of HHRAP and F-5-5.

This alternative was not short-listed.

13.3.4 Coordination of Wastewater Servicing with Neighbouring Municipalities

The City currently has water interconnections with Halton, Haldimand and Niagara. Given that a large portion of the growth is located on the south mountain, and that the natural topography slopes to the south, discussions with Haldimand County were undertaken to determine the feasibility of coordinating wastewater services.

The primary location considered was Caledonia. However, the existing wastewater treatment plant does not have sufficient capacity to treat additional flows from Hamilton. To pursue this option, a trunk sewer would need to be extended through the Greenbelt south to Caledonia and a new treatment plant would need to be constructed. Preliminary discussions indicated that there were limited potential property options to support this alternative. This alternative would require assimilative capacity analysis to determine the feasibility of additional discharge to local surface waters most likely ultimately to the Grand River. Significant coordination for approvals would be required under this alternative based on potential cross-watershed servicing, coordination of services between multiple municipalities, crossing the greenbelt, and proximity to Six Nations. Through discussions with Caledonia, it had not been determined whether a wastewater treatment plant expansion at a new site was a priority for their own servicing needs.

This alternative was not short-listed.

13.3.5 Construction of a New Outfall for Woodward Avenue WWTP to Lake Ontario

This alternative was considered in order to reduce or eliminate discharges to the Hamilton Harbour and support complying with HHRAP and F-5-5 objectives. However, the HHRAP Stage 2 document states that "diversion of WWTP effluent to Lake Ontario be considered only after all other practical and technological feasible options have been implemented." Also, the Stage 2 document goes on to state "to not discharge WWTP effluent to Lake Ontario unless absolutely necessary and if deemed necessary, it is to be subject to BARC, BAIT and public discussion of the issues involved."

This alternative would require locating a new outfall into Lake Ontario with sufficient separation from existing WTP intakes and from significant environmental and public use features in the Lake and along the shoreline. While the direct influence of HHRAP may be reduced, upgrades to plants discharging to Lake Ontario have been subject to increasingly more stringent criteria as well (noting Halton, Peel, Toronto plants). As such, this alternative does not imply a reduced level of treatment would be acceptable or approved.

This alternative would not address treatment capacity and constraint issues on its own and would require coordination with additional servicing components. The Woodward Ave. WWTP would still require expansion.

Given that there are other feasible options, and based on the environmental and approval issues, this alternative was given lower priority and was not short-listed.

13.3.6 Capture and Treatment of Wastewater Flows Utilizing CSO tanks

This alternative is consistent with previous studies undertaken in the City of Hamilton. It would involve construction of additional Combined Sewer Overflow tanks along the western interceptor at the Hamilton Harbour. Additional conveyance upgrades would be required within isolated areas of the collection system. It is anticipated that the HHRAP and F-5-5 targets could be achieved using additional CSO tanks. Real Time Control of the tanks, including inlet control and repumping of tank contents back to the trunks sewers would further enhance the efficiency of the collection system. There would also be refinement to the level of expansion required at the Woodward Ave. WWTP. This alternative is considered a viable option.

13.3.7 Conveyance and Treatment of Wastewater Flows Utilizing New Trunk Sewer Infrastructure

This alternative would involve upgrades to the Woodward Ave. WWTP and construction of trunk sewer infrastructure and conveyance upgrades to convey additional wastewater and wet weather flows to the Woodward Ave. WWTP site. The rationale for this alternative is to reallocate costs required for CSO tanks to the conveyance upgrades. This alternative would also address current conveyance limitations in the western sewer system and upgrade requirements at the Woodward Ave. WWTP. It is anticipated that the HHRAP and F-5-5 targets could be achieved using a combination of conveyance capacity, eliminating additional CSO tanks along the western interceptor, Real Time Control of the system and sufficient capacity at the Woodward Ave. WWTP. This alternative was considered a viable option.

13.4 OVERVIEW OF WASTEWATER SERVICING ALTERNATIVES

The preliminary evaluation of the long list of alternatives led to the development of several wastewater servicing alternatives. Due to the independent servicing needs in different areas of the City of Hamilton wastewater system, the study area was divided into multiple servicing areas to more clearly evaluate the alternatives. The evaluation within each servicing area was then integrated to ensure the comprehensive preferred solution met all objectives system wide.

A number of servicing options were developed for providing wastewater treatment capacity for the urban buildout scenario. Servicing alternatives were developed for the following key servicing issues:

- Wastewater servicing within the former Towns of Waterdown and Dundas
- Southeast Mountain urban boundary expansion area, which also includes lands already approved for development through ROPA 9

- Airport Lands urban boundary expansion area
- Combined Sewer Overflow (CSO) control.

The wastewater servicing alternatives are presented in Table 28.

Table 28 Wastewater Servicing Alternatives

Servicing Area	Alternative ID	Description
Waterdown-Dundas Servicing	WD-WWS-1	The existing servicing areas remain unchanged Central Waterdown serviced through an expanded Waterdown WWTP North and South Waterdown and all of Dundas serviced through an expanded Dundas WWTP
	WD-WWS-2	Decommission Waterdown WWTP, and send all Waterdown flows through the Dundas diversion structure to the Woodward Avenue WWTP. Do nothing at Dundas WWTP, and send excessive flows through the Dundas diversion structure to the Woodward Avenue WWTP.
	WD-WWS-3	Decommission Waterdown WWTP, and send all Waterdown flows to an expanded Dundas WWTP.
	WD-WWS-4	Decommission Waterdown and Dundas WWTPs, and send all Waterdown and Dundas flows through an expanded Dundas diversion structure to the Woodward Avenue WWTP.
Southeast Mountain	SEM-WWS-1	Pump the flows from the Southeast Mountain servicing area to the Red Hill Creek Interceptor System.
	SEM-WWS-2	Service the Southeast Mountain servicing area through a new Centennial Parkway trunk sewer to the Eastern Interceptor System.
Airport Lands	AL-WWS-1a	Collect flows at a single pumping station in the south of the Airport Lands; pump through Ancaster to the Western Interceptor System.
	AL-WWS-1b	Collect flows at a pumping station in the south of the Airport Lands and an intermediate station in the middle of the Airport Lands; pump through Ancaster to the Western Interceptor System.
	AL-WWS-2	Collect flows at a single pumping station in the south of the Airport Lands; pump along Highway 6 to the Red Hill Creek Interceptor system.
	AL-WWS-3	Collect flows at a single pumping station in the south of the Airport Lands; pump along Highway 6 to a new gravity trunk along Dickenson Road and Centennial Parkway to the Eastern Interceptor system.
CSO Control	CSO-WWS-1	Construct additional CSO tanks at the remaining uncontrolled outfalls in order to meet Procedure F-5-5 system-wide.
	CSO-WWS-2	Construct additional conveyance capacity in order to reduce the number of CSO events, and instead treat those flows at the expanded Woodward Avenue WWTP.

14. DESCRIPTION AND EVALUATION OF WASTEWATER SERVICING ALTERNATIVES

14.1 WATERDOWN/DUNDAS WASTEWATER SERVICING ALTERNATIVES

Under the 2031 growth scenario, the total average day flows for the Waterdown service area are expected exceed the rated treatment capacity at the Waterdown plant. The projected flows in the Dundas WWTP service area approach but do not exceed the plant rated capacity.

There currently exists a wastewater diversion structure and storage tank to the east of the Dundas WWTP. Under normal operating conditions, this diversion structure receives wastewater flows from the northern and southern portions of Waterdown, and pumps them along Cootes Drive into the Woodward Avenue system. Under extreme wet-weather conditions, flows in excess of the peak capacity of the Dundas WWTP are also sent through the diversion structure to the Woodward Avenue WWTP system.

Based on the baseline review of the Woodward Ave. WWTP and the projected flows in its service area, the Woodward Ave. WWTP will require upgrades. The City is considering decommissioning either or both of the Dundas and Waterdown plants, in favour of centralizing the treatment operations. Doing so could have the following benefits:

- Reduce operational costs by avoiding the duplication of facilities and treatment processes
- Reduce loadings to Cootes Paradise associated with the effluent from the Dundas and Waterdown plants
- Potentially avoid substantial capital costs associated with upgrading or repairing the Dundas and Waterdown plants.

Four servicing options have been developed regarding the future wastewater treatment for the communities of Dundas and Waterdown. These will be further described and evaluated in the following sections.

14.1.1 Alternative WD-WWS-1

Description and Infrastructure Requirements

Alternative WD-WWS-1 would maintain the status quo, which is as follows:

- The central portion of Waterdown would be serviced through the Waterdown WWTP.
- The northern and southern portions of Waterdown would be serviced at the Woodward Avenue WWTP, through the Borer's Creek trunk sewer and the Dundas diversion structure.
- All Dundas flows would be treated at the Dundas WWTP, with extreme wet weather events potentially bypassing to the Dundas diversion structure, and ultimately to the Woodward Ave WWTP.

The servicing schematic for this alternative is provided in Figure 15a.

Under this alternative, the average day capacity of the Waterdown WWTP would need to be increased from 2.7 ML/d to 3.7 ML/d. Part of this upgrade would address the current capacity shortfall, and the balance would service future growth.

Under this alternative, there are no upgrades for additional capacity required at the Dundas WWTP.

Capital Cost

The estimated capital costs associated with increasing the existing capacity of the Waterdown WWTP by 33 percent is estimated to be in an order of magnitude of $10 million.

Timing and Phasing Issues

The average day flow to the Waterdown WWTP currently exceeds the plant's rated capacity. While the plant is still operating below its effluent loading limits, the existing capacity shortfall should be addressed immediately, taking into consideration future flows to the plant.

Impact Assessment

The potential for impacts associated with Alternative WD-WWS-1 was assessed, and options for mitigation of these impacts were reviewed. Details on the assessment are included in the following paragraphs.

Natural Environment Factors:

This alternative carries significant potential impacts to the natural environment due to the effects that the plant effluent has on Cootes Paradise. Cootes Paradise is a very significant wetland, and is protected under the Hamilton Harbour Remedial Action Plan. As such the City should be trying to limit the loadings to Cootes Paradise.

The Waterdown WWTP discharges to Cootes paradise via Grindstone Creek. A high percentage of the flow in Grindstone Creek consists of treated effluent from the plant. As such, a 33 percent increase in the treated flows at the plant would have a significant impact on the flows within Grindstone Creek. This could lead to erosion within the creek, impacts to existing vegetation and aquatic species, and possibly even change the course that the creek currently follows.

Socio-Cultural Factors:

Waterdown is a very small community, and there are a number of residential land uses not far from the WWTP. As such, any expansion of the plant could increase odours associated with the treatment processes, impacting the residents of the community.

Legal-Jurisdictional Factors:

It is not anticipated that any additional land would be required for an expansion of the Woodward Avenue WWTP.

Technical Factors:

The Waterdown WWTP is an aging facility, so it is questionable as to whether the facility should be expanded to the degree required to treat flows from the existing service area.

Maintaining the facility in operation and increasing its capacity will require ongoing and increased operations and maintenance costs.

Economic Factors:

This alternative carries a relatively high cost when compared against the benefits derived from the potential expansion of the treatment processes. The same treatment capacity could be installed at the Woodward Avenue WWTP at a lower cost.

14.1.2 Alternative WD-WWS-2

Description and Infrastructure Requirements

Alternative WD-WWS-2 would result in the following servicing for Waterdown and Dundas:

- The Waterdown WWTP would be decommissioned, and replaced with a sewage pumping station
- The southern portion of Waterdown would continue to flow by gravity to the Borer's Creek trunk sewer and the Dundas diversion structure
- The northern and central portions of Waterdown would be pumped to the Borer's Creek trunk sewer, and these flows would also be treated at the Woodward Avenue WWTP
- All Dundas flows would be treated at the Dundas WWTP, with extreme wet weather events potentially bypassing to the Dundas diversion structure.

The servicing schematic for this alternative is provided in Figure 15b.

Capital Cost

The capital cost estimate for infrastructure required for the 2031 development scenario for Alternative WD-WWS-2 is presented in Table 29.

Table 29 Capital Cost of Servicing Alternative WD-WWS-2

Description	Cost (Millions)
Decommission Waterdown WWTP	$ 0.50
New Waterdown SPS	$ 6.00
New Waterdown SPS Forcemain	$ 1.80
Woodward Avenue WWTP Upgrades	$ 3.70
Total for Alternative WD-WWS-2	**$ 12.00**

Timing and Phasing Issues

The current average day flow rate to the Waterdown plant is already approaching and exceeding the plant's rated capacity. As such, there is no capacity at the existing facility to accommodate any additional development. While the plant is meeting its effluent requirements, the existing capacity shortfall should be addressed immediately.

Impact Assessment

The potential for impacts associated with Alternative WD-WWS-2 was assessed, and options for mitigation of these impacts were reviewed. Details on the assessment are included in the following paragraphs.

Natural Environment Factors:

This alternative would result in only positive environmental impacts with the decommissioning of the Woodward WWTP; a significant source of pollutant loadings to Cootes Paradise will be eliminated.

Decommissioning of the Waterdown WWTP would result in a decrease of baseflow to the Grindstone Creek. However, through coordination with review agencies, it has been agreed that it is not an environmentally sound practice to rely on effluent from a wastewater treatment plant to maintain baseflow in a creek.

Socio-Cultural Factors:

From a social perspective, replacing the WWTP with a sewage pumping station is expected to have negligible impact to the community. Only temporary disruption during construction is expected. In addition, the facility can be architecturally blended in with the surroundings.

Legal-Jurisdictional Factors:

It is not anticipated that any additional land would be required for construction of a new sewage pumping station on the plant site prior to decommissioning of the plant.

Technical Factors:

Aside from the new sewage pumping station to replace the treatment plant, no additional system upgrades will be required under this alternative. The existing equalization tank and sewage pumping station at the Dundas diversion are appropriately sized to accommodate the increased flows from Waterdown.

Because there will be no increase required in the firm pumping capacity of the sewage pumping station, the peak flow rate conveyed to the Woodward Avenue WWTP system will not increase. This will therefore lead to negligible impacts at the Woodward Avenue WWTP.

Economic Factors:

Operation and maintenance costs for the sewage pumping station versus the existing Waterdown WWTP will be decreased.

14.1.3 Alternative WD-WWS-3

Alternative WD-WWS-3 would result in the following servicing for Waterdown and Dundas:

- The Waterdown WWTP would be decommissioned, and replaced with a sewage pumping station.
- The southern portion of Waterdown would continue to flow by gravity to the Borer's Creek trunk sewer and the Dundas diversion structure.
- The northern and central portions of Waterdown would also be pumped to the Borer's Creek trunk sewer, and ultimately to the Dundas diversion structure.
- The Dundas diversion structure would be expanded and retro-fitted such that the Waterdown flows are pumped to the Dundas WWTP instead of the Woodward WWTP.
- The Dundas WWTP would have to be upgraded to accommodate the Waterdown flows.

The servicing schematic for this alternative is provided in Figure 15c.

Under this alternative, the average day capacity of the Dundas WWTP would need to be increased from 18 ML/d to 31 ML/d.

Capital Cost

The capital cost estimate for infrastructure required for the 2031 development scenario for Alternative WD-WWS-3 is presented in Table 30.

Table 30 Capital Cost of Servicing Alternative WD-WWS-3

Description	Cost (Millions)
Decommission Waterdown WWTP	$ 0.50
New Waterdown SPS	$ 6.00
New Waterdown SPS Forcemain	$ 1.80
Dundas WWTP Upgrades	$ 15.60
Total for Alternative WD-WWS-3	**$ 23.90**

Timing and Phasing Issues

Treating all of the wastewater generated in Waterdown at the Dundas WWTP would require a significant upgrade at the Dundas plant. The construction period of the Dundas WWTP plant could impact the development rate in Dundas as well as Waterdown. Ability to keep the existing plant operating at full capacity during construction can be an obstacle.

Impact Assessment

The potential for impacts associated with Alternative WD-WWS-3 was assessed, and options for mitigation of these impacts were reviewed. Details on the assessment are included in the following paragraphs.

Natural Environment Factors:

This alternative carries significant potential impacts to the natural environment due to the effects that the plant effluent has on Cootes Paradise. Cootes Paradise is a very significant wetland, and is protected under the Hamilton Harbour Remedial Action Plan. As such the City should be trying to limit the loadings to Cootes Paradise.

Decommissioning of the Waterdown WWTP would result in a decrease of baseflow to the Grindstone Creek. However, through coordination with review agencies, it has been agreed that it is not an environmentally sound practice to rely on effluent from a wastewater treatment plant to maintain baseflow in a creek.

Socio-Cultural Factors:

Dundas is a fairly small community, and there are a residential land uses in the vicinity of the existing WWTP. As such, any expansion of the plant could increase odours associated with the treatment processes, impacting the residents of the community.

Legal-Jurisdictional Factors:

Significant coordination with review agencies would be required to establish acceptable treatment and effluent targets and objectives.

Technical Factors:

The Dundas WWTP is an aging facility, so it is questionable as to whether the facility should be expanded to the degree required to treat flows from the combined Waterdown and Dundas service areas.

On the other hand, the Dundas WWTP is currently in good operational condition, and is operating below its rated capacity. From a technical perspective, there is no reason to decommission the plant at this time.

Economic Factors:

This alternative carries a relatively high cost when compared against the benefits derived from the potential expansion of the treatment processes. The same treatment capacity could be installed at the Woodward Avenue WWTP for a much lower cost.

14.1.4 Alternative WD-WWS-4

Alternative WD-WWS-4 would result in the following servicing for Waterdown and Dundas:

- The Waterdown and Dundas WWTPs would both be decommissioned, with flows from their existing service areas instead directed to the Dundas diversion structure.
- The Dundas diversion tank would need to be expanded to a total volume of 17,000 m^3 to provide equalization storage for the combined Waterdown/Dundas service area.

- The pumping capacity of the Dundas diversion structure and the receiving trunk sewer in the Woodward Avenue WWTP system would both need to be upgraded in order to accommodate the increased flows.
- The combined treatment capacities of the Waterdown and Dundas WWTPs would be required at the Woodward Avenue WWTP.

The servicing schematic for this alternative is provided in Figure 15d.

Capital Cost

The capital cost estimate for infrastructure required for the 2031 development scenario for Alternative WD-WWS-4 is presented in Table 31.

Table 31 Capital Cost of Servicing Alternative WD-WWS-4

Description	Cost (Millions)
Decommission Waterdown WWTP	$ 0.50
New Waterdown SPS	$ 6.00
New Waterdown SPS Forcemain	$ 1.80
Decommission Dundas WWTP	$ 0.50
Expand the Dundas Diversion Tank	$ 4.25
Install additional pumping capacity at the Dundas Diversion Structure	$ 0.20
Upgrades to the receiving sewer	$ 6.00
Woodward Avenue WWTP Upgrades	$ 31.00
Total for Alternative WD-WWS-4	**$ 50.45**

Timing and Phasing Issues

Because this alternative requires an upgrade to both the equalization tank and the sewage pumping station at the Dundas diversion, the Dundas WWTP could not be decommissioned until substantial upgrades were completed along the Western Sanitary Interceptor.

Impact Assessment

The potential for impacts associated with Alternative WD-WWS-4 was assessed, and options for mitigation of these impacts were reviewed. Details on the assessment are included in the following paragraphs.

Natural Environment Factors:

This alternative would result in positive environmental impacts. With the decommissioning of the Woodward and Dundas WWTPs, two sources of loadings to the Grindstone Creek and Cootes Paradise would be eliminated.

Decommissioning of the Waterdown WWTP would result in a decrease of baseflow to the Grindstone Creek. However, through coordination with review agencies, it has been agreed that it is not an environmentally sound practice to rely on effluent from a wastewater treatment plant to maintain baseflow in a creek.

Socio-Cultural Factors:

From a social perspective, replacing the WWTPs with sewage pumping stations is expected to be very well received by the communities.

Legal-Jurisdictional Factors:

This alternative does not carry any additional land acquisition considerations, as there is sufficient site capacity at the Woodward Avenue WWTP to service the entire Service Area.

Technical Factors:

This alternative would require significant upgrades of the Western Sanitary Interceptor, and might also require that the existing Main-King CSO tanks be reconfigured due to the increased average day flows that would be present at that location.

The Dundas WWTP is currently in good operational condition, and is operating below its rated capacity. From a technical perspective, there is no reason to decommission the plant at this time.

Economic Factors:

While the City would benefit by consolidating all of its wastewater treatment operations at a single location, the capital costs associated with the system upgrades that would be triggered are substantial.

14.1.5 Information Matrix for Waterdown/Dundas Wastewater Servicing Alternatives

Table 32 presents a comparison of the costs and impacts of the Waterdown/Dundas wastewater servicing alternatives.

14.1.6 Preliminary Selection of the Preferred Waterdown/Dundas Servicing Alternative

Alternative WD-WWS-2 is preliminarily selected as the preferred servicing alternative for Waterdown and Dundas, with the following rationale:

- This alternative addresses the existing capacity issues at the Waterdown WWTP, while minimizing the new infrastructure requirements
- This alternative makes the most effective use of existing treatment capacity, without triggering an expansion of an aging plant
- Because the peak flows to the Western Interceptor will not change, this alternative will have little downstream impacts
- Because there are no major infrastructure upgrades required, this alternative will allow for earlier development in Waterdown than the other alternatives considered
- This alternative carries the lowest capital cost of the alternatives considered.

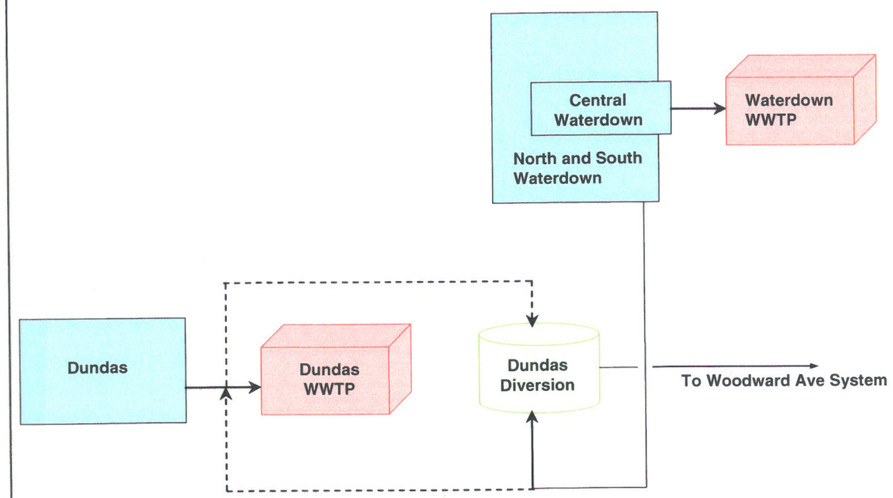


Figure 14a – Maintain existing service areas.
Waterdown WWTP expansion required.

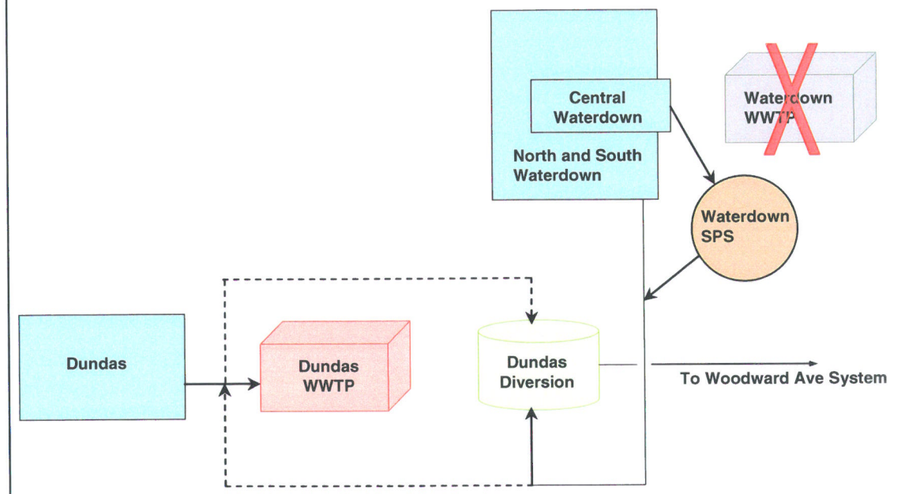


Figure 14b – Decommission Waterdown WWTP; pump flows to Borer's Creek Trunk Sewer.
Borer's Creek Trunk Sewer conveys flow to the Dundas diversion.
New Waterdown SPS required.

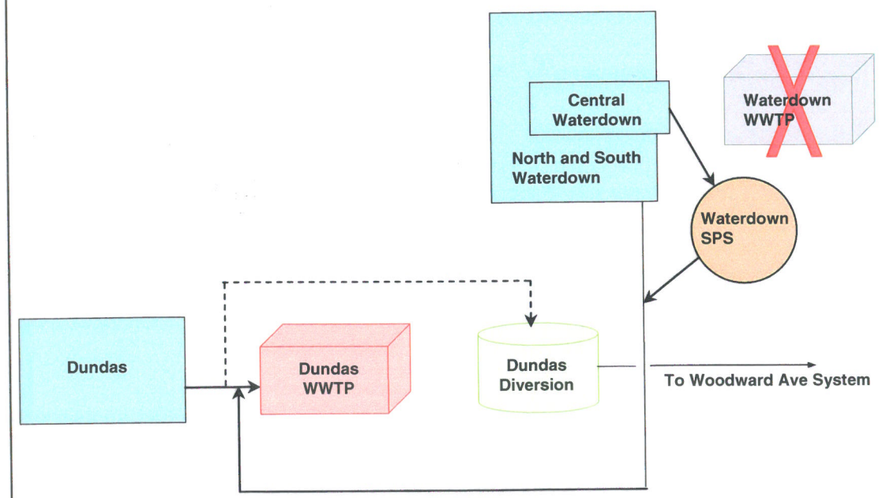


Figure 14c – Decommission Waterdown WWTP; pump flows to Borer's Creek Trunk Sewer.
Borer's Creek Trunk Sewer conveys flow to the Dundas WWTP.
Dundas WWTP expansion required.

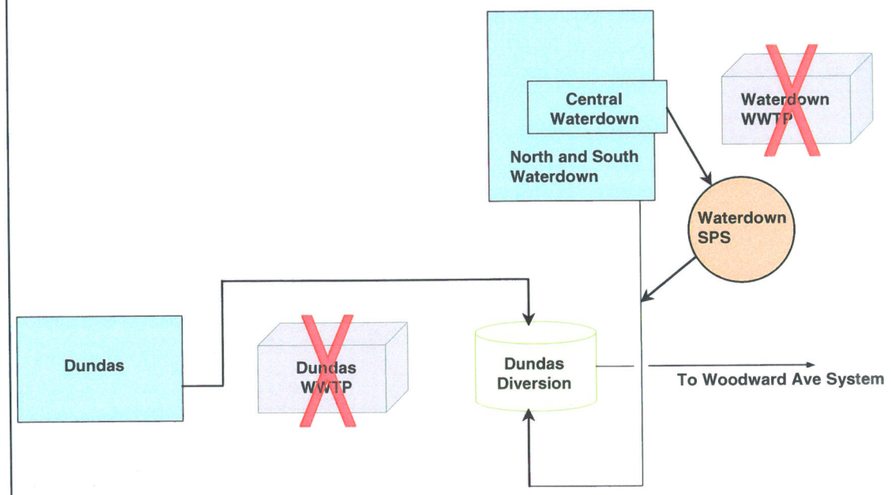


Figure 14d – Decommission Waterdown WWTP and Dundas WWTP.
Increase equalization tank volume and pumping capacity at the diversion.
Western Sanitary Interceptor upgrades required.

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Integrated Water & Wastewater Master Plan

Waterdown / Dundas
Wastewater Servicing Alternative Schematics

KMK Consultants Limited

Figure 15

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Table 32 Information Matrix of Waterdown/Dundas Wastewater Servicing Alternatives

Evaluation Criteria	WATERDOWN/DUNDAS WASTEWATER SERVICING – ALTERNATIVE 1	WATERDOWN/DUNDAS WASTEWATER SERVICING – ALTERNATIVE 2	WATERDOWN/DUNDAS WASTEWATER SERVICING – ALTERNATIVE 3	WATERDOWN/DUNDAS WASTEWATER SERVICING – ALTERNATIVE 4
Description	♦ The existing servicing areas remain unchanged ♦ Central Waterdown serviced through an expanded Waterdown WWTP ♦ North and South Waterdown and all of Dundas serviced through an expanded Dundas WWTP	♦ Decommission Waterdown WWTP, and send all Waterdown flows through the Dundas diversion structure to the Woodward Avenue WWTP. ♦ Do nothing at Dundas WWTP, and send excessive flows through the Dundas diversion structure to the Woodward Avenue WWTP.	♦ Decommission Waterdown WWTP, and send all Waterdown flows to an expanded Dundas WWTP.	♦ Decommission Waterdown and Dundas WWTPs, and send all Waterdown and Dundas flows through an expanded Dundas diversion structure to the Woodward Avenue WWTP.
Natural Environment Factors	♦ Loadings to Cootes Paradise would increase ♦ Increased plant effluent could have a significant impact on the Grindstone Creek (erosion, loss of vegetation, impact to aquatic species)	♦ Only positive. A significant source of pollutant loading would be removed from Cootes Paradise ♦ Removing the plant effluent could result in very low baseflow in the Grindstone Creek during dry periods of the year.	♦ Overall loadings to Cootes Paradise would increase	♦ Only positive. A significant source of pollutant loading would be removed from Cootes Paradise ♦ Removing the plant effluent could result in very low baseflow in the Grindstone Creek during dry periods of the year.
Socio-Cultural Factors	♦ Construction noise during the WWTP expansion ♦ Potential for increased odours from the plant, which might affect nearby residents	♦ This alternative is likely to be well received by the community	♦ Construction noise during the WWTP expansion ♦ Potential for increased odours from the plant, which might affect nearby residents	♦ This alternative is likely to be well received by the communities
Legal-Jurisdictional Factors	♦ None. No additional land would be required	♦ None. The new SPS could be built on the existing WWTP site	♦ This alternative might require additional land for expansion of the Dundas WWTP	♦ None. No additional land would be required
Technical Factors	♦ Limitations in expanding the Waterdown WWTP ♦ It is an aging facility, so there is limited value in a significant upgrade	♦ Will require a new SPS ♦ No impact is anticipated to the Woodward Avenue WWTP system	♦ Limitations in expanding the Dundas WWTP ♦ It is an aging facility, so there is limited value in a significant upgrade	♦ This alternative would trigger significant upgrades to the Dundas diversion structure and pumping station, and also to the Western Interceptor. ♦ This would require replacement of existing plant capital at the Woodward Ave WWTP
Economic Factors	♦ High cost with no tangible benefit	♦ Lowest capital cost of the alternatives considered	♦ High cost with no tangible benefit	♦ While there would be long-term operational savings, this alternative carries significant up-front costs.
Overall Alternative Rank				

Most Preferred **Least Preferred**

14.2 SOUTHEAST MOUNTAIN WASTEWATER SERVICING ALTERNATIVES

14.2.1 Servicing Area

The Southeast Mountain urban boundary expansion area will provide much of the residential land required under the 2031 development plan. The full extent of this urban boundary expansion is shown in Figure 2.

Upon full buildout of this area, which is anticipated by 2031, this area is expected to have a population of over 41,000 residents, and will provide 3,500 jobs. Development of this area is anticipated to begin in 2014, but 90 percent of the forecasted growth will occur between 2021 and 2031.

The Rymal Road Planning Area is included within this area. The servicing study for the Rymal Road Planning Area had previously identified the need for additional trunk sewer capacity for full buildout. It indicated that extensive upgrades to the Red Hill Creek Sanitary Interceptor would be required. This area is already approved for development through ROPA 9.

The topography of the Southeast Mountain area generally slopes to the south towards Binbrook. Only the northeast portion of the area bounded by Mud Road, Upper Centennial Parkway, Highland Road and Second Road has the opportunity of draining by gravity to a portion of the existing wastewater collection system.

Two wastewater servicing alternatives have been developed for the Southeast Mountain, and these are further described in the following sections.

14.2.2 Alternative SEM-WWS-1

Description and Infrastructure Requirements

Alternative SEM-WWS-1 is based on servicing the Southeast Mountain Area – including ROPA 9 – through existing infrastructure in the surrounding areas, where possible:

- The northeast portion would be serviced by gravity through the Felker Trunk to the RHCSI
- The balance of the area would be pumped from a pumping station located at the lowest point in the area (near the intersection of Golf Club Road and Highway 56) to the Davis Creek trunk sewer, and ultimately the Red Hill Creek Sanitary Interceptor.

The infrastructure requirements for this alternative are presented in Figure 16.

This alternative would require a 1,000 L/s sewage pumping station, which would be sized to service the Southeast Mountain area and the existing serviced areas in Binbrook. The combined Southeast Mountain and Binbrook flows would then be pumped into the Davis Creek Trunk via a twinned 600 mm forcemain.

Due to existing capacity limitations in the RHCSI, the Red Hill Valley CSO Tunnel (which is currently under construction) would have to be extended in both the upstream and

downstream directions, such that it runs from the Greenhill CSO Tanks to the Woodward Avenue WWTP.

Capital Cost

The capital cost estimate for infrastructure required for the 2031 development scenario for Alternative SEM-WWS-1 is presented in Table 33.

Table 33 Capital Cost of Servicing Alternative SEM-WWS-1

Description	Cost (Millions)
Sewage Pumping Station (1,000 L/s)	$ 6.50
Twin Existing 600 mm Forcemain (2,000 m)	$ 4.50
RHCSI Upgrades (6,000 m)	$ 45.00
Total for Alternative SEM-WWS-1	**$ 56.00**

Timing and Phasing Issues

The east portion of ROPA 9 and the second phase of Binbrook development are pending construction of the additional trunk infrastructure.

Impact Assessment

The potential for impacts associated with Alternative SEM-WWS-1 was assessed, and options for mitigation of these impacts were reviewed. Details on the assessment are included in the following paragraphs.

Natural Environment Factors:

This alternative carries significant impacts to the natural environment due to the extensive construction activities that would be required within the Red Hill Creek Valley.

Socio-Cultural Factors:

Due to the predominant land use within the Southeast Mountain urban boundary expansion area being residential, there would be a high likelihood that the required sewage pumping station would be situate adjacent to residential land uses. Opportunities might arise that would mitigate the impact of the pumping station siting, but those cannot be anticipated at this time.

A more significant social impact would result from the construction activities required to expand the RHCSI. The Red Hill Valley Expressway will be in service by the time that these construction activities would need to be scheduled, resulting in significant delays to commuters soon after the Expressway is put into service.

Legal-Jurisdictional Factors:

The City would need to secure a site for the pumping station near the intersection of Golf Club Road and Highway 56.

Depending on the final alignment of the forcemains and gravity sewers, easements might also be required.

Technical Factors:

The main technical consideration under this alternative lies in the difficulties that would be encountered in increasing the capacity of the RHCSI, especially considering it's proximity to the Expressway. It would be impractical to begin significant new construction activities so soon after the completion of the highly controversial Red Hill Valley Expressway project.

Economic Factors:

Due to the expected difficulties associated with upgrading the RHCSI, this alternative carries an extremely high capital cost.

The annual operation costs associated with the new sewage pumping station are expected to be moderate.

14.2.3 Alternative SEM-WWS-2

Description and Infrastructure Requirements

Wastewater Servicing Alternative SEM-WWS-2 is based on the entire service area draining to a deep trunk sewer along Centennial Parkway. The depth of the sewer would eliminate the need for a sewage pumping station, and would also permit servicing of the Airport Lands through the Centennial Trunk.

Instead of directing the flows associated with ROPA 9, Binbrook and the Urban Boundary expansion areas to sewers or interceptors with existing capacity limitations, this alternative would make use of existing unused capacity in the Eastern Sanitary Interceptor. Since the Red Hill Creek Sanitary Interceptor carries combined sewage from the Fennell Trunk, servicing the Southeast Mountain lands through the fully-separated Eastern Interceptor system conforms with the City's policy of providing separated storm and sanitary sewers for new development.

This alternative would require construction of a 1,200 mm trunk sewer along Upper Centennial. Due to the required sewer depth required to facilitate gravity flow, some sections would need to be tunnelled. The total length of the new sewer would be approximately 8,000 m, with approximately 1,000 m of that length being more than 10 m below the existing grade.

The proposed Centennial Trunk Sewer could discharge into the existing Battlefield Trunk sewer following twinning of this trunk over a distance of approximately 2,000 m.

The infrastructure requirements for this alternative are presented in Figure 17.

Capital Cost

The capital cost estimate for infrastructure required for the 2031 development scenario for Alternative SEM-WWS-2 is presented in Table 34.

Table 34 Capital Cost of Servicing Alternative SEM-WWS-2

Description	Cost (Millions)
Centennial Trunk Sewer – Including Tunnelling (1,200 mm)	$ 34.50
Battlefield Trunk Upgrades (2,000 m)	$ 4.00
Total for Alternative SEM-WWS-2	**$ 38.50**

Timing and Phasing Issues

There is currently a Class EA for servicing ROPA9 being completed. There is potential for development in the ROPA9 area to be accelerated before completion of the Centennial trunk sewer. The Class EA has made provision for a new sewage pumping station to pump flows from the eastern limit back to the Felker sub-trunk. While capacity analysis shows this interim servicing is acceptable, it is recommended that the long term solution for ROPA9 involve conveying flows to the new Centennial trunk sewer.

Also, a the subsequent sections will demonstrate, the Centennial trunk sewer will provide conveyance capacity to support growth in the Airport Lands and Binbrook. As such, the timing of this project is also related to the potential development rate in these areas.

Impact Assessment

The potential for impacts associated with Alternative SEM-WWS-2 were assessed, and options for mitigation of these impacts were reviewed. Details on the assessment are included in the following paragraphs.

Natural Environment Factors:

This alternative carries potential impacts to the natural environment associated with the required construction activities on the Battlefield Trunk sewer, which lies along Battlefield Creek. The total length of sewers along Battlefield Creek that would require twinning is approximately 2 km.

This alternative would also require six new creek crossings, and would require crossing the Niagara Escarpment. The Escarpment crossing would be within the existing road allowance, which would minimize the overall environmental impact.

Socio-Cultural Factors:

Once the Red Hill Valley Expressway is put into service, much of the existing traffic along Centennial Parkway can utilize the expressway as an alternate or primary transportation route. As such, there would be an opportunity for the City to upgrade the existing Centennial Parkway and install the required wastewater infrastructure. The impact of this alternative on existing traffic flow can be mitigated as a result of the Red Hill Valley Expressway.

Legal-Jurisdictional Factors:

While most of the sewer construction would occur in existing right-of-ways, an easement might be required between Centennial Parkway and the Battlefield Trunk sewer.

Technical Factors:

Aside from the tunnelling requirements associated with the deep sewer construction, no additional technical concerns are anticipated under this alternative.

Economic Factors:

While there would be high capital costs associated with the tunnelling of sections of the Centennial trunk sewer, these would be offset by the lack of annual pumping costs.

14.2.4 Information Matrix for Airport Lands Wastewater Servicing Alternatives

Table 35 presents a comparison of the costs and impacts of the Airport Lands Wastewater Servicing Alternatives.

14.2.5 Preliminary Selection of the Preferred Southeast Mountain Servicing Alternative

Alternative SEM-WWS-2 is preliminarily selected as the preferred servicing alternative for the Southeast Mountain, with the following rationale:

- This alternative has the lowest potential environmental impacts.
- The need for a pumping station is eliminated.
- This alternative makes use of existing reserve capacity within the Eastern Sanitary Interceptor and the Battlefield Trunk Sewer.
- This other alternative would have added the wastewater flows from a separated system to existing combined systems (the Red Hill Creek Sanitary Interceptor).
- This alternative presents an opportunity to remove additional separated sewer flow from the RHCSI, mitigating some of the existing capacity limitations. It would also be able to service future development of the South Mountain, such as the existing business park or a future expansion of the urban boundary outside of the current planning horizon.
- This alternative carries a 33 percent lower capital cost than Alternative SEM-WWS-1, and eliminates the annual operational costs associated with the sewage pumping station.

City of Burlington

Lake Ontario

Haldimand County

Region of Niagara

- Growth Area drains by gravity to the south, necessitating a new pumping station.

- Some conveyance upgrades required. (Approx. 2,000m)

- Red Hill Creek Sanitary Interceptor upgrades required. (Approx. 6,000m)

Red Hill Creek Sanitary Interceptor Upgrade

FM Upgrade

New SPS

Legend

- Pumping Station
- Existing Sewer
- Upgrades Required
- Rural Settlement Area
- Expansion to Airport
- Potential Urban Boundary Expansion
- Potential New Business Park
- Intensification Area
- Niagara Escarpment
- Greenbelt
- Urban Boundary

Hamilton

Integrated Water & Wastewater Master Plan

South-East Mountain Wastewater Servicing

Alternative 1

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City of Burlington

Lake Ontario

Region of Niagara

- Growth Area serviced by a new trunk sewer along Centennial Parkway

- Some conveyance upgrades required. (Approx. 1,000m)

Sewer Upgrade

New Centennial Trunk Sewer

Legend

- Pumping Station
- Existing Sewer
- Upgrades Required
- Rural Settlement Area
- Expansion to Airport
- Potential Urban Boundary Expansion
- Potential New Business Park
- Intensification Area
- Niagara Escarpment
- Greenbelt
- Urban Boundary

Hamilton

Integrated Water & Wastewater Master Plan

Sout-East Mountain Wastewater Servicing

Alternative 2

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Figure 17

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Table 35 Information Matrix of Southeast Mountain Wastewater Servicing Alternatives

Evaluation Criteria	SOUTHEAST MOUNTAIN WASTEWATER SERVICING ALTERNATIVE 1	SOUTHEAST MOUNTAIN WASTEWATER SERVICING ALTERNATIVE 2
Description	♦ Southeast Mountain Expansion Area drains by gravity to the south. ♦ Flows are then pumped to the Davis Creek trunk sewer, and ultimately to the Red Hill Creek Sanitary ♦ Interceptor (RHCSI)	♦ Southeast Mountain Expansion Area drains by gravity to a new trunk ♦ Sewer along Centennial Parkway. ♦ This new trunk would also service Binbrook. ♦ The new trunk could also be sized to service Airport Lands.
Natural Environment Factors	♦ Significant environmental impact associated with additional construction activities in the Red Hill Creek valley.	♦ 6 new creek crossings. ♦ Niagara Escarpment crossing.
Socio-Cultural Factors	♦ The new pumping station might be adjacent to residential land uses. ♦ Construction would impact use of the expressway.	♦ New trunk sewer construction will cause disruptions along Centennial ♦ Parkway, however construction would be coordinated with other road improvements. ♦ Sections of the existing collection system that would require upgrading are located within existing parkland.
Legal-Jurisdictional Factors	♦ A property will be required for a pumping station in the south end of the expansion area. ♦ Easements might be required for forcemains and gravity sewers.	♦ Easements might be required for the Centennial Trunk sewer.
Technical Factors	♦ Increasing the capacity of the Red Hill Creek Sanitary Interceptor would be difficult.	♦ Maintaining gravity flow along the Centennial Trunk will require tunnelling in some sections.
Economic Factors	♦ Approximate capital cost: $56.0M. ♦ Moderate annual pumping costs.	♦ Approximate capital cost: $38.5M. ♦ No annual pumping costs.
Overall Alternative Rank	○	●

Most Preferred ● ◔ ◐ ◔ ○ **Least Preferred**

14.3 AIRPORT LANDS WASTEWATER SERVICING ALTERNATIVES

14.3.1 Servicing Area

The Airport Lands urban boundary expansion area surrounds Hamilton International Airport, and will provide much of the employment lands required under the 2031 development plan.

Due to the proximity to the Airport, these lands are not suitable for intensive residential development, though some residential development is expected in the outlying areas.

Upon full buildout of this area, which is anticipated by 2031, this area is expected to provide 3,500 jobs. Development of this area is anticipated to begin in 2014, with two-thirds of the expected job growth occurring between 2021 and 2031.

Four wastewater servicing alternatives have been developed for the Airport Lands, and these are further described in the following sections. The following considerations are consistent for all four servicing alternatives:

- The northern portion of the Airport Lands – north of Book Road – is generally graded towards Ancaster, and would be serviced through an extension of the existing Ancaster system.
- The northeast corner of the Airport Lands – bounded by Glancaster Road to the west, and Dickenson Road to the south – is generally graded to the east, and would be serviced through an extension of the Highway 6 system.
- The balance of the Airport Lands is generally graded away from Lake Ontario, to the southeast corner of the development area. A sewage pumping station would be required at this location to pump the wastewater into the gravity system.

14.3.2 Alternative AL-WWS-1a

Description and Infrastructure Requirements

Wastewater Servicing Alternative AL-WWS-1a is based on the following servicing:

- The northern portion would be serviced through Ancaster
- The northeast corner would be serviced through the Highway 6 system
- The balance would be pumped from the southeast corner of the Airport Lands northward along Fiddler's Green Road to the Ancaster system.

The portions of the Airport Lands directed to the Ancaster system would pass under the Lincoln Alexander Parkway immediately to the east of Highway 403, where there currently exists available sewer capacity.

This alternative would require a 500 L/s sewage pumping station in the southeast corner of the Airport Lands, which would be connected to the Ancaster system through 11.4 km of forcemains. Some existing sewer upgrades would be required.

The infrastructure requirements for this alternative are presented in Figure 18.

Capital Cost

The capital cost estimate for infrastructure required for the 2031 development scenario for Alternative AL-WWS-1a is presented in Table 36.

Table 36 Capital Cost of Servicing Alternative AL-WWS-1a

Description	Cost (Millions)
Sewage Pumping Station (500 L/s)	$ 7.50
600 mm Forcemain (11,400 m)	$ 8.90
Upgrades to Existing Sewers (3,000 m)	$ 9.00
Total for Alternative AL-WWS-1a	**$ 25.4**

Timing and Phasing Issues

Other than upgrades to the existing system, no timing or phasing issues are anticipated for development of the northern or northeast portions of the Airport Lands.

Phasing of development for the portion of the Airport Lands that will drain to the new sewage pumping station could prove difficult in that the SPS and entire 11.4 km forcemain would be required before any development could occur.

Impact Assessment

The potential for impacts associated with Alternative AL-WWS-1a was assessed, and options for mitigation of these impacts were reviewed. Details on the assessment are included in the following paragraphs.

Natural Environment Factors:

Two projects associated with this project have potential environmental impacts associated with crossing of waterways:

- A gravity sewer would be required under the Welland River in the southeast of the Airport Lands (in the vicinity of the proposed sewage pumping station)
- 15 new creek crossings would be required along the proposed forcemain route.

In addition to these potential impacts, this alternative would result in increased flows to the Western Sanitary Interceptor, where there are existing significant environmental issues related to combined sewer overflows discharging to Hamilton Harbour. While the City is currently undertaking measures to reduce the impact of CSO discharges to the Harbour, directing additional flows to that system could undermine those efforts, or result in a more costly solution to the CSO issue.

Socio-Cultural Factors:

In general, the proposed projects would have negligible to minor long-term impact during operations. Most of the servicing would be constructed in undeveloped areas, and would

therefore have negligible impacts during construction. Construction of the forcemain could require traffic detours which might affect local traffic destined for the Airport.

The required upgrades to the existing system would cause temporary traffic disruptions in developed areas of Ancaster.

Legal-Jurisdictional Factors:

The City would need to secure a site for the pumping station in the southeast corner of the development area.

Depending on the final alignment of the forcemains and gravity sewers, easements might also be required.

Technical Factors:

The main technical considerations under this alternative is that the majority of the Airport Lands will be serviced through a single sewage pumping station, and that the forcemain would exceed 11 km in length.

Economic Factors:

This alternative carries high annual operating costs, due to the required capacity of the sewage pumping station, and the distance over which the flows must be pumped.

14.3.3 Alternative AL-WWS-1b

Description and Infrastructure Requirements

Wastewater Servicing Alternative AL-WWS-1b is based on the following servicing:

- The northern portion would be serviced through Ancaster
- The northeast corner would be serviced through the Highway 6 system
- The balance would be pumped to the Ancaster system from **two** separate pumping stations; one in the southeast corner of the Airport Lands, and the other in a more central location such as the intersection of Fiddler's Green Road and Butter Road.

Like the previous alternative, the portions of the Airport Lands directed to the Ancaster system would pass under the Lincoln Alexander Parkway immediately to the east of Highway 403, where there currently exists available sewer capacity.

This alternative would still require a 500 L/s sewage pumping station, only this would be located in the vicinity of Fiddler's Green Road and Butter Road. The pumping station in the southeast corner would be smaller, and convey flows to the intermediate station. The total forcemain length would still be 11.4 km, but almost half of that distance would require a smaller diameter.

This alternative provides greater flexibility of phasing than does Alternative AL-WWS-1a, in that development could occur in the central portion of the designated lands without requiring that the full forcemain be constructed.

The infrastructure requirements for this alternative are presented in Figure 19.

Capital Cost

The capital cost estimate for infrastructure required for the 2031 development scenario for Alternative AL-WWS-1b is presented in Table 37.

Table 37 Capital Cost of Servicing Alternative AL-WWS-1b

Description	Cost (Millions)
Intermediate Sewage Pumping Station (500 L/s)	$ 7.50
600 mm Forcemain (6,400 m)	$ 5.00
Southeast Sewage Pumping Station (300 L/s)	$ 4.00
450 mm Forcemain (5,000 m)	$ 3.00
Upgrades to Existing Sewers (3,000 m)	$ 9.00
Total for Alternative AL-WWS-1b	**$ 28.50**

Timing and Phasing Issues

Other than upgrades to the existing system, no timing or phasing issues are anticipated for development of the northern or northeast portions of the Airport Lands.

Phasing of development for the portions of the Airport Lands requiring pumping to Ancaster could proceed from north to south with only the intermediate station and a shorter forcemain required initially. Only once development progressed to south of Butter Road would the second pumping station be required in the southeast corner.

Impact Assessment

The potential for impacts associated with Alternative AL-WWS-1b was assessed, and options for mitigation of these impacts were reviewed. Details on the assessment are included in the following paragraphs.

Natural Environment Factors:

This alternative carries the same natural environment impacts as Alternative AL-WWS-1a.

Two projects associated with this project have potential environmental impacts associated with crossing of waterways:

- A gravity sewer would be required under the Welland River in the southeast of the Airport Lands (in the vicinity of the proposed sewage pumping station)
- 15 new creek crossings would be required along the proposed forcemain route.

In addition to these potential impacts, this alternative would result in increased flows to the Western Sanitary Interceptor, where there are existing significant environmental issues related to combined sewer overflows discharging to Hamilton Harbour. While the City is currently undertaking measures to reduce the impact of CSO discharges to the Harbour,

directing additional flows to that system could undermine those efforts, or result in a more costly solution to the CSO problem.

Socio-Cultural Factors:

The socio-cultural impacts of this alternative are the same as those from Alternative AL-WS-1a.

In general, the proposed projects would have negligible to minor long-term impact during operations. Most of the servicing would be constructed in undeveloped areas, and would therefore have negligible impacts during construction. Construction of the forcemain could require detours which might affect traffic destined for the Airport.

The required upgrades to the existing system would cause temporary traffic disruptions in developed areas of Ancaster.

Legal-Jurisdictional Factors:

As in Alternative AL-WWS-1a, the City would need to secure a site for the pumping station in the southeast corner of the development area, and would likely require easements for forcemains and gravity sewers.

In this alternative, as second site would be needed for the intermediate sewage pumping station at the intersection of Fiddler's Green Road and Butter Road.

Technical Factors:

Under this alternative, the main technical considerations of Alternative AL-WWS-1a are addressed partly.

The addition of the intermediate sewage pumping station facilitates phasing, and limits the length of the 600 mm forcemain from the full length of 11.4 km to 6.4 km.

Economic Factors:

This alternative carries a higher capital cost than Alternative AL-WWS-1a, but the portion of those costs associated with the southeast pumping station and forcemain could be deferred until development south of Butter Road occurs.

This alternative also carries the high annual operating costs of pumping the required flow rates over the distance required to get to the Ancaster gravity system and higher operating and maintenance costs resulting from multiple stations.

14.3.4 Alternative AL-WWS-2

Description and Infrastructure Requirements

Wastewater Servicing Alternative AL-WWS-2 is based on the following servicing:

- The northern portion would be serviced through Ancaster
- The northeast corner would be serviced through the Highway 6 system

- The balance would be pumped from the southeast corner of the Airport Lands northward along Highway 6 to the Red Hill Creek Sanitary Interceptor system.

This alternative would require a 500 L/s sewage pumping station in the southeast corner of the Airport Lands, would trigger upgrades at the existing Highway 6 sewage pumping stations, and would require additional upgrades to the Red Hill Creek Sanitary Interceptor.

The infrastructure requirements for this alternative are presented in Figure 20.

Capital Cost

The capital cost estimate for infrastructure required for the 2031 development scenario for Alternative AL-WWS-2 is presented in Table 38.

Table 38 Capital Cost of Servicing Alternative AL-WWS-2

Description	Cost (Millions)
Sewage Pumping Station (500 L/s)	$ 7.50
600 mm Forcemain (1,000 m)	$ 0.78
Upgrade SPS HC027 (400 L/s of additional capacity)	$ 3.90
Upgrade HC027 Forcemain (500 m)	$ 0.45
Upgrade SPS HC019 (500 L/s of additional capacity)	$ 4.88
Upgrade HC019 Forcemain (500 m)	$ 0.45
Upgrade SPS HC018 (700 L/s of additional capacity)	$ 6.83
Upgrade HC018 Forcemain (1,000 m)	$ 0.90
Upgrades to Red Hill Creek Sanitary Interceptor (3,500 m)	$ 10.50
Total for Alternative AL-WWS-2 (excluding engineering and contingencies)	**$ 36.19**

Timing and Phasing Issues

Other than upgrades to the existing system, no timing or phasing issues are anticipated for development of the northern or northeast portions of the Airport Lands.

Phasing of development for the portion of the Airport Lands that will drain to the new sewage pumping station could prove difficult in that the SPS and entire 11.4 km forcemain would be required before any development could occur.

Impact Assessment

The potential for impacts associated Alternative AL-WWS-2 were assessed, and options for mitigation of these impacts were reviewed. Details on the assessment are included in the following paragraphs.

Natural Environment Factors:

Two projects associated with this project have potential environmental impacts associated with crossing of waterways:

- A gravity sewer would be required under the Welland River in the southeast of the Airport Lands (in the vicinity of the proposed sewage pumping station).
- Just one new creek crossing would be required along the proposed forcemain route.

Socio-Cultural Factors:

In general, the proposed projects would have negligible to minor long-term impact during operations.

However, most of the servicing would be constructed along the busy Highway 6 corridor, and would cause traffic disruptions along a 7 km stretch from Chippewa Road to Twenty Road.

Legal-Jurisdictional Factors:

The City would need to secure a site for the pumping station in the southeast corner of the development area.

Additional easements would not likely be required, as all of the proposed forcemains and gravity sewers would be located along existing streets and right-of-ways.

Technical Factors:

Under this alternative, the majority of the Airport Lands would still be serviced through a single high-capacity sewage pumping station, but the forcemain length would be significantly reduced in comparison with Alternatives AL-WWS-1a and AL-WWS-1b.

This alternative would require significant upgrades at the three existing pumping stations along Highway 6. However, the site capacities at these stations are a significant constraint.

This alternative would also require significant upgrades to the Red Hill Creek Sanitary Interceptor which is considered a non-starter from an environmental and implementation perspective.

Economic Factors:

This alternative carries moderate annual operating costs, due to the decreased distance over which the flows would need to be pumped. Overall capital costs are high given the level of downstream upgrades required.

14.3.5 Alternative AL-WWS-3

Description and Infrastructure Requirements

Wastewater Servicing Alternative AL-WWS-3 is based on the following servicing:

- The northern portion would be serviced through Ancaster
- The northeast corner would be serviced through the Highway 6 system
- The balance would be pumped from the southeast corner of the Airport Lands northward along Highway 6 to a future trunk sewer that would flow east along

Dickenson Road. This sewer would terminate at a new trunk sewer flowing south along Centennial Parkway, which would ultimately convey the flows to the Eastern Sanitary Interceptor.

This alternative would require a 500 L/s sewage pumping station in the southeast corner of the Airport Lands. Rather than to increase the capacities of the existing sewage pumping stations along Highway 6, this alternative would have the flows pumped along the entire 4 km stretch to Dickenson Road, where the forcemain would discharge into a new gravity sewer. An additional pumping station and 0.5 km long forcemain would be required near the intersection of Dickenson Road and Miles Road. After this point, flows would be carried by gravity all the way to the Eastern Sanitary Interceptor.

The infrastructure requirements for this alternative are presented in Figure 21.

Capital Cost

The capital cost estimate for infrastructure required for the 2031 development scenario for Alternative AL-WWS-3 is presented in Table 39.

Table 39 Capital Cost of Servicing Alternative AL-WWS-3

Description	Cost (Millions)
Sewage Pumping Station (500 L/s)	$ 7.50
600 mm Forcemain along Highway 6 (4,000 m)	$ 4.70
New Highway 6 Sewer (1,000 m)	$ 2.00
New Dickenson Road Sewer (9,600 m)	$ 15.40
New Dickenson Road Sewage Pumping Station (500 L/s)	$ 7.50
New Dickenson Road Forcemain (500 m)	$ 0.50
Total for Alternative AL-WWS-3	**$ 37.6**

Timing and Phasing Issues

Other than upgrades to the existing system, no timing or phasing issues are anticipated for development of the northern or northeast portions of the Airport Lands.

This servicing strategy is dependent on the implementation of the Centennial trunk sewer.

Impact Assessment

The potential for impacts associated with Alternative AL-WWS-3 was assessed, and options for mitigation of these impacts were reviewed. Details on the assessment are included in the following paragraphs.

Natural Environment Factors:

Two projects associated with this project have potential environmental impacts associated with crossing of waterways:

- A gravity sewer would be required under the Welland River in the southeast of the Airport Lands (in the vicinity of the proposed sewage pumping station).

- 11 new creek crossings would be required along Highway 6 and Dickenson Road the proposed sewers and forcemains.

Socio-Cultural Factors:

In general, the proposed projects would have negligible to minor long-term impact during operations. Most of the servicing would be constructed in undeveloped areas, and would therefore have negligible impacts during construction. Construction of the new Highway 6 forcemain would cause temporary disruptions along the busy Highway 6 corridor.

Legal-Jurisdictional Factors:

The City would need to secure a site for the pumping station in the southeast corner of the development area, and another for a second sewage pumping station near the intersection of Dickenson Road and Miles Road.

Technical Factors:

The main technical considerations under this alternative is that the majority of the Airport Lands will be serviced through a single sewage pumping station. The forcemain length under this scenario is less (4 km) when compared to the other options.

This alternative would be combined with the Southeast Mountain servicing, and could also provide servicing for development of the South Mountain that is outside of the current 30-year planning horizon.

This alternative could also be used to re-route some flows that currently drain to the Red Hill Creek Sanitary Interceptor. Specifically, this alternative would be used to service all of Binbrook, and could also be used to receive flows from the English Church Road sewage pumping station. Removing these existing flow contributions to the Red Hill Creek Sanitary Interceptor would provide capacity for intensification on other areas that are tributary to the RHCSI.

Economic Factors:

While this alternative requires two sewage pumping stations, it carries moderate annual operating costs, due to the decreased lengths of the forcemains.

14.3.6 Information Matrix for Airport Lands Wastewater Servicing Alternatives

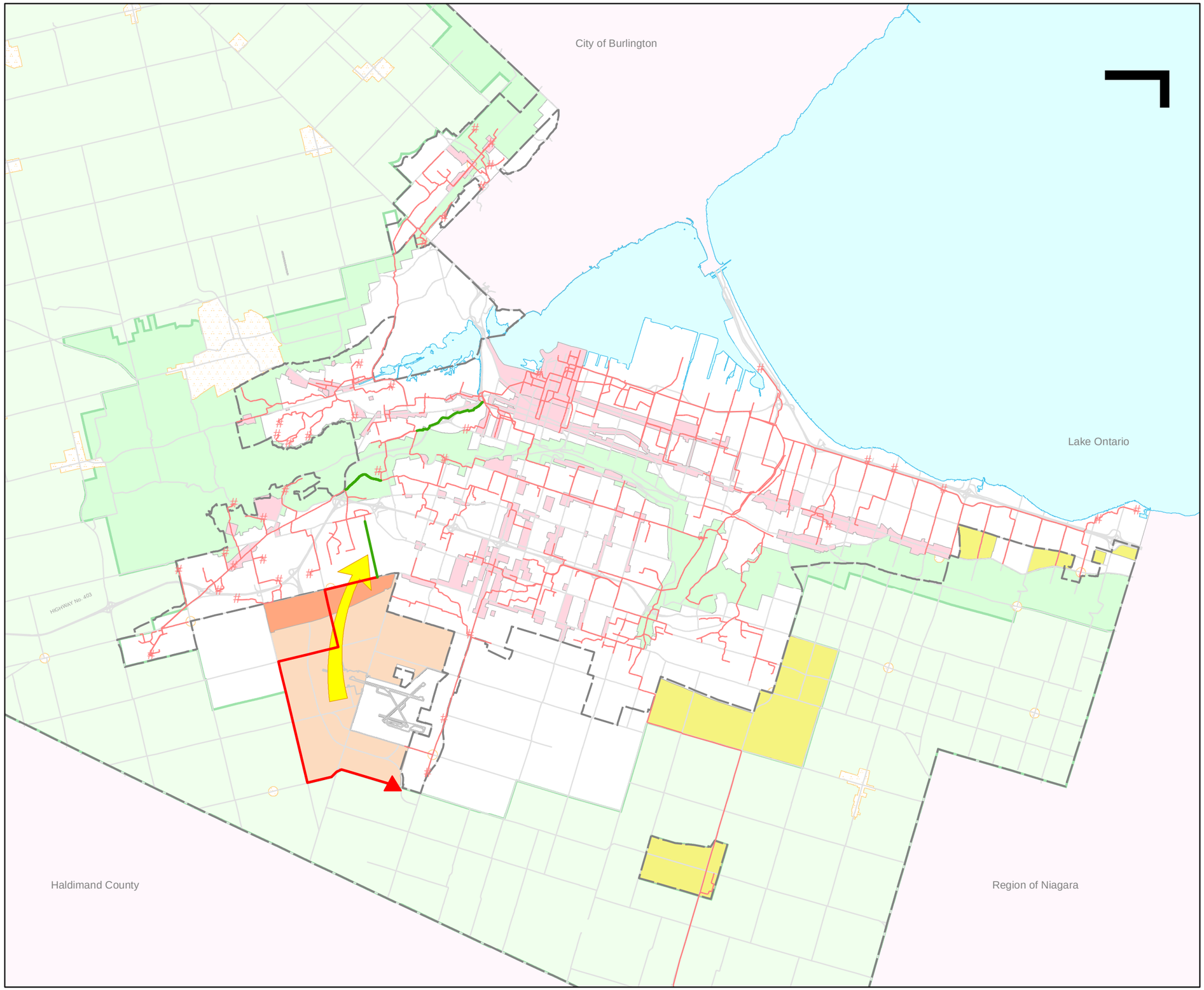
Table 40 presents a comparison of the costs and impacts of the Airport Lands Wastewater Servicing Alternatives.

14.3.7 Preliminary Selection of the Preferred Airport Lands Servicing Alternative

Alternative AL-WWS-3 is preliminarily selected as the preferred servicing alternative for the Airport Lands, with the following rationale:

- This alternative has the lowest potential environmental impacts.
- The total forcemain length is minimized

- This alternative makes use of existing reserve capacity within the Eastern Sanitary Interceptor.
- The other alternatives would have added the wastewater flows from a separated system to existing combined systems (either the Western Sanitary Interceptor or the Red Hill Creek Sanitary Interceptor), which the City wishes to avoid.
- This alternative presents an opportunity to remove additional separated sewer flow from the RHCSI, mitigating some of the existing capacity limitations. It would also be able to service future development of the South Mountain, such as the existing business park or a future expansion of the urban boundary outside of the current planning horizon.



Legend

- Pumping Station
- Existing Sewer
- Upgrades Required
- Rural Settlement Area
- Expansion to Airport
- Potential Urban Boundary Expansion
- Gravity flow to Ancaster
- Gravity flow to new SPS
- Intensification Area
- Niagara Escarpment
- Greenbelt
- Urban Boundary

Hamilton

Integrated Water & Wastewater Master Plan

Airport Lands
Wastewater Servicing

Alternative 1a

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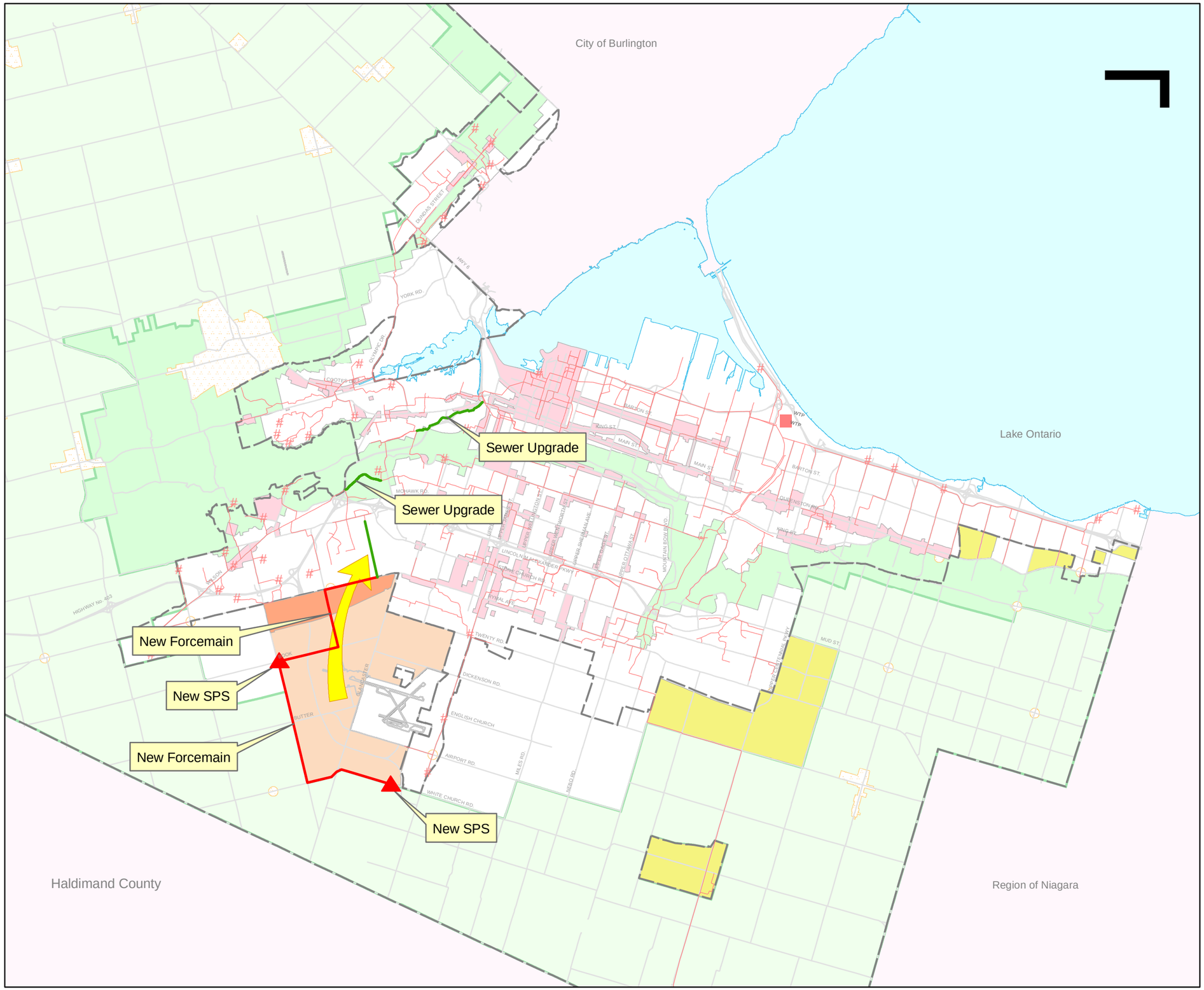

Legend

- Pumping Station
- Existing Sewer
- Upgrades Required
- Rural Settlement Area
- Expansion to Airport
- Potential Urban Boundary Expansion
- Gravity flow to Ancaster
- Gravity flow to new SPS
- Intensification Area
- Niagara Escarpment
- Greenbelt
- Urban Boundary

Hamilton

Integrated Water & Wastewater Master Plan

Airport Lands
Wastewater Servicing

Alternative 1b

KMK Consultants Limited

Figure 19

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City of Burlington

Lake Ontario

Haldimand County

Region of Niagara

-The northern portion of the Airport Lands drains by gravity towards the existing Ancaster service area.

-The southern portion drains by gravity to the south, necessitating a new sewage pumping station.

-Flows would be pumped to Highway 6, triggering upgrades of the three existing sewage pumping stations, and approximately 5,500 m of forcemains and gravity sewers.

Upgrade SPS

Sewer Upgrade

Upgrade SPS

Sewer Upgrade

Upgrade SPS

New SPS

Legend

- Pumping Station
- Existing Sewer
- Upgrades Required
- Rural Settlement Area
- Expansion to Airport
- Potential Urban Boundary Expansion
- Gravity flow to Ancaster
- Gravity flow to new SPS
- Intensification Area
- Niagara Escarpment
- Greenbelt
- Urban Boundary

Hamilton

Integrated Water & Wastewater Master Plan

Airport Lands
Wastewater Servicing

Alternative 2

Nov 22, 2006
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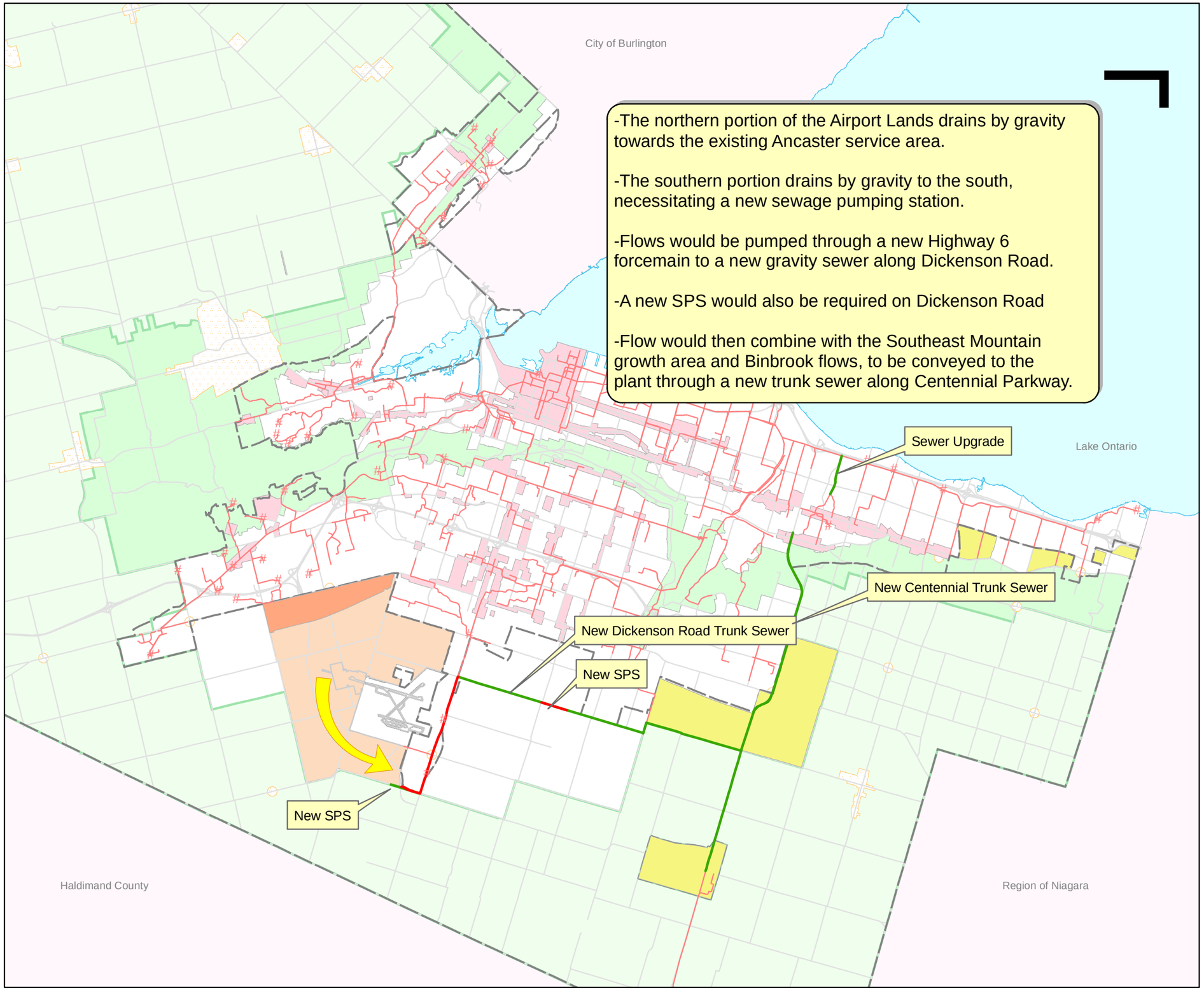

Legend

- Pumping Station
- Existing Sewer
- Upgrades Required
- Rural Settlement Area
- Potential Urban Boundary Expansion
- Gravity flow to new SPS
- Gravity flow to Ancaster
- Intensification Area
- Niagara Escarpment
- Greenbelt
- Urban Boundary

Integrated Water & Wastewater Master Plan

Airport Lands
Wastewater Servicing

Alternative 3

KMK Consultants Limited

Figure 21

Nov 22, 2006
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Table 40 Information Matrix of Airport Lands Wastewater Servicing Alternatives

Evaluation Criteria	AIRPORT LANDS WASTEWATER SERVICING ALTERNATIVE 1a	AIRPORT LANDS WASTEWATER SERVICING ALTERNATIVE 1b	AIRPORT LANDS WASTEWATER SERVICING ALTERNATIVE 2	AIRPORT LANDS WASTEWATER SERVICING ALTERNATIVE 3
Description	♦ Airport Lands drains by gravity to a new sewage pumping station in the southeast. ♦ Flows are pumped through the Ancaster system to the Western Interceptor.	♦ Airport Lands drains by gravity to two new sewage pumping stations; one in the southeast corner, and the other in about the middle of the growth area. ♦ Flows are pumped through the Ancaster system to the Western Interceptor.	♦ Airport Lands drains by gravity to a new sewage pumping station in the southeast. ♦ Flows are pumped to the existing Highway 6 system, and eventually to the Red Hill Creek Sanitary Interceptor.	♦ Airport Lands drains by gravity to a new sewage pumping station in the southeast. ♦ Flows are pumped to the existing Highway 6 system, and then along Dickenson Road to a new Centennial Parkway trunk sewer.
Natural Environment Factors	♦ Requires constructing a gravity sewer under the Welland River in the southeast of the Airport Lands. ♦ 15 new creek crossings required along forcemain route. ♦ Increased flows to the Western Interceptor could result in additional sanitary sewage overflow events to Hamilton Harbour.	♦ Requires constructing a gravity sewer under the Welland River in the southeast of the Airport Lands. ♦ 15 new creek crossings required along forcemain route. ♦ Increased flows to the Western Interceptor could result in additional sanitary sewage overflow events to Hamilton Harbour.	♦ Requires constructing a gravity sewer under the Welland River in the southeast of the Airport Lands ♦ 11 creek crossings along Highway 6 would need to be upgraded. ♦ 1 new creek crossing required along Highway 6.	♦ Requires constructing a gravity sewer under the Welland River in the southeast of the Airport Lands. ♦ 11 new creek crossings required along Highway 6 and Dickenson Road.
Socio-Cultural Factors	♦ Upgrading the existing system will cause temporary disruptions in developed areas of Ancaster.	♦ Upgrading the existing system will cause temporary disruptions in developed areas of Ancaster.	♦ Upgrading the existing system will cause temporary disruptions along the busy Highway 6 corridor, from Chippewa Road to Twenty Road (7 km).	♦ Upgrading the existing system will cause temporary disruptions along the busy Highway 6 corridor, from Chippewa Road to Dickenson Road (5 km). ♦ Building new systems will cause temporary disruptions along rural routes (Dickenson Road).
Legal-Jurisdictional Factors	♦ A property will be required for a pumping station in the southeast corner of the Airport Lands. ♦ Easements might be required for forcemains and gravity sewers.	♦ A property will be required for a pumping station in the southeast corner of the Airport Lands. ♦ A property will be required for a second pumping station near the intersection of Fiddler's Green Road and Book Road. ♦ Easements might be required for forcemains and gravity sewers.	♦ A property will be required for a pumping station in the southeast corner of the Airport Lands.	♦ A property will be required for a pumping station in the southeast corner of the Airport Lands. ♦ A property will be required for a second pumping station along Dickenson Road.
Technical Factors	♦ Airport Lands serviced through a single high-capacity sewage pumping station. ♦ High-capacity forcemain will be extremely long (approximately 11 km).	♦ Constructing two pumping stations will facilitate the phasing of development ♦ While the total forcemain length would remain approximately 11 km, having two pumping stations would shorten the length of the high-capacity forcemain (to approximately 6.5 km).	♦ Airport Lands serviced through a single high-capacity sewage pumping station. ♦ The three existing pumping stations along Highway 6 will require substantial upgrades. ♦ SITE CAPACITIES AT EXISTING SEWAGE PUMPING STATIONS ARE A SIGNIFICANT CONSTRAINT. THIS ALTERNATIVE IS NOT FEASIBLE.	♦ Airport Lands serviced through a single high-capacity sewage pumping station. ♦ Moderate forcemain length of approximately 4 km. ♦ This alternative can be combined with the South-East Mountain servicing. ♦ Provides for future servicing of the South Mountain lands.
Economic Factors	♦ Approximate capital cost: $25.4M. ♦ High annual operating costs.	♦ Approximate capital cost: $28.5M. ♦ High annual operating costs.	♦ Approximate capital cost: $36.2M. ♦ Moderate annual pumping costs as there is an opportunity to take advantage of gravity flow along some stretches of Highway 6.	♦ Approximate capital cost: $37.6M. ♦ Moderate annual pumping costs due to the decreased length of forcemains.
Overall Alternative Rank	◐	◐	○	●

Most Preferred ● ◔ ◐ ◕ ○ **Least Preferred**

14.4 COMBINED SEWER OVERFLOW CONTROL

Much of the older areas of the City still utilize a single pipe for the collection of both sanitary wastewater emanating from homes and businesses, and storm water runoff. As discussed in earlier sections of the document, the true wastewater flow rate is readily predictable and consistent over time. The rate of wastewater flow varies throughout the day reflecting both the peak hourly domestic usage and recurring industrial-commercial patterns. In separated systems the conveyance capacity and downstream treatment would be based on all flows being contained within the system.

The rate of flow in a storm system, or combined system , is directly related to the rainfall intensity and duration. Storm events are characterized by return frequency or the probability of the same magnitude of the storm event recurring within a specified number of years, i.e. a 5 or 10 year storm is statistically likely to occur only once in 5 and 10 years respectively. Stormwater flows are usually much larger then sanitary wastewater flows generated in the same land area, and to achieve economically viability, the capacity allowed for storm flow has been set at a 5 year storm, with the knowledge and expectation that the system will overflow or surcharge during larger storms.

In Hamilton, the larger rainfall events result in greater dilution of the wastewater constituents, but also result in overflow. Over the past 10 years, the City has worked proactively to address this and has built six CSO tanks, with a seventh tank and in-line storage facility under construction to store this excess flow and re-pump it back to the trunk sewer once the storm has subsided. However, there are still a number of uncontrolled overflow locations. Following the completion of these two additional projects, 11 uncontrolled CSO outfalls will remain.

14.4.1 MOE Procedure F-5-5 and HHRAP

Going forward, the design criteria for the collection system previously detailed, adopts the requirements of MOE Policy F-5-5 and HHRAP targets.

Notwithstanding the requirements of the follow-on studies, the approach adopted for the collection system to ensure compliance with the City's policies, including meeting F-5-5 and HHRAP requirements will have a direct impact on the plant flows, loadings and operations.

14.4.2 2031 Modelling Results

Wastewater modelling results for the 2031 preferred growth alternative indicate that the City will not be in compliance with Procedure F-5-5, based on the current collection system attributes and rainfall patterns of 1988, which has been previously identified as an 'average' rainfall year.

While the modelling results indicate that 90% control of wet-weather flows can be achieved with system upgrades, the following were reported, in contravention of the City's CSO policy:

- CSOs are reported by the model during dry-weather conditions
- 26 CSO events were reported at the Birch CSO

- 7 CSO events were reported at the Parkdale CSO
- 26 CSO events were reported at the Dunn CSO
- 8 CSO events were reported at the Sterling CSO.

The modelling results also indicate that dry weather flow may also be discharged before the full capabilities of the Woodward Ave. WWTP are exceeded.

While additional CSO tanks have been previously identified as viable options at these locations, there are additional options that should be considered.

14.4.3 Alternative Solutions

Based on the City's commitment to F-5-5, and the results of the modelling exercises to date, the preferred solution will incorporate the optimum balance of collection system and treatment plant upgrades.

The range of collection system upgrades should consider, but not be limited to, the following CSO control options:

- Local improvements to control structures
- Construction of additional CSO tanks
- Constructing additional conveyance capacity.

It is recommended that the assessment of CSO control options cover the entire study area provided in Figure 22.

Further details regarding the individual CSO control options are addressed in the following paragraphs.

Local Improvements to Control Structures

The combined system modelling results indicate that there are instances where flows in the combined sewer are bypassing the Western Sanitary Interceptor and discharging into Hamilton Harbour before the hydraulic capacity of the connections to the Interceptor are reached. This situation even occurs in situations when the Interceptor has not reached its peak conveyance capacity. This indicates that some CSO events appear to be triggered by hydraulic constraints within the flow regulator structures, and not necessarily by capacity limitations within the collection system.

A field program should be established in order to confirm the elevations of each of the CSO control weirs within the combined sewer system. These should then be compared with the elevations in the hydraulic model to establish whether the reported dry-weather CSO events are the result of inaccurate system information. Based on the results of the inspection program and future modelling scenarios, it might be possible to adjust the elevations of some of the weirs in order to assist in meeting F-5-5.

While it is not expected that local improvements to control structures will provide a complete solution, it may reduce the extent and cost of other required improvements.

Construction of Additional CSO Tanks

Modelling results have indicated that the existing CSO tanks are an effective means of controlling CSO discharges at the locations within the system where they have already been constructed. As such, it is anticipated that construction of additional CSO tanks would allow the City to meet F-5-5.

There are, however, operational concerns with installing CSO tanks. Wastewater system operators have indicated that it is sometimes difficult to empty the existing tanks within 48 hours due to prolonged periods of elevated flows through the WWTP. If the tanks aren't emptied before a second event occurs, the potential of a CSO bypass occurring increases. Also, when wastewater is stored for extended periods, the potential for growth of filamentous organisms exists. These can compromise treatment efficiency, and lead to elevated effluent loadings to the Harbour.

Adding additional tanks will make it more difficult to ensure that all of the tanks are drained in a timely matter, and this in turn will be made more challenging by the increase in dry-weather flows in the Interceptor associated with the population growth within the Western Interceptor service area.

Construction of Additional Conveyance Capacity

Construction of additional conveyance capacity paralleling the existing trunk sewer has also been shown through model simulations to be an effective solution to eliminating CSOs at specific outfall locations. While it avoids the potential operational issues related to storing wastewater in CSO tanks for an extended period, it might not result in an increased treatment volumes. While intercepting additional CSO flows and conveying them to the plant site provides an opportunity for the wastewater to be treated rather than stored, the additional flows will exceed the capacity of the plant and be bypassed at this location.

14.4.4 Preferred System Upgrades

Given that the wastewater treatment plant upgrades and some of the potential collection system upgrades are subject to further requirements of the Class EA process, it is determined that the optimum balance of system upgrades be established through the follow on Phases 3 and 4.

City of Burlington

Lake Ontario

Region of Niagara

Legend

- # Pumping Station
- Existing Sewer
- Rural Settlement Area
- Expansion to Airport
- Potential Urban Boundary Expansion
- Potential New Business Park
- Niagara Escarpment
- Greenbelt
- Urban Boundary

Hamilton

Integrated Water & Wastewater Master Plan

CSO Control Recommendation

Nov 22, 2006
1:125,000
2590-D-78

14.5 INTENSIFICATION AND DEVELOPMENT RELATED WASTEWATER SYSTEM IMPROVEMENTS

This section describes projects related to existing capacity limitations or needed to service future intensification of development within the existing service area or needed for local servicing of new growth areas. There are generally more limited available servicing alternatives for these projects based on the extents and current location of the existing infrastructure.

Additional servicing requirements were reviewed from the 2004 Development Charges Study. This study identified a number of local servicing projects that would not normally be included in the scope of a Master Planning exercise. However, because these projects meet the DC criteria, their validity within the context of the Master Plan was reviewed, and they have been included in the capital program where applicable.

The projects related to intensification and/or development in local service areas can be categorized as follows:

- Existing system upgrades or new projects which would be applicable to the Class EA process and usually are considered Schedule B projects
- Local servicing requirements that are implemented under the Planning Act as Schedule A activities given that their need and location is typically refined subject to plan of subdivision and are located to service a new development or site only

Additional project details for these projects is provided in Appendix A-1. The capital program and timing is detailed in Appendix A-3.

14.5.1 System Upgrades – Schedule B Projects

14.5.1.1 Twenty Road Sewage Pumping Station

The Twenty Road SPS is located at the intersection of Twenty Road and Highway 6, in the former municipality of Mount Hope. The station currently has a firm pumping capacity estimated at 130 L/s, and a total pumping capacity of 170 L/s with both pumps in operation.

There are existing capacity limitations at this station. In particular, it is located downstream of the English Church Road SPS, which has a rated capacity with one pump in operation of 210 L/s. Upgrades of this station are not triggered by on the recommended servicing strategy for the Airport Lands, however additional capacity is required to support current limitations. Plus, expansion of this sewage pumping station will support some localized servicing of the Airport Lands in the northern sections.

The immediate requirements for this pumping station are installation of a third pump, and twinning of the existing 300 mm diameter forcemain. This project carries an estimated capital cost of $4.0M, and has a required in-service date of 2007.

All of the construction activities related to this project will be contained within the existing right-of way along Highway 6. No significant environmental, socio-cultural or technical constraints are anticipated.

14.5.1.2 Mountain Brow Trunk Sewer / First Street Sewage Pumping Station

The Mountain Brow Trunk Sewer will service a large percentage of the new development that is anticipated in the north end of Waterdown. A separate Class EA integrated with Secondary Planning process was undertaken to select the preferred alignment for this sewer, which is as follows:

- Southwest along Mountain Brown from the City limits to 60 m northeast of Flanders Drive
- Northwest along an easement to the First Street SPS.

In order to convey the flows by gravity to the First Street SPS, some deep sections of sewer will required. The Mountain Brow sewer flows will trigger an upgrade of the First Street SPS from its existing firm capacity of 200 L/s to 400 L/s. This can be achieved by adding a third pump at the station, for which there is space and sufficient forcemain capacity.

The total cost of the required upgrades is estimated at $4.3M, and has a required in-service date of 2010 in coordination with anticipated growth in Waterdown South. Construction will take place within an existing road right-of-way, and along an easement in an undeveloped area.

14.5.1.3 Highway 403 Trunk Sewer

The Highway 403 Trunk Sewer is a 900 mm combined sewer that parallels Highway 403, from the Royal CSO Tank to the Main-King CSO Tank. Modelling results for the existing development conditions indicate that this sewer does not have sufficient capacity to convey flows resulting from a 5-year design storm. Flow monitoring data from the downstream end of this reach of sewer also suggests that there are some potential bottlenecks in the upstream reaches. As such, this sewer will require upgrading in order to service future flows.

Modelling of the 2031 development scenario indicates that the 2 km stretch of sewer will require twinning, at a cost of $6.6M.

Based on the preferred growth option, there is projected development north of Aberdeen Ave along Longwood Road which is referred to as the McMaster Innovation Park. Local servicing of this development area will be required and a gravity sewer conveying flows north to the Highway 403 trunk sewer is a potential solution.

Based on the servicing needs of the McMaster Innovation Park, there may be opportunity to provide an alignment for the Highway 403 Trunk Sewer in coordination with the servicing needs along Longwood Road.

14.5.1.4 Ancaster-to-Fennell Trunk Sewer

Hydraulic modelling of the existing conditions and data collected during the 2004 flow monitoring program indicate that there are existing hydraulic constraints within the stretch of sewer that connects the Ancaster system to the Fennel trunk sewer. Specifically, the stretch from the intersection of Rice Avenue and Sanatorium Road to the intersection of Columbia Drive and Delmar Drive requires twinning.

This 2.5 km stretch consists of sewers ranging in diameter from 900 mm to 1,350 mm. Twinning of the sewer will cost approximately $6.8M, and will be required in service by 2009.

14.5.1.5 Binbrook Sewage Pumping Station

The existing Binbrook SPS has a rated capacity of 200 L/s, and growth projections indicate the requirement to upgrade the firm capacity of this station to 400 L/s by 2011. The SPS upgrade will consist of adding a third 200 L/s pump, and it will also require twinning of the existing 450 mm forcemain.

These improvements carry an estimated capital cost of $4.0M.

14.5.1.6 Shaver Road Sewage Pumping Station

The Shaver Road SPS is located in Ancaster, north of Highway 403. The station has an existing capacity of 6 L/s. Growth projections for the area will trigger a station capacity upgrade to 45 L/s.

Because of capacity limitations on the existing site, and the topography of the area, it is proposed that the new station will be located farther south on Shaver Road. This new location will create a larger gravity catchment for the sewage pumping station. This project will require new gravity sewer and forcemain in connection with the new sewage pumping station location and decommissioning the old sewage pumping station. The capital cost of the new SPS and horizontal works is estimated at $2.9M. The required in-service date for the new station is 2014.

14.5.1.7 Scenic Drive Sewage Pumping Station

The Scenic Drive SPS currently has two pumps installed, with a firm pumping capacity of 57 L/s. Development data from the existing service area indicates potential peak flows to the station approaching 95 L/s, which would require installation of a third pump at this location.

Based on the actual operation of the station, it is not anticipated that this upgrade will be required until 2016. The costs of installing a third pump are estimated at $0.2M.

14.5.1.8 Calvin Street Sewage Pumping Station

The Calvin Street SPS has an existing rated capacity of 59 L/s. The station is located downstream of the Braithwaite SPS, which has a firm capacity of 37 L/s. The station is currently operating near it's firm capacity, and full build-out of the Calvin Street SPS and Braithwaite Avenue SPS catchment areas will trigger an upgrade at Calvin.

It is anticipated that a third pump will need to be installed in 2016, at a cost of $0.2M.

14.5.2 Local Servicing – Schedule A Projects

14.5.2.1 Harmony Hall Sewage Pumping Station

The Harmony Hall SPS is located northwest of the intersection of Garner Road and Southcote Road. It currently has a firm pumping capacity of 15.6 L/s.

Future development to the south and west of the SPS will trigger a capacity upgrade to 100 L/s, which exceeds the site capacity of the existing station. As the station is aging, and

also in need of repairs, the preferred solution is to replace the existing SPS with a new, upgraded facility. A new 200 mm forcemain will also be required as part of this project. As the existing Southcote sewer does not have sufficient capacity where the existing forcemain discharges into it, the new forcemain will extend a further 400 m up Southcote to a location where there is sufficient reserve capacity.

This solution provides an efficient means of servicing the area. A larger gravity catchment area will be established through the new location of the SPS which will allow for decommissioning the old SPS. Based on the topography of the area, a new SPS is the only cost effective solution.

These improvements carry an estimated capital cost of $6.3M, and will be required in service by 2008.

14.5.2.2 Winona Sewage Pumping Station

The Winona SPS is located in the former municipality of Stoney Creek, north of the QEW and west of Fifty Road. The existing station is located downstream of the Fifty Road SPS, and has a firm capacity of 88 L/s.

A recent upgrade of the Fifty Road SPS and planned development within the Winona SPS catchment area have triggered the installation of a third pump at this station, and twinning of the existing 300 mm forcemain.

These improvements are required in service by 2008, and will cost an estimated $0.9M.

14.5.2.3 West 18th Street Sewer Upgrades

The West 18th Street sewer is located east of Garth Street and south of Bendamere Avenue. Hydraulic modelling of this sewer indicated surcharging under the five-year design storm, and flow monitoring data collected in 2004 showed significant wet-weather flow response, and surcharging of the sewer.

As such, this sewer will require twinning along a 2 km stretch, at a cost of approximately $3.3M.

14.5.2.4 Scenic Drive and Bowman Street

Modelling results have also reported significant sewer surcharging in the sewers along Scenic Drive and Bowman Street, though there is no flow monitoring data for this sewer to confirm these results.

Twinning the sewers along these streets would cost an estimated $2.3M. Prior to increasing the capacity of the sewers on these streets, it is recommended that flow monitoring be undertaken to verify the flow monitoring results.

15. PREFERRED SERVICING SOLUTIONS

This section presents the projects associated with each of the preferred water and wastewater servicing strategies.

15.1 WATER SERVICING SOLUTION AND IMPLEMENTATION PROGRAM

The preferred water servicing solution was identified through a review and comparative evaluation of alternative servicing strategies for the Master Plan study area.

The preferred solution is presented in Figure 23.

The implementation program for the preferred servicing strategy is provided in Table 41, with a more complete breakdown included in Appendix A-3.

Table 41 Projects Included in the Preferred Water Servicing Solution

Year Req'd in Service	Master Plan Project No.	Project	Total Estimated Cost (Millions)
2008	W-01	Waterdown North Elevated Tank	$6.0M
2008	W-02	New HD16A Pumping Station	$3.0M
2008	W-03	Parkside Drive Watermain	$1.5M
2008	W-04	HD12A Governor's Road Pumping Station Upgrades	$2.1M
2008	W-05	Governor's Road PD11 Watermain Extension	$0.2M
2008	W-06	Governor's Road PD22 Watermain Extension	$0.7M
2009	W-07	Waterdown South Elevated Tank	$4.5M
2009	W-08	New HD03B Highland Gardens Pumping Station	$4.0M
2009	W-09	Garner Road Watermain	$6.2M
2009	W-10	HD007 Highland Pumping Station Upgrades	$6.9M
2009	W-11	HD007 Highland Reservoir Expansion	$8.2M
2010	W-12	Centennial Pkwy Trunk Feedermain	$11.3M
2010	W-13	Centennial Pkwy Trunk Feedermain	$9.9M
2011	W-14	Pressure District 18 Elevated Tank	$5.3M
2011	W-15	HD002 Ferguson Pumping Station Upgrades (Standby Power)	$1.5M

Year Req'd in Service	Master Plan Project No.	Project	Total Estimated Cost (Millions)
2011	W-16	HD012 Lynden Ave Pumping Station Upgrades	$2.1M
2011	W-17	Sedimentation Tank upgrades	$15.0M
2011	W-18	Pre-Chlorination system upgrades	$1.0M
2014	W-19	Locke St Watermain	$1.4M
2014	W-20	HD019 Binbrook/Hwy56 Pumping Station Upgrades	$6.4M
2016	W-21	HD06B Tunbridge Pumping Station Upgrades (HD07A)	$3.5M
2016	W-22	HD07A Feedermain	$5.7M
2016	W-23	Pressure District 7 Elevated Tank	$5.3M
2016	W-24	Stone Church Trunk Feedermain	$22.1M
2019	W-25	HD016 Trunk Feedermain	$6.7M
2019	W-26	HD016 York/Valley Road Pumping Station upgrades	$6.0M
2021	W-27	Airport Lands Trunk Watermain	$11.7M
2022	W-28	HD05A Greenhill Pumping Station Upgrades	$5.0M
2023	W-29	Woodward Ave. WTP Expansion	$2.0M
2023	W-30	Binbrook Trunk Feedermain	$5.5M
		Total Cost	**$171.0M**

15.2 WASTEWATER SERVICING SOLUTION AND IMPLEMENTATION PROGRAM

The preferred wastewater servicing solution was identified through a review and comparative evaluation of alternative servicing strategies for the Master Plan study area.

The preferred solution is presented in Figure 24.

The implementation program for the preferred servicing strategy is provided in Table 42, with a more complete breakdown included in Appendix A-3.

Table 42 Projects Included in the Preferred Wastewater Servicing Solution

Year Req'd in Service	Master Plan Project No.	Project	Total Estimated Cost (Millions)
2007	WW-1	HC018 - Twenty Road SPS Upgrades	$2.6M
2007	WW-2	HC018 - Twenty Road SPS Forcemain	$1.4M
2008	WW-3	New HC008 - Harmony Hall SPS	$5.5M
2008	WW-4	New HC008 - Harmony Hall Forcemain	$0.7M
2008	WW-5	HC008 - Harmony Hall SPS Decommission	$0.1M
2008	WW-6	HC016 - Winona SPS Upgrades	$0.2M
2008	WW-7	HC016 - Winona SPS Forcemain Twinning	$0.9M
2008	WW-8	New Waterdown SPS	$6.0M
2008	WW-9	New Waterdown Forcemain	$1.8M
2008	WW-10	Waterdown WWTP	$0.5M
2009	WW-11	Ancaster-to-Fennell Trunk Sewer Twinning	$0.8M
		Ancaster-to-Fennell Trunk Sewer Twinning	$1.2M
		Ancaster-to-Fennell Trunk Sewer Twinning	$3.9M
		Ancaster-to-Fennell Trunk Sewer Twinning	$0.9M
2010	WW-12	West 18th Street Sewer Twinning	$3.3M
2010	WW-13	Combined Sewer Overflow Control	$80.0M
2010	WW-14	New Centennial Trunk Sewer	$24.5M
		New Centennial Trunk Sewer	$10.0M
2010	WW-15	Woodward Ave. WWTP Upgrades	$340.1M
2010	WW-16	Mountain Brow Trunk Sewer	$2.3M
		Mountain Brow Trunk Sewer	$1.6M
2010	WW-17	DC014 - First Street SPS Upgrades	$0.4M
2011	WW-18	Scenic Drive Sewer Twinning	$1.3M

Year Req'd in Service	Master Plan Project No.	Project	Total Estimated Cost (Millions)
2012	WW-19	Bowman Street Sewer Twinning	$1.0M
2011	WW-20	HC058 - Binbrook SPS Upgrades	$0.2M
2011	WW-21	Highway 56 Forcemain Twinning	$3.8M
2012	WW-22	Hwy 403 Trunk Sewer Twinning	$6.6M
2012	WW-23	New Airport Lands SPS	$7.5M
2012	WW-24	New Airport Lands Highway 6 Forcemain	$4.7M
2012	WW-25	New Highway 6 Trunk Sewer	$2.0M
2012	WW-26	New Dickenson Road Trunk Sewer	$15.4M
2012	WW-27	New Dickenson Road SPS	$7.5M
2012	WW-28	New Dickenson Road Forcemain	$0.5M
2014	WW-29	New HC053 - Shaver Road SPS	$1.2M
2014	WW-30	New HC053 - Shaver Road Forcemain	$0.4M
2014	WW-31	New Shaver Road Sewer	$1.2M
2014	WW-32	HC053 - Shaver Road SPS Decommission	$0.1M
2014	WW-33	Battlefield Trunk Sewer Twinning	$2.2M
		Battlefield Trunk Sewer Twinning	$1.8M
2016	WW-34	HC002 - Scenic Drive SPS Upgrades	$0.2M
2016	WW-35	HC011 - Calvin Street SPS Upgrades	$0.2M
2021	WW-36	HC056 - Green Road Upgrades	$0.8M
2021	WW-37	HC056 - Green Road Forcemain Twinning	$0.1M
		TOTAL COST	**$547.4M**

Legend

- Pump
- Reservoir
- Plant
- Watermain
- Watermain Upgrades

Hamilton

Integrated Water & Wastewater Master Plan

Water Servicing

Preferred Water Servicing Alternatives

KMK Consultants Limited

Nov 22, 2006
1:125,000
2590-D-73

City of Burlington

Lake Ontario

Haldimand County

Region of Niagara

Sewer Upgrades

New Dickenson Road Trunk Sewer

Legend

- Pumping Station
- New SPS
- SPS Upgrades Required
- Existing Sewer
- New or Upgraded Gravity Sewer
- New or Upgraded Forcemain
- Rural Settlement Area
- Potential Urban Boundary Expansion
- Potential New Business Park
- Intensification Area
- Niagara Escarpment
- Greenbelt
- Urban Boundary

Hamilton

Integrated Water & Wastewater Master Plan

Wastewater Servicing

Recommended Preferred Solution

KMK Consultants Limited

Figure 24

Nov 22, 2006

1:125,000

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16. IMPLEMENTATION

The preferred servicing strategies will support the short and long term servicing needs of the approved growth areas as well as addressing Hamilton Harbour water quality and provide flexibility for servicing potential growth areas in the future.

Under the Municipal Class EA, the Schedule A projects are pre-approved and may proceed to implementation. Upon completion of the master plan or Phase 2 of the EA process, Schedule B may proceed to Phase 5, Implementation, subject to finalization of the 30 day review period and assuming no Part II Orders (bump ups) are received. Schedule C projects must complete Phases 3 & 4 of the EA process prior to proceeding to implementation.

This Notice of Completion for this Master Plan is issued with respect to Schedule 'B' projects only which include the following:

Project	Location
Wastewater	
HC018 - Twenty Road SPS Upgrade and Twin Forcemain	Hamilton Mountain
Mountain Brow Trunk Sewer	Waterdown
DC014 - First Street SPS	Waterdown
Hwy 403 Trunk Sewer Twinning - Royal to Main-King	Hamilton
Ancaster-to-Fennell Trunk Sewer Twinning	Hamilton Mountain
Centennial Trunk Sewer	Hamilton/Hamilton Mountain
HC058 - Binbrook SPS Upgrade	Binbrook
HC056 - Green Road SPS Upgrade and Twin Forcemain	Stoney Creek
Decommission Waterdown WWTP	Waterdown
New Waterdown SPS and Forcemain at WWTP	Waterdown
Airport Lands SPS and Hwy 6 Forcemain	Hamilton Mountain
Hwy 6 Trunk sewer	Hamilton Mountain
Decommission Harmony Hall SPS	Ancaster
Dickenson Road trunk sewer	Hamilton Mountain
Dickenson Road SPS and Forcemain	Hamilton Mountain
HC053 – New Shaver Road SPS	Ancaster
HC002 – Scenic SPS Upgrade	Hamilton Mountain
HC011 – Calvin Street SPS Upgrade	Ancaster

Project	Location
Water	
Waterdown North Elevated Tank	Waterdown
New HD16A Pumping Station	Waterdown
Parkside Drive Watermain	Waterdown
HD12A – Govenor's Rd. Pumping Station Upgrades	Dundas
Waterdown South Elevated Tank	Waterdown
New HD03B – Highland Gardens Pumping Station	Hamilton
HD007 Highland Pumping Station Upgrades and Reservoir Expansion	Hamilton Mountain
Centennial Trunk Feedermain	Hamilton/Hamilton Mountain
Pressure District 18 Elevated Tank	Ancaster
HD002 Ferguson Pumping Station Upgrades (Standby Power)	Hamilton
HD012 Lynden Ave Pumping Station Upgrades	Dundas
HD019 Binbrook/Hwy 56 Pumping Station Upgrades	Binbrook
HD06B Tunbridge Pumping Station Upgrades (New Zone 7 pumps - HD07A)	Hamilton Mountain
Pressure District 7 Elevated Tank in growth node	Hamilton Mountain
Stone Church Trunk Feedermain	Hamilton Mountain
HD016 Trunk Feedermain	Dundas to Waterdown
HD016 York/Valley Rd Pumping Station Upgrades	Dundas
HD05A Greenhill Pumping Station Upgrades	Hamilton
Binbrook Trunk Feedermain	Hamilton Mountain/Binbrook

City Staff have discussed the interdependencies of the work at the Woodward Avenue WWTP and the proposed CSO and conveyance upgrades with primary equivalency treatment at either the Woodward Avenue WWTP or at a remote location with Ministry of Environment (MOE) staff. There has been consensus reached with MOE during the Master Plan process to allow the City to proceed beyond Phase 1 and 2 based on the preferred servicing solution for the combined sewer overflow control. The preferred solution will be developed through fulfilling the Class EA Phase 3 and 4 requirements for both undertakings. This study process will include the review and selection of a preferred design alternative.

17. REFERENCES

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