Final Report

Guelph Wastewater Treatment Master Plan

Prepared for

City of Guelph

April 2009

CH2MHILL

345572T1T8_WB082008002KWO

Executive Summary

Introduction

The Wastewater Treatment Master Plan (WWTMP) was initiated by Wastewater Services in November 2006. Assistance in the development and completion of the WWTP was provided by the consulting firm of CH2M HILL.

The purpose of the WWTMP is:

To develop a 50-year Wastewater Treatment Plan to provide direction for wastewater infrastructure planning, investment and implementation to the year 2054.

The WWTMP reviewed the City's existing Wastewater Treatment infrastructure and identified future requirements in light of anticipate growth identified in the City's Local Growth management Strategy. The WWTMP identified alternatives to address future servicing requirements as well as improvements and upgrades which would benefit existing customers.

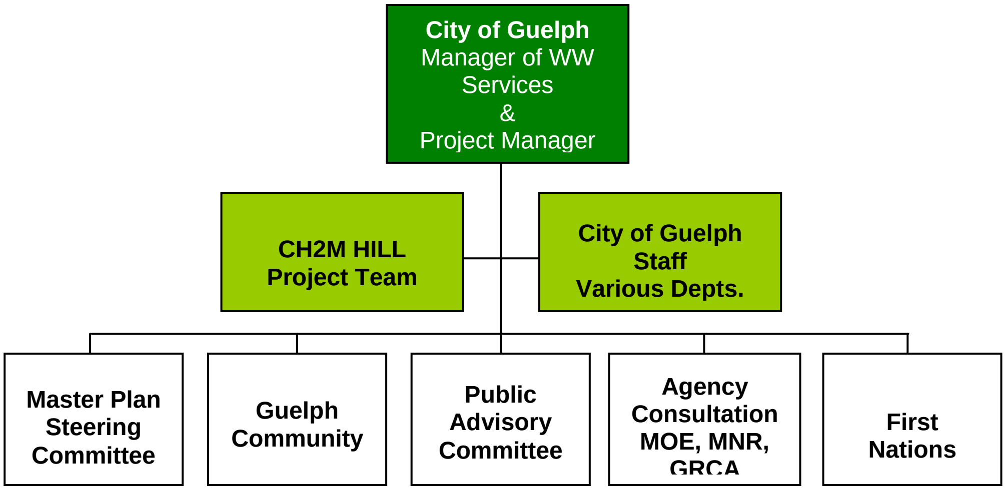
Master Planning Process

The study was completed in accordance with the Master Planning provisions of the Municipal Class Environmental Assessment (EA) process (*Municipal Engineers Association, October 2000 as amended in 2007*), under Ontario's Environmental Assessment Act. The Master Planning process allows a municipality to develop the need and justification for specific projects under a broad planning framework. A Master Plan should be reviewed every 5 years to determine the need for detailed review and updates. Specific projects identified in the Master Plan may require additional Class EA planning and approvals before their implementation.

Consultation Program

To facilitate effective communication with stakeholders, a consultation plan was developed for the WWTMP, which goes beyond the Class EA requirements, to afford stakeholders an opportunity to offer greater input into the Master Planning process. Figure ES-1 shows the stakeholders involved in the consultation process.

Figure ES-1: Master Plan Stakeholders



Linkages to Other City Initiatives

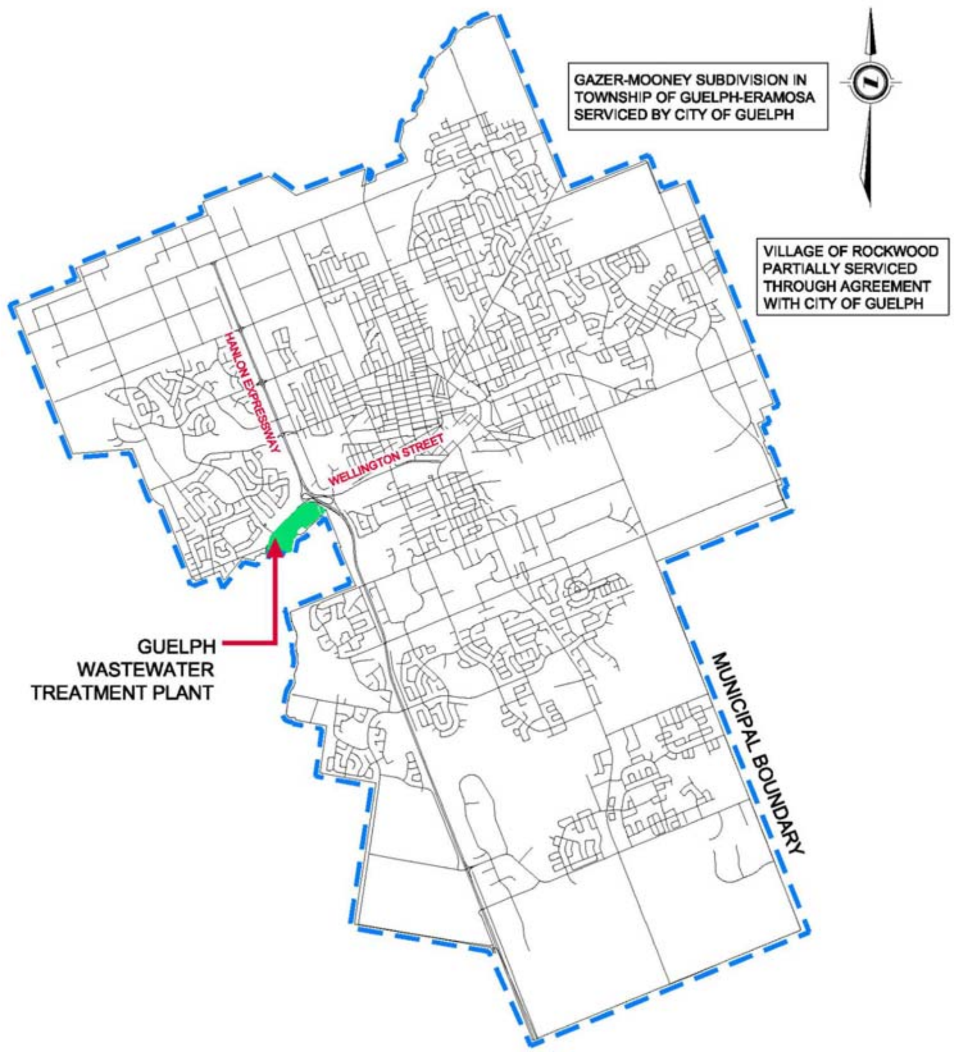
The City is undertaking, or has recently undertaken, a number of planning initiatives and strategies that examine the changing demographics and regulatory environments in the City, and the potential impacts of these changes on municipal services. While each of these studies are separate initiatives, the approach to and results of each will influence the others. Figure ES-1 shows the relationship to other City initiatives.

Figure ES-2: Linkages to other City Initiatives

Study Area

The Guelph WWTP is located at 530 Wellington Street West, adjacent to the Speed River at the corner of Wellington Road and Highway 6 (the Hanlon). The Study Area for the WWTMP is shown in Figure ES-3 and encompasses the urban boundaries of the City. The WWTP currently treats wastewater from the City, as well as the Village of Rockwood and the Gazer-Mooney subdivision located in the Township of Guelph-Eramosa.

Figure ES-3: Guelph Wastewater Treatment Master Plan Study Area



Existing Conditions

As part of the Master Planning process the existing conditions at the Guelph WWTP were reviewed. This included a review of the current wastewater treatment process as well as an examination of current and approved capacity. The Guelph WWTP is currently rated for an average daily flow of 64 ML/d (averaged over a 365-day period). The City has approval from the Ministry of the Environment (MOE) to expand the plant to an average daily flow of 73.3 ML/d. The plant is currently receiving average flows of 54.4 ML/d.

Wastewater Generation Rates

In order to predict future wastewater flows, it is important to determine the wastewater generation rate based on the current population. Based on current information reviewed the per capita wastewater generation rate for Guelph is 478 litres per capita per day (Lpcd), which also accounts for industrial, commercial, and institutional (ICI) flows. This rate is representative of total wastewater flows arriving at the WWTP, including extraneous Inflow and Infiltration (I/I) into the sewer system.

Current Initiatives at the WWTP

The City prepared the WWTMP while undertaking a number of projects to improve the processes at the plant. The following lists current initiatives at the WWTP:

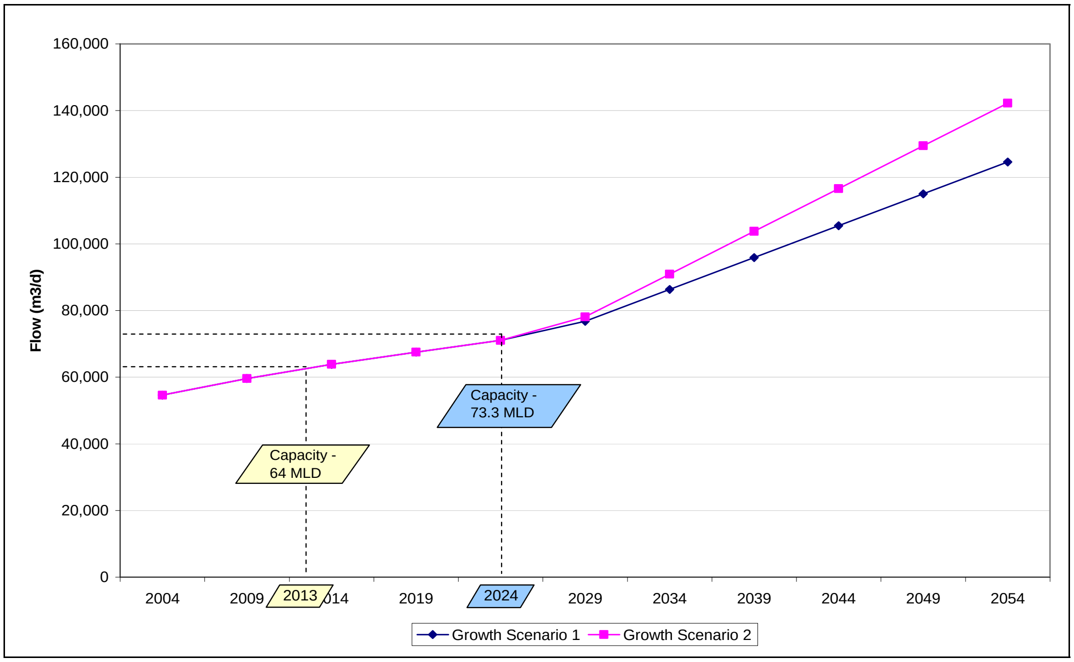
- Plant Optimization
- Digester Expansion
- Biosolids Storage
- Waste Activated Sludge (WAS) Thickening Demonstration
- Lystek Demonstration
- Bypass Mitigation Program

Future Wastewater Servicing Requirements

Based on the changing growth pressures, in 2006, Guelph City Council initiated a four-phase Growth Management Strategy. Based on the timing of the GMS process, growth projection scenarios were not available for integration into this WWTMP. It was agreed that population projections developed and endorsed during the Water Supply Master Plan (WSMP) would be used as part of the WWTMP to facilitate consistency between the two planning initiatives.

As population in the City increases, so will the wastewater volume that requires treatment. Future wastewater flow projections are shown graphically in Figure ES-4. By the year 2054, it is projected that the City may need to provide wastewater treatment capacity for 144 ML/d. This flow projection is used as a basis for determining future treatment requirements for the Guelph WWTP.

Figure ES-4: Wastewater Flow Projections for the Guelph WWTP (2004 – 2054)



Potential future effluent compliance limits were developed based on maintaining or reducing current loading rates at a future flow rate of 144 MLD. These compliance limits, and associated loadings, are compared to current (64 MLD) and approved (73.3 MLD) limits, as shown in Table ES.1.

TABLE ES.1: Comparison of existing and View of Proposed Potential Future Compliance Limits

Parameters	Limits (mg/L)			Loads (kg/d)		
	64 MLD	73.3 MLD	144 MLD	64 MLD	73.3 MLD	144 MLD
Summer Limits						
TSS	10	8	2	622	586	288
$cBOD_5$	–	–	2	–	–	288
TOD	22	16.5	-	1,426	1,210	-
Ammonia	–	1	0.5	–	73	72
Total Phosphorus	0.38	0.3	0.1	24	22	14
Winter Limits						
TSS	10	8	2	622	586	288
$cBOD_5$	7.4	4	2	473	293	288
TOD	–	–	–	–	–	–
Ammonia	3.4	1.5	0.75	218	110	108
Total Phosphorus	0.7	0.5	0.15	46	37	22

Wastewater Treatment Alternatives

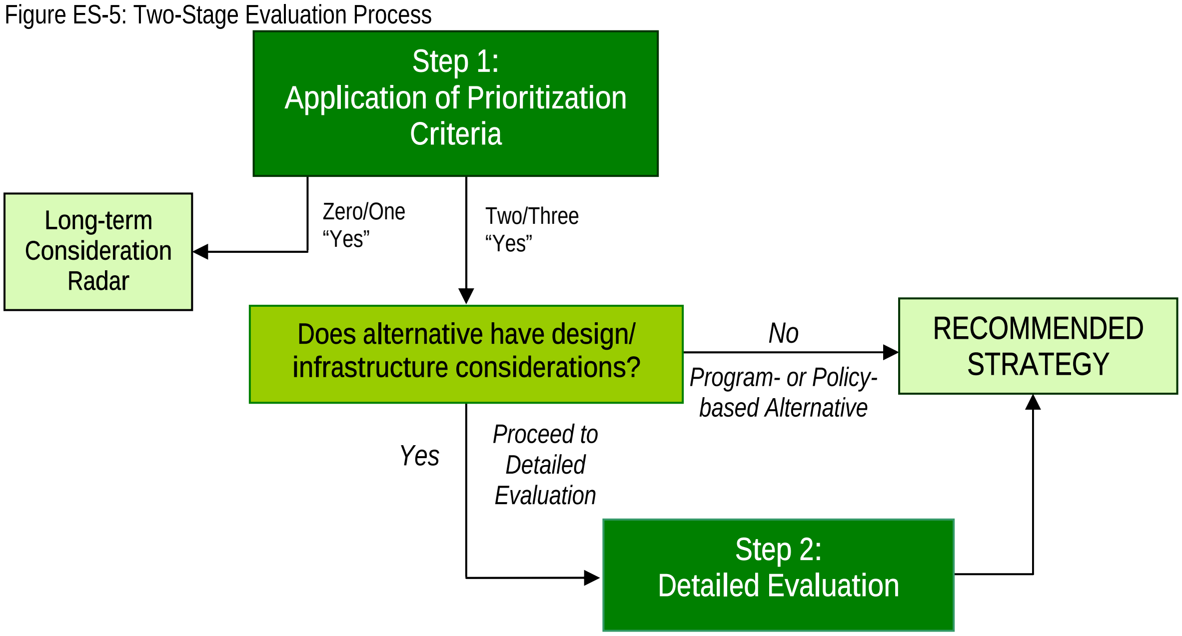
The following descriptions provide a brief overview of the alternative solutions that will be evaluated as part of the Wastewater Treatment Master Plan.

- Planning Alternatives
  - "Do Nothing": Is used as a baseline for comparison
  - Limit Growth: Growth projections are being examined as part of the Growth Management Strategy
- Source Control Alternatives
  - Inflow and Infiltration: Reducing extraneous flows from entering the sewer system, e.g. through cracked pipes, maintenance hole covers, and connect roof leaders
  - Sewer Use By-law: Controlling the types and amounts of certain parameters that may enter the sewer system; may require some industries to pretreat wastewater.
  - Water Conservation: Reducing the amount of wastewater generated
- Discharge Location Alternatives
  - Existing WWTP Outfall to Speed River: Examination of the capacity of the Speed River to accept additional treated effluent flows and loads
  - New Outfall to Alternate Receiver: Examination of discharging effluent to a larger receiving water body to accept additional flows and loads
  - Effluent Reuse: Reusing treated effluent for seasonal irrigation on lands such as golf courses and municipal landscaping
  - Aquifer Disposal: Disposal by injecting into a non-potable aquifer
- Treatment Location Alternatives
  - Existing WWTP: Continuing treatment at the existing location
  - Satellite Plant(s) at Discharge Location(s): If alternate discharge location is found to be appropriate, construction of a new (satellite) plant on the Grand River system to manage a portion of the wastewater flows
  - Satellite Plants at Generation Locations and Pump to Outfall(s): Construction of a new facility located where new wastewater generation (growth) is anticipated with effluent pumped to a new outfall located on the Grand River system
- Treatment Technology Alternatives
  - Conventional: Preliminary, primary and secondary treatment processes, effluent disinfection
  - Tertiary: Provision of additional stage of treatment, could include sand filtration or biological contactors for ammonia removal (nitrification)
  - Advanced: Application of advanced treatment technologies, such as membrane filtration, to achieve higher quality effluent than primary and tertiary
  - Emerging: Application of advanced tertiary oxidation, carbon adsorption or new technologies to further reduce organic contaminants

Evaluation

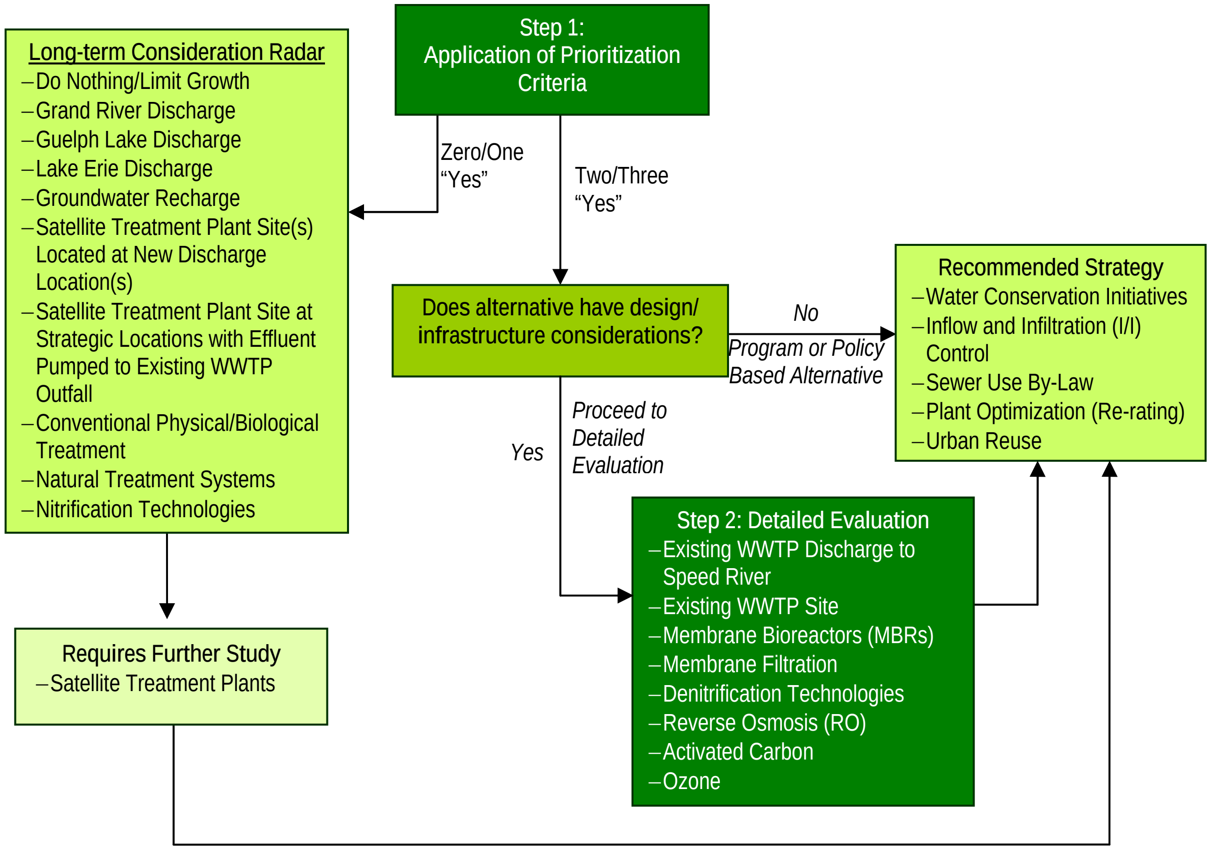
For this Master Plan exercise, a two-stage decision process was developed. Stage 1 was an initial prioritization exercise and Stage 2 involved a detailed evaluation. During the prioritization stage an alternative shows promise with further study if it meets two or three of the prioritization criteria. Those alternatives that meet only one or none of the criteria will continue to be considered over the long-term. A graphical representation of the two-stage evaluation methodology is shown in Figure ES-5.

Figure ES-5: Two-Stage Evaluation Process



The results of the Prioritization Stage are shown in Figure ES-6.

Figure ES-6: Prioritization Results Summary



Recommended Master Plan Components

The recommended strategy components for Guelph's Wastewater Treatment Master Plan can be divided into three categories: Studies, Programs/Policies and Infrastructure.

Studies

The following studies were identified as required to assist the City in obtaining a better understanding of the outlined topics.

Study	Description
Urban Reuse	Urban reuse involves diversion of a portion of treated effluent for applications, such as: municipal/golf course irrigation, construction dust control, dual water systems, or industrial applications Study would look at market analysis, costs and regulatory requirements.
Facility Plan	This is a tool that the City can use for detailed capital investment and help to integrate recommendations from master plans along with maintenance requirements. Study would summarize recommendations on a cost and land allocation basis and assist the City in developing their detailed

	investment planning.
Energy Audit of the Guelph WWTP	This audit would contribute to the City's Community Energy Plan by looking at current and potential future uses at the WWTP. Study would make recommendations for replacement of existing equipment and future specifications of equipment and look at potential operation modifications that could be made. Renewable energy produced that the plant would also be quantified. The project should also look at the plant's carbon footprint in regards to greenhouse gas emissions.
Climate Change Adaptation	This study would look at predicted climate change scenarios as they relate to the Guelph area. This undertaking would involve integration with other organizations, such as the Grand River Conservation Authority, doing work on this topic.
Sewer Use By-Law Review and Update	This by-law is an important tool the City uses to control the quality of wastewater that reaches the WWTP. This study would review the City's current by-law in detail and make recommendations for improvements

Programs/Policies

A key component of this Master Plan is the continuation and enhancement of current programs and policies. These programs have and will continue to have beneficial impacts on the WWTP.

Program/Policy	Description
Water Conservation and Efficiency	The City's Water Efficiency program has effectively reduced the per capita water consumption over the years. The City continues to update and enhance this program which could contribute to reductions in per capita wastewater generation.
Inflow and Infiltration Control	Inflow and Infiltration (I/I) is extraneous flow that enters the wastewater collection system. Through the City's Water and Wastewater Servicing Master Plan recommendations have been made to reduce I/I from entering the system and arriving at the WWTP.
Optimization	The City will continue to look at potential opportunities for optimization of the WWTP by looking at potential bottlenecks and seeing how the WWTP can be operated differently to reduce these bottlenecks.
Water Managers of the Grand	The City will continue to be active in the Water Managers of the Grand. They will work with the GRCA to improve the monitoring along the Speed River, which will assist in identifying areas to be targeted for improvement of the overall health of the Grand River Watershed.

Infrastructure

The recommended infrastructure components have been divided into three timeframes: short-term (2009– 2020), mid-term (2021 – 2031), and long-term (2032 – 2054).

The recommendations summarized within the table are based on best information available at the time of this Master Plan. Changes in available technology and/or regulatory conditions, will likely impact some of the recommendations in the future. Therefore, all recommendations and flow projections will be reviewed during each update of the Master Plan, which is to occur every 5 years.

Timeframe	Current Recommendation/Direction
Short-term (2009 – 2020)	Based on current projections, flows during this timeframe will not exceed the 73.3 MLD capacity approved in the 1998 Schedule C Class EA. Recommendations to upgrade the WWTP to 73.3 MLD have already been examined and approved under a previous Class EA process and were not re-examined under this Master Plan.
Mid-term (2021 – 2031)	Based on current flow projections, the approved capacity of 73.3 MLD is anticipated be reached by approximately 2024. Prior to the commencement of the expansion design, a Schedule C Class EA will need to be completed and approved. At the current time, advanced treatment technologies, such as membranes, are anticipated to be required.
Long-term (2032 – 2054)	The review and evaluation of treatment alternatives indicated that, at this time, tertiary membrane technology is the preferred method of achieving long-term effluent quality compliance limits beyond 2031. Consideration was given to staged treatment capacity expansions from 2031 to 2054 to provide a total treatment capacity of 144 MLD at the Guelph WWTP.

Implementation

The estimated costs associated with the recommendations in the implementation plan have been summarized in Table ES.2. This table also includes projects previously identified by the City, which have been incorporated into the current approved capital budgets.

Figure ES-7 shows a proposed outline for implementation of the recommended strategy components. Final prioritization and implementation of the projects will be completed by the City.

It is important to note that the City will be reviewing and updating this Master Plan every five years as shown on the schedule.

Table ES.2: Costing Estimates for Master Plan Recommendations

Recommendation	2008 – 2011	2012 – 2018	2019 - 2025	2026 – 2031	2032 - 2054
From Master Plan Recommendations					
Facility Plan	$75,000				
SCADA System Plan (Under Facility Plan)	$75,000				
Urban Reuse Study	$500,000				
Energy Audit at the WWTP	$90,000				
Climate Adaptation Studies	$35,000				
Sewer Use By-Law Review and Update	$75,000				
Master Plan Updates	$200,000	$200,000	$200,000	$400,000	$800,000
Future Studies[1]		$500,000	$500,000	$500,000	$1,500,000
Schedule C Class EA for 85 MLD Expansion		$400,000			
Design and Construction of 85 MLD Expansion			**$60,000,000**		
Long Term Expansions				**$60,000,000**	**$120,000,000**
From Previous Studies/Ongoing Maintenance/Upgrades					
Phase 2 Expansion to 73.3 MLD[2]	$10,000,000	$20,000,000			
Optimization – Plant Rerating	$400,000	$100,000			
Biosolids Facility Upgrade	$5,000,000	$37,000,000			
Digester No. 6		$6,000,000			
Dewatering Facility Expansion			$10,000,000		
Solids Stabilization Expansion			$15,000,000		
Secondary Pumping Expansion		$8,000,000			
Misc. WWTP Upgrades/Maintenance	$4,000,000	$4,000,000			
SCADA Upgrades	$550,000				
Administration Building Upgrades	$1,000,000				
Disinfection Upgrades		$8,000,000			
Totals	$22,000,000	$84,200,000	$85,700,000	$60,900,000	$122,300,000

[1] - A placeholder dollar value has been provided for future studies which wil be recommended from Master Plan updates

[2] - Cost for 73.3. MLD expansion from previously approved Schedule C Class EA

- Cost estimates do not include escalation

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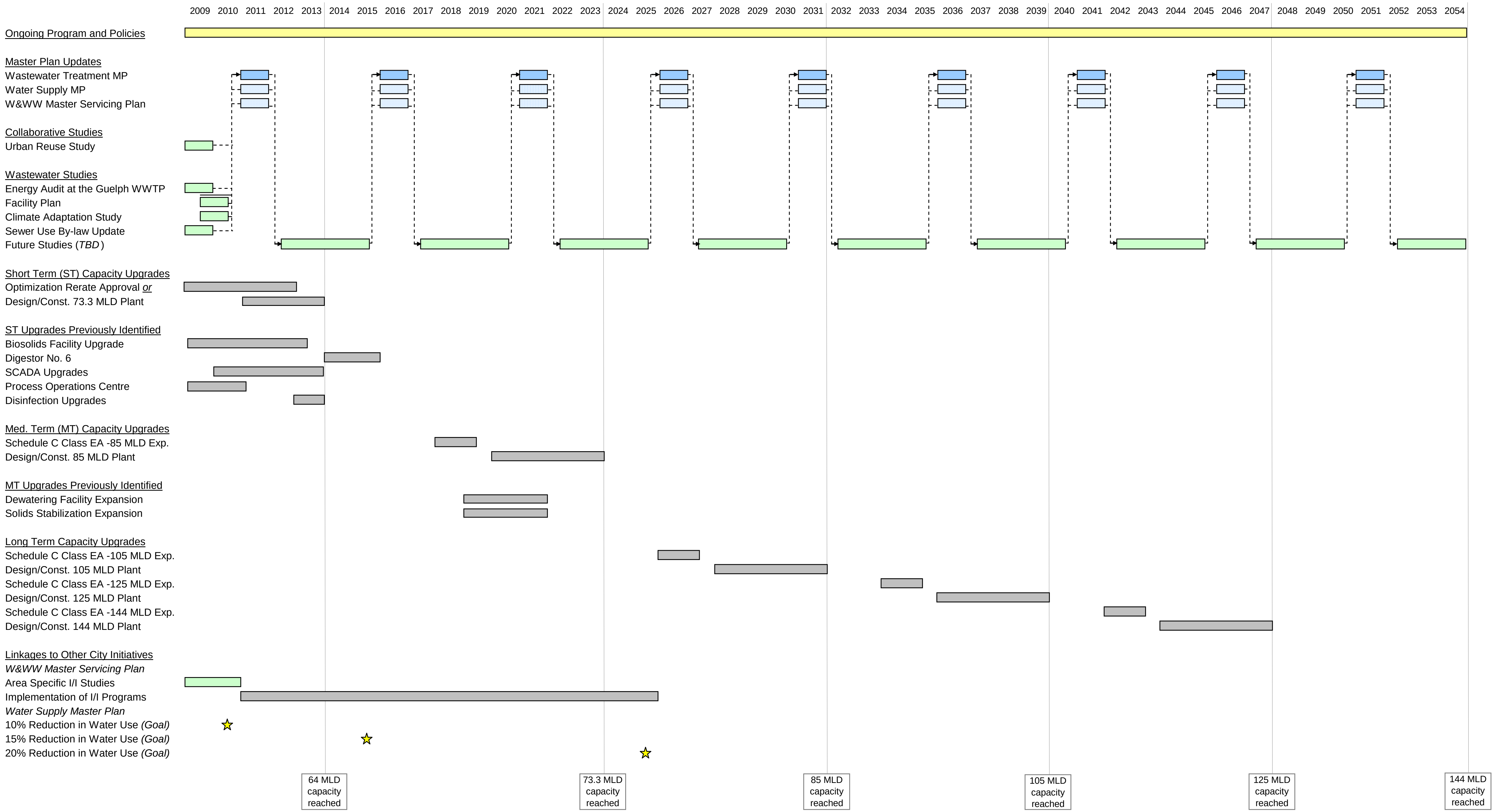
Figure ES-7: WWTMP Proposed Implementation Schedule



NOTES:

Implementation timeline is based on current projected flow rates and best available information. Recommendations may be deferred or modified based on the success of City programs, population projections and findings from subsequent Master Plan updates

Collaborative Studies require coordination between multiple City divisions such as Wastewater Services,Engineering,Planning and Waterworks

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1. Introduction and Background

The Guelph Wastewater Treatment Plant (WWTP) is located at 530 Wellington Street, along the Speed River. The WWTP is owned and operated by the City of Guelph (City). The WWTP receives domestic, institutional, commercial, and industrial wastewater from the City and a portion of the Village of Rockwood. The WWTP also services the Gazer-Mooney subdivision, located north of the City in the Township of Guelph-Eramosa.

TABLE 1.1
History of Guelph WWTP

	1958	Built Plant No. 2
Built Plant No.3	1968	
	1978	Installed Rotating Biological Contactors Added Automatic Backwash Filters for Nitrification and Filtration
Upgraded Instrumentation and Control	1979	
	1980	Built Outfall Extension
Built Sludge Dewatering Facilities Built Plant Headworks	1983	
	1986	Retrofit to Fine Bubble Aeration
Upgrade to Plant No. 1	1987	
	1992	Upgraded Dewatering Facility
Built Sludge Composting Facility	1995	
	1996	Upgraded Digester and Heating
Upgraded Digester No. 3	1997	
	1998	Wastewater Treatment Strategy Class EA
Stage 1 Expansion – Built Plant No. 4	2001	
Class EA Update Stage 2 Expansion	2007	Biosolids Management Master Plan Class EA
	2008	Digester Capacity Expansion – Built Digester 5

The City's original WWTP was constructed more than 100 years ago. Over time, components of the plant were upgraded or replaced. The oldest section, which is still in use, was constructed in 1958. Over the years, the plant has been upgraded and expanded to accommodate growth within the City and to meet more stringent effluent quality requirements. Table 1.1 summarizes the City's major WWTP upgrades and studies.

As it grows, the City needs to ensure that the infrastructure is in place to support this growth while still providing services on a sustainable basis. The City is undertaking a number of planning initiatives to address future demands while adhering to current and future regulatory requirements. The Guelph Wastewater Treatment Master Plan (WWTMP) examines the City's current and future demands on the wastewater treatment infrastructure.

1.1 Class Environmental Assessment Requirements

The *Municipal Class Environmental Assessment* (Class EA) document prepared by the Municipal Engineer's Association, October 2000, as amended in June 2007, outlines the approved Class EA process. The Class EA document includes the following five phases of assessment:

- Phase 1: Definition of the Problem
- Phase 2: Identification and Assessment of Alternative Solutions and Selection of a Preferred Solution
- Phase 3: Identification and Assessment of Alternative Sites/Design Concepts and Selection of a Preferred Site/Design
- Phase 4: Preparation of an Environmental Study Report (ESR)
- Phase 5: Implementation

Figure 1-1 illustrates the Class EA planning and design process.

The Class EA document assigns municipal water, wastewater and transportation projects into three possible schedules, depending on their characteristics (that is, Schedule A, B, or C projects). The schedule that a project falls under determines the planning and design phases that must be followed.

Schedule A projects are minor operational and upgrade activities and may go ahead without further assessment once Phase 1 of the Class EA process is complete (that is, the problem is reviewed, and a solution is confirmed).

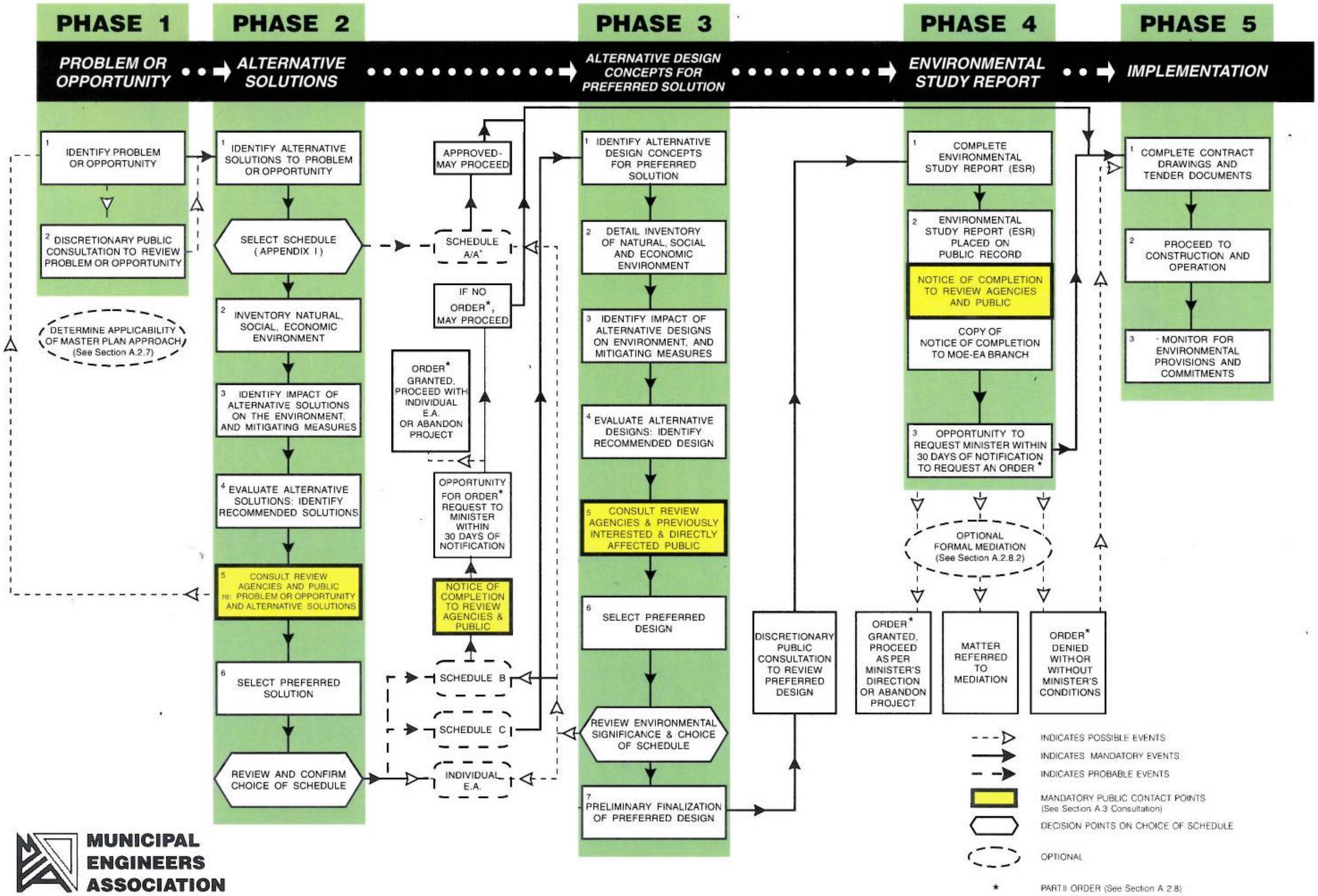
Schedule B projects must proceed through the first two phases of the process. Proponents must identify and assess alternative solutions to the problem, inventory potential impacts to the natural, social, economic and technical environments, and select a preferred solution. They must also contact relevant agencies and affected members of the public. Provided that no significant impacts are found and no requests are received to elevate the project to Schedule C or undertake the project as an Individual EA (Part II Order), the project may proceed to detailed design and implementation (Phase 5).

Schedule C projects require more detailed study, public consultation, and documentation, as they may have more significant impacts. Projects categorized as Schedule C must proceed through all five phases of assessment. An ESR must be completed and available for a 30-day public review period before proceeding to implementation (Phase 5).

FIGURE 1-1
Municipal Class Environmental Planning and Design Process

[From: Municipal Engineers Association (October 2000, as amended in 2007)]

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



If there are major issues that cannot be resolved once the final ESR is completed, individuals may request the Minister of Environment (Minister) to require the City to comply with Part II of the EA Act. Upon receiving a Part II Order request, the Minister reviews the request and study information and makes one of the following decisions: deny the request, refer the matter to mediation, or require completion of an Individual EA. The Minister considers many factors in making decisions, including the adequacy of the planning process, the potential for significant adverse environmental effects after mitigation measures are considered, the participation of the requester in the planning process, and the nature of the request.

1.1.1 Master Planning Process

Master Plans are long-range plans that examine a given infrastructure system's current and future requirements using EA planning principles. The Master Plans must, at a minimum, address Phases 1 and 2 of the Class EA process as shown in Figure 1-1 and described in the previous section. Master Plans develop a framework for planning a group of related projects that are required to accommodate demands on a system over a long period of time.

The Master Planning process allows a municipality to develop the need and justification for specific projects under a broad planning framework. A Master Plan should be reviewed every 5 years to determine the need for detailed review and updates. Specific projects identified in the Master Plan may require additional Class EA planning and approvals before their implementation.

1.1.2 Master Plan Report Organization

This Master Plan, which documents the planning process, as well as results and recommendations for the City's wastewater treatment services to the year 2054, contains the following 11 sections:

- Section 1: Introduction: Provides an overview of the Class EA process and background on other City planning initiatives.
- Section 2: Master Plan Needs Statement: Outlines the purpose and rationale for this Master Plan, as well as defines the Study Area.
- Section 3: Existing Conditions: Provides an overview of existing conditions as they relate to the technical, natural, social, and economic environments.
- Section 4: Future Wastewater Servicing Requirements: Examines projected population and flow rates, as well as considerations for future effluent quality.
- Section 5: Wastewater Treatment Alternatives: Provides a long list of treatment alternatives, including: planning, source control, discharge location, treatment location, and treatment technology options.
- Section 6: Evaluation Methodology: Describes the two-stage evaluation process to evaluate alternatives.
- Section 7: Prioritizing the Long List of Alternatives: Describes the results from the prioritization process.

- Section 8: Detailed Evaluation of Infrastructure Components: Provides a summary of the detailed evaluation process.
- Section 9: Recommended Master Plan Components: Summarizes the recommendations to incorporate into the Master Plan, including an implementation schedule.
- Section 10: Stakeholder Consultation: Describes the consultation activities that took place throughout the Master Planning process, as well as their impacts.
- Section 11: References

1.2 Project Approach

The Master Plan was completed in a comprehensive, integrated manner. A detailed decision-making process and consultation plan were developed by CH2M HILL to ensure that various influences and conditions were considered and that stakeholders had an opportunity to offer input to the master planning process.

1.2.1 The Decision-making Process

The decision-making process for the WWTMP follows Phases 1 and 2 of the Municipal Class EA process. The approach from these phases was further refined to assist in the Master Planning process for the Guelph Wastewater Treatment system. Key components of the decision-making process included:

- Problem definition
- Examination of existing conditions
- Definition of future needs and constraints
- Development of evaluation criteria
- Development of long list of alternatives
- Alternatives evaluation
- Development of short list of alternatives
- Development of the WWTMP

Consultation was a critical component of the Master Planning process, from the initiation stages to final recommendations. Key consultation milestones are shown integrated with the decision-making process in Figure 1-2.

1.3 Consultation Program

To facilitate effective communication with stakeholders, a consultation plan was developed for the WWTMP, which goes beyond the Class EA requirements. The City wants to afford stakeholders an opportunity to offer input into the Master Planning process. Figure 1-3 illustrates the organizational framework for stakeholder involvement and demonstrates how various stakeholder groups are integrated. The Stakeholder Consultation section of this report (Section 10) describes the consultation activities in further detail.

FIGURE 1-2
Decision-Making Process

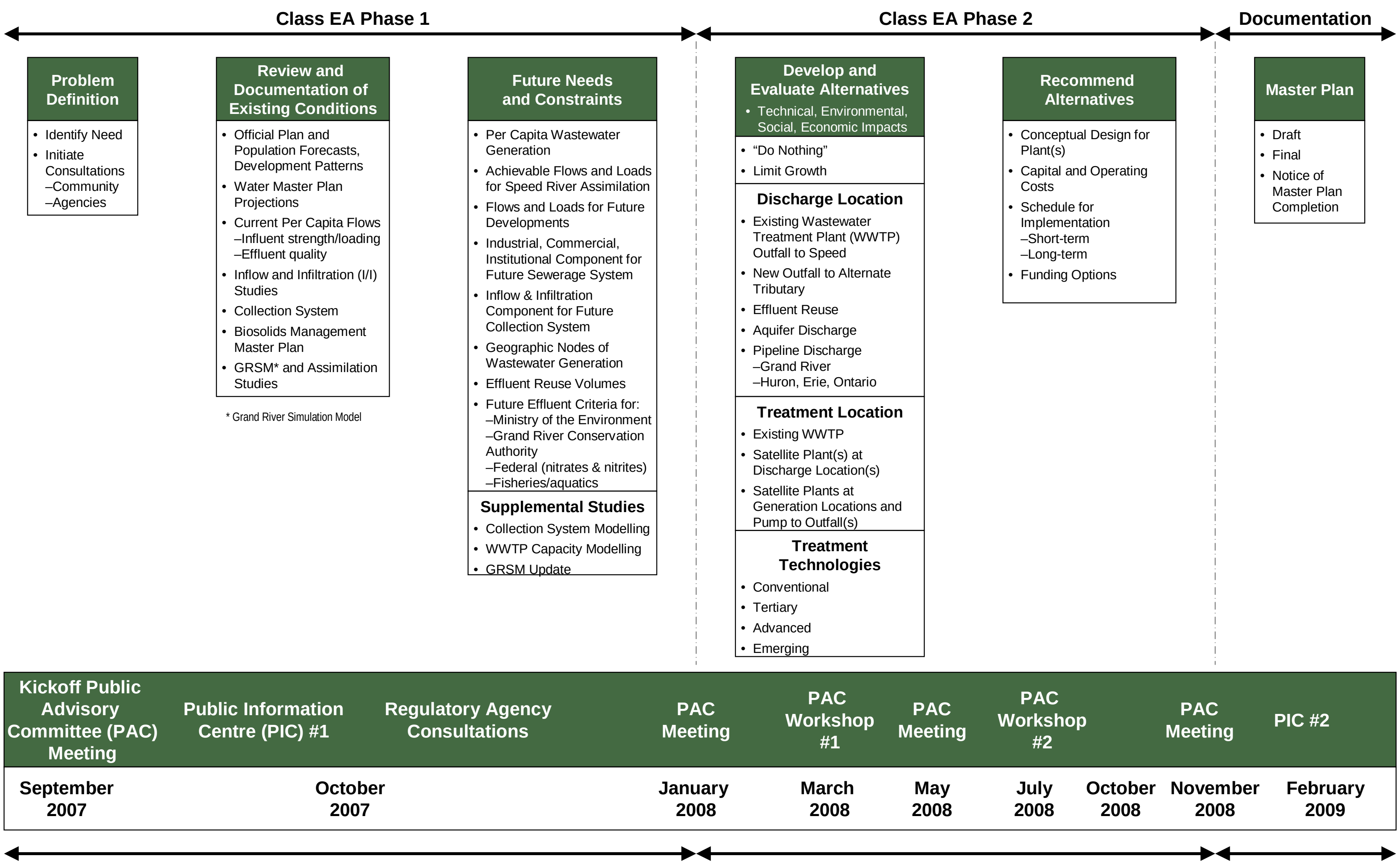
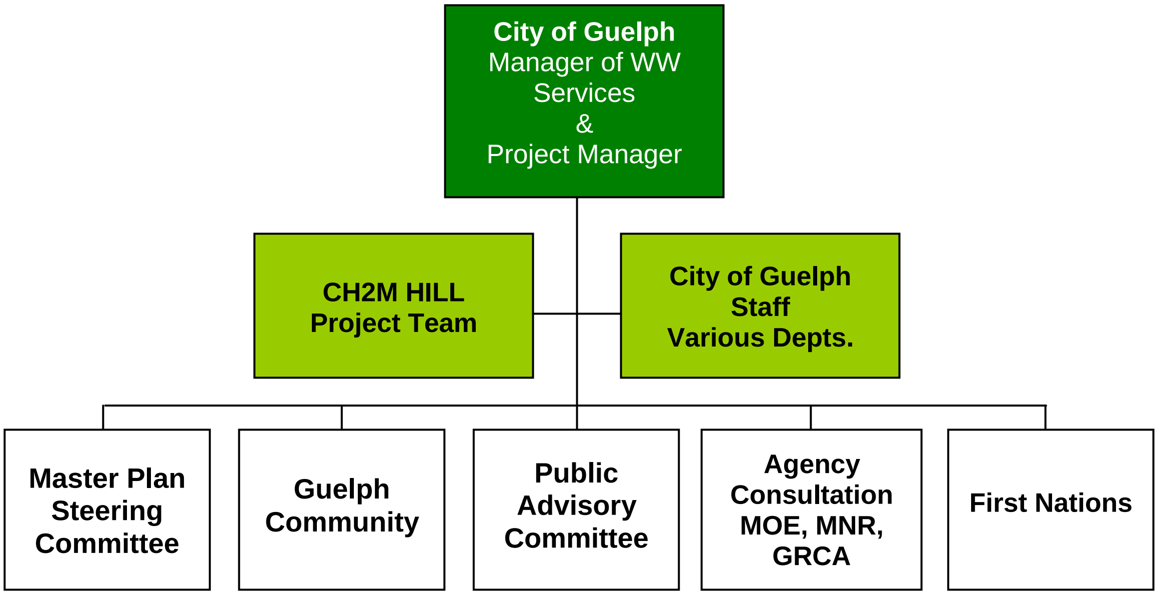


FIGURE 1-3
Stakeholder Consultation Framework



The stakeholder groups' roles and responsibilities are as follows:

City of Guelph Manager of Wastewater Services and Project Manager

The City's Manager of Wastewater Services, Project Manager, and staff are responsible for undertaking projects in a manner consistent with the City's Guiding Principles for Public Involvement (Guelph, 2006). The Guiding Principles are intended to encourage a "Way-of-Work" that fosters collaboration and creative decision-making at all levels of the City and throughout the community. The City's Project Manager coordinated activities with other City departments, as needed to meet the Master Plan project requirements.

City Council

The recommendations from the Master Plan project are presented to the Guelph City Council. The Council is collectively responsible to the citizens of Guelph. Each Council member is responsible to represent their Ward constituents while balancing the City's needs.

Master Plan Steering Committee

This committee was responsible for advising on the Master Plan decision process and related technical activities and issues. Committee members reviewed project information provided before meetings and actively participated in meetings. Committee members represent the interests of their respective organization.

Table 1.2 delineates the Steering Committee members and their associated titles and/or organizations.

TABLE 1.2
Guelph Master Plan Steering Committee

Title	Name
Manager of Wastewater Services	Cameron Walsh
Director of Environmental Services	Janet Laird
Project Manager, Wastewater Services	Kiran Suresh
Optimization Specialist, Wastewater Services	Gerard Wheeler
Supervisor Operations, Wastewater Services	Tim Robertson
Manager of Infrastructure Planning, Design and Construction	Don Kudo
City Engineer, Engineering Services	Richard Henry
Manager Waterworks Division	Peter Busatto
Director, Community Design and Development Services	Jim Riddell
Senior Policy Planner, Community Design and Development Services	Paul Kraehling
Senior Communications Officer, Corporate Communications	Tara Sprigg
Communications Coordinator, Corporate Communications	Laurie Watson
Senior Water Quality Supervisor, Grand River Conservation Authority	Sandra Cooke
Water Quality Engineer, Grand River Conservation Authority	Mark Anderson
CH2M HILL Project Manager	Warren Saint
CH2M HILL Environmental Assessment/Communications	Diana Vangelisti
CH2M HILL Engineering Support	Pam Law

Public Advisory Committee

The Public Advisory Committee (PAC) was responsible for providing advice and feedback to the WWTMP project team at key milestone points over the course of the study, including for the following Master Plan components:

- The problem statement
- Key issues and context for the Master Plan decision process
- Wastewater Treatment service alternatives
- Class EA evaluation methodology and decision criteria
- Consultation activities and results
- Related Master Plan issues and items, as identified through the study

The PAC membership includes representatives from the following community sectors:

- Business/Industry
- Environment
- Agriculture
- Development
- Community/Social
- Academia
- Community-at-Large

A member of Guelph Council also participated on the PAC. An independent member of the Community acted as PAC Chair. City staff and the consultant team served as resources for the PAC meetings.

Consultation with Guelph Community and Neighbours

The citizens of Guelph had the opportunity to participate in the Master Plan process through the consultation program elements including Public Information Centres (PICs), newsletters, and the City's website, where project information was posted. The citizens of Guelph have a responsibility to ask questions and provide comments about the project, so that they can learn about the project.

Agency Consultation

The City along with CH2M HILL engaged the participation of review agencies at key milestone points during the Master Plan decision process. The review agencies were responsible for reviewing and providing feedback on study information according to their agency mandates.

First Nations Communities

The City consulted directly with the Six Nations of the Grand River (Six Nations group) as part of the Master Planning Process. The Six Nations group requested a meeting with the City to discuss its current and planned water and wastewater initiatives. The City has communicated with representatives from the Six Nations Council to arrange a meeting to discuss the City's infrastructure plans.

1.4 Linkages to Other City Initiatives

The City is undertaking, or has recently undertaken, a number of planning initiatives and strategies that examine the changing demographics and regulatory environments in the City, and these changes' impacts on municipal services. The master planning studies develop long-range frameworks to assist the City in future planning decisions. While each of these studies are separate initiatives, the approach to and results of each will influence the others. Figure 1-4 illustrates the major planning initiatives that will be integrated into the WWTMP. A brief description of each study is included within this section of the report.

FIGURE 1-4
City of Guelph Planning Initiatives

1.4.1 Growth Management Strategy

The City, which has experienced considerable growth over the past decade and anticipates significant future growth, has been designated by the provincial government as an Urban Growth Centre under the Places to Grow Act. To address the challenges associated with managing growth, the City completed a Growth Management Strategy (GMS).

The GMS began in 2006 and was completed over a two-year period in four phases. Each of the phases is described in Table 1.3.

TABLE 1.3
Phases of the City of Guelph's Growth Management Strategy

Strategy Phase	Description
Phase I	Assess growth pressures in Guelph, compile public input
Phase II	Identify, plan, design, and evaluate alternative urban form options
Phase III	Analyze the alternative urban form options in terms of their financial, environmental, transportation, and servicing implications and evaluating the options
Phase IV	Determine how the preferred option will work and develop an implementation strategy

All four phases of the GMS have been completed with the Phase IV report going to Council in January 2009.

Guelph City Council adopted the GMS recommendations on June 23, 2008 which included:

1. That the City of Guelph plan for a population target of 169,0000 people to the year 2031 (equivalent to Places to Grow population of 175,000). The variance

between the two projections is based on adding an additional 3.6% which represents the typical undercount of residents in the census data.

2. That the City plan for a steady rate of population increase.

3a. That employment growth in the City should be planned to keep pace with population growth.

3b. That in addition to the GMS recommendation, the current ‘Employment Lands Strategy’ will inform future additional employment requirements and opportunities.

4a. That within the ‘Built-up” area of the City, residential intensification opportunities will be identified in the Downtown ‘Urban Growth Centre’.

4b. That in addition to the ‘residential intensification opportunities’ within the ‘Built-up’ area, opportunities to provide higher density residential in the ‘Mixed use Nodes’ of the Official Plan will be examined.

4c. That all development including higher residential density and mixed-use development be planned within the ‘Greenfield’ areas of the City based on the implementation of the Community Energy Plan.

4d. That a provision for affordable housing be planned within the City.

5. That development to meet the objectives of the Provincial Growth Plan and the GMS will be accommodated on lands contained within the existing corporate boundaries for the City of Guelph

6. That in order to meet the objectives of the Provincial Growth Plan and the City’s GMS, that the province be asked to address the provision of health care needs in the City of Guelph.

1.4.2 Water Supply Master Plan

In September 2006, the City released its Water Supply Master Plan (WSMP) final report. As stated in the final report the WSMP’s purpose was to “carry out a study to identify a strategy that will increase the capacity of the City’s existing water system and provide additional security of supply.” The WSMP was developed to ensure that water will be provided in a “safe, reliable and cost-effective manner to satisfy current and long-term municipal demand requirements” (Earth Tech, 2007).

As part of the WSMP, population projections for this timeframe were developed based on existing and projected population forecasts. These confirmed projections will be used for the WWTMP planning and decision-making process and will be discussed further in Section 4.1 of this report.

The WSMP concluded that, depending on the success of conservation and demand management programs, the existing groundwater supply system will be at or close to its maximum servicing capability by approximately 2010 to 2015. To address supply demands, the WSMP developed recommendations that were categorized according to short-, mid- and long-term implementation timeframes. The recommendations are summarized as follows:

Water Conservation and Demand Management – This involves implementing the recommendations from the Water Conservation and Efficiency Study, including ongoing peak demand management, as well as expansion of conservation efforts resulting in a 10 percent decrease in average use and a 3 percent reduction in unaccounted for water. Other recommendations included undertaking a rate study to address Bill 175 (Sustainable Water and Sewerage Systems Act) and examining the viability of wastewater reuse. The impact of water conservation on the WWTP and the viability of wastewater reuse will be examined further as part of the WWTMP.

Expand Existing Groundwater Supply System – Recommendations from this area include: 1) implementingation of the recommendations from the Arkell Class EA, which could increase water supply by up to 14 Percent, and 2) investigating optimization of the existing groundwater supply collection system by increasing the capacity of existing wells, returning existing wells to service, and investigating new well locations.

Establish New Surface Water Supply – Local – This recommendation includes discussions with surrounding municipalities, the MOE, and the Grand River Conservation Authority (GRCA) regarding local surface water sources and aquifer storage and recovery. Feasibility and related costs are to be investigated by the City.

The investigation portion of these recommendations are to be undertaken during the short-term timeframe, with implementation commencing during the mid- to long-term timeframes.

1.4.3 Water and Wastewater Master Service Plan

In parallel with the WWTMP, the City completed the Guelph Water and Wastewater Servicing Master Plan (W&WW SMP). The purpose of the W&WW SMP is to determine how best to service the water distribution/storage and wastewater conveyance needs for the City. An additional goal is to enable a better understanding of the water distribution and sewer network infrastructure and the systems' characteristics for the purpose of enhancing the reliability, operational efficiency, and capability of the water distribution and sewer network systems in meeting existing and future water and wastewater needs.

The W&WW SMP addressed the wastewater collection system which directs flows to the WWTP. Recommendations for the collection system could have a direct influence on the WWTP; therefore, it was important to establish and continue communication between the two planning exercises. One specific area which overlaps between the two studies and could have an influence on the WWTMP decision is the examination of inflow and infiltration (I/I) which impacts quantities of wastewater reaching the WWTP.

The W&WW SMP was completed in July 2008, and recommendations included trunk sewer replacements, reinforcement of gravity sewers, installation of new gravity sewers, and opportunities to provide storage to attenuate peak flows. Recommendations to address I/I included the introducing a roof leader/sewer disconnection program and undertaking rehabilitation activities.

1.4.4 Wastewater Treatment Strategy Class EA Update

The Wastewater Treatment Strategy Schedule C Class Environmental Assessment (Class EA) was undertaken as an update to the Wastewater Treatment Strategy; Class EA was completed in March 1998. As part of the Class EA, the City committed to evaluating emerging and innovative technologies to determine a preferred technology for implementation as part of the Stage 2 expansion of the Guelph WWTP. Stage 2 will increase the capacity of the WWTP from 64 MLD to 73.3 MLD, which was approved in the 1998 Class EA.

In 2007, the CH2M HILL completed an update to the 1998 Class EA for the City. The purpose of the 2007 Class EA update was to provide an update on the existing conditions in the years that had passed since completing the Wastewater Treatment Strategy, including the completion of the Stage 1 expansion (increase of WWTP capacity from 55 MLD to 64 MLD).

The update also examined emerging and innovative wastewater treatment technologies to determine which would be pilot tested to determine a preferred choice of technology for implementation in the Stage 2 expansion.

1.4.5 Biosolids Management Master Plan

The purpose of the Biosolids Management Master Plan (BMMP) was to identify an environmentally sound, reliable, and cost-effective plan to manage and dispose of biosolids generated at the Guelph WWTP.

The Guelph BMMP is related to the 2007 Class EA Update and the 1998 Wastewater Treatment Strategy because the innovative treatment technologies evaluated in the Class EA Update are focused on treating the liquid stream of the wastewater conveyed to the plant. The technologies selected for implementation will all generate biosolids with similar quality and quantity characteristics.

1.4.6 Community Energy Plan

The City produced the final versions of their Community Energy Plan (CEP) in April 2007. The City recognized the growing importance of effective energy and water management, so, in 2004, formed a consortium to develop their CEP. The implementation of the CEP will ensure the City’s long-term competitiveness and environmental performance through the five goals which are supported by specific recommendations in the plan:

1. Guelph will be the place to invest, supported by its commitment to a sustainable energy future.
2. Guelph will have a variety of reliable, competitive energy, water, and transport services available to all.
3. Guelph energy use per capita and resulting greenhouse gas emissions will be less than the current global average.
4. Guelph will use less energy and water per capita than comparable Canadian cities.
5. All publicly funded investments will visibly contribute to meeting the other four CEP goals.

1.4.7 Stormwater Management Master Plan

The City has initiated a Stormwater Management Master Plan (SWM MP). The SWM MP is a long-term plan for safely and effectively managing stormwater runoff from urban areas, while improving the ecosystem health and ecological sustainability of the Eramosa and

Speed Rivers and their tributaries. Improvements to the City's stormwater management will contribute to the overall improvement of watershed health and could impact assimilative capacity on the Speed River. The SWM MP is anticipated to be completed in 2009.

2. Master Plan Needs Statement

2.1 Mission Statement

In keeping with the City's strategic plan, community vision, corporate responsibility, core values, and demonstrated commitment to environmental stewardship, develop a comprehensive master plan that addresses the long-term wastewater treatment servicing needs of the community over the next 50-year planning horizon.

2.2 Master Plan Purpose

The purpose of the Guelph WWTMP is to develop a Wastewater Treatment Plan to provide direction for wastewater infrastructure planning, investment, and implementation to the year 2054.

2.3 Planning Period for the Master Plan

To remain consistent with the planning period used for the WSMP, the WWTMP will develop a strategy to 2054. Using the same timeframe allows plan updates to occur at the same intervals and allows the City to allocate capital funding and resources for various infrastructure projects over a comparable planning period.

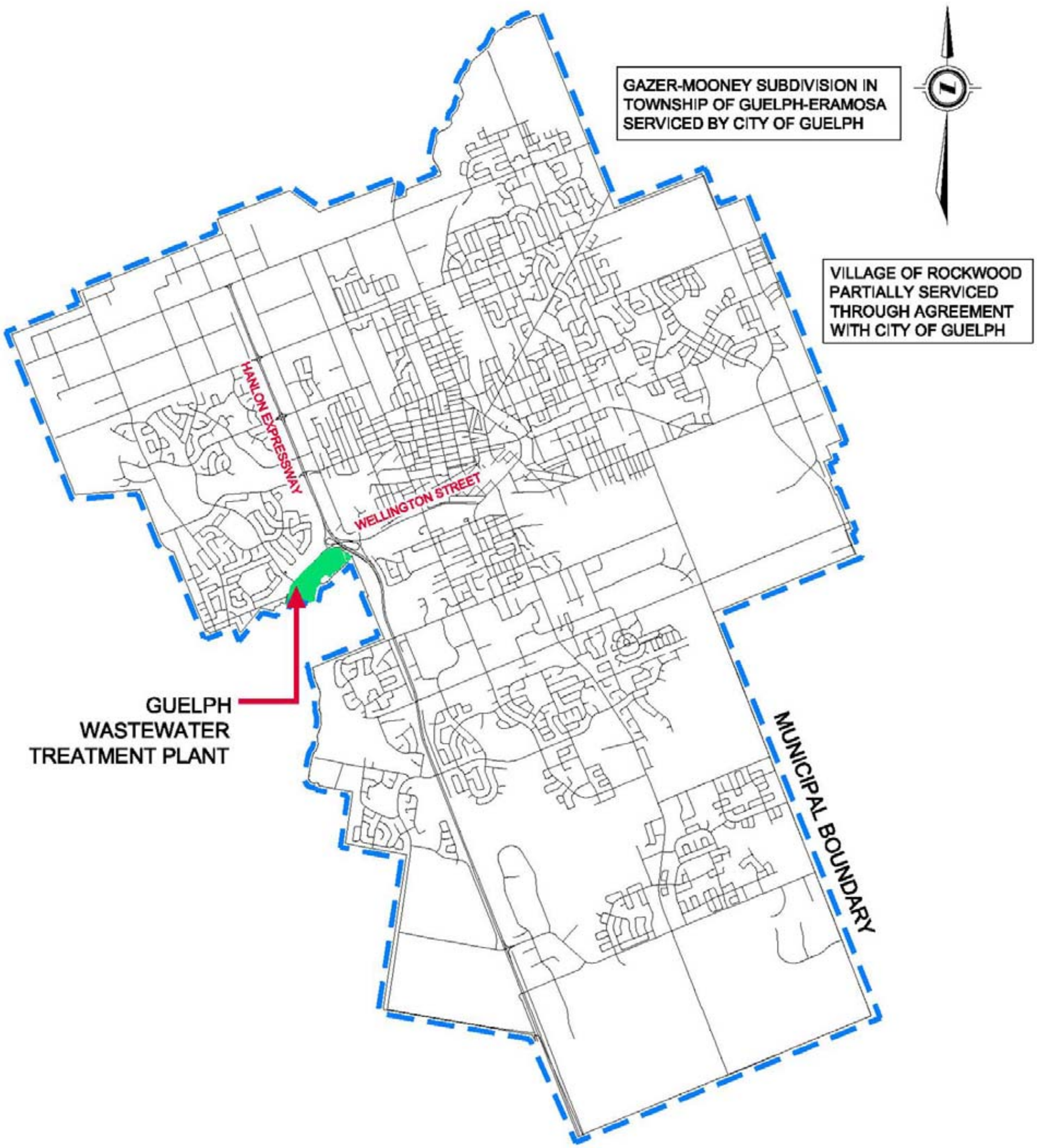
2.4 Rationale for this Study

The City of Guelph is a community which has experienced a considerable amount of growth and is projected to continue growing into the future. With growth comes increasing demand on municipal infrastructure and services. Planning to address these demands requires the consideration of existing and future conditions which may influence the development of appropriate and sustainable alternatives. The City is preparing long-term master plans to address municipal servicing requirements over a 50-year timeframe. This 50-year strategy for the provision of wastewater services will support and compliment the other master planning exercises currently underway for the City's long-term water supply and waste management alternative disposal strategy. Together, these plans will guide the City as it works to achieve its strategic plan goals.

2.5 Study Area Definition

The Guelph WWTP is located at 530 Wellington Street West, adjacent to the Speed River at the corner of Wellington Road and Highway 6 (the Hanlon). The Study Area for the WWTMP is shown in Figure 2-1 and encompasses the urban boundaries of the City. Figure 2-1 also shows the location of the WWTP. The WWTP currently treats wastewater from the City, as well as the Village of Rockwood and the Gazer-Mooney subdivision located in the Township of Guelph-Eramosa.

FIGURE 2-1
Guelph Wastewater Treatment Master Plan Study Area



3. Existing Conditions

This section of the Master Plan documents the existing conditions within the Study Area, including the existing technical, natural, social, and economic conditions.

3.1 Technical Environment

For this master plan, the technical environment includes the existing WWTP and the wastewater collection system.

3.1.1 Existing Wastewater Treatment Plant

Wastewater arriving at the Guelph WWTP undergoes multiple stages of treatment, including: preliminary, primary, secondary, tertiary, and disinfection. The final treated effluent is discharged to the Speed River. In addition to the liquid treatment train referred to above, the WWTP also separates and treats solids from the wastewater in a separate process. Grit and screenings from preliminary treatment are sent directly to landfill. All other solids (referred to as biosolids) are ultimately used for land application programs, when seasonally available, or are sent to landfill for disposal.

An aerial photograph of the WWTP, showing the various components of the treatment processes at the plant, is shown in Figure 3-1. The process flow diagram, in Figure 3-2, demonstrates how these processes are interconnected to produce the final treated effluent. Detailed descriptions of each of the wastewater treatment processes are included in the document *Introduction to Wastewater Treatment*, produced by the City and found in Appendix A.

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FIGURE 3-1
Treatment Processes at the Guelph WWTP

LEGEND:

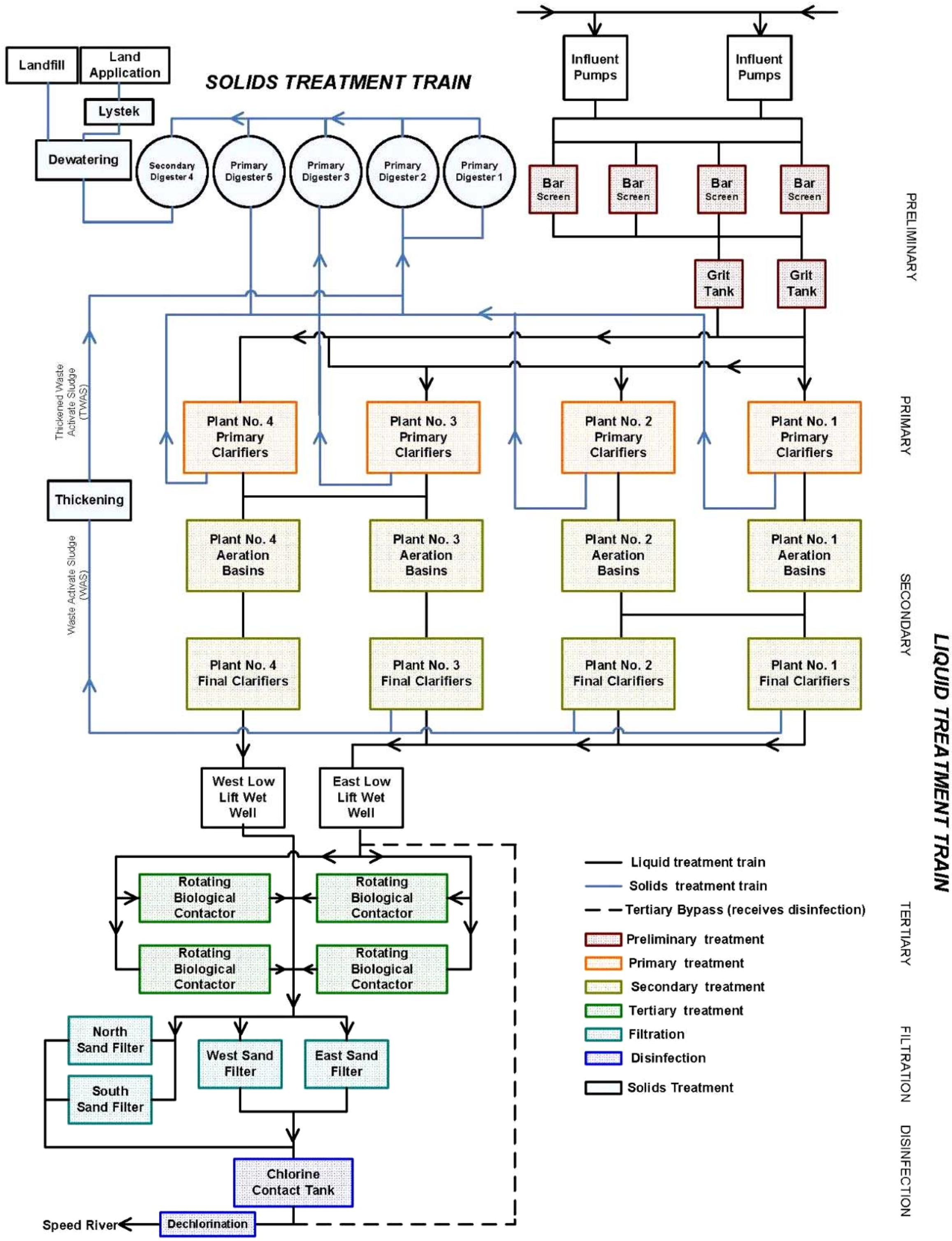
BUILT STRUCTURES:

(A) SLUDGE DEWATERING FACILITY	(L) PLANT No.1
(B) SLUDGE COMPOSTING FACILITY	(M) HEADWORKS
(C) ENERGY FACILITY	(N) CHLORINE CONTACT TANK AND DECHLORINATION FACILITY
(D) ADMINISTRATION BUILDING	(O) MAINTENANCE AND STORAGE BUILDING
(E) DIGESTER No.2	(P) ROTATING BIOLOGICAL CONTACTORS
(F) DIGESTER No.1	(Q) SAND FILTERS No.1 AND 2
(G) PLANT No.3	(R) SAND FILTERS No.3 AND 4
(H) DIGESTER No.4	(S) HUMANE SOCIETY ANIMAL SHELTER
(I) DIGESTER No.3	(T) BELL SWITCHING STATION
(J) PLANT No.4	(U) OUTFALL (NOT VISIBLE)
(K) PLANT No.2	(V) SODIUM HYPOCHLORIDE AND ALUMINIUM SULPHATE STORAGE

PRPOPERTY LINE

0 50 100 200m
SCALE

FIGURE 3-2
Guelph WWTP Process Flow Diagram



3.1.2 Current Wastewater Flows

The Guelph WWTP is currently rated for an average daily flow of 64 ML/d (averaged over a 365-day period).The City has approval from the Ministry of the Environment (MOE) to expand the plant to an average daily flow of 73.3 ML/d. The plant is currently receiving average flows of 54.4 ML/d. The WWTP receives wastewater from the City as well as the Village of Rockwood and the Gazer Mooney subdivision located within Eramosa Township. Rockwood currently contributes approximately 930 m^3/d (0.93 ML/d), or approximately 2%, of the total flow to the WWTP. The Gazer Mooney subdivision contributes an estimated 55 m^3/d (0.054 MLD) or approximately 0.1% of the total flow to the WWTP.

Wastewater Generation Rates

In order to predict future wastewater flows, it is important to determine the wastewater generation rate based on the current population. Table 3.1 summarizes data used to estimate the per capita wastewater generation rate. The Guelph WWTP treats wastewater from Rockwood as well as the City of Guelph. The 2006 population data does not include Rockwood or the Gazer Mooney subdivision; therefore, it was necessary to subtract these flows prior to calculating the per capita generation rate.

TABLE 3.1
Current flow and population data for the Guelph WWTP

Parameter	Value
Total Average Daily Flow (2006)	55,896 m^3/d
Average Daily Flow from Rockwood (2006)	956 m^3/d
Estimated Average Daily Flow from Gazer Mooney subdivision (2006)[1]	55 m^3/d
Average Daily Flow from Guelph only (2006)	54,885 m^3/d
2006 Population (from census)[2]	114,943

[1] Flows from Gazer Mooney estimated based on 230 L/cap-d, an average of 3 residents per household and 79 houses in the subdivision

[2] 2006 Statistics Canada

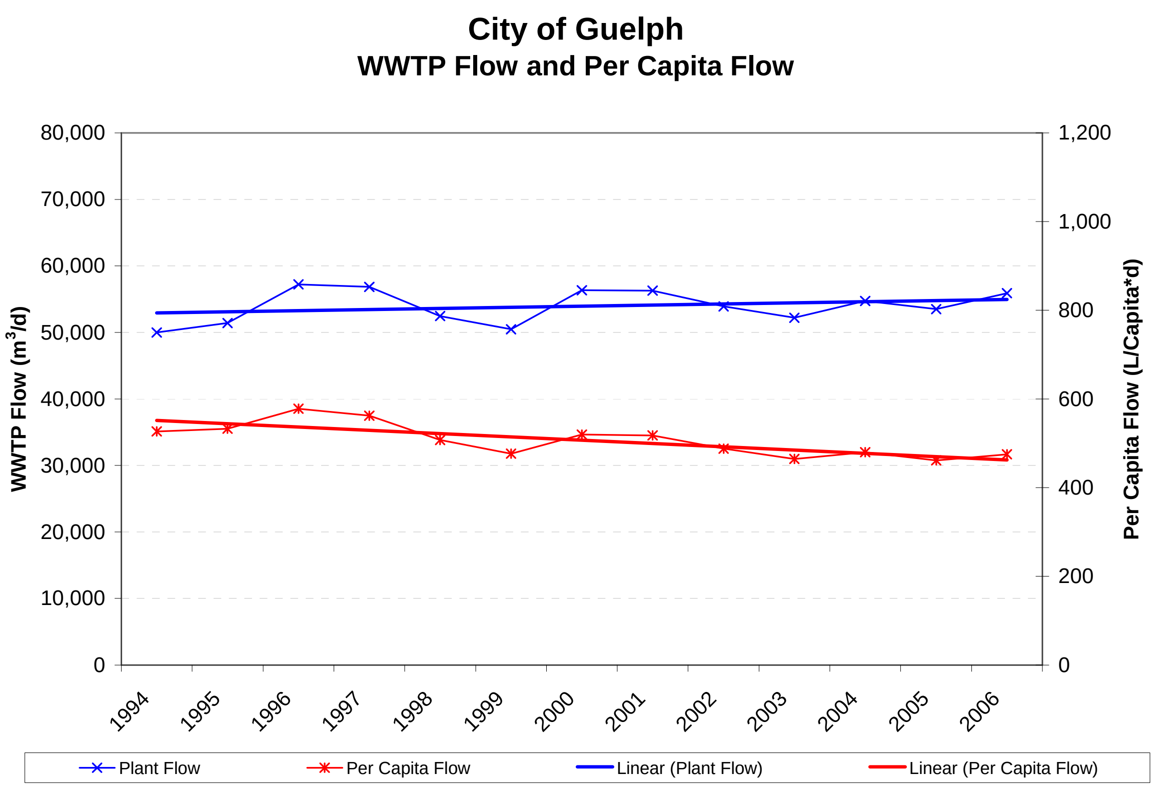
Based on the information summarized in Table 3.1, the per capita wastewater generation rate for Guelph is 478 litres per capita per day (Lpcd), which also accounts for industrial, commercial, and institutional (ICI) flows. This rate is representative of total wastewater flows arriving at the WWTP, including I/I.

Inflow is stormwater or snowmelt that enters the sewer system through direct discharges, such as roof leaders or manhole covers. Infiltration is groundwater that enters the system through cracks or leaking sewer pipe joints. These extraneous flows are collectively referred to as I/I.

I/I was examined as part of the W&WW SMP. An examination of flows within the collection system found that the average I/I flow associated with a 25-year design storm was 0.3 L/s/ha, which is higher than the design rate of 0.1 L/s/ha. The investigation found that certain areas of the City had higher I/I rates than others. Recommendations for further study and the development of an I/I strategy was included as part of the Master Servicing Plan.

The progress that the City and its residents have made in terms of water conservation and improvements in I/I is reflected in the flow values shown in Figure 3-3. This figure shows that although the wastewater flows conveyed to the WWTP have increased moderately over time, the per capita flows (flows per person) have decreased during this same time period. The reduction in per capita flow indicates that although population in the City has increased, the total wastewater flows received at the WWTP have not increased at the same rate resulting in deferral in the need to increase infrastructure capacity.

FIGURE 3-3
WWTP Flows and Per Capita Flows (1994 – 2006)



3.1.3 Current Effluent Quality Compliance Limits

The effluent quality compliance limits for the Guelph WWTP are set by the MOE and stated in the Certificate of Approval (CofA) for sewage, which defines performance and reporting criteria. Table 3.2 summarizes the current CofA effluent quality compliance limits for the WWTP based on a rated capacity of 64 MLD.

TABLE 3.2
Guelph WWTP Current Effluent Compliance Limits at 64 MLD

Parameter	Summer		Winter	
	Loading (kg/d)	Concentration (mg/L)	Loading (kg/d)	Concentration (mg/L)
TOD	1,426	22	–	–
$cBOD_5$	–	–	473	7.4
TSS	622	10	622	10
NH_3-N	–	–	218	3.4
TP	24.5	0.38	46	0.7

3.1.4 WWTP Approved Treatment Capacity

The WWTP has a current average capacity of 64 MLD. As part of the master planning process, a high-level capacity assessment of the individual treatment processes was undertaken to determine where, if any, hydraulic or loading bottlenecks exist under average and estimated peak flow conditions. The desk-top assessment found that under current conditions, the unit processes reviewed had sufficient treatment capacity, with no significant limiting unit processes (bottlenecks) or underutilized treatment capacity. The results of the assessment for each treatment process can be found in Appendix B.

3.1.5 Current Initiatives at the WWTP

The City prepared the WWTMP while it was undertaking a number of projects to improve the processes at the plant. The City ran demonstration/pilot processes to observe the effectiveness of new technologies on treating Guelph wastewater. The following section briefly describes each of these initiatives.

Plant Optimization – The City has initiated a wastewater facility comprehensive optimization program. Among the objectives of the program is to work with City staff, regulatory agencies, and external partners and stakeholders to achieve exemplary, sustainable, and economical performance from the physical assets and operator skills, and to be a leader in North American in terms of protecting the environment and establishing Best Management Practices (BMPs).

Facilitation of the optimization program involves maximizing human skills to achieve the program's technical objectives. Integral to the technical objectives is to implement staff-led capacity demonstrations of all liquid treatment and biosolids handling facilities. These demonstrations will potentially demonstrate capability greater than the current rated capacities of each liquid train. The existing four liquid trains have a combined nominal rated capacity of 64 MLD. By maximizing the human infrastructure, it is anticipated that the successful capacity demonstrations would result in a re-rating of the existing facility.

Capacity that is demonstrated through re-rating would extend the timelines of the current upgrade program and schedule. Strategically, all demonstrated capacity that results in either capital cost deferral or savings, will contribute towards delivering the recently adopted Strategic Plan and the tagline "City that makes a difference".

Digester Expansion – In order to maintain sufficient digester capacity for future flows and loads, the City recently constructed and commissioned one additional primary digester with a hydraulic capacity of 2,440 m^3. This digester adds redundancy to the system, allowing existing digesters to be removed from service for cleaning, one digester at a time.

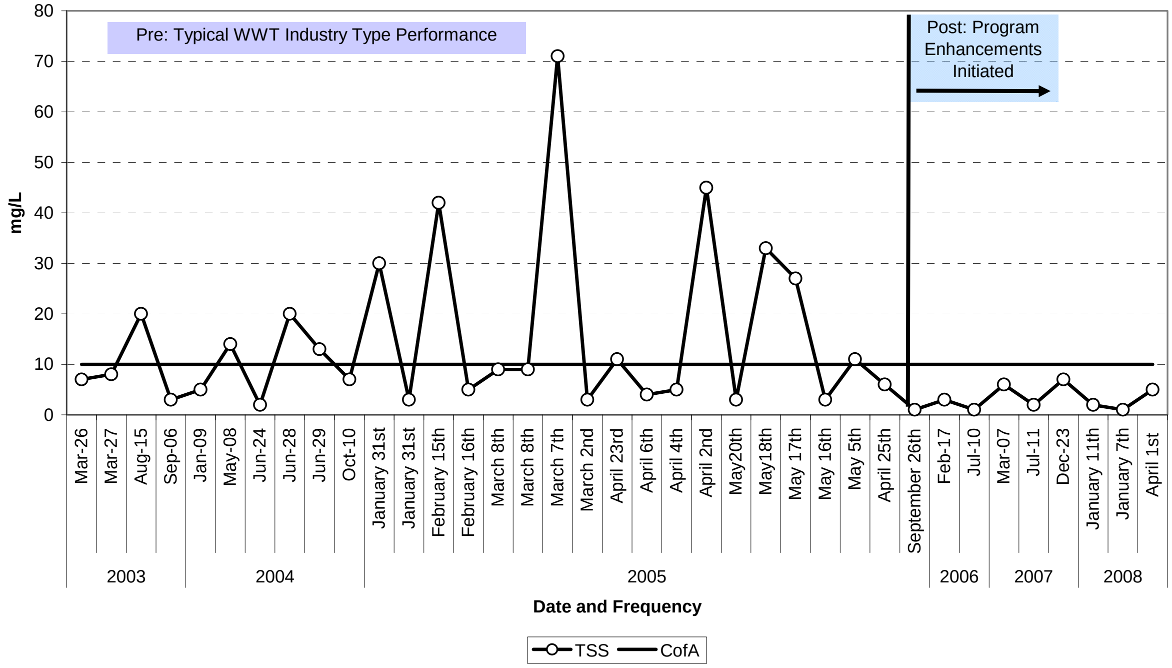
Biosolids Storage – The City is examining the design requirements of biosolids storage facilities. The facilities will store the biosolids after they have been dewatered and prior to being sent offsite for their end-use. This additional storage will allow more flexibility in the end-use of the biosolids produced at the WWTP.

Waste Activated Sludge (WAS) Thickening Demonstration – Historically, WAS from the biological treatment of dissolved and colloidal contaminants was returned to near the beginning of the primary treatment process. There, it would be co-thickened in the primary clarifiers prior to being sent to the digesters. Mechanically thickening the WAS in a separate process stream is more efficient, as it allows the WAS to be thickened to a higher percent of solids prior to being sent to the anaerobic digesters. This allows more solids to be digested while using the same or less volume; thus, increasing the capacity of the digesters and the efficiency of the primary clarifiers. In the summer of 2006, the City initiated operation of a rotating drum thickener (RDT) as a pilot study to monitor the effects of thickening the WAS from Plants Numbers 1 and 2 on digester capacity.

Lystek Demonstration – The Lystek process is used on dewatered biosolids to produce a product that has the characteristics of a fluid (low viscosity) with a high percent solids content. This low viscosity product is easier to pump and land apply than dewatered biosolids but maintains a higher percent solids than liquid biosolids. The City has been operating a Lystek demonstration unit since 2003 and is monitoring the effect of this process on operations and biosolids management.

Bypass Mitigation Program – Since 2005, the City has applied significant resources aimed at reducing the frequency and quality of tertiary sandfilters bypass events. These resources have not been capital intensive in nature and have primarily entailed developing and implementing more effective operations and management policies. The chart shown in Figure 3-4 represents the suspended solids for individual tertiary sandfilter bypass events compared to the monthly average suspended solids criteria as outlined in the Certificate of Approval (CofA) for the Guelph WWTP. The graph covers the period of 2003 to April 2008. It is important to note that the bypass events were short duration only and were partial by-passes of the tertiary sandfilters due, primarily, to solids overloading. None of the by-pass events resulted in a non-compliance condition of the effluent quality criteria defined in the CofA.

FIGURE 3-4
Frequency and Concentration of Bypass Events at the Guelph WWTP (2003 – 2008)



The types and range of management and operations policies and practices that have been adopted are numerous, and include for example regular and rigorous sludge accountability evaluations to ensure that the City can account for the expected sludge mass produced every day based on current hydraulic and organic loading. Additional practices include operating policies to ensure the sludge mass retained in critical unit processes is adequate for effective treatment, but minimal to reduce the impact of hydraulic surges associated with storm events, that tend to result in solids transport to downstream unit processes. These policies and practices are designed to establish a multiple barrier effect that minimizes the contaminant concentration in the effluent leaving the facility. These new policies and procedures have resulted in the trend shown from 2005 onward.

In the future, an additional operational practice, step feed, will be adapted to further manage wet weather events will be to implement. Step feed is a storm specific operational tool designed to provide adequate treatment for the characteristic of the raw sewage during storm events, but minimizes the hydraulic impact on each unit process.

3.1.6 Wastewater Collection System

The City has approximately 460 km of sanitary sewer main, ranging in age from 1 year to 100+ years old. This network of sanitary sewer pipes and four sewage pump stations deliver all of the sanitary sewage from the City and other sources to the WWTP on Wellington Street. As discussed in Section 1.3, the wastewater collection system is being examined through the W&WW SMP.

3.1.7 Wastewater Generation

Municipal wastewater is contributed by a number of different sectors, including: residential and ICI. The quantity and quality of the wastewater generated by each contributor has an effect on the wastewater stream for treatment that enters the WWTP. Through their Sewer Use By-law, the City has programs and policies in place to control the substances that are discharged to the sewers. The By-law regulates the concentration of specific contaminants that may be discharged to the sanitary sewer collection system (City of Guelph, 1996).

Sewer Use By-Law

By-law Number (1996)-15202, enacted by the Corporation of the City of Guelph on July 16, 1996, and repealing By-law (1991)-13792, is a comprehensive by-law covering all aspects of sewer use control.

The overall objectives of the Guelph Sewer Use By-law can be identified as follows:

A. To prevent the introduction of pollutants into the Guelph WWTP that will interfere with its operation;

B. To prevent the introduction of pollutants into the Guelph Sewage Works that will pass through the WWTP inadequately treated, into receiving waters, or otherwise be incompatible with the WWTP;

C. To protect both Guelph Sewage Works personnel and the general public who may be affected by wastewater or residuals from the treatment of pollutants introduced into the sewer system;

D. To not impair the ability to reuse and recycle treated wastewater and residuals from the treatment of wastewater;

E. To provide for fees for the equitable distribution of the cost of operation, maintenance, and improvement of the Guelph Sewage Works; and

F. To enable the City to comply with the conditions of its Certificate of Approval for Sewage Works, residual use and disposal requirements, and any other Federal or Provincial regulations to which the Guelph WWTP is subject.

The By-law applies to all users of the Guelph Sewage Works. It authorizes the issuance of individual wastewater discharge approvals; provides for monitoring, compliance, and enforcement activities; establishes administrative review procedures; requires user reporting of sewer discharges; and provides for the setting of fees for the equitable distribution of costs resulting from the program established herein.

As it exists now, the City of Guelph By-law Number (1996)-15202 includes:

- The control of discharges of conventional and metal contaminants and toxic and hazardous substances to sanitary and storm sewers
- Waste Survey reporting requirements
- Overstrength Surcharge Compliance Agreements
- Sampling and Analysis
- Spill control and reporting requirements

The By-law also covers:

- The requirements for the preparation of BMP Plans
- Hauled Sewage Discharge Permit
- General and Specific Reporting Requirements for industrial dischargers

Industrial Discharges

Loading at the WWTP can be greatly affected by contributions from industrial wastewater generators. Recently, Cargill Inc. (formerly, Better Beef Ltd.) and Sleeman Breweries Ltd. installed pretreatment processes to decrease the contaminant loading to the Guelph sanitary sewer system. Based on raw wastewater influent strengths, it is estimated that the commissioning of these pretreatment systems decreased the influent concentrations of Total Suspended Solids (TSS) and carbonaceous biochemical oxygen demand ($cBOD_5$) from 311 and 239 mg/L to 247 and 151 mg/L, respectively.

Based on a high level investigation, it was found that if all industries achieved the By-Law could have an impact on the influent to the WWTP, particularly in terms of $cBOD_5$ loading. With the exception of the biological treatment process (aeration tanks and rotating biological contactors), the capacity of the plant processes is determined, under typical loadings, on a hydraulic basis. Therefore, the reduction to the By-Law concentration would be most beneficial to the biological treatment units unless it was accompanied by a corresponding decrease in industrial water use.

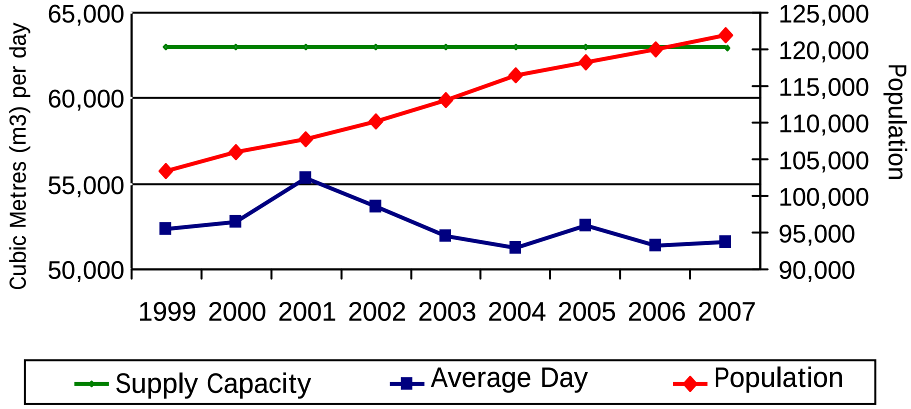
3.1.8 Water Conservation

Water conservation decreases the amount of water that is produced and may decrease the amount of wastewater generated. As stated in the City's Water Supply Master Plan (WSMP), between 1999 and 2006, the Water Conservation & Efficiency (WC&E) Plan has decreased water usage by approximately 2,000 m^3/day. These reductions are partially due to changes in industrial and commercial water users but are also largely due to the programs listed below. The estimated reductions in daily water consumption for each of these programs is included in parenthesis.

- Toilet Replacement Program (450 m^3/day)
- Industrial, Commercial, and Institutional (ICI) Efficiency Program (300 m^3/day)
- Unaccounted for Water (UFW) Initiatives (1,100 m^3/day)

In 1999, UFW was approximately 14 percent of the water supply. By September 2006, that value decreased to 12 percent. The City has set the target reduction to 10 percent by 2010. The additional 2 percent reduction will be achieved through water main repairs and servicing. Figure 3-5 shows how the City's conservation initiatives have resulted in a decrease in average water consumption while the City's population continues to increase.

FIGURE 3-5
Historical Average Day Water Production
(From City of Guelph's Presentation to Public Advisory Committee, July 2008, see Appendix G)



As part of the WSMP, a comparison was made between the City's water usage (210 Lpcd) and the average usage of 22 countries from the Organization for Economic Co-operation and Development (176 Lpcd). The WSMP summarized from these findings that Guelph could decrease its water usage. The City's per capita water consumption is 22 percent greater than the average of sampled countries. As a result, the WSMP set a target reduction of 20 percent, which is almost equal to the average consumption across the 22 countries sampled.

The WSMP recommended the following short-term water conservation actions to help achieve the 20 percent reduction in water consumption (10 percent by 2010):

- Fully implement the WC&E Plan
- Conduct a water rate study to increase rates (used to finance activities such as UFW Initiatives), as increased rates generally curb water usage
- Evaluate wastewater reuse options to offset non-potable water demands

Long-term water consumption implementation outlined in the WSMP included a 15 percent reduction in per capita water consumption by 2017, and 20 percent by 2025.

It is recognized that wastewater generation may not be directly impacted by all water conservation efforts. For example, decreases in outdoor water use will not have an impact on wastewater generation.

3.2 Natural Environment

3.2.1 Speed River Conditions

The final treated effluent from the Guelph WWTP is discharged to the Speed River. The Speed River is part of the Grand River watershed. The River is classified as a warm water fishery and as an MOE Policy 2 Receiving Stream for total phosphorus, un-ionized ammonia, and dissolved oxygen (DO) as defined by Procedure B-1-5. This means that increased discharges, on a mass basis, are only allowed if it can be demonstrated that the river quality, with respect to these parameters, remains constant or improves. A number of studies have been completed to examine the condition of the Speed River and its ability to accept future increased flows from the WWTP.

An assimilative capacity study was completed in 1996 as a follow-up to a 1994 study (CH2M, 1994 & 1996). The 1996 study resolved outstanding issues from the previous study, including:

- Collection of field data to update water quality and flow analysis
- Participation in the Grand River basin study

This study confirmed that the Speed River can assimilate 73.3 MLD of effluent based on the effluent criteria developed in 1994. These effluent criteria are further discussed in the Future Effluent Quality Requirements section of this report.

An update to the assimilative capacity study was commenced in 2004 as part of the 2007 Class EA Update (CH2M HILL, 2007). The objective of this update was to confirm the 73.3 MLD effluent criteria based on updated information available and to review any changes in the receiving environment since the completion of the 1996 study. During the 8-year period between modelling exercises, the GRCA was able to increase the baseflow of the Speed River during low-flow conditions, achieving their flow targets a greater percentage of the time. All other receiver conditions remain essentially unchanged. As a result, the 2004 update confirmed the results of the 1996 study and the effluent criteria in the 1998 Class EA.

A report to the GRCA Committee of the Whole in September 2007 called the *State of Water Quality in the Grand River Watershed (2002 to 2006)* indicated that increases in nutrient levels within the Speed and Grand Rivers are a cumulative effect of multiple point and non-point urban and rural sources. While DO downstream of the City is slightly lower than upstream stations, levels still remain mostly above the Provincial Water Quality Objective of 4.0 mg/L. The report states that although the Speed River receives effluent from the City's WWTP, the high level of treatment provided at the plant helps the River keep its equilibrium and minimizes any negative impacts (GRCA, 2007).

The City continues to participate in Grand River basin studies, furthering the development of the Grand River Simulation Model (GRSM). The City also participates as a member of the Water Managers of the Grand; they meet regularly to discuss how to improve the state of the Grand River Watershed.

3.3 Social Environment

3.3.1 Official Plan (2006)

The City of Guelph's Official Plan (OP) is a document summarizing the City's goals, objectives, and policies which guide existing and future land use and change. The OP promotes sustainability in the social, economic, and natural environments and was last updated and consolidated in November 2006.

Section 4 of the Guelph OP relates to Municipal Services. Section 4.4 relates specifically to Wastewater Treatment. The objective of the policies related to wastewater treatment is as follows:

> *To protect the quality of watershed resources upstream and downstream of the City's wastewater treatment facility*

The policies related to wastewater treatment are:

- The City will continue to implement a wastewater treatment strategy that promotes proactive industrial waste management practices, and encourages wastewater reduction and ongoing upgrades to the City's wastewater treatment facility to promote and improve water quality of the Speed River.
- The land use policies of Subsection 7.15, "Water Management," outline the policies that are applicable to the City's wastewater treatment facility, located on the northern edge of the Speed River, West of the Hanlon Expressway. Subsection 7.15 refers to adherence to the *Environmental Protection Act*, ensuring proper separation distances and development of land adjacent to waste management sites.

The GMS, described in Section 1.3.1 in this report, relates to the social environment through the examination of population growth and future land use.

3.3.2 Strategic Plan (2007)

The City of Guelph's Strategic Plan was developed in a collaborative manner through communication with residents and City staff. The intent of the Strategic Plan is to:

- Ensure the ongoing, effective, and efficient delivery of a full range of relevant programs and services
- Continue on a successful path towards securing a prosperous and sustainable future for generations to come

The Strategic Plan vision is:

> *To be the City that makes a difference…. Acting locally and globally to improve the lives of residents, the broader community and the world.*

The mission is:

> *To achieve excellence through leadership, innovation, partnerships and community engagement.*

The Strategic Plan outlines goals and objectives in each of the following categories:

- Urban design and sustainable growth
- Personal and community well-being
- Economic opportunity
- Arts, culture, and heritage
- Government and community involvement
- Natural environment

All of the above-mentioned categories relate to wastewater treatment in Guelph and to this Master Planning process.

3.4 Economic Environment

The economic environment can impact municipal services in a number of ways. The economic growth of a municipality is impacted by the industrial sector and the growth within this sector. The type of industries that develop within Guelph can impact discharges to the wastewater collection system.

Guelph's Economic Development Strategy cited the following types of companies on which to focus economic development activities:

- Advanced Manufacturing: Uses leading-edge, advanced manufacturing methods and technologies in the pursuit of continuous improvement
- Environmental Technologies: Provides scientific, technical, energy efficiency, environmental, and engineering consulting services
- Life Science, Agri-food, and Biotechnology: Includes government, education, biotechnology, agri-food technology, agricultural supply, equipment, food processing, associations, research, marketing, and other services

The Guelph OP also indicates that municipal servicing be provided considering economics. One objective of the municipal servicing section of the OP is as follows:

- To set out a staging and phasing program for the logical, economic expansion of services

4. Future Wastewater Servicing Requirements

4.1 Projected Growth

Based on the changing growth pressures, in 2006, Guelph City Council initiated a four-phase Growth Management Strategy. Based on the timing of the GMS process, growth projection scenarios were not available for integration into this WWTMP. It was agreed that population projections developed and endorsed during the WSMP would be used as part of the WWTMP which would maintain consistency between planning initiatives. These projections can be updated as numbers are available from the GMS.

Two growth scenarios from the WSMP were carried forward to be used in the WWTMP. These scenarios are shown in Figure 4-1. The projected populations are included in Table 4.1. These two scenarios were chosen, as they appear to be closest to the Places to Grow projection range of 175,000 – 195,000 in 2031. As indicated, these projections are being examined as part of the City's GMS.

FIGURE 4-1
Population Projections for the City of Guelph (2004 – 2054)

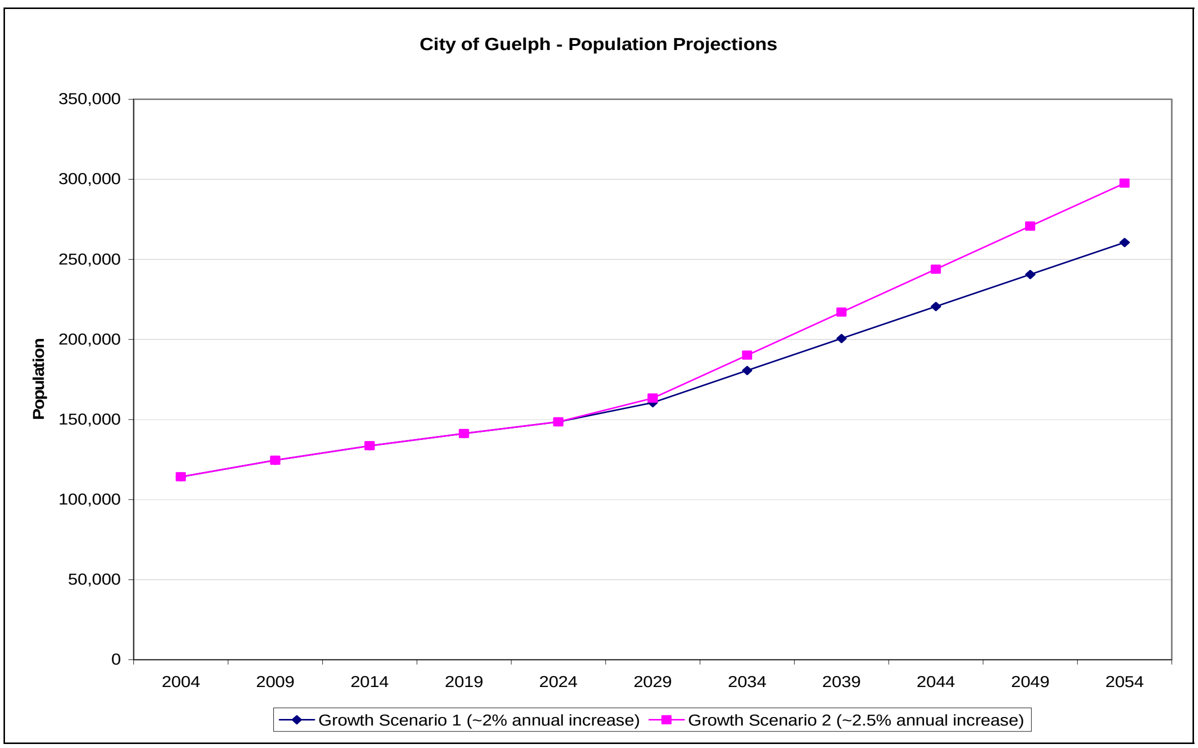


TABLE 4.1
Population Growth Scenarios for the City of Guelph

Year	Scenario 1	Scenario 2
2004	114,200	114,200
2009	124,600	124,600
2014	133,600	133,600
2019	141,300	141,300
2024	148,600	148,600
2029	160,600	163,400
2034	180,600	190,200
2039	200,600	217,100
2044	220,600	243,900
2049	240,600	270,800
2054	260,600	297,600

4.2 Projected Wastewater Flows

As population in the City increases, so will the wastewater volume that requires treatment. As part of the WSMP, a study was completed by C.N. Watson to project growth in the various sectors. The study found that growth within the residential sector is anticipated to occur at a similar rate as growth in the ICI sector. Using the conclusions from this study, it was predicted that wastewater generation from each sector would also increase at a similar rate; therefore, the ratio of residential to ICI waste is projected to be relatively constant over the study period.

The population projections shown in Figure 4-1 are representative of the City of Guelph only, as indicated previously; this does not include the contributions from the Village of Rockwood or the Gazer-Mooney subdivision. The City recently updated a Memorandum of Understanding with the Village of Rockwood, which confirmed that wastewater flows from Rockwood will be accepted up to a maximum of 1,710 m^3/d. The Gazer-Mooney subdivision has been completely built out, and it is not anticipated that the flow contributions from this area will increase in the future. As the flows from the subdivision are 0.1 percent of the current flows, they were not included in the future projections. Future flow projections for the City of Guelph were calculated by multiplying the population projections by the current per-capita wastewater generation rate of 478 Lpcd. The basis for the per-capita calculations can be found in Section 3.1.2 of this report. This per capita value reflects the strides that the City has made in water conservation efforts. Rockwood flows were estimated by taking the average 2004 flows and increasing at the same rate as the City of Guelph flows to a maximum of 1,710 m^3/d.

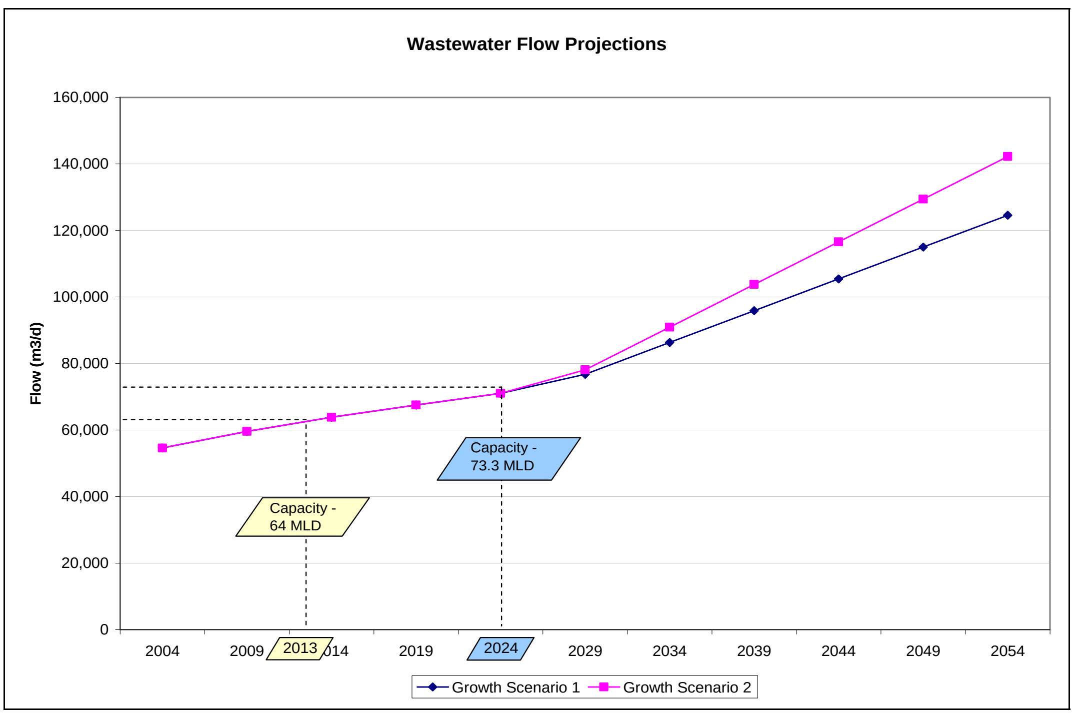
The wastewater flow projections for each of the growth scenarios are summarized in Table 4.2.

TABLE 4.2
Future Wastewater Flow Projections for Guelph and Rockwood

Year	Scenario 1 (m^3/d)			Scenario 2 (m^3/d)		
	Guelph	Rockwood	Total	Guelph	Rockwood	Total
2004	54,588	925	55,513	54,588	925	55,513
2009	59,559	1,010	60,568	59,559	1,010	60,568
2014	63,861	1,083	64,943	63,861	1,083	64,943
2019	67,541	1,145	68,686	67,541	1,145	68,686
2024	71,031	1,204	72,235	71,031	1,204	72,235
2029	76,767	1,301	78,068	78,105	1,324	79,429
2034	86,327	1,463	87,790	90,916	1,541	92,457
2039	95,887	1,625	97,512	103,774	1,710	105,484
2044	105,447	1,710	107,157	116,584	1,710	118,294
2049	115,007	1,710	116,717	129,442	1,710	131,152
2054	124,567	1,710	126,277	142,253	1,710	143,963

Future wastewater flow projections are shown graphically in Figure 4-2. By the year 2054, the City may need to provide wastewater treatment capacity for 144 MLD. This flow projection is used as a basis for determining future treatment requirements for the Guelph WWTP.

FIGURE 4-2
Wastewater Flow Projections for the Guelph WWTP (2004 – 2054)



As discussed previously, the current WWTP has a rated capacity of 64 MLD (64,000 m^3/d). Based on current projections, it is anticipated that this capacity will be sufficient until the year 2013; at which time, the Stage 2 expansion is to be constructed and commissioned. The

Stage 2 expansion has an approved capacity to 73.3 MLD. Based on current projections, it is anticipated that this capacity will be reached in 2024.

The flow projections outlined within this report are a conservative estimate, based on future per capita wastewater generation rates remaining consistent with current values. This is based on the approach outlined by the Ministry of the Environment (MOE) in *Procedure D-5-1: Calculating and Reporting Uncommitted Reserve Capacity at Sewage and Water Treatment Plants.* This Procedure indicates that to determine capacity for future growth that projections should be based on the current average day flow.

Programs such as water conservation, I/I variation and effluent reuse could impact these per capita rates. Plant optimization may also extend the need for capital upgrades. The potential impact of these initiatives is discussed and included in Section 5.3, Source Control/Non-expansion Alternatives. It is recommended that for planning purposes, the projections outlined in Table 4.2 be used. This approach is consistent with the approach used in the WSMP. These projections will be reviewed and revised with every update to this Master Plan.

4.3 Future Effluent Quality Requirements

The quality of effluent from a WWTP is based on the receiving water body's ability to assimilate the flows and loads. The assimilative capacity is based on existing conditions within the receiving stream--in this case, the Speed River. As noted previously, the Speed River is a Policy 2 receiver for total phosphorus, un-ionized ammonia, and DO, meaning that increased discharges are only allowed if it can be demonstrated that the river quality, with respect to these parameters, remains constant or improves (MOE, 1994). In order not to violate the Policy 2 criteria, this requires that the daily mass loading of these contaminants do not increase over time. For the Guelph WWTP, this means that as effluent flows increase, the effluent quality requirements will become more stringent so as not to increase the contaminant mass loadings. In order to predict the impact and future effluent discharges on the Speed River, a mass balance was developed and used by CH2M HILL to examine the impact of flows beyond the currently approved 73.3 MLD. For the Guelph WWTP this means that as effluent flow increase above 73.3 MLD, the effluent requirements will become more stringent so as not to increase the contaminant mass loadings.

4.3.1 Stage 2 Expansion (73.3 MLD Capacity)

Benthic monitoring was completed in 1999 and 2000, prior to the Stage 1 expansion, and again in November 2004 to evaluate the water quality in the Speed River in the vicinity of the WWTP. Results of the samples taken (one upstream and two downstream of the WWTP outfall) are indicative of very high water quality. This was evidenced by the diversity of species in the samples collected, the presence of sensitive members of the benthic community, and minimal variation between samples.

Also as part of the 2005 Class EA Update, the receiving water assessment review was updated (originally completed in 1996). The review concluded that the 1996 MOE-approved effluent criteria for ammonia, total phosphorus, and TOD/BOD continue to be appropriate for the Guelph WWTP Stage 2 expansion (expanded design flow of 73.3 MLD). The current and future effluent limits are summarized in Table 4.3.

TABLE 4.3
Guelph WWTP – Current and Future Effluent Compliance Limits

Parameter (Design Flow)	Summer				Winter			
	64 MLD		73.3 MLD		64 MLD		73.3 MLD	
	Loading (kg/d)	Conc. (mg/L)	Loading (kg/d)	Conc. (mg/L)	Loading (kg/d)	Conc. (mg/L)	Loading (kg/d)	Conc. (mg/L)
TOD	1,426	22	1,210	16.5	–	–	–	–
$cBOD_5$	–	–	–	–	473	7.4	293	4
TSS	622	10	596	<8	622	10	586	8
NH_3-N	–	–	73	1	218	3.4	110	1.5
TP	24.5	0.38	22	0.3	46	0.7	37	0.5

4.3.2 Achieving Future Provincial and Federal Effluent Targets

Various federal and provincial policies, guidelines, and legislation impact on the requirements for long-term municipal wastewater management planning. The most notable of these are summarized below.

Canadian Environmental Protection Act (CEPA)

The *Canadian Environmental Protection Act*, 1999 (CEPA 1999) is an Act respecting the protection of the environment and human health through pollution prevention activities in order to contribute to sustainable development. Proclaimed on March 31, 2000, the new CEPA 1999 is Canada's primary piece of environmental legislation based on pollution prevention, shifting the focus off of managing environmental pollution and onto preventing environmental pollution. The new Act provides the federal government with the legislation to protect the environment and human health, establishes strict deadlines for controlling certain toxic substances, and requires the virtual elimination of toxic substances which are bioaccumulative and persistent and are primarily the result of human activity.

Substances that are assessed as "toxic" according to Section 11 of CEPA may be placed on Schedule 1 of the Act. Consideration is then to be given to developing regulations, guidelines, or codes of practice to control any aspect of the lifecycle of these substances. As of August 13, 2003, there were 68 substances on the CEPA Schedule 1 Toxic Substances List.

CEPA 1999 includes information-gathering provisions (Sections 46 to 53) that specifically address the creation of inventories of data (Section 46) and state that the Minister shall establish a national inventory of releases of pollutants (Section 48). These provisions under CEPA 1999 form the primary legislative basis for the National Pollutant Release Inventory (NPRI).

The National Pollutant Release Inventory (NPRI) was established in 1992 to require companies and certain municipal facilities to report information on releases and transfers of pollutants to the Government of Canada on an annual basis. Reporting is required for 42 facilities in the City, including the Guelph WWTP and the Eastview Landfill.

Canadian Water Quality Guidelines for the Protection of Aquatic Life help to protect all plants and animals that live in our lakes, rivers, and oceans by establishing acceptable levels for substances or conditions that affect water quality, such as toxic chemicals, temperature, and acidity. As long as conditions are within the levels established by the guidelines, one would not expect to see negative effects in the environment. The guidelines are based on toxicity data for the most sensitive species of plants and animals found in Canadian waters and act as science-based benchmarks for the protection of 100 percent of the aquatic life species in Canada, 100 percent of the time.

Pollution Prevention Planning (P2 Planning)

On June 7, 2003, the Canada Gazette carried a Proposed Notice under the *Canadian Environmental Act*, requiring the preparation and implementation of Pollution Prevention Plans for ammonia dissolved in water, inorganic chloramines, and chlorinated wastewater effluents, all of which are specified in the List of Toxic Substances in Schedule 1 of CEPA 1999.

The application of the Notice is as follows:

> *"The Final Notice will apply to persons who, in addition to other criteria, own a wastewater collection system or wastewater treatment system which collects or treats liquid or waterborne sewage, industrial wastes, commercial wastes or institutional wastes, where the annual effluent release from the system to surface water is greater than or equal to 5 000 m^3 per day."*

The Notice requires any wastewater system with the following criteria to prepare and implement Pollution Prevention Plans that specifically address the use of chlorine or chlorine compounds in the wastewater system and the discharge of chlorinated effluents to surface water bodies. Consequently, this Notice applies to the Guelph WWTP:

- An average annual discharge of 5,000 m^3 per day during 2004 or 2005
- A concentration of total residual chlorine in the effluent released to surface water greater than 0.02 mg/L in any sample during either 2004 or 2005, based on representative sampling

In order to achieve this risk management objective, persons subject to this Notice must conduct a process audit for chlorine by June 15, 2006 when preparing and implementing their Pollution Prevention Plans.

Based on the findings of the process audit, facilities must implement actions that minimize the use and release of chlorine and chlorine compounds by December 15, 2008. The wording of the Notice implies that there is an obligation to consider implementing dechlorination or an alternative method of disinfection.

The risk management objective for this Notice is to achieve and maintain a concentration of total free residual chlorine that is less than or equal to 0.02 mg/L in the effluent released to surface water by December 15, 2009.

The instrument chosen under CEPA to manage ammonia dissolved in water is a document entitled, *Guideline for the Release of Ammonia Dissolved in Water Found in Wastewater Effluents*.

The Guideline will require that all utilities that meet the discharge threshold ensure:

1. The concentration of ammonia deposited to surface water frequented by fish should not be acutely toxic. This also does not mean that ammonia can't be present at all, only that it can't be toxic according to the usual test for acute toxicity.
2. Wastewater systems should not release ammonia in quantities or concentrations resulting in a concentration of unionized ammonia (UIA) greater than 0.019 mg/L in the aquatic environment. The Guideline also gives guidance on determining if site conditions will impact the chronic toxicity of ammonia.

The City submitted their P2 Plan to Environment Canada in 2007. The preferred approach for the Guelph WWTP to address the requirements under CEPA is to continue to provide dechlorination prior to effluent discharge.

Water Management Policies, Guidelines and Provincial Water Quality Objectives of the Ontario Ministry of the Environment and Energy

The water management policies and guidelines supporting Provincial Water Quality Objectives (PWQOs) are the basis for establishing acceptable limits for water quality and quantity, consistent with the protection of the aquatic ecosystem and ground-water. They are equally applicable to local site-specific situations, an entire watershed, or the Great Lakes. They establish the limit or the extent to which a water resource can be used without interfering with other uses. The PWQO listing is routinely updated to reflect new or revised objectives.

In setting the limits or requirements for the protection of the water resource, the protection of other media, such as land and air, must be considered and are taken into account in the Approvals and Environmental Assessment processes. A project may have to be altered or scaled down to achieve the appropriate protection of all media. Multi-media considerations may lead to more stringent limits compared to those needed to protect the water resource alone.

MOE's environmental protection strategy places priority on preventing, then minimizing, the creation of pollutants. When the creation of pollutants cannot be avoided, the Ministry's priority is to prevent their release to the environment and then to minimize their release.

a) Pollution Prevention

A guiding principle for the management of pollutants is that the pollution prevention approach is far more desirable than end-of-pipe treatment. Pollution prevention includes practices that, through conservation or more efficient use of hazardous or non-hazardous materials, eliminate or reduce the use of energy, water, or other resources. Finding alternative production processes and chemicals and using BMPs and water conservation are preferable approaches to simply concentrating on meeting the established effluents limits through waste treatment.

b) Management of Hazardous Substances

Hazardous substances (i.e., persistent, bioaccumulative toxic substances), should be dealt with in regard to their impact on the ecosystem. These hazardous properties make control on an ecosystem and multi-media (air, water, land) basis absolutely essential. The hierarchal management approach of reducing discharges to zero through banning or phasing out, or at the very least, curtailing escape to the environment as much as possible, is one of the fundamental approaches for the control of these pollutants in Ontario.

c) Municipal and Industrial Strategy for Abatement (MISA)

The goal of the limits and regulations developed through the MISA program is the virtual elimination of persistent toxic substances. Generally, the effluent limits contained in these regulations are based on levels attainable by best available and economically feasible treatment technology. These regulations represent a major and important component in the Ministry's strategy to abate pollution sources and improve the ecosystem.

d) Watershed Planning

Watershed planning considerations address the inter-relationships of the hydrologic regime, water use patterns, and land use planning; thus, making watershed planning a preferred basis for water management decisions. In keeping with the ecosystem approach to water resource management, the inter-relationship of surface and ground water quality and quantity have to be recognized in water management decision-making processes. For example, decisions related to Permits to Take Water should be reviewed for their potential cumulative impact on water quality.

Any activity that has the potential for affecting water quality or quantity requires close scrutiny. For example, the development of land and the resulting non-point sources of pollution have proven to have significant impact on water resources so deserve careful attention. The inter-relationships of land use management and water management have to be clearly understood and considered if the principles of protection, preservation, and sustainability are to be preserved.

4.3.3 Emerging Contaminants of Concern

The CofA lists the traditional contaminants of concern for the treatment of residential and industrial wastewater. Recently, with the advent of more sophisticated analytical tools, new contaminants have arisen that have the potential to become a concern and be the subject of future water quality regulations in wastewater effluent and drinking water supplies.

Endocrine Disrupting Chemicals

A group of contaminants that is emerging as a concern are called endocrine disrupting chemicals or EDCs. The endocrine system is a collection of glands that respond to chemical signals. These chemical signals, the hormones, are typically secreted into the blood stream, are transported to a target tissue, and interact with the target tissue to produce an effect. EDCs are natural and synthetic compounds that can interfere with these normal endocrine system functions.

EDCs are defined as those compounds that can potentially disrupt the normal functioning of the endocrine system by mimicking the actions of naturally-occurring hormones, by blocking the receptors in cells that receive hormones, or by affecting synthesis, transport, metabolism, and excretion of hormones.

The endocrine system is complex; therefore, it can be disrupted at any one of the steps required to maintain balance within the body. Many natural and synthetic chemicals exist that are either known to interfere or are suspected of interfering with the production, secretion, binding, release, modification, or excretion of hormones. Several groups of known or suspected EDCs exist, and some have been heavily researched for their effects on the endocrine system. These groups are outlined as follows.

Pharmaceuticals/Personal Care Products

Pharmaceuticals are a group of synthetic compounds that are designed to produce a specific effect. These include, but are not limited to: antibiotics, antidepressants, anticonvulsants, analgesics, cholesterol-reducing medications, and synthetic hormones (birth control, hormone replacement therapy, etc.). Personal Care Products include nutraceuticals, fragrances, sun-screen agents, and numerous other compounds that may also have active metabolites capable of interacting with the endocrine or nervous systems.

Naturally-occurring Hormones

Naturally-occurring hormones include mycoestrogens and phytoestrogens. They originate from fungus and plants (soybeans, wheat, peas) and can be consumed in the diet. Naturally-occurring hormones can also be classified as EDCs.

EDC Environmental Pathways

EDCs can end up in wastewater through direct discharge into sewers from residential, commercial, and industrial areas. They can also come from stormwater runoff due to increased use of antibiotics and hormones in farming. However, most of the compounds found in wastewater are naturally produced by plants and animals. The increase in awareness of these compounds is due to new laboratory methods which have enabled the detection of these compounds throughout the environment.

Due to the nature of EDCs and their pathways into receiving waters, source control and source separation are important for reducing EDC loads entering the environment and improving wastewater treatment efficiency. No amount of regulation will completely remove these substances from use; therefore, wastewater treatment will play an important role in reducing EDCs in the environment.

Effect of EDCs

The effect of endocrine disrupters on human health and their fate in wastewater and water treatment processes is still a very new field of research. No studies to date have effectively linked low concentrations of EDCs in wastewater to adverse health effects to humans. The U.S. Environmental Protection Agency (EPA) is at the beginning of the process of determining if additional requirements to control sources of EDCs to the environment are needed.

EDCs are currently not regulated, and much of the governmental and academic research is focused on determining methods for effective screening and detection of estrogenic and pharmaceutical compounds. Many commonly used pharmaceutical and personal care products are now being evaluated for endocrine-disrupting potential.

Many projects are currently underway to determine the implications of EDCs on wastewater treatment and their fate through conventional wastewater treatment processes. This will provide information to optimize treatment processes for the removal of EDCs. There is also a need to develop reliable detection methods, which is being addressed by the scientific community. Many of the possible EDCs that may be of concern do not currently have reliable detection testing methods available.

In Canada, Environment Canada and the National Water Research Institute are expanding on international efforts related to EDCs from a Canadian perspective. Environment Canada's national strategy for addressing EDCs involves the following:

- National leadership/communication on EDC
- National and international harmonization of screening and testing protocols
- Establishment of a better knowledge of effects of EDCs in ecosystems
- Assessment/action on priority substances

In addition, Health Canada is examining the impacts of EDCs which will aid in developing regulations to cover these compounds.

The advancement of analytical techniques, along with a greater understanding of the effects of the potentially damaging impacts of various organic compounds on the overall health and the reproductive health of aquatic life, has promoted a focus on the widespread presence of various pharmaceuticals and personal care products (PPCPs) and EDCs contained in municipal WWTP effluents. The occurrence of these compounds in municipal wastewaters is mainly due to unregulated activities of individuals rather than to regulated industrial discharges. However, future regulations could well impose severe limits on the discharge of PPCPs and EDCs from WWTPs. The combination of a municipally run centralized facility for the return of unused PPCPs, along with an aggressive public awareness campaign, should be considered by the City. Such a campaign may be more effective if coordinated by or in conjunction with the GRCA.

4.3.4 Phosphorus

Phosphorus continues to be the limiting nutrient to vegetative growth in Ontario streams and lakes. Phosphorus discharges lead to the growth of aquatic macrophytes in receiving waters, which, in turn, impact on the ambient dissolved oxygen (DO) levels. Plant synthesis during the day time increases the oxygen concentration in the receiver, while respiration at night time can reduce the oxygen supply to limits which place stress on aquatic organisms, leading to deterioration in benthic quality.

Regulations are likely to continue to place tighter and tighter limits on effluent discharge of total phosphorus (TP) to receiving waters. The current CofA limit for the Guelph WWTP is 0.3 mg/L TP during the summer period and 0.5 mg/L during the winter period. Discussions with the MOE have indicated that current TP limits in some Ontario municipalities are as low as 0.1 mg/L. It would be prudent to assume that the allowable TP concentrations may be required to be even lower at some time in the future for continued effluent discharge to the Speed and/or Grand Rivers.

There are other improvements that can be made to a river which can reduce the DO fluctuations due to excessive aquatic plant growth, raise the background DO levels, and, in general, assist in rejuvenating the river. These include shading of river banks, development of shoreline wetlands, installation of aeration steps, etc.

4.3.5 Ammonia

Nitrogen is also a nutrient required by aquatic vegetation; however, it is generally available from uncontrollable sources in concentrations non-limiting to plant growth. Nitrogen in the form of unionized ammonia (UIA), however, imparts chronic toxicity at low levels and lethal toxicity at higher concentrations to various aquatic organisms. Rainbow trout and daphnia are used as the test species in determining ammonia toxicity levels. Such toxicity levels are pH and temperature dependent; consequently, the allowable ammonia concentration prior to toxicity effects occurring changes from night time to day time and from season to season. The ammonia limits approved by the MOE at 73.3 MLD are 1 mg/L during the summer and 1.5 mg/L during the winter.

An alternative to reducing effluent ammonia concentration to lower limits would be to modify the conditions in the receiving water such that temperature and pH are reduced, thereby decreasing the UIA fraction of the total ammonia. This could potentially be accomplished through the construction or development of wetlands at locations in the Speed and Grand Rivers. Such wetlands could provide cooling effects during the hot and dry summer periods and have a stabilizing effect on river pH. Improvements to the health of the Speed and Grand Rivers are being examined through the Water Managers of the Grand.

4.3.6 Nitrates

At this time, there is no PWQO for nitrates. Based on discussions with the MOE, it has been indicated that they are in the process of developing a PWQO for nitrate which will most likely be required in future effluent quality criteria. The concentration for nitrates discussed for a phased in implementation is 2.9 mg-N/L.

The intent of this review is to determine the potential impacts this pending PWQO could have on the Guelph WWTP. In addition, a brief technology review has been included for discussion.

Nitrates in the Speed River

To determine potential impacts on the effluent requirements of the Guelph WWTP, it was necessary to determine the current level of nitrates in the Speed River. Seventy-fifth percentile data was obtained from two sampling locations on the Speed, the Guelph Dam Reservoir upstream of the City’s urban boundaries and the Edinburgh station. Sampling at this station was stopped in 1995 and re-initiated in 2007. The 75th percentile values for each station are as follows:

- Guelph Dam Reservoir 2.5 mg-N/L
- Edinburgh Station 1.43 mg-N/L

Based on discussions with the GRCA, it is thought that the decrease in nitrate concentration between the two stations is due to the confluence of the Eramosa River which is low in nitrates.

Potential Impacts on the Guelph WWTP Effluent

Based on MOE Procedure B-1-5, *Deriving Receiving-Water Based, Point-Source Effluent Requirements for Ontario Waters*, the Speed River would be designated as a Policy 1 receiver for nitrates, as the current water quality is better than the PWQO for this parameter. For Policy 1 receivers, the water quality in the river must be maintained at or better than the PWQO (MOE, 1994).

Initial calculations were performed to determine the potential effluent nitrate requirements for the next phased expansion (73.3 MLD), at a low flow of 1.0 m^3/s (historical 7Q20 values range from 0.7 – 1.9, with an average of 1.2 m^3/s). To achieve a downstream concentration of 2.9 mg-N/L (assuming complete mixing), the effluent nitrate limit would be 4.6 mg-N/L. For the projected future flows (144 MLD), the effluent nitrate limit would need to be approximately 3.8 mg-N/L. The current average effluent concentration of nitrates from the Guelph WWTP (2005 – 2007) is 20 mg-N/L.

4.3.7 Future Effluent Compliance Limits (beyond 73.3 MLD)

As a Policy 2 Receiving Stream, future discharges to the Speed River are only allowed if it can be demonstrated that that the river quality, with respect to total phosphorus, UIA, and DO, remains constant or improves. In order to achieve these requirements, the effluent quality compliance limits (as stipulated in the CofA) must be improved to allow for an increase in future effluent flows without an increase in loading.

As discussed in Section 4.2, Projected Wastewater Flows, the projected flow rate at the WWTP in 2054 is between 126,000 and 144,000 m^3/d (126 – 144 MLD). As a Policy 2 Receiving Stream, in order to increase flows to the Speed River, the effluent quality from the WWTP must be improved such that no net increase in loading occurs.

Potential future effluent compliance limits were developed based on maintaining or reducing current loading rates at a future flow rate of 144 MLD. These compliance limits, and associated loadings, are compared to current (64 MLD) and approved (73.3 MLD) limits, as shown in Table 4.4.

TABLE 4.4
Comparison of existing and View of Proposed Potential Future Compliance Limits

Parameters	Limits (mg/L)			Loads (kg/d)		
	64 MLD	73.3 MLD	144 MLD	64 MLD	73.3 MLD	144 MLD
Summer Limits						
TSS	10	8	2	622	586	288
$cBOD_5$	–	–	2	–	–	288
TOD	22	16.5	-	1,426	1,210	-
Ammonia	–	1	0.5	–	73	72
Total Phosphorus	0.38	0.3	0.1	24	22	14
Winter Limits						
TSS	10	8	2	622	586	288
$cBOD_5$	7.4	4	2	473	293	288
TOD	–	–	–	–	–	–

TABLE 4.4
Comparison of existing and View of Proposed Potential Future Compliance Limits

Parameters	Limits (mg/L)			Loads (kg/d)		
	64 MLD	**73.3 MLD**	**144 MLD**	**64 MLD**	**73.3 MLD**	**144 MLD**
Ammonia	3.4	1.5	0.75	218	110	108
Total Phosphorus	0.7	0.5	0.15	46	37	22

To examine potential impacts of future flows, a mass balance was completed to see potential downstream concentrations of TP and UIA. The calculations showed an improvement in downstream TP and UIA when compared to the projected downstream concentrations with the approved effluent limits for 73.3 MLD. Based on the calculations performed, concentrations of UIA and TP improved by 25 and 50 percent, respectively.

In addition to the mass balance calculations, the GRSM was run by the GRCA to evaluate the impact of the increased flows and proposed concentrations on the downstream DO levels. The output from the model found that with the decrease in total phosphorus, ammonia, and BOD loadings, there was an improvement in downstream DO levels at 144 MLD, as compared to model runs using current (64 MLD) and future (73.3 MLD) limits.

5. Wastewater Treatment Alternatives

5.1 What is an Alternative

By definition, an alternative means feasible alternative ways of solving an identified problem (deficiency) or addressing an opportunity, from which a *preferred solution* is selected.

(Source: Municipal Class Environmental Assessment June 2000)

For the purposes of this Master Plan, the City must develop a preferred solution (strategy) to provide wastewater treatment for 144 MLD, projected to be generated by the City by 2054.

This Master Plan considered five "sets" of alternatives, including:

1. Planning
2. Source control
3. Discharge location
4. Treatment location
5. Treatment technology

The intent of this Master Planning process is to develop a strategy that includes a combination of alternatives to meet the short-, medium-, and long-term needs for wastewater treatment for the City.

The alternatives described in this section constitute the long-list of potential alternatives. These alternatives were subject to an initial prioritization exercise, followed by a more detailed evaluation to determine the preferred strategy components of the Master Plan. The description and results from the prioritization and evaluation process are included in Section 6, Evaluation Methodology.

5.2 Planning Alternatives

5.2.1 Do Nothing/Limit Growth

In order for the "Do Nothing" alternative to be a feasible option, growth would need to be limited to not exceed the current approved treatment capacity of the WWTP (73.3 MLD). As mentioned previously, growth within the City is being examined as part of the GMS. Findings from the City's Master Planning processes, including the WSMP, the W&WW SMP, and this WWTMP, will be used as part of the GMS to examine how much growth can be sustainably accommodated.

It is anticipated that the City will continue to see growth, the extent of which will consider infrastructure improvements and limitations. At this time, "do nothing" is not a feasible option and will only be considered further in this study as a baseline for comparison with other alternative solutions.

5.3 Source Control/Non-expansion Alternatives

Controlling or reducing wastewater generation at its source can help to improve the efficiency of a WWTP and may defer the need to upgrade and expand existing infrastructure. Several alternatives for the City are presented in the following subsections.

5.3.1 Water Conservation Initiatives

The City initiated a Water Conservation & Efficiency (WC&E) program in the early 1990s. This program has been successful in reducing water consumption within the City.

The recommendations for water conservation and demand management from the City's WSMP included a reduction in water consumption of 10 percent by 2010 and a reduction in unaccounted for water from 13 to 10 percent during this same time period. Recommendations for the City's water conservation program to achieve these targets included undertaking a rate study and updating the 1999 WC&E Study to reflect new conservation methods and technologies. Long-term water consumption implementation outlined in the WSMP included a 15 percent reduction in per capita water consumption by 2017 and 20 percent by 2025.

The ongoing implementation of the City's WC&E program will see benefits realized by both the water supply system and the wastewater system. As previously indicated, it is important to understand that beneficial impacts of water efficiency programs on water supply and wastewater systems may be different and cannot be assumed to be equal. For example, initiatives related to reduction in outdoor water use will not reduce the volume of wastewater reaching the WWTP for treatment.

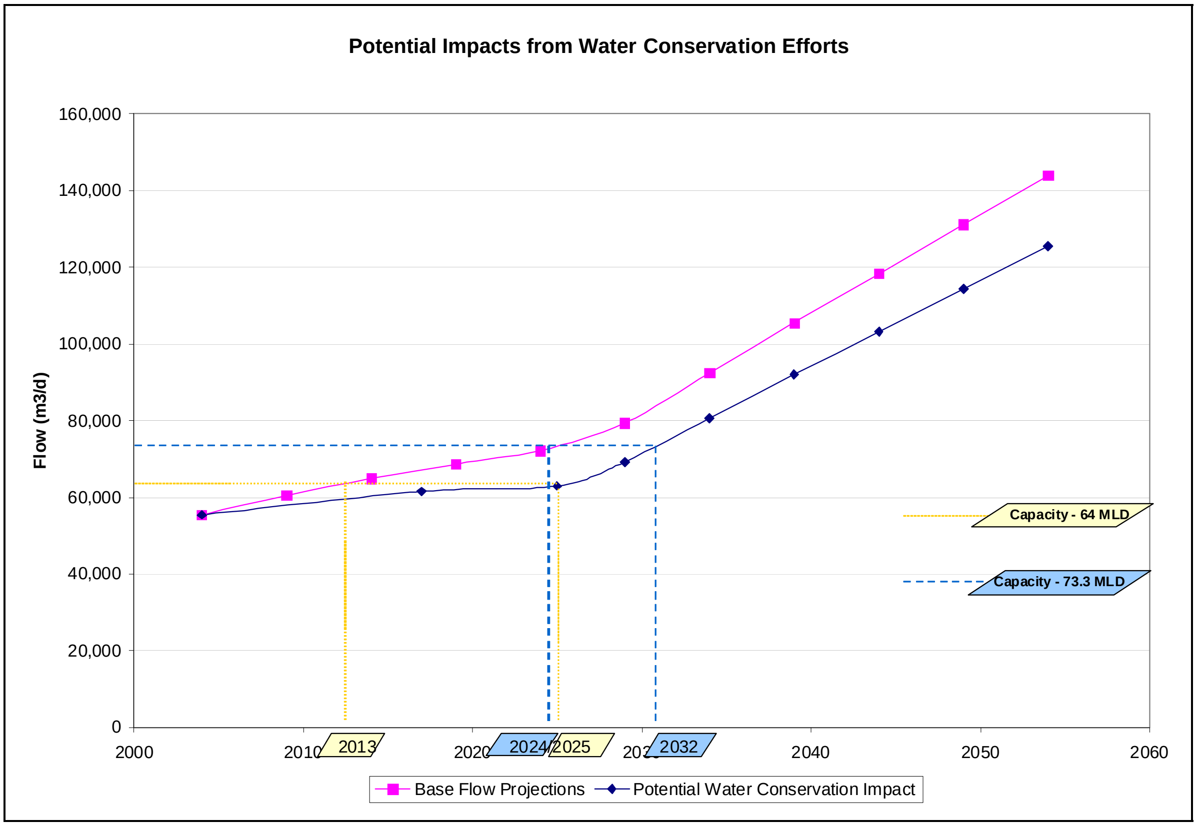
The success of the City's water conservation efforts to date have already contributed to a deferral of the required expansion of the WWTP, from the original date of 2010, outlined in the 1998 Master Plan, to approximately 2013.

Potential Impact of Water Conservation Efforts

The potential impacts of achieving the water reduction targets outlined in the WSMP were examined. Not all water reductions will be realized as direct reductions in wastewater reaching the WWTP. Therefore, a reduction in per capita wastewater generation of 10 percent in 2017 and an additional 5% resulting a total reduction of 15% by 2025 were considered in the flow reduction calculations.

As can be seen in Figure 5-1, achieving the water conservation targets could have an impact in deferring the required capacity expansions at the WWTP. For capital planning purposes, the base flows without water conservation considerations will be used. This is a conservative approach for budgetary planning and consistent with the approach used in the WSMP. If conservation targets are achieved and the impacts are seen at the WWTP, the investment in any capital expansions can be deferred.

FIGURE 5-1
Potential Impacts from Water Conservation Efforts



Grey Water Reuse

Grey water reuse can be a potential component of a water conservation program. Effluent water generated at a residence can be defined by three general categories – rain water, grey water, and black water.

1. Rain water is commonly collected in rain barrels or cisterns and reused onsite.
2. Black water can be defined as effluent from toilets and dishwashers and is not used for onsite water reuse.
3. Grey water is domestic wastewater produced from showers, clothes washing, and hand-wash water and can be reused onsite.

Grey water reuse, although practiced in select areas outside of Ontario, is mostly a conceptual-level water conservation initiative at present time. Prior to a recent update in June 2006, the Ontario Building Code did not permit grey water reuse for domestic purposes. The amended regulation now confirms *Storm sewage* or *grey water* that is free of solids may be used for the flushing of water closets, urinals, or the priming of traps. While new regulatory amendments remove one barrier to implementation, public perception and economic viability still remain potential obstacles. Onsite water reuse is an option that needs to be considered on a development level basis.

An update to the City's WC&E Strategy commenced in the spring of 2008. Part of this strategy will examine innovative water conservation options, such as onsite water reuse.

5.3.2 Inflow and Infiltration Control

The City's W&WW SMP examined the City's I/I and made recommendations for addressing issues associated with these extraneous flows. The recommendations from the W&WW SMP included additional studies to develop strategies to implement I/I reduction programs. Once some of the main sanitary trunk replacements have been completed, the W&WW SMP also recommended the installation of additional flow monitoring to identify the resulting I/I reductions.

5.3.3 Sewer Use By-Law

The City has a Sewer Use By-Law that regulates the type and amount of substances which can be discharged to the sanitary sewer system. The City has worked with major industrial dischargers to reduce contaminant loadings to the sanitary sewer system and subsequently to the WWTP. The majority of industrial dischargers are meeting the By-Law limits for TSS and BOD loading, and the City continues to work with industries in non-compliance to achieve the By-Law limits. Local industries working with the City to ensure that they are in compliance with the Sewer Use By-law has proved to be quite successful to date. With major local industries installing pretreatment facilities, this has resulted in a reduction in solids loading at the WWTP. This reduction in loading has resulted in cost savings for the City, including the deferral of the construction of a sixth digester, as well as a decrease in overall solids production at the plant, resulting in operational improvements.

Modifications and updates to the existing By-Law may increase the effectiveness and usability of the document. A more comprehensive review of the City's current Sewer Use By-Law can be found in Appendix C. Some recommendations for the existing By-Law include:

- General reorganization of the By-Law, including a table of contents
- Review and update of the restricted substances lists
- Review of surchargeable parameters
- Review of wording on enforcement, offences, and penalties

5.3.4 Plant Optimization (Re-rating)

Plant optimization involves examining existing process tankage and equipment to identify any performance or capacity limiting factors and then developing mitigation measures to overcome the identified bottlenecks.

The City has initiated a program to examine the feasibility of optimizing the existing facility. This study will examine the existing treatment processes to see where operational modifications may be made to improve these processes. In general, these modifications rely on increased monitoring and increased reliance on operator skills.

If it is found that modifications to the existing processes can result in an increased treatment capacity, an amendment to the existing CofA would be required before the City could operate the WWTP at this new capacity level. To receive approval for a re-rating of the

WWTP, the City would first need to confirm that the WWTP continues to meet water quality objectives for the Speed River. Based on the requirements of the Speed River as a Policy 2 receiver, this will require an improvement in effluent compliance limits to prevent additional loading from being discharged to the River.

It is recommended that the City continue with the ongoing optimization study to determine the feasibility of optimizing the Guelph WWTP.

5.4 Discharge Location Alternatives

For a 50-year Master Plan exercise, it was considered reasonable to review the feasibility of an alternative discharge location (receiving water) for WWTP effluent, as well as effluent reuse alternatives.

5.4.1 Existing WWTP Discharge to Speed River

This alternative considers maintaining the existing WWTP outfall to the Speed River.

Assimilative Capacity of the Speed River

Initial investigations, as described in Section 4.3.6, confirm that assimilative capacity is available in the Speed River, providing there is a corresponding increase in effluent quality. As a Policy 2 Receiving Water for total phosphorus, un-ionized ammonia, and DO, increased discharges are only allowed if it can be demonstrated that the river quality, with respect to these parameters, remains constant or improves.

A mass balance exercise was performed to determine the potential downstream impact of increased effluent discharge on both total phosphorus and UIA with the proposed effluent limits at 144 MLD. The findings from these calculations showed some improvement in downstream UIA, and in downstream total phosphorus as compared to current conditions. The GRSM was run to determine the impact of future effluent discharges on the downstream DO in the river. Initial results showed a defined improvement in downstream oxygen levels.

Potential impacts not investigated as part of this study were the impacts on hydraulics during high flow conditions, and potential impacts from the effluent temperature. It is noted, however, that the WWTP effluent temperatures are lower than the typical summer temperatures in the Speed River, which may result in improved downstream conditions. Based on initial conversations with the GRCA, the increased WWTP flow contribution is not anticipated to be significant compared to peak river flow conditions; however, this needs to be confirmed in the approval process prior to any future expansions. The GRCA has a mandate to investigate temperature regimes within the Grand River Watershed. It is recommended that the City continue to work with the GRCA through the Water Managers of the Grand, to assist in investigating future temperature impacts.

Future Studies

Prior to subsequent WWTP expansions (beyond 73.3 MLD), more detailed investigations of the potential impacts on the Speed River will be required. The City has commenced discussions with the GRCA and the MOE on the requirements of future assimilative capacity studies. These discussions will confirm modelling requirements, including river flow values to be used for the assessment.

Monitoring

The City has been involved, and will continue to be involved with the GRCA to optimize the monitoring stations along the Speed River. The objective of the improved monitoring program is to gain a better understanding of the impacts of various contributors to the river. These include urban and rural discharges, as well as point source discharges including the Guelph WWTP. The integrated monitoring program will provide improved spatial resolution for the GRSM model and future assimilative capacity studies. In 2007, the GRCA re-instated the Provincial Water Quality Monitoring station at Edinburgh Road, immediately upstream of the WWTP. In addition, the GRCA will continue to provide sampling downstream of the WWTP to measure nutrients, suspended solids, and DO.

The GRCA conducts monitoring throughout the Grand River Watershed. The City will continue to have access to a large set of water quality data, which will assist with future efforts to assess the contributions from the Guelph WWTP on river water quality.

5.4.2 Alternate Discharge Location

As part of the Master Plan process, the potential for alternate discharge locations was examined. The areas investigated for discharge included the Grand River Watershed, Guelph Lake, as well as the larger Lake Erie Watershed.

Grand River Discharge

Based on current studies on the Grand River Watershed and communications with the GRCA, there are currently no locations within the Grand River or its contributing tributaries with assimilative capacity to receive additional discharges of wastewater effluent. Current available data revealed that most of the other areas in the Grand River watershed are already stressed. Should environmental constraints change and additional assimilative capacity is found within the watershed, then further comprehensive investigation and modelling would be required. This would be necessary before a new permit could be issued to construct a new discharge in an alternate location.

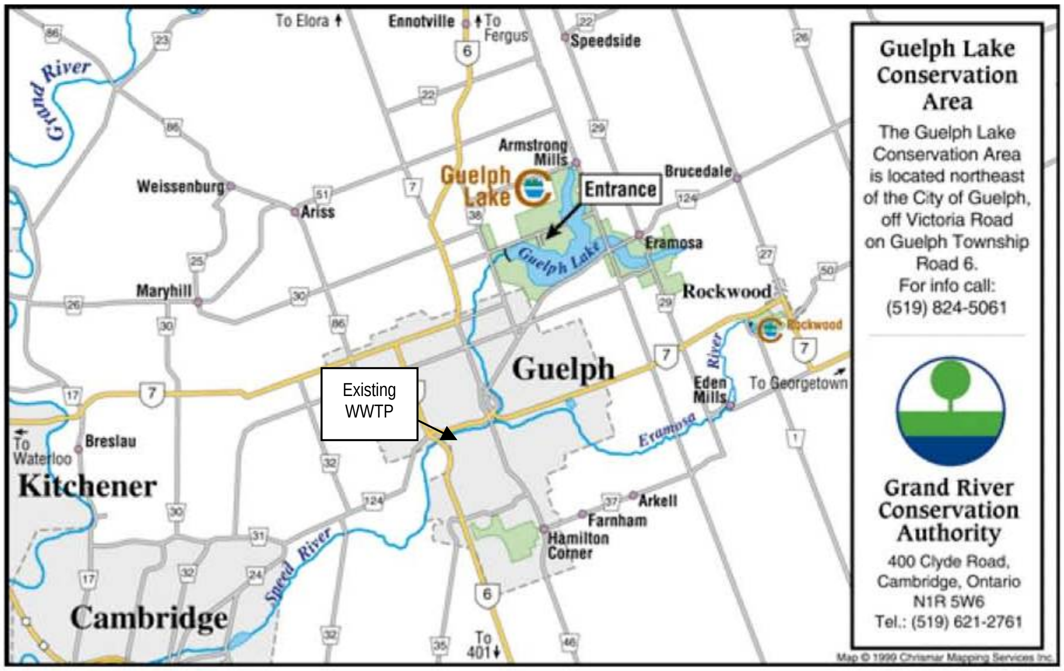
Guelph Lake Discharge

Guelph Lake is a constructed lake built in 1974. The lake was constructed to provide flood control and flow augmentation for the downstream reaches of the Speed River. The Guelph Lake Conservation Area is a popular location for camping and seasonal recreation. There are two beaches on the lake, and it is home to sailing and rowing clubs. The lake is shallow, and is currently hypereutrophic, meaning that it is nutrient rich with algal growth.

The location of Guelph Lake in relation to the existing wastewater treatment plant, as well as the existing urban boundaries, can be seen in Figure 5-2.

FIGURE 5-2
Guelph Lake

[Map from Grand River Conservation Authority Website www.grandriver.ca]



The feasibility of discharging to Guelph Lake would need to be confirmed through more detailed investigations. However, due to its current recreational use and lower assimilative capacity, the lake is not considered to be a likely potential candidate for an alternate discharge location. In order for the lake to be considered further as a candidate, the detailed investigations would need to examine:

- *Assimilative capacity* – Guelph Lake is a shallow lake already rich in nutrients, and this may result in limited assimilative capacity.
- *Impact on downstream assimilative capacity* – Introducing wastewater effluent upstream may have an impact on the assimilative capacity of the existing outfall downstream on the Speed River.
- *Effluent requirements* – The proximity of water contacting recreational activities, as well as the nutrient rich conditions of the lake, may result in a need for very stringent effluent quality requirements.
- *Impacts on hydraulics/flow augmentation* – One of the main purposes of Guelph Lake is to provide flow augmentation to the Speed River, thus, introducing additional flow into Guelph Lake may assist in this function.
- *Future plans for the lake* – As part of the WSMP Guelph Lake was identified as a potential future surface water supply.

Lake Erie Discharge

Discharge to Lake Erie would require the construction of a pipeline to Lake Erie from various municipalities within the Lake Erie Watershed. The "Big Pipe" issue has been discussed in southwestern Ontario municipalities for several years. Such a project would be sizeable, and typically beyond the capacity of a single municipality to support. Based on economic considerations, a discharge pipeline is considered financially feasible when planned in conjunction with the construction of a water supply pipeline, as part of a bigger system project. The planning, route selection, permitting and construction of a pipeline would include major capital costs. It would also require comprehensive analyses and coordination and collaboration between the municipalities that would be served by the infrastructure. Currently, the Region of Waterloo, in association with the City of Brantford and Haldimand County, are examining the technical feasibility of a water supply pipeline from Lake Erie to the Region of Waterloo, with connection to Brantford. As part of the WSMP, the City investigated the option of a Great Lake Water Supply from Lake Erie. At this time, this alternative is considered to be not feasible for the City. The City may wish to monitor the activities of the Region of Waterloo and the City of Brantford, as these municipalities could further the discussion and analysis of the Lake Erie option.

5.4.3 Effluent Reuse

Effluent reuse has been on the City's radar screen since it completed its 1998 Wastewater Treatment Strategy. At that time, few options had a proven track record and no operating programs existed in Canada. Since 1998, effluent reuse has emerged as a feasible option for some municipalities. Accordingly, effluent reuse is now being considered as part of the City's Master Plan exercise.

The assimilation capacity of the Speed River is at its lowest during the low flow, hot summer periods. With climate change trends, these periods may increase in frequency, duration, and intensity. Summer is also the most likely period for effluent reuse opportunities.

Effluent from the Guelph WWTP also has beneficial impacts on downstream reaches of the Speed and Grand Rivers. Guelph WWTP's effluent acts as an indirect potable water source for downstream water supplies, and also provides additional assimilative capacity to downstream discharges. These factors need to be considered with any alternative where significant quantities of effluent would be diverted from the Speed River.

Reuse Options

Urban water reuse systems have two major components: wastewater treatment and a distribution system. The extent of each of these components depends on the end use of the recycled effluent. One of the key elements of operating an effluent reuse program is ensuring a safe and reliable water source for reclamation applications. A number of U.S. states have published treatment standards or guidelines outlining specific treatment requirements, and/or effluent quality limits. A list of the ranges of current published effluent reuse criteria can be found in Appendix D. Based on existing guidelines, criteria are divided into the following categories (EPA, 2004):

- *Unrestricted urban reuse* – Irrigation of areas in which public access is not restricted, such as: parks, playgrounds, school yards, and residences that engage in toilet flushing, air conditioning, fire protection, construction, ornamental fountains, and aesthetic impoundments.

- *Restricted urban reuse* – Irrigation of areas in which public access can be controlled, such as golf courses, cemeteries, and highway medians.
- *Agricultural reuse on food crops* – Irrigation of food crops which are intended for direct human consumption; often further classified as to whether the food crop is to be processed or consumed raw.
- *Agricultural reuse on non-food crops* – Irrigation of fodder, fibre, seed crops, pasture land, commercial nurseries, and sod farms.
- *Unrestricted recreational reuse* – An impoundment of water in which no limitations are imposed on body-contact water recreation activities.
- *Restricted recreational reuse* – An impoundment of reclaimed water in which recreation is limited to fishing, boating, and other non-contact recreational activities.
- *Environmental reuse* – Reclaimed water used to create constructed wetlands, enhance natural wetlands, and sustain or augment stream flows.
- *Industrial reuse* – Reclaimed water used in industrial facilities, primarily for cooling system make-up water, boiler-feed water, process water, and general washdown.
- *Groundwater recharge* – Use of either infiltration basins, percolation ponds, or injection wells to recharge potable or non-potable aquifers.
- *Indirect potable reuse* – The intentional discharge of highly-treated reclaimed water into surface waters or groundwater that are or will be used as a source of potable water. This can include discharge into a reservoir that will be used as a raw water supply. The introduction of wastewater effluent to potable aquifers is a relatively new process. There have been limited applications of this process due to potential, associated health risks. There have been a few applications of this technology in California and plans for implementation in Australia.

In addition to the categories listed, direct potable reuse is an option for effluent reuse. Direct potable reuse occurs when treated wastewater is introduced directly into a water supply system. Indirect potable reuse can also be further divided into *planned* and *unplanned*, with unplanned generally occurring where an existing water supply has historically had a treated wastewater component resulting from an upstream or inter-basin discharge from an existing WWTP.

Reuse in Canada

There are currently two provinces that have developed guidelines for water reuse, Alberta and British Columbia. Alberta guidelines are related only to irrigation, with application to certain crop lands in specific geographies. British Columbia guidelines outline quality criteria for a number of end uses, including: irrigation, chemical spraying, fire fighting, toilet and urinal flushing, ponds and decorative uses, stream augmentation, habitat restoration, driveway and street washing, snow making, dust suppression, and industrial uses (Exall et al, 2004).

There are a few golf courses within Ontario that use treated effluent for irrigation. Site-specific approval for effluent reuse in Ontario would need to be discussed with the MOE and the local Medical Officer of Health. Permits for these activities would be required.

Potential for Reuse in Guelph

The existing effluent from the City could already be classified as unplanned, indirect, potable reuse for downstream water users along the Speed and Grand Rivers, including the community of Ohsweken in the Six Nations of the Grand River Territory, which draws surface water from the Grand River downstream of Brantford. The current effluent discharge can also be considered an environmental reuse. During low-flow conditions, the effluent from the WWTP represents a significant portion of the Speed River flow. Future, potential, reuse opportunities within the City could include:

- *Urban reuse* – Potential for use as irrigation water for municipal landscaping and local golf courses. A conceptual-level study completed for the City by AquaTeam in 2004 examined potential options for reuse within the City. A copy of this report is included in Appendix D.
- *Groundwater recharge* – Based on initial discussions with City of Guelph Waterworks staff, there does not appear to be any non-potable aquifers for groundwater recharge within the Guelph area. Feasibility of recharge to a potable aquifer, which would also be considered a planned, indirect, potable reuse would need to be determined. To determine the feasibility of this option, a site-specific risk assessment would need to be completed which looked at wastewater quality in conjunction with aquifer characteristics. Additional treatment would most likely also be required for this alternative. As there is no precedence for these types of applications in Ontario, regulatory requirements for this option would need to be discussed with the MOE.

Additional Considerations

The potential for wastewater effluent reuse should be further investigated, as a means to decrease effluent discharge requirements and to reduce seasonal water demand. Potential areas which will require further investigation as more information becomes available include the potential impact of emerging contaminants, such as EDCs, as well as limitations on application areas with pending source water protection legislation.

5.5 Treatment Location Alternatives

As additional wastewater treatment capacity is required, it will be necessary to construct additional treatment processes. The possibility of constructing new facilities at a number of different locations, including the existing WWTP, is described in the following subsections.

5.5.1 Existing Wastewater Treatment Plant Site

In this alternative, future wastewater treatment capacity up to 144 MLD will be provided at the existing WWTP site located at 530 Wellington Street West.

There are a number of projects that are planned or in construction at the Guelph WWTP that are not shown on the existing site plan. These include:

- Process Operations Centre
- Stage 2 expansion (to 73.3 MLD)
- Future disinfection

- Digester No. 5
- Future digester
- Biosolids storage

The proposed location for each of these projects is shown in Figure 5-3.

As can be seen, the majority of the eastern portion of the site is occupied by existing processes or planned and approved upgrades. Future expansions, beyond 73.3 MLD, will likely need to be constructed in the available area to the west of the planned Process Operations Centre. Based on the existing boundaries of the site, there should be sufficient physical space for required expansions to 2054. There are no major obstacles to this alternative; it is the most compatible with the existing infrastructure, as it would use the existing collection system, plant processes, and staff.

5.5.2 Satellite Treatment Plant Site(s) at New Discharge Location(s)

In this alternative, the existing WWTP would be maintained and upgraded. A satellite treatment facility would be constructed if a new discharge location was found to be the preferred method for future effluent discharge, beyond the 73.3 MLD expansion. The satellite treatment plant could be sized to treat any portion of current or future flows generated based on available siting constraints. New sewers and new pumping stations may be required based on the site location to convey wastewater to the satellite plant. Based on initial investigations, Guelph Lake could be examined as a potential, alternate, discharge location if a satellite plant were to be constructed in the north east portion of the City. This option may interfere with future water supply sources, as Guelph Lake was cited as a potential option for future drinking water supply. There do not appear to be any additional locations in proximity to the municipal boundaries where additional discharge locations could be sited.

FIGURE 5-3
Planned Projects at the Guelph WWTP

LEGEND:

1. PROCESS OPERATIONS CENTRE
2. STAGE 2 EXPANSION (TO 73.3 MLD)
3. FUTURE DISINFECTION
4. DIGESTER No.5
5. FUTURE DIGESTER
6. BIOSOLIDS STORAGE

0 50 100 200m
SCALE

5.5.3 Satellite Treatment Plant Site at Strategic Locations, with Effluent Pumped to Existing WWTP Outfall

In this alternative, the existing WWTP would be maintained and upgraded, and a new satellite facility would be constructed to treat future wastewater flows in the proximity of areas anticipating future growth and/or intensification, such as the south end of Guelph. Wastewater flows could be diverted from the current collection system by intercepting the existing trunk sewers and diverting flows to the new plant. With this alternative, treated effluent would be conveyed back to the existing outfall at the WWTP and discharged to the Speed River. Depending on the availability of City-owned land or the ability to procure land for a new plant, this alternative is feasible. However, the alternative would not make the most of the City's existing infrastructure and would also require additional administration, laboratory, and operations staff to manage more than one facility. In addition, new dewatering and stabilization treatment processes and equipment would be required at the new plant, or solids would require transportation to the existing WWTP.

5.6 Treatment Technology Alternatives

5.6.1 Conventional Physical/Biological Treatment

Traditional wastewater treatment is achieved through two categories of treatment: physical and biological. The physical wastewater treatment processes involve removing solids, such as:

- Grit removal
- Primary clarification
- Secondary clarification
- Filtration

Biological processes break down organic and inorganic components of the wastewater. This is done primarily by bacteria. Bacteria are found as part of the following processes:

- Suspended growth systems, such as an activated sludge system (aeration basins)
- Fixed film systems, such as rotating biological contactors (RBCs), trickling filters, and biological aerated filters

The Guelph WWTP is classified as a conventional activated sludge (CAS) system with tertiary treatment. The major unit processes are grit removal; primary clarification; secondary treatment by an activated sludge system, including secondary clarification; tertiary treatment by RBCs; and sand filtration. The addition of ferrous chloride aids in the precipitation of phosphorus, and disinfection is achieved through a chlorination/ dechlorination process. The existing conventional treatment processes at the WWTP allow the City to comply with the effluent limits outlined for wastewater flows up to 64 MLD. To achieve the approved effluent limits for the 73.3 MLD expansion, additional ammonia removal or nitrification is required. Nitrification technologies are further discussed in the following section. More advanced treatment technologies will be required to achieve improved effluent quality beyond 73.3 MLD.

5.6.2 Natural Treatment Systems

The most common type of natural treatment system is an artificial (constructed) wetland. Treatment wetlands are designed to regulate water depth and residence time, as well as provide a tertiary polishing step to wastewater treatment. Bacteria and fungi attached to the plants may remove biodegradable organics and nitrogen. Metals and phosphorus become bound in plant material and sediment. Treatment wetlands require a large footprint and are most commonly used for smaller rural communities with lower volume wastewater flows and greater flexibility in land availability. As discussed, the Speed River is a Policy 2 receiver, and future effluent limits are required to be more stringent to ensure no increase in loading to the receiving water body (MOE, 1994). Treatment wetlands would not be able to achieve the effluent quality limits that would be required beyond the 73.3 MLD expansion.

5.6.3 Advanced Wastewater Treatment Technologies

Nitrification Technologies

As part of the 1997 City of Guelph Wastewater Treatment Strategy Class EA, it was recognized that additional technologies needed to be examined to provide additional ammonia removal or nitrification. Currently, for Plants 1 to 3, nitrification is being provided within the aeration tanks, with some supplemental nitrification provided through the existing RBCs. Plant 4 provides nitrification within the aeration tank, and the effluent from this plant bypasses the RBCs. As RBC technology cannot nitrify to the effluent ammonia limits required beyond the current 64 MLD capacity, it was recommended that with the Stage 2 expansion to 73.3 MLD and beyond, nitrification be provided either completely within the aeration tanks, which may require de-rating the capacity of Plants 1-3, or by a different method. As part of the Class EA update completed in 2008, four technologies were short-listed for further evaluation:

- Teritiary Nitrification with Biological Aerated Filters (BAF)
- Integrated Fixed-film Activated Sludge (IFAS)
- Nitrifier Bioaugmentation
- Sidestream Treatment technologies, including SHARON®

An evaluation was completed on these technologies, and the Nitrifier Bioaugmentation treatment option generated the highest score in the evaluation exercise, followed by IFAS, Teritiary Nitrification with BAF, and then SHARON® Anammox Processes, respectively. Based on the evaluation, the City will review the Nitrofier Bioaugmentation process to determine specific operating requirements for the Guelph WWTP. In addition, the City will review the operation of IFAS treatment technology currently under a full-scale pilot test at a treatment plant in Peel Region to determine its appropriateness for the Guelph WWTP. A final selection of treatment technology will be made based on an evaluation of the results of the two investigations compared to the base expansion alternative of constructing a new Plant 5. Alternatively, through the optimization study, the City will examine the potential to nitrify within the existing aeration tanks at the higher Stage 2 flows. If this method is found to be feasible, it will be incorporated with the results from the overall study examining re-rating of the capacity of the WWTP.

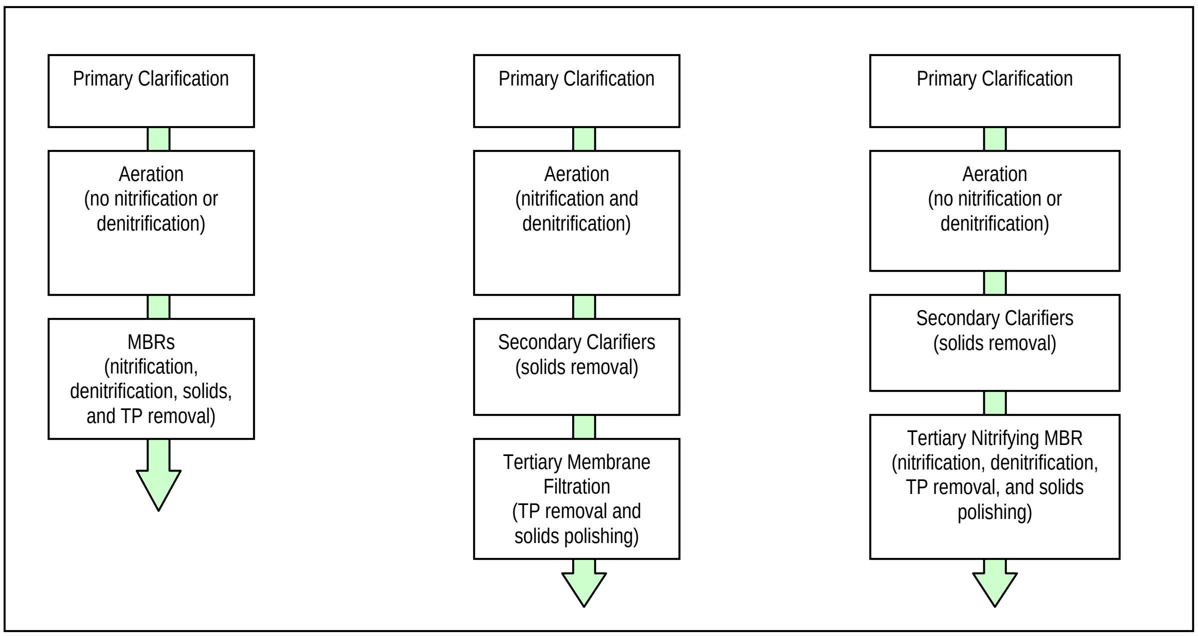
Membrane Technologies

Membranes are a technology that have traditionally been used in water treatment processes and are becoming more common as an advanced treatment technology for WWTPs. Membrane installations at WWTPs have traditionally taken the place of the secondary clarifiers with the installation of a membrane bioreactor (MBR). Recently, plants have started to install membranes downstream of the secondary clarifiers as a tertiary treatment step; these membranes can be installed in an MBR or as a membrane filter.

Figure 5-4 shows the differences between the technologies through process flow diagrams. For the three technologies, the main differences are the location of the membranes (after the secondary clarifiers or replacing the secondary clarifiers), as well as the technology's ability to nitrify or denitrify, which lower the ammonia and total nitrates in a plant's effluent.

FIGURE 5-4
Advanced Technologies – Membrane Options

Membrane Bioreactors



MBR systems are suspended growth activated sludge treatment systems that rely upon membrane equipment for liquids/solids separation prior to discharge of the effluent. MBRs take the place of the secondary clarifiers in conventional WWTPs, as well as in some cases, replacing tertiary treatment processes, such as the RBCs at the Guelph WWTP. MBRs can expand the capacity of a WWTP, providing higher quality effluent with a smaller footprint.

There are two general types of membrane equipment suitable for wastewater treatment: immersed sheet and immersed fibre systems, which are both designed for installation within the bioreactor. Immersed fibre membrane technologies are the most popular for MBR application, since they can more readily accommodate the high concentrations and types of solids found in activated sludge bioreactors. The benefits of MBR systems generally include:

- Biomass can be completely retained; effluent solids concentrations are <1 mg/L.
- Long solids retention times can be achieved; sludge production is reduced as a result.

- Solids retention time can be reliably separated from hydraulic retention time, allowing independent control of both.
- Secondary clarifiers and effluent filters can be eliminated; thereby, reducing the plant footprint area.
- Unlike clarifiers, the quality of solids separation is not dependent on the mixed liquor suspended solids (MLSS) concentration or characteristics. Since elevated MLSS concentrations are possible, the aeration basin volume can be reduced, further reducing plant footprints.
- Excellent effluent quality can be obtained.
- Processes are easily automated; operator requirements are reduced.
- A barrier against pathogens, such as the chlorine-resistant organisms, *Cryptosporidium* and *Giardia*, is provided.

Current MBRs are being designed to enhance nitrification, as well as phosphorus removal, through chemical addition. MBRs are able to achieve superior effluent quality as compared to traditional activated sludge plants, including those with tertiary treatment. The effluent limits outlined in Section 4.3.6, are achievable with an MBR facility.

Tertiary Membrane Bioreactors (MBRs)

Membrane technology can also be used as a tertiary treatment process in a WWTP. This process uses the same technology as the MBR but does not replace the secondary clarification process. With this process, fewer membranes are required, but additional conventional treatment (aeration tanks and secondary clarifiers) are required. This configuration requires a larger footprint than the traditional MBR integration but takes less units and energy, as the majority of the solids removal is completed within the secondary treatment stage. With a tertiary MBR, nitrification and denitrification takes place in this tertiary step.

Tertiary Membrane Filtration

Tertiary membrane filtration is similar to a tertiary MBR. Phosphorus removal and solids polishing take place with this treatment step. The difference in the two technologies is that tertiary membrane filtration does not nitrify or denitrify. With the implementation of this technology, removal of ammonia and nitrates would take place primarily in the secondary treatment process.

Successful long-term operation of any membrane system depends, in a large part, on the performance of the equipment used in that system. That performance is determined by the characteristics of the membrane and modules, the membrane construction, operation and flux maintenance, and the wastewater characteristics. Membrane performance has been examined by the University of Guelph at the Guelph WWTP, and the results of these studies will be considered in future investigations of this technology.

Denitrification Technologies

As described in Section 4.3.6, there are potential implications on effluent requirements with the pending PWQO limit for nitrates. There are numerous technologies that can be used to remove nitrate at a municipal WWTP. Generally, the processes can be broken down into categories that relate to the area where the nitrate or nitrogen removal (N-removal) process takes place. These broad categories include:

- Removal in the mainstream secondary treatment process
- Removal in a tertiary treatment process
- Removal in a process that separately treats centrate

Nitrate removal generally requires a mixed anoxic zone, a zone without oxygen, within the treatment process. The organisms that remove nitrates require an environment deplete of oxygen. The anoxic zone or zones is followed by an aerobic treatment process.

Based on discussions with WWTP operations staff, and accounting for integration with future operations plans for the Guelph plant, initial recommendations for the introduction of denitrification, as required, would be through step-feed denitrification in the mainstream process and a sidestream process to remove nitrate in the centrate prior to reintroduction to the main treatment process. The appropriate denitrification technologies for the Guelph WWTP should be confirmed through more detailed, site-specific investigations once future effluent nitrate requirements are confirmed.

If nitrates become regulated in the future, denitrification will be integrated into either the existing or the preferred future treatment processes. Therefore, denitrification technologies will not be evaluated as a standalone technology as part of this Master Plan, but will be considered part of the preferred solution when it is found to be required.

5.6.4 Emerging Wastewater Treatment Technologies

New technologies are being introduced to wastewater treatment practices to provide higher quality effluents for specific applications. These technologies, while not new technologies, are relatively new to wastewater treatment. Currently, reverse osmosis, ozone, and activated carbon are common technologies for water treatment and supply. These technologies provide a higher water quality than can be realized through traditional and even advanced wastewater treatment applications. These technologies require pretreatment from an advanced treatment process, such as membranes, and are generally only used on a portion of wastewater effluent for specific applications, such as reuse.

These technologies may become more applicable for wastewater treatment facilities considering future changes in regulatory requirements, as well as to accommodate changes in wastewater characteristics or changes in the condition of the receiving stream.

Reverse Osmosis (RO)

RO is a high-pressure filtration process which can remove dissolved inorganic chemicals and suspended particulate matter. It is typically implemented as a polishing step after traditional MBR processes. Pressure is applied to the higher concentration effluent side, which is passed through a semi-permeable membrane to provide a higher quality effluent. Some effluent reuse projects in the U.S. are using a combination of microfiltration, nanofiltration, and RO prior to groundwater recharge of potable water aquifers.

Activated Carbon

Activated carbon removes contaminants from an effluent stream through adsorption or mass transfer. Activated carbon is an effective method of removing a wide range of contaminants. Contaminants that can be removed include non-biodegradable organic compounds, chlorinated organic compounds, pesticides, dyes, and others. Carbon requires replacement or reactivation as the media becomes spent and no longer effectively removes contaminants.

Ozone

Ozone (O_3) is a chemical form of oxygen (O_2). Ozone is a strong oxidizing agent and is used to control odour, as well as to kill bacteria and viruses. Ozone may not kill some large cysts or other large organisms and should be used in combination with a prefiltration process.

6. Evaluation Methodology

For this Master Plan exercise, a two-stage decision process was developed. The two stages are outlined as follows and described in further detail in this section of the report.

Stage 1 – Prioritization

The first stage includes the identification of a long list of alternative solutions for:

- Planning alternatives
- Treatment technology alternatives
- Effluent discharge/management alternatives
- Non-expansion alternatives

For a 50-year master planning exercise, it is important to identify alternatives that are appropriate and feasible for implementation in the short-term (10 years), medium-term (25 to 30 years), and long-term (50 years). An initial prioritization exercise provides a means to prioritize the long list of alternatives for the City. Options are reviewed to identify those alternatives:

- Determined to be the most feasible for implementation sooner in the planning period
- That show promise and may require more study or demonstration before they can be determined feasible for the City
- That are of interest yet have not been demonstrated to a sufficient degree to deem them feasible for the City or may require a particular trigger for implementation, such as a regulatory change—These alternatives will be maintained on a “radar screen” and monitored over time

Stage 2 – Detailed Evaluation

In the second stage of assessment, the alternatives with higher prioritization will be subject to more rigorous assessment using detailed evaluation criteria that consider the technical, natural, social, and economic environments. The results of the evaluation will identify the most preferred strategy options for the City to implement.

6.2 Prioritization Methodology

As indicated, the evaluation will be completed in two stages. The initial stage involves an examination of all of the alternatives to determine prioritization for implementation.

The long list of alternatives will be prioritized based on a set of criteria presented in Table 6.1.

TABLE 6.1
Prioritization Criteria

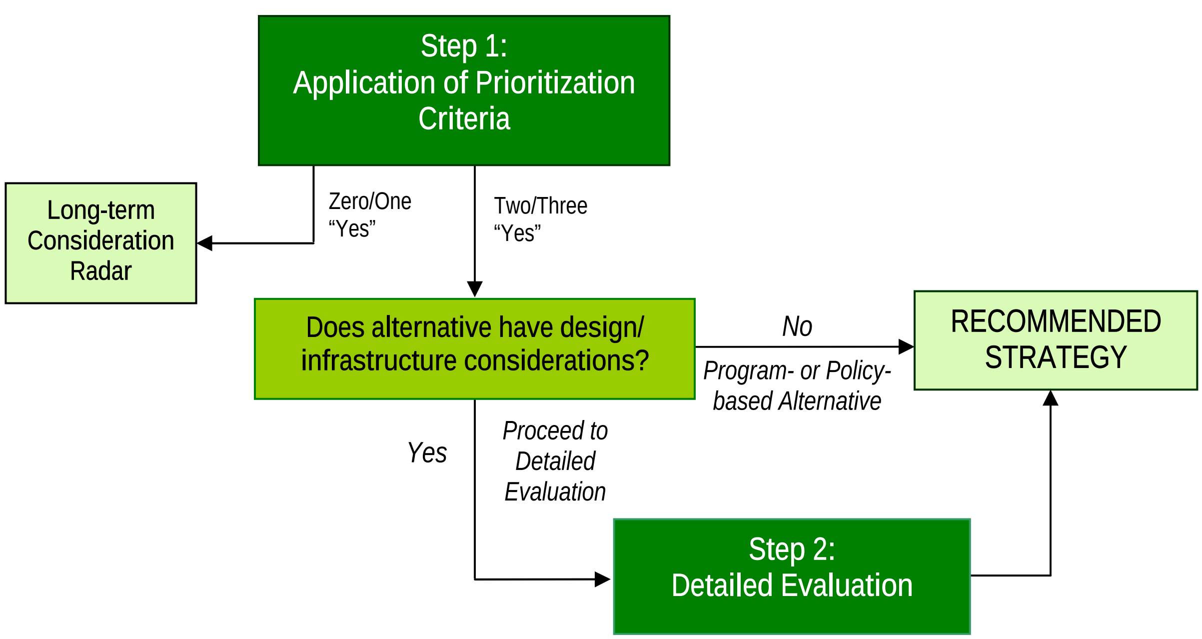
Prioritization Criteria	Consideration
Practicality – given existing conditions in Guelph	Alternative provides the opportunity to take advantage of the City's existing infrastructure and is within the City's ability to implement (technically, financially, regulatory).
Sustainability – consistent with the City's strategic plan	Alternative contributes to a solution that protects community and environmental health and well-being for current and future residents of the City of Guelph.
Efficiency – consistent with responsible municipal management	Alternative achieves the intended use and has the potential to meet or exceed Ontario's regulatory requirements and standards.

An alternative must meet all of the prioritization criteria in order to be considered feasible to implement at any time. This will be determined by applying the criteria to each alternative and determining a response of either "Yes," the criteria can be met or, "No," the criteria cannot be met at this time. An alternative shows promise with further study if it meets two of the three criteria. Those alternatives that meet only one or none of the criteria will continue to be considered over the long-term. Some of these alternatives may show promise, but have been given a no based on unknowns where additional information is required. Where this is the case, further study will be recommended to fill these information gaps. The remaining alternatives will be re-evaluated at subsequent WWTMP updates.

Program- or policy-based alternatives which meet the criteria for short- or medium-term will be integrated into the recommended strategy. Alternatives requiring design and/or constructed infrastructure will be evaluated further, using the detailed evaluation criteria described in the following subsections to determine the more preferred alternative to be integrated into the strategy.

A graphical representation of the two-stage evaluation methodology is shown in Figure 6-1.

FIGURE 6-1
Two-Stage Evaluation Process



6.3 Detailed Evaluation Criteria and Methodology

The detailed evaluation criteria used for this Master Plan are presented in Table 6.2. The criteria categories reflect the principles of environmental assessment planning as they address technical, natural, social, and economic environments. The criteria respond to the City's desire for a sustainable plan. Each defined criterion has established measures that were used during the evaluation exercise, whose steps are described below.

Step 1 – Develop Alternative Description

The first step was to develop an overall description of the alternative. This included required physical works to implement the alternative and operational or other issues needed to support implementation, including pilot-testing or demonstration prior to design and implementation.

Step 2 – Develop Initial Cost Opinions

The project team developed initial cost opinions for each of the alternatives based on defined assumptions.

Step 3 – Apply Evaluation Criteria to Each Alternative

The evaluation was conducted as a collective exercise with City staff and members of the consultant team using an evaluation matrix spreadsheet. For each alternative, a measure (score) was assigned. The scores were then totalled and normalized by category to provide an overall score. For the detailed evaluation exercise, all categories (technical, natural, social, and economic) were valued with equal weighting. The alternatives in each grouping with the highest scores were then considered the most preferred strategy options to meet the requirements set out for the WWTMP.

Step 4 – Develop Master Plan Recommendations

Based on the results of the detailed evaluation, a strategy was developed for providing wastewater servicing for City. The strategy includes the most feasible components for planning, treatment technology, treatment location, effluent discharge, and management, as well as non-expansion measures. The strategy also identifies options that need to remain in the plan for future consideration over the long-term. An implementation plan was also prepared to explain the schedule requirements for various plan components in the short-, medium-, and long-term, as well as the associated permits and approval requirements.

TABLE 6.2
Evaluation Criteria

Evaluation Category	Definition	Impact Measure
		Technical Environment
Performance Record	The ability of the alternative to perform with a high degree of reliability and predictability in both process operations and effluent quality	**10** – The alternative includes proven technology with a high degree of reliable performance. **5** – The alternative includes newer technology with a growing record of demonstrated performance reliability. **1** – The alternative includes innovative technology with a limited performance record and unconfirmed reliability – requires further testing/demonstration to determine feasibility for Guelph.
Ability to meet treatment capacity requirements (Short-, Medium-, Long-term)	The ability of the alternative to provide the wastewater treatment requirements for short-, medium-, and/ or long-term needs	**10** – The alternative can provide short-, medium-, and long-term treatment requirements. **5** – The alternative can provide short-term and may provide medium-term requirements. **1** – The alternative may only provide long-term requirements.
Ease of Implementation	The ability of the alternative to be implemented with minimal disruption to existing wastewater treatment operations; minimal need to require system modifications	**10** – The alternative can be implemented with no disruption to existing service. **5** – The implementation of the alternative may result in minor disruptions to existing service. **1** – The implementation of the alternative may require significant or periodic disruptions to existing service.
Regulatory Constraints	The ability of the alternative to be approved with minimal, if any, conditions	**10** – The alternative can be readily approved. **5** – The alternative can be approved with minimal conditions. **1** – The alternative can be approved with significant or onerous conditions.
		Natural Environment
Surface Water Quality	The potential for the Speed River to assimilate the WWTP effluent within regulatory requirements	**10** – The alternative will provide a high degree of protection to the water quality of the Speed River all year, and treated effluent can be readily assimilated. **5** – The alternative will provide a high degree of protection to the water quality of the Speed River for most of the year, and treated effluent may require seasonal discharge conditions to meet assimilation requirements. **1** – The alternative may present a threat to the water quality of the Speed River during low flow periods, and there may be significant restrictions to treated effluent discharge conditions.

TABLE 6.2
Evaluation Criteria

Evaluation Category	Definition	Impact Measure
Ground Water Quality and Supply	The potential for the alternative to avoid sensitive groundwater resources for the City of Guelph and to protect overall groundwater quality and quantity	**10** – The alternative provides the greatest level of protection to sensitive groundwater resources and to the overall groundwater quality and quantity. **5** – The alternative provides an acceptable level of protection to sensitive groundwater resources and to overall groundwater quality and quantity. May require careful monitoring over the long-term to maintain protection. Contingency measure may be required. **1** – The alternative poses unacceptable risks to the protection-sensitive groundwater resources and to the overall quality and quantity of groundwater.
Terrestrial Habitats and Corridors	The potential for the alternative to avoid negative impacts to terrestrial habitats and corridors	**10** – The alternative will avoid terrestrial habitats and corridors. **5** – The alternative may require special measures to protect terrestrial habitats and corridors. **1** – The alternative will result in an unacceptable loss of terrestrial habitats and corridors.
Aquatic Habitats and Fisheries	The potential for the alternative to protect or enhance aquatic habitats and fisheries	**10** – The alternative will protect aquatic habitats and fisheries and has the potential to provide enhancements. **5** – The alternative may require special measures to protect aquatic habitats and fisheries. **1** – The alternative will result in an unacceptable loss of aquatic habitat and fisheries.
Air Quality	The potential for the alternative to minimize any increase in greenhouse gas (GHG) emissions	**10** – The alternative will make a significant contribution to the City's goal to reduce GHG emissions. **5** – The alternative will make a modest contribution to the City's goal to reduce GHG emissions. **1** – The alternative will not make a measurable contribution to the City's goal to reduce GHG emissions.
Flood Plain	The potential for the alternative to maintain the existing flood plain and flood volume capacity in the Speed River	**10** – The alternative will maintain the existing flood plan and flood volume capacity. **5** – The alternative will require specials measures to maintain the existing flood plain and flood volume capacity. **1** – The alternative will result in an unacceptable loss of floodplain and will require significant measures to replace lost flood volume capacity.

TABLE 6.2
Evaluation Criteria

Evaluation Category	Definition	Impact Measure
Wetlands	The potential for the alternative to protect and maintain wetlands	**10** – The alternative will avoid wetlands. **5** – The alternative may require special measures to maintain wetland protection. **1** – The alternative will result in an unacceptable threat to wetlands.
	Social Environment	
Land Use Compatibility	The potential for the alternative to support the City of Guelph's GMS recommendations	**10** – The alternative is consistent with and strongly supports the City's GMS recommendations. **5** – The alternative requires special measures to be consistent with the City's GMS recommendations. **1** – The alternative is not consistent with the City's GMS recommendations.
Community Growth Requirements	The potential for the alternative to be implemented, as needed, for short-, medium-, and long-term community needs	**10** – The alternative can be in service to meet short-, medium-, and long-term scheduling requirements. **5** – The alternative can be in service to meet medium- and long-term scheduling requirement but may not meet short-term service schedule requirements. **1** – The alternative may only meet long-term servicing requirements.
Occupational Health and Safety	The potential for the alternative minimize risks to occupational health and safety	**10** – There are no risks to occupational health and safety. **5** – There are minor risks to occupation health and safety that can be properly managed. **1** – There are significant risks to occupation health and safety which require significant training and or risk management plans to minimize risks to acceptable levels.
Community Health and Safety	The potential for the alternative to minimize risk to community health and safety	**10** – There are no risks to community health and safety. **5** – There are minor risks to community health and safety that can be properly managed. **1** – There are significant risks to community health and safety which require significant measures and risk management plans to minimize risks to acceptable levels.

TABLE 6.2
Evaluation Criteria

Evaluation Category	Definition	Impact Measure
Urban Design Requirements and Aesthetics	The potential for the alternative to support the City's design standards and community aesthetics	**10** – The alternative is consistent with and supports the City's design standards and community aesthetics. **5** – The alternative requires special measures to be consistent with the City's design standards and community aesthetics. **1** – The alternative is not consistent with the City's design standards and community aesthetics.
Community Energy Plan	The potential for the alternative to produce energy for community use	**10** – The alternative can provide a significant amount of energy for community use, in addition to meeting the demands of the WWTP. **5** – The alternative can provide a moderate amount of energy for community use, in addition to meeting the demands of the WWTP. **1** – The alternative can provide a limited or minimal amount of energy for community use, in addition to meeting the demands of the WWTP.
Heritage and Cultural Resources	The potential for the alternative to avoid heritage and cultural resources	**10** – The alternative will avoid heritage and cultural resources. **5** – The alternative may require special measures to protect heritage and cultural resources. **1** – The alternative may pose an unacceptable risk to heritage and cultural resources.
	Economic Environment	
Capital Costs	The relative costs of land, equipment, and facilities when compared to other alternatives	**10** – The alternative has the lowest capital costs relative to other alternatives. **5** – The alternative is in the mid-range of capital costs relative to other alternatives. **1** – The alternative has the highest capital costs relative to other alternatives.
Lifecycle Costs	The relative lifecycle costs (including Operations and Maintenance [O&M] and Depreciation/Replacement) when compared to other alternatives	**10** – The alternative has the lowest lifecycle costs relative to other alternatives. **5** – The alternative is in the mid-range of lifecycle costs relative to other alternatives. **1** – The alternative has the highest lifecycle costs relative to other alternatives.
Funding Availability	The potential for the alternative to be eligible for funding from provincial or federal programs	**10** – The alternative is eligible for existing provincial and/or federal funding. **5** – The alternative in not eligible for existing funding programs but may be eligible for anticipated, future, funding programs. **1** – The alternative is not eligible for existing for anticipated, future programs.

7. Prioritizing the Long List of Alternatives

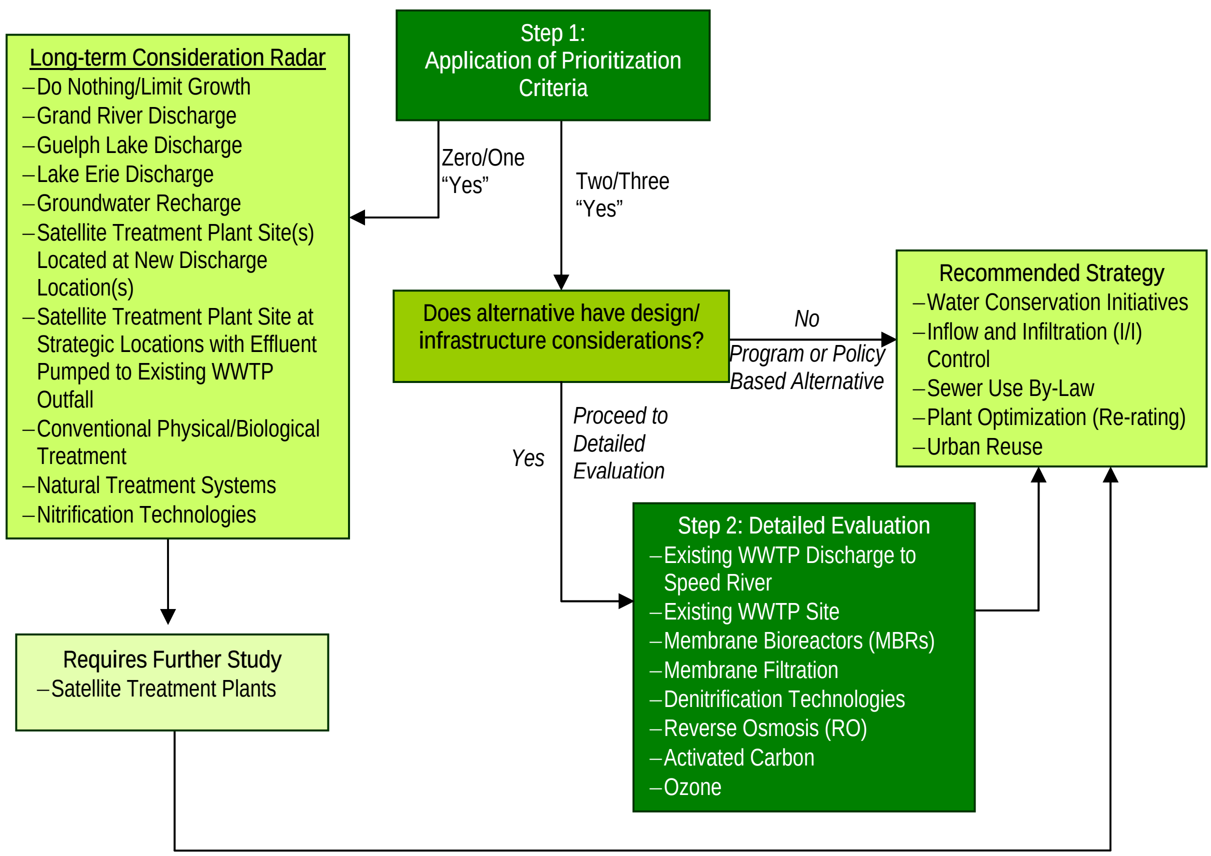
As described in Section 6, Evaluation Methodology, the initial step in the two-stage evaluation is a prioritization of the alternatives.

7.1 Prioritizing the Long List and Results

The long list of alternatives was prioritized using the criteria described in Table 6.1. As indicated, an alternative must meet all of the prioritization criteria in order to be considered feasible to implement at any time. In order to be carried forward for more detailed evaluation or for integration into the Master Plan, the alternative must received a minimum of two "yeses" with the aforementioned criteria.

The prioritization exercise was completed with the PAC. A summary of the results from the prioritization exercise are shown in Figure 7-1. Based on input from the PAC, it was decided that while there is insufficient information currently available to proceed with a satellite treatment plant option, this is an area that merited further study and is being carried forward as part of the implementation plan as a study recommendation.

FIGURE 7-1
Prioritization Results Summary



7.2 Prioritization Results

Table 7.1 shows the results of the prioritization exercise as they relate to the specific prioritization criteria. Details on the rationale for the “Yes” or “No” designation for each criteria has been provided in Appendix E.

TABLE 7.1
Prioritization Results

Alternative	**Criteria 1** **Practicality – Given Existing Conditions in Guelph** Alternative provides the opportunity to take advantage of the City's existing infrastructure and is within the City's ability to implement (technically, financially, regulatory).	**Criteria 2** **Sustainability – Consistent with the City's Strategic Plan** Alternative contributes to a solution that protects community, including environmental health and well-being for current and future City residents.	**Criteria 3** **Efficiency – Consistent with Responsible Municipal Management** Alternative achieves the intended use and has the potential to meet or exceed Ontario's regulatory requirements and standards.	Priority Assignment
Planning Alternatives				
Do Nothing/Limit Growth	NO	NO	NO	Zero Yeses – Will not proceed to detailed evaluation
Source Control/Non-expansion Alternatives				
Water Conservation Initiatives	YES	YES	YES	Three Yeses – As a program- or policy-based alternative, this option will be carried forward for integration into the Master Plan strategy.
Inflow and Infiltration (I/I) Control	YES	YES	YES	Three Yeses – As a program- or policy-based alternative, this option will be carried forward for integration into the Master Plan strategy.
Sewer Use By-Law	YES	YES	YES	Three Yeses – As a program- or policy-based alternative, this option will be carried forward for integration into the Master Plan strategy.
Plant Optimization (Re-rating)	YES	YES	YES	Three Yeses – As a program- or policy-based alternative, this option will be carried forward for integration into the Master Plan strategy.
Discharge Location Alternatives				
Existing WWTP Discharge to Speed River	YES	YES	YES	Three Yeses – This option will be carried forward for detailed evaluation.
Grand River Discharge	NO	NO	NO	Zero Yeses – Will not proceed to detailed evaluation.
Guelph Lake Discharge	NO	NO	YES	One Yes – Will not proceed to detailed evaluation.
Lake Erie Discharge	NO	NO	NO	Zero Yeses – Will not proceed to detailed evaluation.
Effluent Reuse				
Urban Reuse	YES	YES	YES	Three Yeses – Further study is required on this option; therefore, the option will be carried forward as a study program/City initiative to be integrated into the Master Plan strategy.
Groundwater Recharge	YES	NO	NO	Zero Yeses – Will not proceed to detailed evaluation.
Treatment Location Alternatives				
Existing WWTP Site	YES	YES	YES	Three Yeses – This option will be carried forward for detailed evaluation.
Satellite Treatment Plant Site(s) Located at New Discharge Location(s)	NO	NO	YES	One Yes – Will not proceed to detailed evaluation.
Satellite Treatment Plant Site at Strategic Locations with Effluent Pumped to Existing WWTP Outfall	NO	NO	YES	One Yes – Will not proceed to detailed evaluation.
Treatment Technology Alternatives				
Conventional Physical/Biological Treatment	YES	NO.	NO	One Yes – Will not proceed to detailed evaluation.
Natural Treatment Systems	NO	NO	NO.	Zero Yeses – Will not proceed to detailed evaluation.
Advanced Treatment Technologies				
Nitrification Technologies	YES	NO	NO	One Yes – Will not proceed to detailed evaluation.
Membrane Bioreactors	YES	YES	YES	Three Yeses – This option will be carried forward for detailed evaluation.
Tertiary Membrane Bioreactors	YES	YES	YES	Three Yeses – This option will be carried forward for detailed evaluation.
Tertiary Membrane Filtration	YES	YES	YES	Three Yeses – This option will be carried forward for detailed evaluation.
Emerging Wastewater Treatment Technologies				
Reverse Osmosis (RO)	YES	YES.	YES	Three Yeses – This option will be carried forward for detailed evaluation.
Activated Carbon	YES	YES	YES	Three Yeses – This option will be carried forward for detailed evaluation.
Ozone	YES	YES	YES	Three Yeses – This option will be carried forward for detailed evaluation.

Hold on Long-term Radar Screen	Policy or Program for integration into Master Plan Strategy	Infrastructure component requiring detailed evaluation

8. Detailed Evaluation of Infrastructure Components

8.1 Detailed Evaluation

A detailed evaluation of infrastructure-based treatment alternatives was completed by the Project Team and City representatives. Detailed scoring for each alternative is included in the tables provided in Appendix E. Details have been provided for each infrastructure-related alternative, with an explanation of how each score was determined.

The scores per criteria category (natural, social, environmental, economic) and the sensitivity scenarios provided by each PAC member were applied to the scoring. The impact of these scenarios is included in each summary table. A summary of the results for each alternative category is included within this section of the report, full details on the scoring, including all of the sensitivity scenarios provided by each of the PAC members is provided in Appendix E.

8.1.1 Discharge Locations

Table 8.1 summarizes evaluation scoring for using the existing outfall.

TABLE 8.1
Evaluation for Existing Outfall

		Sensitivity Scenarios				
		Equal Weighting	**Technical Priority**	**Natural Priority**	**Social Priority**	**Economic Priority**
Existing Outfall	Technical	25	70	10	10	10
	Natural	22	8.6	60	8.6	8.6
	Social	22	8.7	8.7	60.9	8.7
	Economic	21	8.3	8.3	8.3	58.1
	Total/100	**89**	**96**	**87**	**88**	**85**

The existing discharge location was evaluated to look at potential impacts and consideration for mitigation measures. The scores overall were generally high, with consideration for some potential modifications that may need to be made to the outfall in the future. The outfall appears to have sufficient hydraulic capacity to handle increased flows in the future.

Additional study will be required to consider the impact of increased effluent flow on downstream river geomorphology or localized sediment and erosion. Modifications such as energy dissipation at the outfall location may be needed in the future.

8.1.2 Treatment Locations

Table 8.2 summarizes evaluation scoring for using the existing WWTP location.

TABLE 8.2
Evaluation for WWTP Location

		Sensitivity Scenarios				
		Equal Weighting	**Technical Priority**	**Natural Priority**	**Social Priority**	**Economic Priority**
Existing WWTP	Technical	22	61.6	8.8	8.8	8.8
	Natural	22	8.6	60	8.6	8.6
	Social	20	8	8	56	8
	Economic	25	10	10	10	70
	Total/100	**89**	**88**	**87**	**83**	**95**

The prioritization found that the existing treatment location would be preferred for future expansions. Consideration would have to be given to mitigate social impacts, such as potential odour, noise, visual aesthetics, and truck traffic, as it is anticipated that future development will take place immediately across Wellington Road.

8.1.3 Advanced Treatment Technologies

Table 8.3 summarizes evaluation scoring for the three advanced treatment technologies.

TABLE 8.3
Evaluation of Advanced Treatment Technologies

		Sensitivity Scenarios				
		Equal Weighting	**Technical Priority**	**Natural Priority**	**Social Priority**	**Economic Priority**
MBR	Technical	16	45.5	6.5	6.5	6.5
	Natural	20	8	56	8	8
	Social	22	8.7	8.7	60.9	8.7
	Economic	9.3	3.7	3.7	3.7	25.9
	Total/100	**67**	**66**	**75**	**79**	**49**
Tertiary Membrane	Technical	22	61.6	8.8	8.8	8.8
	Natural	20	8	56	8	8
	Social	22	8.7	8.7	60.9	8.7
	Economic	13	5.3	5.3	5.3	37.1
	Total/100	**77**	**84**	**79**	**83**	**63**
Tertiary Nitrifying MBR	Technical	13	37.1	5.3	5.3	5.3
	Natural	20	8	56	8	8
	Social	22	8.7	8.7	60.9	8.7
	Economic	21	8.3	8.3	8.3	58.1
	Total/100	**76**	**62**	**78**	**83**	**80**

The evaluation of the three membrane alternatives found that the conventional MBR scored lower than the other two membrane options. This is partially due to the higher energy demand required for conventional MBR operation. Conventional MBR requires additional energy to keep membranes clean, so more membranes are required for this technology. Based on the evaluation of the two tertiary membrane options, both are being recommended to be carried forward for consideration in future expansions at the Guelph WWTP.

8.1.4 Emerging Technologies

As discussed, emerging technologies are being introduced to wastewater treatment practices to provide higher quality effluents for specific applications. The end-use for a higher quality effluent could apply to certain types of effluent reuse, such as potable reuse. In addition, future, more stringent effluent quality requirements may be regulated to address emerging contaminants, such as EDCs or PPCPs.

At this point in time, it is difficult to define the extent of emerging technologies that may be required in the future. Findings from the effluent reuse study being recommended for the City, as well as future direction from the government and research into EDC and PPCP removal, will assist in defining the need for this technology in the future. It is for this reason that emerging technologies were not evaluated in detail but will be held for future consideration by the City.

9. Recommended Master Plan Components

The following section summarizes the results of the prioritization and detailed infrastructure evaluation and provides additional details on how these results will be integrated into the City's WWTMP.

9.1 The Wastewater Treatment Master Plan

The objective of the Guelph WWTMP is to provide the City with direction on wastewater treatment infrastructure, planning, investment, and implementation to the year 2054. The recommendations summarized in this section have been developed with input from members of the PAC, the public, City staff, the project's technical team, and other stakeholders. Through the decision-making process, the importance of including treatment infrastructure recommendations, program and policy recommendations, and studies to fill information gaps and provide the City with additional information for decision-making moving forward was recognized.

The following section divides the recommendations into studies, program and policies, and infrastructure. Following these descriptions is an implementation schedule which provides proposed timelines for these recommendations. It is recognized that these timelines and recommendations will be reviewed and revised with subsequent updates to the WWTMP every 5 years.

9.2 Alternatives Requiring Additional Study

During the prioritization process, it was discovered that there were alternatives requiring additional information before the City could develop a path forward. The following subsections describe areas recommended for further study as part of the WWTMP.

9.2.1 Urban Reuse

Urban reuse of treated effluent involves the diversion of a portion of the WWTP effluent to be used for applications, such as: municipal and golf course irrigation, construction dust control, dual water systems, or industrial applications. The recommended study should build upon the original work completed for the City by AquaTeam Solutions in 2004, which examined potential end-uses for reclaimed wastewater. A copy of this report has been included in Appendix D.

Study Objectives:

The following objectives should be achieved as a result of this study:

- Confirmed market demand for reclaimed effluent
- Analysis of capital and operating costs for treatment and conveyance of reclaimed effluent

- Confirmation of effluent diversion's beneficial impacts on the Speed River
- Determination of regulatory requirements/limitations for reclaimed effluent applications

Study Components:

In order to achieve the aforementioned objectives, the following tasks should be included in the study scope:

- Meetings with regulatory agencies to discuss regulatory requirements and/or limits on reclaimed effluent. This may include water quality requirements, limitations on potential end-uses, and monitoring requirements. Regulatory requirements should be confirmed to determine which potential end-uses that will assist with the market segment analysis will be approved.
- Once the regulatory requirements have been discussed, a market segment analysis should be completed based on the parameters determined. An initial estimate was completed by AquaTeam Solutions which produced potential values for sewer flushing, onsite WWTP use, street cleaning, dust control, dual residential systems, golf course irrigation, and flower bed and park/sports facilities irrigation. The City-managed water uses, such as sewer flushing, onsite use, and flower bed and park irrigation, should be confirmed through discussions with the various City departments. Industrial uses were not quantified as part of the original study and should be determined through discussions with local industries which have a potential use for reclaimed water and that may be in proximity to the WWTP or any proposed conveyance system and that would be willing to use reclaimed wastewater. Similar discussions should take place with local golf course operators. Dual water supply systems would need a commitment between the City and any proposed developer where the dual system may be integrated.
- The beneficial impacts on the Speed River should be confirmed through modelling of proposed effluent diversion scenarios, in conjunction with river conditions during peak diversion times. This work should be undertaken in conjunction with the GRCA. It has been noted by the Water Managers of the Grand that there are beneficial downstream benefits from the Guelph WWTP effluent.
- A conceptual cost estimate for the work that would be required for the effluent reuse should be completed. The required work would include work onsite, which might include additional treatment requirements, flow diversion equipment/facilities, and storage facilities. The cost of conveyance options should also be completed, which may include a "purple pipe" to be used for dual residential servicing or conveyance of reclaimed water for industrial applications or golf course irrigation.

Linkages to Other City Initiatives:

<u>Water and Wastewater Servicing Master Plan</u>
One of the recommendations from the W&WW SMP was to examine the option of a "purple pipe" system to be constructed in conjunction with upgrades to the sanitary sewers and water supply pipes in the City. The Urban Reuse Study should be completed as a joint project with the Engineering and Planning Department to coordinate conveyance recommendations with treatment requirements and planning initiatives.

Water Conservation and Efficiency Program

As part of the update to the Long-term WC&E Strategy, the City is looking for funding and project partners to complete a residential grey water pilot study. The intent of the study is to look at 30 new homes and examine the social feasibility of residential grey water systems, evaluate potential savings associated with the technology, and evaluate the feasibility of grey water reuse within further residential planning applications. If this study proceeds, the findings could be used to demonstrate the technical feasibility and social acceptance of reclaimed water in residential applications.

Estimated Cost to Support this study: $500,000

9.2.2 Facility Plan

A facility plan is a tool that can be used by City staff to examine detailed capital investment requirements at the WWTP over a defined time period. The facility plan would integrate recommendations from the master plans that have been completed at the WWTP (biosolids management plan, Class EA update, and this WWTMP) with upgrades and maintenance requirements identified by operations staff into one comprehensive plan. The Facility Plan should also consider the completion of a SCADA System Plan. This plan would help to coordinate the control system and network for current applications and would assist in future planning and project integration.

Study Objectives:

The following objectives should be achieved as a result of this study:

- Determination of supporting upgrades required for recommendations from master plans (i.e., conveyance piping, hydraulic upgrades, additional pumping)
- Confirmation of required maintenance/refurbishment/upgrade activities
- Requirements to coordinating current SCADA system and future requirements
- Detailed site layout for current and future site planning
- Detailed annual capital investment plan to 2031

Study Components:

In order to achieve the aforementioned objectives, the following tasks should be included in the study scope:

- Identification of planned projects at the WWTP
- Identification of areas proposed for construction of these identified projects onsite
- Discussions on future uses of areas at the existing WWTP site
- Identification of known, current deficiencies requiring upgrades/refurbishment
- Identification of areas that may require upgrades during the planning timeframe
- Discussions on recommendations from Master Plans and upgrades that may be required to support these recommendations
- Development of detailed annual expenditure plan to 2031
- Development of site plan to identify proposed locations of current planned projects, and identification of areas of the site for efficient use of the site for future projects

The aforementioned tasks should be completed in partnership with operations staff. Discussions could be facilitated through workshops.

Linkages to Other City Initiatives:

The Facility Plan will link recommendations from the Biosolids Management Plan, the Class EA Update, and this Treatment Master Plan, with ongoing O&M efforts at the WWTP.

Estimated Cost to Support this study: Facility Plan - $75,000/SCADA System Plan - $75,000

9.2.3 Energy Audit at the Guelph WWTP

The City approved a Community Energy Plan in 2007. This plan set goals to reduce energy use within the City to contribute to a sustainable future. The energy audit results and recommendations for the Guelph WWTP would be integrated into the overall Community Energy Plan.

Study Objectives:

The objective of this study is to look at current and potential future energy uses at the Guelph WWTP and see what improvements can be made to reduce the energy demands at the facility.

Study Components:

The following tasks should be included in the study scope:

- Electricity and natural gas records should be examined to determine average annual energy consumption, as well as seasonal variations in energy use.
- Estimates of energy consumption by operational process, which includes both the treatment processes, as well as administration requirements, such as heating and cooling, should be determined. This analysis should look at where the highest energy consumption is at the WWTP.
- Estimates of renewable energy being produced onsite through the cogeneration facility and heat recovery through the boilers should be examined.
- Options for operational modifications or upgrades to existing equipment should be developed. A cost-benefit analysis should be completed and integrated into an evaluation to determine what modifications could be completed in the short-term to improve the energy efficiency at the WWTP.
- Recommendations for future equipment specifications should be developed. For example, this may include the specification of variable frequency drives (VFDs) for pump equipment.

Linkages to Other City Initiatives:

This energy audit links directly to the City's Community Energy Plan and would contribute to achieving the Plan's goals for energy conservation and long-term sustainability.

Estimated Cost to support this study: $90,000

9.2.4 Satellite Treatment Plants

As part of the Master Planning process, interest was shown by members of the PAC in examining the feasibility of satellite treatment plants as part of new developments occurring within the City. Additional information is required to determine the feasibility of this option, and the City has committed to working in partnership with local developers to determine the feasibility option for new development.

Study Objectives:

The objective of this study is to discuss potential options for satellite treatment plants at future development locations.

Study Components:

To discuss the potential option of satellite treatment facilities it is recommended that the City meet with interested developers. If there appears to be sufficient interest, a workplan would be developed identifying further studies which may be required to examine the feasibility and regulatory requirements associated with this type of undertaking.

Linkages to Other City Initiatives:

<u>Water and Wastewater Servicing Master Plan</u>
A satellite treatment facility may be more beneficial in areas of the City where sanitary sewers are projected to exceed capacity based on future flow projections. This study should examine where these capacity constraints are projected.

<u>Urban Reuse Study</u>
The findings of the Urban Reuse Study should be looked at in conjunction with the feasibility of a satellite treatment plant. The study should examine the feasibility of producing reclaimed water which can be reused within the development where the wastewater was collected.

Estimated Cost to Support this study: $ 0

9.2.5 Climate Change Adaptation Study

In addition to natural variations, contributions from human activities have been impacting the Earth's climate. Human contributions of GHGs to the atmosphere have been altering and will continue to alter weather variables, such as temperature and precipitation.

Study Objectives:

This study should examine the potential impacts to the WWTP that might result from predicted climate changes and develop considerations for emergency planning/adaptation for climate change.

Study Components:

The study should analyze and summarize the predicted climate change scenarios as they relate to the Guelph area. The study should examine the potential risks to the Guelph WWTP associated with the predictions. This may include impacts associated with higher intensity rain events, such as flooding and increased I/I, or potential impacts associated with extended drought periods, such as lower flows in the Speed River.

An analysis of the potential level of risk associated with these impacts, as well as considerations for mitigation, should be developed. This should be done in conjunction with the GRCA who is responsible for flow augmentation on the Speed River. The recommendations for the WWTP should be integrated into the City's emergency preparedness plans.

It is also noted that the GRCA is undertaking climate change investigations as part of the provincial Source Water Protection Planning efforts. It is recommended that this study. coordinate with these efforts.

Linkages to Other City Initiatives:

<u>Water Supply Master Plan, Urban Reuse Study, and Water Conservation and Efficiency Program</u>
One of the predicted impacts associated with climate change is the possibility of extended periods of drought, which could have an impact on water supply and increase the importance of water conservation. Additionally, it could be a driver for the option of reclaimed water for urban reuse.

Estimated Cost to support this study: $35,000

9.2.6 Sewer Use By-Law Review and Update

The Sewer Use By-Law is an important tool that the City has to control the quality of wastewater that reaches the WWTP. As seen through past successes, the enforcement of this By-Law can result in deferral of capital projects at the WWTP and improvements in operations. An initial review of the City's existing Sewer Use By-Law was completed as part of this Master Planning process, and it is recommended, based on this review, that a more thorough review and update of the By-Law be completed.

Study Objectives:

The objective of this study is to review the City's existing By-Law to ensure that it is up to date with current standards, and identify and address any gaps or deficiencies in the By-Law's content or enforcement approach.

Study Components:

- Ensure that the City's existing By-Law is consistent with the changes in federal and provincial regulations, which require that municipalities look at pollution prevention activities as a means of ensuring that WWTP effluents meet receiving water requirements. Council and department policies must be aligned to ensure that activities around wastewater management are not in conflict. Consider the comments identified in the technical memorandum found in Appendix C.
- Ensure that the City's Enforcement By-Law, currently in final stages of development, is referenced in the Sewer Use By-Law once it has been endorsed by Council.
- Conduct a detailed review of all available information on the mature of industries and commercial establishments located in Guelph. This could include:
  - Scott's or North American Industry Classification System (NAICS) Indexes
  - Canadian Environmental Protection Act (CEPA) Schedule 1 Toxic Substances List
  - National Pollutant Release Inventory (NPRI) Appendix 1 - NPRI Substances List for 2004 specific to Guelph's sewerage system

  - PWQOs
  - City industrial compliance monitoring data
  - WWTP influent, effluent, and sludge analytical data

- Develop to the extent possible a list of control parameters specifically applicable to the City.
- Review the costs of providing sewer use control services to ensure that the costs are fairly applied and that all users are paying their fair share. All who discharge to the system are stakeholders, and the City will have to decide how to engage the various stakeholders in the discussion around any proposed changes. Meaningful dialogue with the various stakeholders will be essential as the new/revised policies, regulatory framework, and by-law are developed and phased-in.
- It is suggested that the update of the By-Law be carried out in two phases. The first phase would include developing draft policy requirements and proposed changes to the discharge parameters and control limits, preparing a revised regulatory approach for the various sectors, and discussing the changes with City staff to agree upon a method of communicating these changes to the stakeholders. In the second phase, after the stakeholders' input has been received, prepare a draft policy and regulatory approach, and revised Sewer Use By-Law with the City. The final report will incorporate the City's input and will include a draft by-law and implementation plan.

Estimated Cost to support this study: $75,000

9.3 Ongoing Programs and Policies

In addition to the recommendations for new studies and infrastructure projects, a key component of the WWTMP is the continuation and enhancement of the current programs and policies that the City has implemented. These programs have and will continue to have beneficial impacts on the WWTP.

9.3.1 Water Conservation and Efficiency

The City has developed a WC&E Program targeted at reducing water use within the City. The framework for water conservation was developed originally in 1999 as part of the WC&E Study. Success from the program to date has resulted in reductions in water use within the City and has contributed to the deferral of capacity-related infrastructure upgrades. The City recognizes the importance of conservation and efficiency, and as part of the 2006 WSMP, set new targets for water conservation:

- Reduction of 10 percent (8,000 m^3/day) by 2010
- Reduction of 15 percent (12,000 m^3/day) by 2017
- Reduction of 20 percent (16,000 m^3/day) by 2025

To develop programs and policies to achieve these targets, the City is completing a WC&E Strategy Update in 2008. This update will evaluate alternatives in meeting conservation targets and develop a comprehensive, community-based WC&E Plan for all of the City's sectors.

Success from the City's WC&E Program would have positive impacts at the WWTP. Some reductions in water use in the City may contribute to a reduction in the per capita wastewater flow generation, which could result in the deferral of capacity upgrades in the future.

9.3.2 Inflow and Infiltration Control

The City's W&WW SMP examined the City's I/I and made recommendations for addressing issues associated with these extraneous flows. The recommendations from the SMP included additional studies to develop strategies to implement I/I reduction programs. Once some of the main sanitary trunk replacements have been completed, the SMP also recommended the installation of additional flow monitoring to identify the resulting I/I reductions.

The development of I/I reduction programs will target improvements to reduce the extraneous flows in the collection system. A reduction in I/I will, in conjunction with the City's Water Conservation initiatives, reduce the per capita sewage generation rates which may extend the need for capacity upgrades at the Guelph WWTP. The City will track the success of these programs, and the findings will be integrated into subsequent updates of the WWTMP.

9.3.3 Optimization

The City will continue to look at potential opportunities for optimization of the WWTP. This on-going study looks at the bottlenecks at the facility and then determines how the plant may be operated differently to reduce these bottlenecks and increase the capacity of the overall plant. If found to be successful, the results of this study will need to be presented to the MOE, and an amendment to the existing CofA will be needed to allow the City to operate the WWTP at this higher capacity.

It is recommended that the City continue the optimization program beyond the potential re-rating of the existing facility. The City's approach to engaging and leveraging the skills of the operations staff should remain an important component of the ongoing operation plan for the Guelph WWTP.

9.3.4 Water Managers of the Grand

The City will continue to be active in the Water Managers of the Grand. They will work with the GRCA to improve the monitoring along the Speed River, which will assist in identifying areas to be targeted for improvement of the overall health of the Grand River Watershed.

9.4 Infrastructure Recommendations

The discussions on recommended infrastructure components have been divided into three timeframes: short-term (2008 – 2020), mid-term (2021 – 2031), and long-term (2032 – 2054).

The initial timing for recommended upgrades is based on current projections for future wastewater flows. The flows are best estimates, and it is recognized that they are likely to change in the future based on changes in the rate of population and industry growth, as well as due to future impacts (benefits) of the City's water conservation and I/I programs.

The recommendations outlined within the subsequent sections are based on best information available at the time of this Master Plan. Changes in available technology and/or regulatory conditions, will likely impact some of the recommendations in the future. Therefore, all recommendations and flow projections will be reviewed during each update of the Master Plan, which is to occur every 5 years.

9.4.1 Short-term Requirements (2008 – 2020)

Based on current projections, flows during this timeframe will not exceed 73.3 MLD. Recommendations to upgrade the WWTP to 73.3 MLD have already been examined and approved under a previous Class EA process and were not re-examined under this Master Plan.

It is important to note that the City is completing an optimization study at the Guelph WWTP. This study is investigating opportunities with the existing infrastructure to determine whether additional capacity can be realized through operational modifications. If it is found that the existing WWTP can reliably operate at flows higher than its current, rated, average-day flow capacity, then an addendum to the previous Class EA will need to be completed and approved. Based on current wastewater flow projections, the next plant expansion will be required by 2013. It is recommended that the planning for and design of the expanded facility be commenced a minimum of 3 years in advance of the required upgrade. This means planning should commence in 2011. If required, it is recommended that any piloting of equipment should be commenced immediately upon completion of this Master Plan so that results are available in advance of the next expansion.

Based on the findings of the optimization study, it is possible that 73.3 MLD may be achieved through optimization, that a new Plant 5 will be required, or that a combination of the two may be considered.

9.4.2 Medium-term Requirements (2021 – 2031)

Based on current flow projections, the approved capacity of 73.3 MLD will be reached by approximately 2024. Prior to the capacity being reached, an expansion to the existing facility must be planned, designed, and constructed. Prior to the commencement of the expansion design, a Schedule C Class EA will need to be completed and approved. It is recommended that the Schedule C Class EA be started a minimum of 6 to 7 years in advance of the required treatment facility.

Recommended Capacity and Estimated Effluent Compliance Limits

By 2031, the estimated, average, daily flows reaching the Guelph WWTP will be approximately 85 MLD. The estimate effluent limits for the WWTP at this flow rate are summarized in Table 9.1.

TABLE 9.1
Potential Effluent Limits at 85 MLD

Parameter	Effluent Limit (mg/L)	
	Winter	Summer

TSS	6	6
$cBOD_5$	3	3
Ammonia	1	0.8
Total Phosphorus	0.4	0.2
Nitrates	4.4	4.4

Treatment Technologies

Based on the evaluation completed as part of the Master Planning process, the integration of membrane technologies is recommended to achieve long-term, future effluent quality compliance limits. Two membrane technologies are being carried forward for further investigation and include tertiary membrane filtration and tertiary MBRs. It may be possible for the first expansion beyond 73.3 MLD to use conventional treatment technologies while still achieving the estimated effluent limits described.

Selection of the preferred expansion alternative will need to consider operating and capital costs, the ability to achieve future effluent quality, the ease at which the alternative can be implemented, the proven operation of the technology, and the impact of pending regulatory requirements, including those for nitrates. Each of the three expansion options are described in detail in a technical memorandum found in Appendix F. Considerations for each option are summarized in Table 9.2 and should be investigated in further detail at the Class EA stage for the expansion and during subsequent updates of the Master Plan prior to proceeding with the expansion design. A comparison of capital and operating cost opinions has also been included for consideration.

TABLE 9.2
Summary of Considerations for Future Expansion

Consideration	**Tertiary Membrane Treatment**		**Conventional Tertiary Treatment (new Plant 5 or 6)**
	Tertiary MBR	**Tertiary Membrane Filtration**	
Effluent Quality	Similar to membrane filtration	Similar to Tertiary MBR	Inferior to membrane-based systems. Ultimately will require conversion to membranes to achieve effluent requirements.
Ease of Implementation	Relatively easy	Relatively easy	Relatively easy
State of Technology	Several facilities of similar size (>10 MLD), although not specifically in Tertiary MBR mode (although two-stage activated sludge is well established)	Many facilities of similar size (>30 MLD)	Established
Impact of Future Regulatory Requirements	Capable of meeting future requirements	Capable of meeting future requirements	Likely not capable of meeting future requirements with sand filtration

Capital and Operating Cost Comparison

Capital and operating cost estimates for the three expansion alternatives were carried out to facilitate a comparison. Capital costs estimates include facility costs (e.g., process mechanical; structural; electrical; heating, ventilation, and air conditioning [HVAC]; and architectural) and engineering. In addition, provisions have been allowed for typical contractor mark-up, contractor overhead, bonds, insurance, and mobilization/ demobilization. Costs are based on 2008 dollars and have not been escalated. These estimates should be considered to be Class 5, based on the definition provided by the Association for the Advancement of Cost Engineering (AACE). Table 9.3 summarizes the capital cost estimates for each alternative.

TABLE 9.3
Capital Cost Estimates for Expansion Alternatives

Alternative	Capital Cost Estimate *
Tertiary MBR	**$ 59.5 M**
Conventional Expansion with Sand Filters	**$ 56.7 M**
Conventional Expansion with Membrane Filters	**$ 62.5 M**

*** Cost Estimates include 15 percent for engineering, and 25 percent for the combined costs of contractor mark-up, overhead, bonds, insurance, and mobilization/demobilization.**

As shown, the capital cost for the three alternatives are within 10 percent of each other.

Table 9.4 summarizes the annual energy cost estimates for each alternative. This table shows that the annual energy cost for an MBR is slightly higher than the energy costs associated with a conventional treatment plant with tertiary filtration.

TABLE 9.4
Annual Energy Cost Estimates for Expansion Alternatives

Alternative	Annual Energy Cost Estimate
Tertiary MBR	**$ 505 K**
Conventional Expansion with Sand Filters	**$ 460 K**
Conventional Expansion with Membrane Filters	**$ 460 K**

The annual costs associated with regular O&M for the three alternatives are relatively comparable. Variance can be found in the annual allocations required for equipment replacement. The estimated costs to be allocated for replacement are summarized in Table 9.5. The reasons for the variance include the frequency of replacement, as well as the estimated quantity of equipment that needs to be replaced.

TABLE 9.5
Annual Maintenance Cost Estimates for Expansion Alternatives Based on Equipment Replacement Costs

Alternative	**Annual Replacement Cost Estimate**
Tertiary MBR	$ 216 K

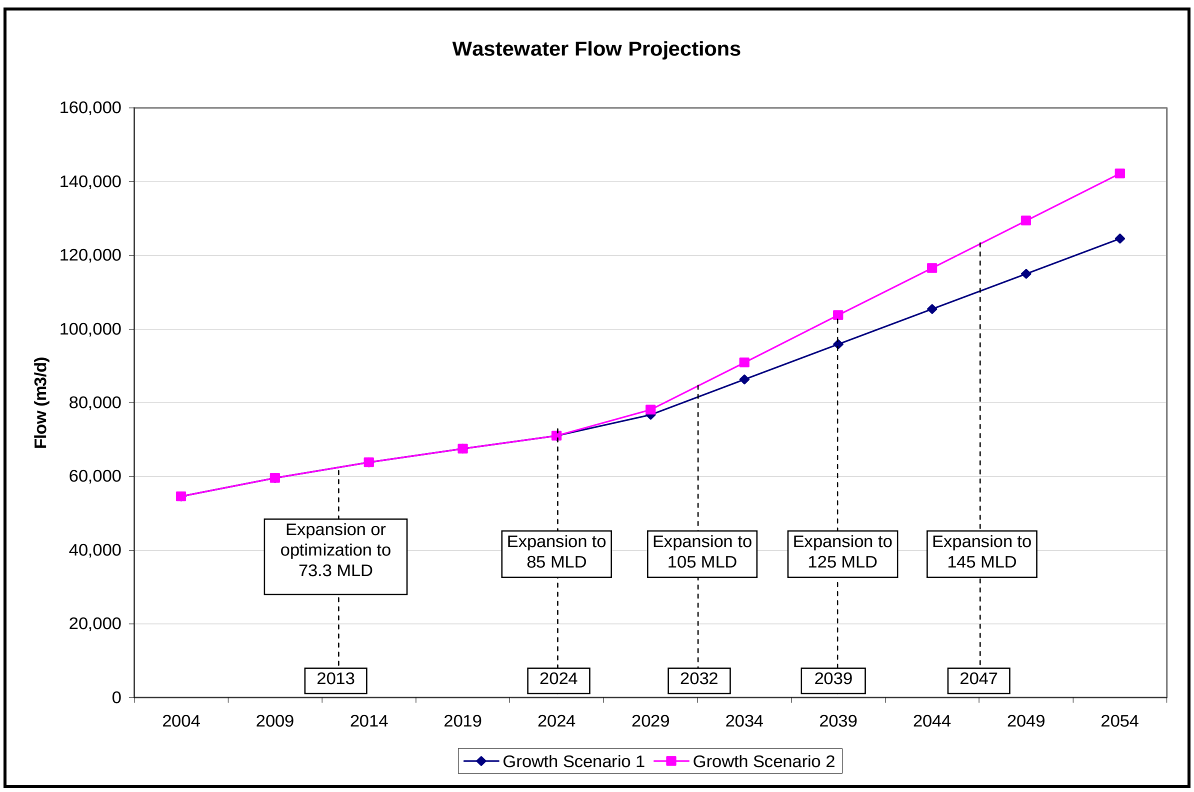
Conventional Expansion with Sand Filters	$ 70 K
Conventional Expansion with Membrane Filters	$ 125 K

It is recommended that the City gain a better understanding of the advanced treatment technologies by scheduling visits to facilities that are successfully operating these processes. Examples of full-scale WWTPs operating tertiary MBRs and tertiary membrane filtration include Traverse City, Michigan, and Gwinnett County, Georgia, respectively.

9.4.3 Long-term Requirements (2032 – 2054)

The review and evaluation of treatment alternatives indicated that, at this time, tertiary membrane technology is the preferred method of achieving long-term effluent quality compliance limits beyond 2031. It is recognized that by this time, treatment technologies will likely change and that wastewater flow rate estimates will also likely vary. Consideration was given to the timing and quantity of expansions that would be required, based on current knowledge, to achieve treatment capacity for flows to 144 MLD. Consideration was also given to staged treatment capacity expansions from 2031 to 2054 to provide a total treatment capacity of 144 MLD at the Guelph WWTP. Modular expansions of 20 MLD were assumed, and Figure 9-1 shows the estimated timing of each of the expansions beyond 2031.

FIGURE 9-1
Timeline for Long-Term Expansions



A conceptual plan view showing what the footprint of the Guelph WWTP may look like in 2054 is shown in Figure 9-2. This is a theoretical layout showing the integration of tertiary MBR technology; just one possibility of what the WWTP might look like in the future. It should also be noted that considerations for expanding beyond Plant 5 at the existing facility must examine hydraulic constraints which could necessitate additional, supporting infrastructure, such as a new headworks for the west side of the existing WWTP site.

FIGURE 9-2
Conceptual Footprint of Guelph WWTP in 2054

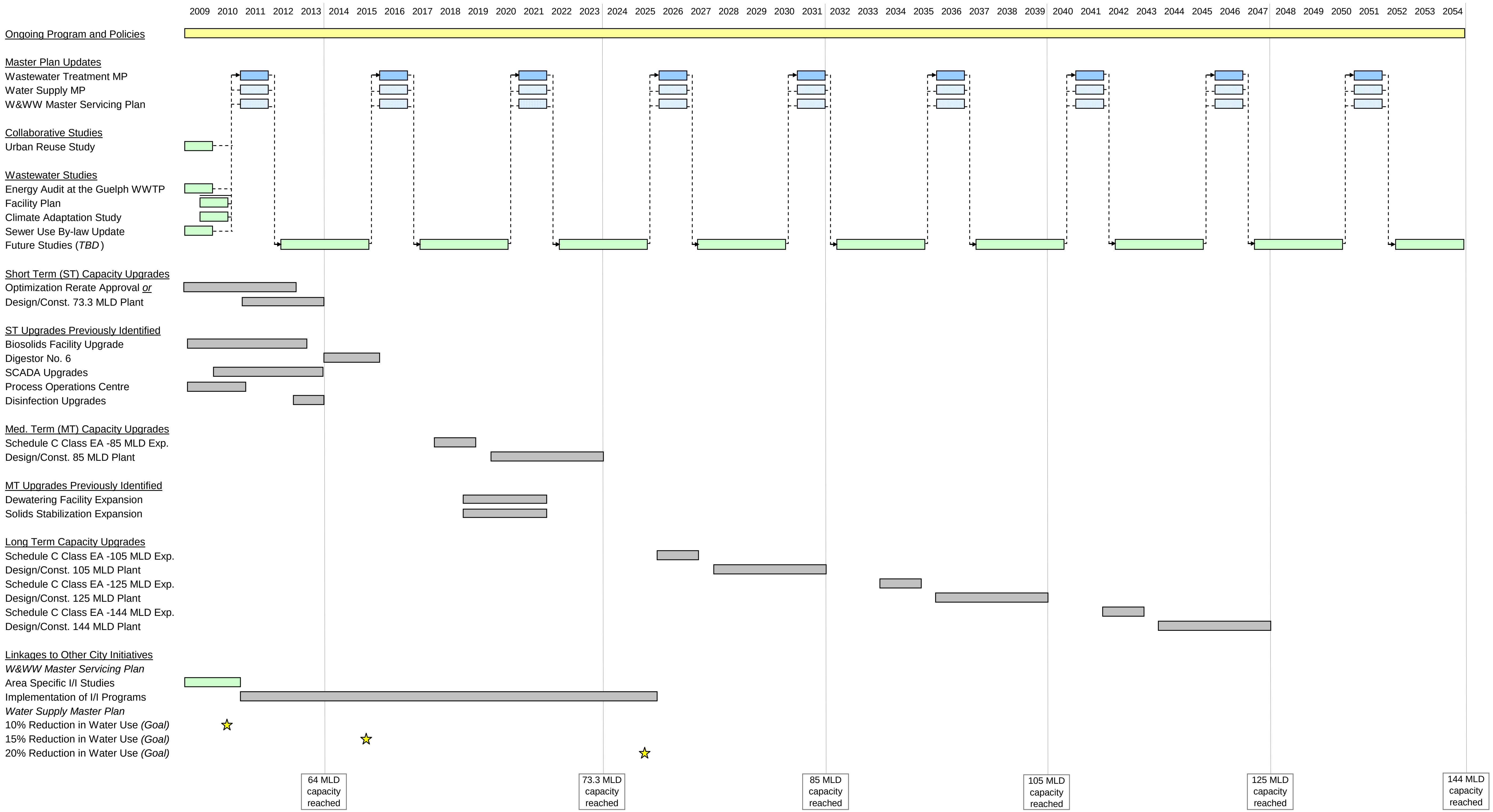
It is recognized that these alternatives will be reviewed and revisited with each of the updates to the WWTMP.

9.5 Implementation Plan and Schedule

The schedule shown in Figure 9-3 visually outlines the recommended timeframe for the studies and infrastructure recommendations described for this Master Plan. The program and policies are recommended to continue over the entire Master Planning timeframe. The City's Master Plans have been prepared in a similar timeframe and will be reviewed in a similar 5-year cycle. This cycle is reflected in the WWMP implementation schedule.

It is also important to note that recommended studies are planned to be undertaken in advance of each Master Plan review to provide the required information needed for each update. The WWMP schedule also incorporates the linkages to other City initiatives, including the milestone targets for the City's WC&E program. The estimated costs associated with the recommendations in the implementation plan have been summarized in Table 9.6. For information purposes, recommendations from the biosolids management plan, previous Class EAs, maintenance upgrades identified through previous studies as well as projects identified by City operations staff. It has been noted in the table, that the timing of the capacity expansions are dependant on anticipated growth and may be impacted by the results of the City's water conservation efforts.

FIGURE 9-3
Guelph Wastewater Treatment Master Plan Implementation Schedule



NOTES:

Implementation timeline is based on current projected flow rates and best available information. Recommendations may be deferred or modified based on the success of City programs, population projections and findings from subsequent Master Plan updates

Collaborative Studies require coordination between multiple City divisions such as Wastewater Services,Engineering,Planning and Waterworks

TABLE 9.6
Costing Estimates for Master Plan Recommendations

Recommendation	2008 – 2011	2012 – 2018	2019 - 2025	2026 – 2031	2032 - 2054
From Master Plan Recommendations					
Facility Plan	$75,000				
SCADA System Plan (Under Facility Plan)	$75,000				
Urban Reuse Study	$500,000				
Energy Audit at the WWTP	$90,000				
Climate Adaptation Studies	$35,000				
Sewer Use By-Law Review and Update	$75,000				
Master Plan Updates	$200,000	$200,000	$200,000	$400,000	$800,000
Future Studies[1]		$500,000	$500,000	$500,000	$1,500,000
Schedule C Class EA for 85 MLD Expansion		$400,000			
Design and Construction of 85 MLD Expansion			**$60,000,000**		
Long Term Expansions				**$60,000,000**	**$120,000,000**
From Previous Studies/Ongoing Maintenance/Upgrades					
Phase 2 Expansion to 73.3 MLD[2]	$10,000,000	$20,000,000			
Optimization – Plant Rerating	$400,000	$100,000			
Biosolids Facility Upgrade	$5,000,000	$37,000,000			
Digester No. 6		$6,000,000			
Dewatering Facility Expansion			$10,000,000		
Solids Stabilization Expansion			$15,000,000		
Secondary Pumping Expansion		$8,000,000			
Misc. WWTP Upgrades/Maintenance	$4,000,000	$4,000,000			
SCADA Upgrades	$550,000				
Administration Building Upgrades	$1,000,000				
Disinfection Upgrades		$8,000,000			
Totals	$22,000,000	$84,200,000	$85,700,000	$60,900,000	$122,300,000

[1] - A placeholder dollar value has been provided for future studies which wil be recommended from Master Plan updates
[2] - Cost for 73.3. MLD expansion from previously approved Schedule C Class EA
- Cost estimates do not include escalation

9.6 Additional Approvals and Permit Requirements

Prior to proceeding to implementation, some of the recommendations described above will require additional approvals and permits. Table 9.7 summarizes these requirements.

TABLE 9.7
Additional Permits and Approvals Required Prior to Implementation

Recommendation	Approvals/Permits
Guelph WWTP Optimization	Under the Class EA, a re-rate to the approved capacity of an existing WWTP without the need for any additional infrastructure does not require further approval as long as the increased flows do not result in an increase in effluent loading to the receiving water body. An amendment to the WWTP's existing CofA will be required. The amendment is issued by the MOE based on an application submitted by the City.
Expansion to 73.3 MLD	A Schedule C Class EA and subsequent update have been completed and approved up to 73.3 MLD; therefore, there are no additional Class EA requirements. The City may proceed with the planned expansion. An amendment to the WWTP's existing CofA will be required. The amendment is issued by the MOE based on an application submitted by the City. Additional permits, such as a building permit, GRCA approvals for work within the floodplain, or Ministry of Transportation approvals for construction within proximity of a provincial highway, will be required prior to construction. All permits required will be confirmed during subsequent design stages.
Expansions beyond 73.3 MLD	Any treatment capacity expansion beyond 73.3 MLD will require the completion of a Schedule C Class EA. An amendment to the WWTP's existing CofA will be required. The amendment is issued by the MOE based on an application submitted by the City. Additional permits, such as a building permit, GRCA approvals for work within the floodplain, or Ministry of Transportation approvals for construction within proximity of a provincial highway, will be required prior to construction. All permits required will be confirmed during subsequent design stages.

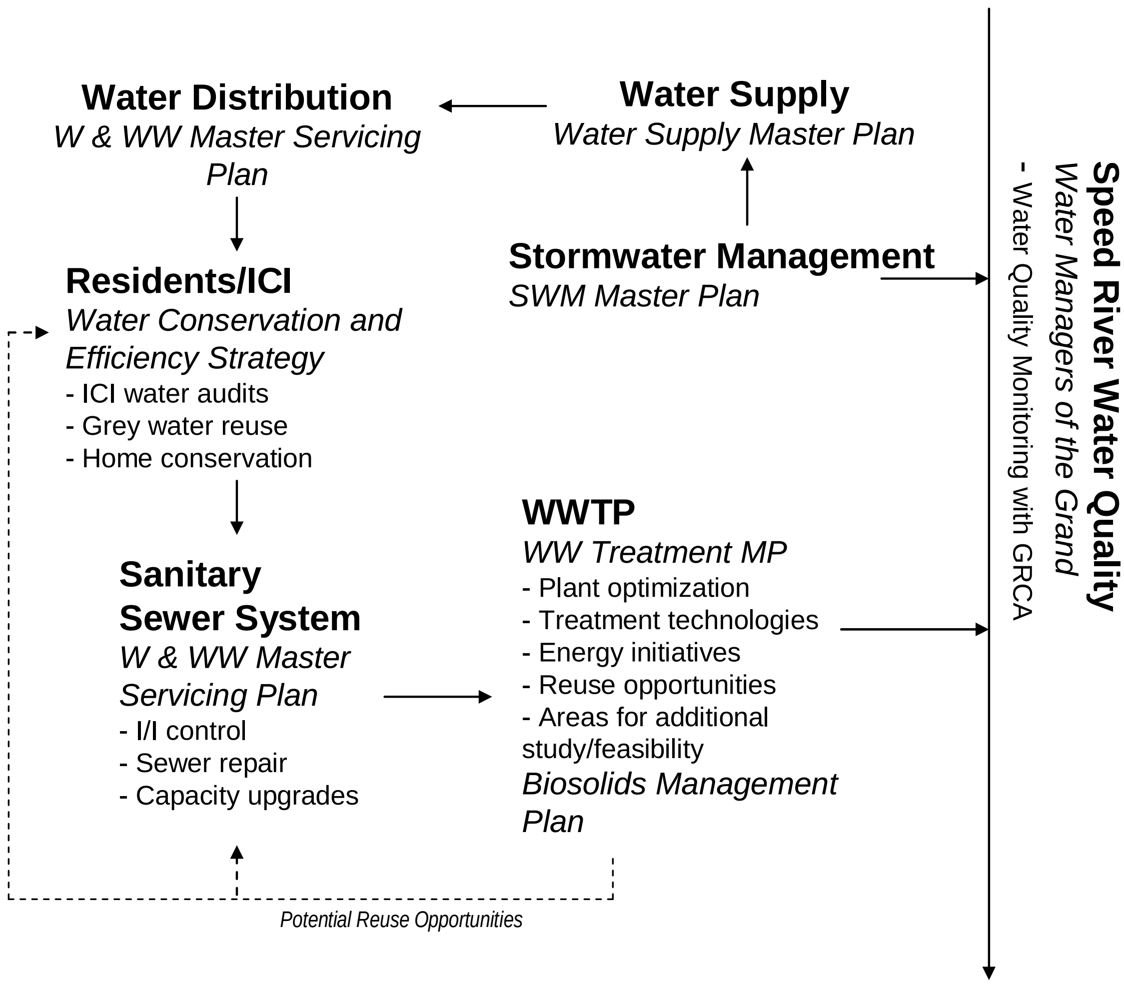
9.7 Master Plan Update/Integration with other Planning Initiatives

Guelph's WWTMP must be reviewed and updated every 5 years, consistent with the requirements set out in the Municipal Class EA document. Through discussion with stakeholders and advisors, it was suggested that the City integrate their Master Planning exercises through an overall Water Management Plan. This Water Management Plan would provide an overall planning framework for the following City infrastructure components:

- Water Treatment and Storage
- Wastewater Treatment and Biosolids Management
- Water Conservation and Efficiency
- Water and Wastewater Servicing
- Stormwater Management

This overall framework would provide a formal linkage between the infrastructure planning initiatives, assist in the integration of capital planning, and allow the City to examine the potential impacts of recommendations on other aspects of City infrastructure. The City will look at the potential opportunities for integrating their current planning initiatives. Figure 9-4 shows some of the potential linkages between the City's existing planning studies.

FIGURE 9-4
Linkages between the City of Guelph's Water-Related Planning Initiatives



9.8 Next Steps

9.8.1 Prioritization and Integration into City Budgeting/Capital Planning

The recommendations included within the previous section will be reviewed by the City and prioritization of projects will be confirmed. This prioritization exercise will take into consideration budget, regulatory requirements, public priorities and integration with other City initiatives. The cost estimates for the various projects will be reviewed and where appropriate refined prior to inclusion in the City's program and capital planning budgets on an annual basis during the budget process.

9.8.2 Ongoing Areas for City Tracking and Review

It has been recognized that there are a number of ongoing City activities, programs and initiatives that may have an impact on the recommendations made within this Master Plan. A number of these items may evolve and change over time and so the City has committed to tracking these items and reviewing their impact on wastewater treatment operations prior to implementing any of the recommendations and/or at each subsequent update of the Master Plan, whichever occurs sooner. These items include results of the WWTP optimization study, water conservation impacts, I/I reduction efforts, economic impacts and variations in growth projections.

10. Stakeholder Consultation

10.1 Communications Activities

The City's communication department assisted with project notifications and in the administrative support for the selection and establishment of the PAC. The communications team also arranged for and managed the transfer of project information prepared by the study team to the City's website.

The Master Plan study was introduced to the community through a Notice of Commencement published in the Guelph Tribune and Guelph Mercury newspapers in May 2008. The first Public Information Centre (PIC) was held on October 24, 2007 and received 30 visitors. The second PIC was held on February 10, 2009 and received approximately 18 visitors. The Notice of Master Plan Completion was published in the local newspapers and appears at the front of this report. The public mailing list from the City's WSMP was used for notification for the WWTMP. The mailing list was expanded as responses to notices and PICs were received. Meeting summaries of the PAC and information presented and received through the PICs were also uploaded to the City's website for easy access by the community.

10.2 Public Advisory Committee

The PAC for the WWMP was established through the City's application protocols and with Council approval. The PAC members included the following members:

TABLE 10.1
PAC Members

PAC Member	Title, Organization
Don Drone	Chair
Ian Smith/Lloyd Longfield	Chamber of Commerce
Doan Bellman	Sleeman Breweries
James Ford	Community-at-Large
Hugh Whiteley	Community-at-Large
Khosrow Farahbakhsh	University of Guelph
Laura Murr	Green Plan Steering Committee
Dorothy Remmer	Green Plan Steering Committee
Paul McLennan	Guelph Developers Association
Gary Nelson	Federation of Agriculture
Bob Bell	City Council

TABLE 10.1
PAC Members

Steering Committee Member	Title
Janet Laird	Director of Environmental Services
Cameron Walsh	Manager of Wastewater Services
Kiran Suresh	Project Manager, Wastewater Services
Gerard Wheeler	Optimization Specialist, Wastewater Services
Tim Robertson	Supervisor Operations, Wastewater Services
Paul Kraehling	Senior Policy Planner
Laurie Watson	Communications Coordinator, Corporate Communications
Tara Sprigg	Senior Communications Officer, Corporate Communications
Don Kudo	Manager of Infrastructure Planning, Design and Construction
Richard Henry	City Engineer, Engineering Services
Peter Busatto	Manager Waterworks Division
Jim Riddell	Director, Community Design and Development Services
Paul Kraehling	Senior Policy Planner, Community Design and Development Services
Sandra Cooke	Senior Water Quality Supervisor, Grand River Conservation Authority
Mark Anderson	Grand River Conservation Authority
Ministry Representative	**Organization**
Scott Gass	Ministry of the Environment
Consultant Team (CH2M HILL)	
Warren Saint	Project Manager
Diana Vangelisti	Communications and EA Specialist
Pam Law	Project Engineer

The PAC was guided by a Terms of Reference and the City of Guelph's Guiding Principles for Public Involvement, both of which are presented in Appendix G.

The PAC was engaged in the decision-making process at five distinct points during the Master Plan exercise. Each meeting had a specific purpose, material content, and anticipated outcome, as presented in Table 10.2.

TABLE 10.2
PAC Meeting Outline

Meeting/Date	Purpose	Topics	Outcome
PAC Meeting#1 **June 2007**	To provide a Project Introduction, present the Study Process, and identify key issues	Master Plan Process and Scope Role of PAC Consultation Plan Problem Statement Key Issues Purpose of Public Information Centre #1	Understanding of roles, and endorsement of study process Identification of key issues moving forward
PAC Meeting #2 **September 2007**	Presentation of existing and future conditions; and discussion of alternatives, evaluation process, and impacts of consultation efforts to date	Existing and Future Conditions Wastewater Service Alternatives Evaluation Methodology and Criteria Results of Consultation Efforts	Endorsement of Alternatives for Evaluation Endorsement of Evaluation Methodology Feedback on Consultation Efforts
PAC Meeting #3 **May 2008**	Presentation of evaluation outcomes, and discussion of recommended Master Plan components	Evaluation Outcomes Recommended Master Plan Components Key Issues Status Purpose of PIC #2	Endorsement of Evaluation Outcomes and Master Plan Recommendations Feedback on Messaging for PIC#2
PAC Workshop **July 2008**	Presentation of City Initiatives related to the WWMP	Growth Management Plan Recommendations W&WW SMP Recommendations Guelph's Water Efficiency Program Wastewater Optimization Program	Provide Broader City Context for Master Plan Recommendations and Linkages to other City Programs and Activities
PAC Meeting #4 **October 2008**	Discuss Draft Master Plan Report	Master Plan Components Implementation Plan and Cost Opinions Results of Public and Agency Consultations	Endorsement of Overall Master Plan and Implementation

PAC meeting summaries are presented in Appendix G. Meetings summaries were also made available on the City's website.

The PAC contributed to the formation of the Master Plan from the initial steps in the process to the preparation of the Final Report. In particular, the PAC informed and influenced the following study activities:

- **Project Mission and Vision** – Suggested that a broad context for the Master Plan be adopted to recognize the linkages to other City initiatives and the need for a coordinated approach to the City's infrastructure planning.

- **Long-term Radar Screen** – Encouraged the on-going consideration and assessment of technology alternatives that require further study or particular "triggers" to make them feasible or attractive to the City for implementation at some point in the future.
- **Sensitivity Analyses** – Contributing sensitivity scenarios were used in the evaluation of alternatives to determine if there would be any changes in the overall evaluation outcome, which was based on an equal weighting of evaluation criteria categories.
- **Climate Change Adaptation** – Recognized the need to include and address the potential impacts of climate changes on the performance of alternative technologies and initiatives in the future phases of the WWMP.

10.3 Agency Consultation Activities

10.3.1 Government Review Team

Regulatory agencies were engaged in the Master Plan process from the outset. Using the Government Review Team list, a Master Plan Agency list was developed. The agencies received the Notice of Master Plan Commencement and the Notice of PICs. Those agencies who responded with an interest in participating in Master Planning continued to be notified of Master Plan study activities.

The GRCA was actively involved in the development of the Master Plan through participation on the PAC and with the study team on specific issues regarding the Speed River water quality and assimilative capacity.

The MOE was engaged in the Master Plan study; specifically, with discussions on the future effluent quality compliance criteria.

The agency mailing list and correspondence received is presented in Appendix H.

10.3.2 First Nations Consultations

First Nations agencies and local First Nations Communities were contacted at the outset of the Master Plan study with the following responses:

Indian and Northern Affairs Canada confirmed that there are no comprehensive claims in the City and requested no further consultations regarding the Master Plan.

Six Nations of the Grand River was consulted directly by the City as part of the Master Planning Process. The City received a request from the Six Nations group for a meeting to discuss the City's current and planned water and wastewater initiatives. The City has been in contact with representatives from the Six Nations Council to arrange a meeting to discuss the City's infrastructure plans.

10.4 Public Issues and Responses

The public issues identified through the WWTMP were consistent with the issues discussed during the City's WSMP preparation and included:

- The need to maintain an aggressive water conservation and efficiency program to minimize wastewater generation
- The consideration of effluent reuse options as a means to protect the water quality in the Speed River

These issues were recognized early in the Master Plan study process and were incorporated into the identification of alternative solutions. Both water efficiency and effluent reuse options have been included in the WWTMP recommendations.

Detailed comments received at the Public Information Centres, as well as the City's responses, are presented in Appendix I.

10.5 Impacts of Consultation on the Master Plan Process

The City WWTMP was developed with a significant level of participation from the PAC, as well as through broader consultation with the Guelph community and regulatory agencies. The direct results of this consultation include the following:

- The WWTMP has been set within a broad context and linked to the City's other, recently completed Master Plans to provide an integrated approach to infrastructure planning and management.
- The recommended components of the WWTMP include a variety of innovative technologies and initiatives that will require further study, pilot testing, and/or a certain "triggers" to bring them forward to action.
- The City has committed to exploring partnership opportunities with community stakeholders to test the feasibility of innovative options for wastewater treatment at the local development scale.

These issues and initiatives have been included in the Master Plan program.

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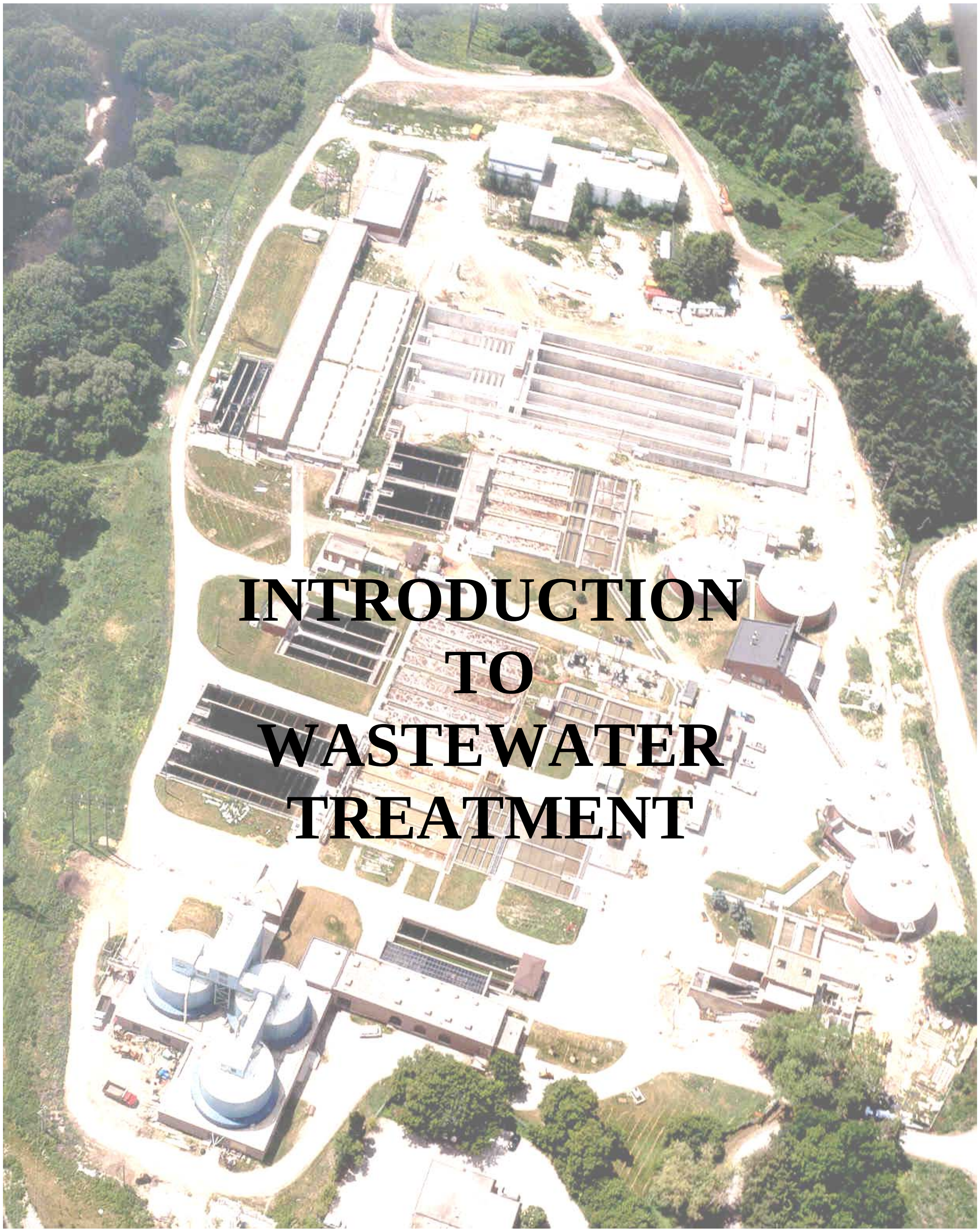
Appendix A
Introduction to Wastewater



INTRODUCTION TO WASTEWATER TREATMENT

City of Guelph

INTRODUCTION

The following material will introduce the reader to the water pollution abatement and control measures practiced by the City of Guelph, Environmental Services Department, Wastewater Services Division.

1.0 HISTORY

You may be surprised to learn that the treatment of wastewater is a relatively modern practice. Although sewers to remove foul-smelling water were common in ancient Rome, it was not until the 19^{th} century that large cities began to understand the necessity of reducing the amount of pollutants in the used water they were discharging to the environment.

Despite large supplies of fresh water and the natural ability of surface waters to cleanse themselves over time, populations had become so concentrated by 1850 that outbreaks of life-threatening diseases became commonplace. These outbreaks were traced to pathogenic bacteria in the polluted water.

What happens in a wastewater treatment plant is essentially the same as what occurs naturally in an ocean, lake, river or stream. The function of a wastewater treatment plant is to speed up this natural cleansing process. The practice of wastewater collection and treatment has been developed and perfected, using some of the most technically sound biological, physical, chemical and mechanical techniques available. As a result, public health and water quality are protected better today than ever before.

2.0 SOURCES

Wastewater can be defined as the flow of used water discharged from homes, businesses, industries, commercial activities and institutions which is directed to treatment plants by a carefully designed and engineered network of pipes. This wastewater is further categorized and defined according to its sources of origin. The term “domestic wastewater” refers to flows discharged principally from residential sources generated by such activities as food preparation, laundry, cleaning and personal hygiene. Industrial/commercial wastewater is flow generated and discharged from manufacturing and commercial activities such as printing, food and beverage processing and production to name a few. Institutional wastewater characterizes wastewater generated by large institutions such as hospitals and educational facilities.

Typically 200 to 500 litres of wastewater are generated for every person connected to the system each day. The amount of flow handled by a treatment plant varies with the time of day and with the season of the year.

3.0 TREATMENT OBJECTIVES

The overall water management objectives of wastewater treatment are associated with the removal of pollutants and the protection and preservation of our natural water resources.

Of specific concern is protection of human health by the destruction of pathogenic organisms present in wastewater prior to treated effluent being discharged to receiving waters.

4.0 WATER POLLUTION CONTROL LEGISLATION

Environment Canada is the federal government agency responsible for environmental protection. Legislation in the form of the Environmental Protection Act provides overall direction for environmental protection in Canada.

The Ontario Ministry of the Environment (MOE) is the provincial government agency responsible for environmental protection in the province of Ontario. One of its tasks is the provision of clean water through pollution control and prevention.

To accomplish its water quality objectives the MOE produced legislation in the form of the Ontario Water Resources Act (OWRA). This legislation in conjunction with various regulations made under the OWRA set out legal requirements for managing environmental issues.

The City of Guelph, Environmental Services Department, Wastewater Services Division (WSD), is engaged in wastewater, storm water and water quality management for the area which it serves. The WSD manages and operates the Wastewater Treatment Plant located at Hanlon and Wellington Street West and is responsible for meeting the treatment standards prescribed by MOE legislation. Further to these requirements, the city has enacted legislation specific to its wastewater operation passed by city council in the form of the Sewer Use By-law (1996)-15202. This By-law specifies the wastewater quality and quantity standards which must be met by wastewater generators who discharge to the city sewer collection and treatment system.

In addition to these pieces of legislation the MOE and the Municipal Engineers Associated of Ontario (MEAO) are jointly involved in developing additional legislation, namely, the Ontario Ministry of Environment Industrial Strategy for Abatement program (MISA). The program includes strategies for the development of analytical systems, adopting plans to address spills into systems, generation of an industrial inventory and an audit of enforcement activities. Certain wastewater pollutants, primarily from industrial sources, have the potential to seriously disrupt the various wastewater process operations and may present serious health risks to the public and employees associated with its treatment. The mandate of the MISA program is to eliminate and control such industrial wastewater discharges at their source.

5.0 WASTEWATER TREATMENT PROCESS

By definition, process means a series of actions or changes. Treatment facilities incorporate numerous processes which in combination achieve the desired water quality objectives. These processes involve the separation, removal and disposal of pollutants present in the wastewater.

The treatment of wastewater is accomplished by four basic methods or techniques; physical, mechanical, biological and chemical.

Physical methods of treatment include the use of tanks and other structures designed to contain and control the flow of wastewater to promote the removal of contaminants.

Mechanical treatment techniques involve the use of machines, both simple and complex in design and operation.

The action of bacteria and other micro-organisms are biological methods of treatment, which play a vital role in the removal of pollutants which cannot be effectively achieved by other means.

Chemical treatment methods enhance the efficiency of other process operations and provide specialized treatment as a result of their addition at various treatment stages.

6.0 DESCRIPTION OF PROCESS OPERATIONS

To gain an understanding of the process operations associated with wastewater treatment it is necessary for the reader to become familiar with the terms and expressions common to this field of work.

The following sections detail the specifics of wastewater treatment and have been formatted to assist readers new to the field encountering this terminology for the first time. These terms and expressions are initially presented in ***bold italic type*** and may be referenced alphabetically in Section 9.0 Glossary of Terms.

6.1 COLLECTION SYSTEM

The collection, or sewer system, is a series of pipes specially designed to transport the millions of litres of wastewater generated each day. Sewer piping is categorized by the type of flow it transports namely **sanitary, storm** and **combined sewers.** The City of Guelph collection system is constructed as a separated sanitary and separated storm sewer collection system. The sanitary system is directed to the wastewater treatment plant. In newer and future development areas of the city the storm system is direct to storm water management systems strategically located throughout the city. In older developed areas of the city storm water is discharged directly to the river. Treatment plants which are connected to storm or combined sewers receive much higher than normal flows during heavy rainfalls and snowmelts.

When and wherever possible collection systems are designed as gravity flow systems. Gravity flow sewer piping is laid with a slope steep enough to maintain a wastewater flow velocity of approximately 0.75 metres per second. This velocity is sufficient to keep all of the materials present suspended in its flow. In areas where it is geographically impossible to allow for gravity flow, lift stations are provided to receive wastewater from low lying areas and pumps are used to transport the wastewater for further transport by gravity sewers.

The complex sewer collection system must be properly maintained to prevent **infiltration, inflow or exfiltration** from occurring within the system. The integrity and function of the collection system is achieved through routine inspection, cleaning and repair and planned replacement of system components.

6.2 PRELIMINARY TREATMENT

Influent to treatment plants contains pieces of wood, rags, plastics and other debris. Sand, eggshells and other coarse **inorganic** material is present in the flow in addition to **organic** matter from household, industrial, commercial and institutional water use.

Preliminary treatment provides for the removal of large debris and heavy inorganic material contained in the wastewater flow.

One of the first treatment operations involves screening of the influent wastewater flow. Mechanical screens consisting of parallel bars or stepped plates placed at an angle in the path of the wastewater flow are used to remove this debris. Mechanical rakes clear debris from the bars and these screenings are washed and compressed to remove excess water and ultimately disposed of by burial in a landfill. Removal of these materials protects the treatment plant's piping and downstream equipment from blockage and/or damage.

Following screening operations the wastewater flow passes into aerated channels designed to slow the flow velocity to 0.3 metres per second. Here heavy inorganic materials separate from the wastewater and settle. The settled inorganic material is referred to as grit. Periodically, the settled grit is removed from the channels, washed and ultimately disposed of by burial in a landfill. Grit is very abrasive and its removal early in the treatment process reduces wear on pumps and other equipment. This inorganic material would otherwise eventually settle in other process areas and take up effective treatment volume or capacity.

6.3 PRIMARY TREATMENT

The wastewater, with large debris and grit removed is directed to **primary treatment** operations. By volume wastewater is greater than 99.9 % water and less than 0.1 % solid material in the form of dissolved, suspended, and settable solids.

Although this may seem a very minuscule quantity of material, if left untreated and discharged serious negative affects would be experienced in the **receiving waters**. The separation and removal of a significant portion of this material is accomplished during primary treatment.

During primary treatment wastewater flows into and through large settling tanks or clarifiers where the flow velocity is reduced to afford hydraulic **detention times** of between 2 and 4 hours. Here initial separation occurs, with 40 to 50 % of the heavier settle able solids forming a raw or primary sludge on the bottom of the settling tanks, and lighter materials to float to the tanks surface. This sludge, with a typical volatile solids content of 75 %, is collected and discharged to other process operations for further treatment. The floated materials, primarily consisting of fats, oils and grease are skimmed from the tanks surface and are also directed to further treatment operations.

The non-settle able dissolved and suspended solid materials remaining in the wastewater flow exiting the settling tanks, referred to as primary effluent, are directed to other process operations to undergo further treatment. Primary effluent contains 60 to 70 % of the total solids contained in the plant influent.

6.4 ANAEROBIC DIGESTION

During primary treatment initial separation of the materials present in the wastewater was accomplished producing raw or primary sludge and primary effluent. The physical characteristics and organic strength, as measured by the **biochemical oxygen demand (BOD)**, of each product are uniquely different. **Secondary treatment** processes serve to further treat these products and are typically biological forms of treatment.

The sludge produced during primary settling is directed to large enclosed tanks void of free molecular oxygen, known as **digesters**. Here **anaerobic bacteria** utilize the organic material present in the sludge as a food source and produce carbon dioxide and methane gas. The action of these anaerobic bacteria stabilize the raw or primary sludge and alters the characteristics of the original sludge improving its dewaterability for further processing.

During the digestion period, typically 15 to 28 days, conditions suitable to maximize the biological activity of the anaerobic bacteria are maintained. The digester tank contents are heated to maintain a temperature of 35- 37 degrees Celsius, mixed to provide contact of organic material with bacteria and prevent the formation of a scum blanket.

Anaerobic digestion usually takes place in two stages. Contents of the second stage digestion tanks are periodically allowed to rest unmixed to encourage settling of the stabilized digested biosolids. Solids are withdrawn and directed to solids handling operations for excess water removal and further processing.

The end products of digestion are **stabilized biosolids** and a relatively clear liquid called **supernatant** which is withdrawn or overflows the secondary digestion tanks. Supernatant is returned to the plant influent to again undergo treatment and remove material which it contains.

Gas produced during digestion is comprised of 35 % carbon dioxide and 65 % methane by volume and is used to fuel the facilities hot water boilers and cogeneration engines. Heat energy produced is used for digester and domestic building heating. Electrical energy generated is consumed on site and offsets the total quantity of electricity required to be purchased.

6.5 ACTIVATED SLUDGE

The organic material present in the primary effluent, which overflows the primary settling tanks exhibits certain characteristics which require additional forms of treatment. This organic material is comprised of dissolved and finely divided suspended or, **colloidal solids** which account for the turbid appearance of the primary effluent.

By nature, the dissolved organic material present in the influent will remain in solution in the liquid flow during primary treatment. The colloidal solids present are very small in size and mass and do not settle during primary treatment. It is not possible nor practical to increase the detention time of the wastewater in the primary tanks in an effort to remove these colloidal solids. Increased detention times would promote the development of **septic** conditions within the settling tanks and solids removal efficiencies would actually decrease.

To treat the primary effluent waste stream a secondary biological treatment process is used known as the **activated sludge process**. This process effectively removes the dissolved organic material in addition to a portion of the colloidal matter and converts the remaining colloidal material to a biological sludge which rapidly settles. Activated sludge consists of sludge particles produced by the growth of organisms in the presence of free dissolved oxygen. The term "activated" comes from the fact that the particles are alive and teeming with bacteria, fungi and protozoa. These micro-organisms cleanse the wastewater by using the organic material present as a food source to grow and reproduce. The organisms stabilize soluble or colloidal solids by partial **oxidation** forming carbon dioxide, water, and sulphate and nitrate compounds.

There are many variations or modifications of the activated sludge process however basic principles of operation apply to all. Wastewater to be treated is thoroughly mixed with the activated sludge to form what is termed **mixed liquor**. The mixed liquor flows through large aeration basins which allow for detention times between 4 to 6 hours. Here, oxygen is dissolved into the mixed liquor by blowing air through the flow or by mechanical surface mixers which splash the mixed liquor into the air allowing oxygen from the atmosphere to be dissolved. Following this aeration period the **aerobic** organisms present in the mixed liquor are directed to a secondary clarifier where they **flocculate** and settle to form a sludge. A portion of this settled sludge is sent back to the beginning of the process as return activated sludge to maintain and continue the process. Sludge produced in excess of process requirements is wasted or discharged from the treatment system back to the primary settling tanks or a separate sludge thickening operation.

6.6 CHEMICAL TREATMENT

Although primary and secondary treatment operations are efficient in removing most wastewater pollutants, some pollutants require special forms of treatment for their removal. Phosphorous is one such pollutant of special concern. Left untreated, phosphorus contained in the final effluent of a wastewater treatment plant may have a serious negative impact on receiving waters. Phosphorous is one of the major nutrients associated with the growth of aquatic plants. Sources of phosphorous include; human waste, detergents containing phosphate additives and corrosion control chemicals used in water supplies and industrial discharges. High concentrations of phosphorous in receiving waters promote excessive growth of algae and aquatic plants which may disrupt the natural ecological balance of the receiving water. Rapid deterioration of water quality could result in acceleration of the eutrophication process of the receiving body of the water.

Phosphorus removal methods may be characterized as being either biological or **chemical precipitation** techniques. The present practice is the use of a metal salt which reacts with soluble phosphorous to form an insoluble precipitate. This precipitate settles with the sludge during settling operations and is thus removed from the wastewater flow. The most common metal salt in use is ferrous chloride, also known as “pickled liquor”. This metal salt solution is a readily available waste by-product of steelmaking operations.

Application points for iron solutions are typically immediately upstream of the primary settling tanks, at the influent end of the aeration tanks, or at both points simultaneously. It is important that chemicals used for phosphorous precipitation be intimately mixed with the wastewater to ensure uniform dispersion to achieve maximum removal efficiencies.

Another essential chemical treatment practiced at wastewater treatment facilities involves **disinfection** of the final effluent. Disease causing or **pathogenic** micro-organisms are potentially present in all wastewaters due to human discharges. These micro-organisms must be removed or killed before treated wastewater is discharged to receiving waters. **Chlorination** for disinfection purposes results in the destruction of essentially all of the pathogenic micro-organisms and thus prevents the spread of waterborne diseases. To further protect receiving waters sodium bisulphate is added following disinfection to dechlorinate the wastewater effluent prior to discharge.

6.7 DEWATERING

Dewatering is a solid handling process operation. Stabilized biosolids from secondary anaerobic digestion are directed to dewatering to remove excess water. This operation reduces the volume and increases the dryness of the solids for further processing. Feed solids typically 1.5 to 2 % on solids content are processed through mechanical belt filter presses, which yield filter cake typically 18 to 19 % in solids content. The feed solids are conditioned with a polymer-coagulating agent and squeezed between woven mesh filter belts. The excess water removed, termed filtrate, and wash water used to clean the woven filter belts is directed back into the wastewater flow for treatment.

6.8 COMPOSTING

Composting is an aerobic biological process providing for the **decomposition** of the organic matter present in the dewatered cake by bacteria and fungi in the presence of oxygen. The City of Guelph is the first wastewater facility in Canada to utilize a high rate, totally enclosed in vessel composting facility. Composting occurs naturally such as decomposition of leaves on a forest floor. This naturally occurring process can be optimized and accelerated by establishing ideal controlled conditions in a bio-mechanical process system. Temperature, food and oxygen availability is controlled to provide for optimum composting conditions.

The process begins by mixing proportionate amounts of dewatered cake, amendment material and a recycle of previously composted material. Amendment is derived from waste wood and provides a carbon-based food source to compliment the nitrogen-rich dewatered cake. The amendment also increases the dryness and porosity of the mix to allow efficient movement of air and oxygen transfer through the compost mass**.** The recycled compost is introduced to supply an active population of micro-organisms in addition to increasing the dryness of the mix. The combined feed material is introduced into the top of a Bio Reactor using a series of screw conveyors and vertical elevating conveyor, Compost material moves in a plug flow fashion from the top of the reactor vessels to the bottom. Material is withdrawn from the bottom of the Bio Reactor vessel and transferred to the top of the Cure Reactor. Heat generated by the growth of the microorganisms raises the temperature of the compost material. Temperatures range between 40 and 60 degrees Celsius or greater are maintained for a minimum period of three consecutive days, which provides for pasteurization and safeguards against harmful bacteria and viruses.

6.9 TERTIARY TREATMENT

Tertiary treatment process operations are incorporated at the City of Guelph Wastewater treatment plant. These are necessitated by the sensitivity and assimilative capacity of the Speed River which receives effluent discharge. Tertiary treatment or effluent polishing operations practiced are nitrification for the removal of ammonia nitrogen and sand filtration for the additional removal of suspended solids.

Ammonia nitrogen, like phosphorus is a nutrient which can promote the excessive growth of algae and aquatic plants which may disrupt the natural ecological balance of the receiving water. Nitrification is an aerobic biological process whereby nitrifying bacteria convert ammonia first to nitrite and subsequently to nitrate. Secondary treated effluent is directed to **Rotating Biological Contactors** (RBC) where this conversion takes place. Thirty-two RBC shafts configured in four parallel treatment trains are employed. Each shaft is 7.6 metres long with a media diameter of 3.6 metres and media surface area of 13,750 m. the media is submerged 40 % in the secondary effluent flow. Driven by air, the shafts slowly revolve in the wastewater at a rate of 1.3 rpm. Bacteria attached to the media converts the ammonia to nitrite and nitrate.

The treatment facility incorporates four low head sand filters for further removal of suspended solids and associated BOD and phosphorus. Each filter is comprised of numerous independent filter cells. Silica sand and anthracite of specific quality is used as the filter medium. RBC effluent is distributed to the filters which provide automatic backdating of the filter media. Filter backwash is directed to the primary treatment process for removal of contained solids.

7.0 DISCHARGE CRITERIA

To ensure the quality of our natural water resources the MOE determines and sets the allowable limits for effluent discharged from wastewater treatment facilities and rated hydraulic capacities within the province through the issue of Certificates of Approval. As may be expected the size of receiving water is important consideration in setting allowable discharge limits. The smaller the body of water the receiving stream represents typically the more stringent the discharge limits.

The principle elements for which discharge standards are prescribed are:

Hydraulic Capacity Rating
TOD total oxygen demand
BOD biochemical oxygen demand
TP total phosphorous
TSS total suspended solids
CR chlorine residual
NH_3 ammonia nitrogen
TKN total kjeldahl nitrogen
EC E. coliform

Hydraulic capacity ratings govern community growth related issues to ensure adequate treatment capacity is available and maintained.

Excessive BOD in the final effluent above the receiving waters natural cleansing ability may deplete the water body of its available oxygen supply and result in stagnant conditions.

Effluent high in TP or NH_3 will encourage growth of algae and aquatic plants which may disrupt the natural ecological cycle of the receiving water.

Discharges containing large quantities of TSS may also result in oxygen depletion resulting from **decomposition** of the organic material present in the receiving water.

Inadequate disinfection of a treatment facilities final effluent may result in the discharge of pathogenic bacteria as indicated by FC bacteriological analysis to receiving waters and lead to an outbreak of waterborne disease.

8.0 CONCLUSIONS

To accomplish treatment of wastewater for the City of Guelph on a 24 hours a day, 7 day per week basis is a demanding task. The proactive approach adopted by the city in providing this essential service will ensure the protection of our natural water resources.

To ensure the service requirements of planned future expansion within the city boundaries millions of dollars have been directed towards modernization and expansion of the various treatment facilities. Modernization will incorporate the use of the best available pollution control technology. The future holds exciting challenges in the wastewater treatment field, which must be met to ensure the protection of our environment.

9.0 GLOSSARY OF TERMS

Sludge particles produced by the growth of organisms (including zoogleal bacteria) in aeration tanks in the presence of free dissolved oxygen. The term "activated" comes from the fact that particles are teeming with bacteria, fungi, and protozoa. Activated sludge is different from primary sludge in that sludge particles contain many living organisms which can feed on materials present in the incoming wastewater.

Aerobic
A condition in which free dissolved oxygen is present in the aquatic environment.

Aerobic Bacteria
A bacterium, which lives and reproduces only in an environment containing oxygen which is available for their respiration (breathing). Oxygen combined chemically; such as in water molecules (H_2O) cannot be used for respiration by aerobic bacteria.

Anaerobic Bacteria
Bacteria that do not utilize free dissolved oxygen to survive but derive oxygen from compounds such as sulphate

Biochemical Oxygen Demand (BOD)
The rate at which microorganisms and chemicals use the oxygen in water or wastewater while stabilizing decomposable organic matter under aerobic conditions. In decomposition, organic matter serves as food for the bacteria and energy results from the oxidation.

Chemical Precipitation
Precipitation induced by the addition of chemicals.

Chlorination
The application of chlorine to water or wastewater, generally for the purpose of disinfection.

Coagulation
The use of chemicals that cause very fine particles to clump together into larger particles. This makes it easier to separate the solids from the liquids by settling, skimming, draining or filtering

Colloids
Very small, finely divided solids (particles that do not dissolve) that remain dispersed in a liquid for a long time due to their small size and electrical charge.

Combined Sewer
A sewer designed to carry both sanitary wastewater and storm or surface water runoff.

Decomposition, Decay
Processes that convert unstable materials into more stable forms by chemical or biological action. Waste treatment encourages decay in a controlled situation so that material may be disposed of in a stable form. When organic matter decays under anaerobic conditions (putrefaction), undesirable odours may be produced. Aerobic processes in common use for wastewater treatment produce much less objectionable odours.

Detention Time
The time required to fill a tank at a given flow or the theoretical time required for a given flow of wastewater to pass through a tank.

Digester
A tank in which sludge is placed to allow decomposition by micro-organisms. Digestion may occur under anaerobic (most common) or, aerobic conditions.

Disinfection
The process designed to kill most micro-organisms in wastewater, including essentially all pathogenic (disease-causing) bacteria. There are several ways to disinfect with chlorine being most frequently used in water and wastewater treatment plants.

Effluent
Wastewater or other liquid raw, partially or completely treated flowing from a basin, treatment process, or treatment plant.

Flocculation
The gathering together of fine particles to form larger particles.

Infiltration
The seepage of groundwater into a sewer system, including service connections. Seepage frequently occurs through defective or cracked pipes, pipe joints, connections or access chamber walls.

Inflow
Water discharged into the sewer system from sources other than regular sanitary connections. This includes flow from yard drains, foundation drains and around access covers. Inflow differs from infiltration in that it is a direct discharge into the sewer rather than a leak in the sewer itself.

Influent
Wastewater or other liquid raw or partially treated flowing into a reservoir, basin, treatment process, or treatment plant.

Mixed Liquid
When return activated sludge is mixed with primary effluent or raw wastewater this mixture is referred to as mixed liquor as long as it is in the aeration tank. Mixed liquor also may refer to the contents of mixed aerobic or anaerobic digesters.

Organic Waste
Waste material, which comes mainly from animal or plant, sources. Organic waste generally can be consumed by bacteria and other small organisms. Inorganic wastes are chemical substances of mineral origin.

Oxidation
Oxidation is the addition of oxygen, removal of hydrogen, or the removal of electrons from an element or compound. In wastewater treatment, organic matter is oxidized to more stable forms.

Pathogenic Organisms
Bacteria, viruses or cysts which can cause disease (typhoid, cholera, dysentery).
There are many types of bacteria which do not cause disease and which are not called pathogenic. Many beneficial bacteria are found in wastewater treatment processes actively treating organic wastes.

Precipitate
To separate (a substance) out in solid form from a solution, as by the use of a reagent. The substance is precipitated.

Preliminary Treatment
The removal of metal, rocks, rags, sand, eggshells, and similar materials which may hinder the operation of a treatment plant. Preliminary treatment is accomplished by using equipment such as bar/step screens, comminutors, and grit removal systems.

Primary Treatment
A wastewater treatment process that takes place in a rectangular or circular tank and allows those substances in wastewater that readily settle or float to be separated from the water being treated.

Receiving Water
A stream, river, lake or ocean into which treated or untreated wastewater is discharged.

Rotating Biological Contactors
Secondary biological treatment device consisting of a rotating shaft surrounded by plastic discs called media, which is partially submerged in the wastewater to be treated. A biological slime layer which attaches to the media effects treatment.

Secondary Treatment
A wastewater treatment process used to convert dissolved or suspended materials into a form more readily separated from the water being treated. Usually the process follows primary treatment. The process commonly is a type of biological treatment followed by secondary clarifiers that allows solids to settle out of the water being treated.

Septic
This condition is produced by anerobic bacteria. If severe, the wastewater turns black, gives off foul odours, contains little or no dissolved oxygen and creates a heavy oxygen demand.

Stabilize
To convert to a form that resists change. Organic material is stabilized by bacteria which convert the material to gasses and other relatively inert substances. Stabilized organic material generally will not give off obnoxious odours.

Storm Sewer
A separate sewer that carries runoff from storms; surface drainage, street wash and snow melt and do not include domestic and industrial wastes.

Supernatant
Liquid removed from settled sludge. Supernatant commonly refers to the liquid between the sludge on the bottom and the scum on the surface of an anaerobic digester. This liquid is usually returned to the influent of the treatment plant or to the primary clarifier.

Suspended Solids
Solids that are very small in size and mass which do not readily settle.

Volatile
A volatile substance is one that is capable of being evaporated or changed to a vapour at a relatively low temperature.

Appendix B
Guelph WWTP Capacity Assessment

Guelph WWTP Capacities

Average Flow Condition	54,400 m^3/day
Peak Flow Condition	81,600 m^3/day
Peak Instantaneous Flow	108,430 m^3/day

Plant Flow Split	Plant No. 1	25%	Avg. = 13,600 m3/day	Peak = 20,400 m3/day	Peak Inst. = 27,108 m3/day
	Plant No. 2	20%	Avg. = 10,880 m3/day	Peak = 16,320 m3/day	Peak Inst. = 21,686 m3/day
	Plant No. 3	20%	Avg. = 10,880 m3/day	Peak = 16,320 m3/day	Peak Inst. = 21,686 m3/day
	Plant No. 4	35%	Avg. = 19,040 m3/day	Peak = 28,560 m3/day	Peak Inst. = 37,951 m3/day

Liquid Train

Operation/ Process	Unit Capacity		Design Guideline	Comments
Inlet Sewers	No.	Two (2)		
	Size	1,200 mm, 1,650 mm		
Influent Pumping	No.	Three (3)	Firm Capacity for peak instantaneous flow.	Peak Instantaneous Flow, 108,430 m^3/day < Firm Capacity 130,000 m^3/day .: No Issue.
	Type	Screw		
	Capacity (each)	65,000 m^3/day		
	Total Capacity	195,000 m^3/day		
	Firm Capacity	130,000 m^3/day		
Screening	No.	Three (3)	Firm Capacity for peak instantaneous flow.	Peak Instantaneous Flow, 108,430 m^3/day < Firm Capacity 130,000 m^3/day .: No Issue.
	Type	Bar		
	Width	1,300 mm		
	Capacity (each)	65,000 m^3/day		
	Total Capacity	195,000 m^3/day		
	Firm Capacity	130,000 m^3/day		

Operation/ Process	Unit Capacity		Design Guideline	Comments
Grit Removal	No.	Two (2)	Detention time = 2 to 5 minutes at peak sewage flow rate – the longer retention times provide additional benefit in the form of pre-aeration. (*Source*: MOE Guidelines, 1984, page 8-4.)	Detention time at peak flow conditions = Total Tank Volume, 480 m^3 / Peak Flow, 81,600 m^3/day = 5.8824 * 10^{-3} day = 0.141 hour = 8.47 minutes. .: No Issue.
	Type	Aerated Tanks		
	Tank Volume (each)	240 m^3		Detention time at peak inst. flow conditions = 480 m^3 / 108,431 m^3/day = 4.4 * 10^{-3} day = 0.106 hour = 6.37 minutes. .: No Issue.
	Total Tank Volume	480 m^3		
	Tank Area (each)	60 m^2		
	Total Tank Area	120 m^2		
Primary Clarifiers	No. of Primary Clarifiers	Eight (8)	Typical design information for primary sedimentation tanks (*Source*: Metcalf & Eddy, 4th Ed. 2003, pages 396, 398.)	Overflow Rate (Avg. Flow) = 54,400 m^3/day / 2,444 m^2 = 22.3 m^3/m^2•day .: Low but No Issue.
	Total SA of all the Primary Clarifiers	2,444 m^2		Overflow Rate (Peak Inst. Flow) = 108,430 m^3/day / 2,444 m^2 = 44.4 m^3/m^2•day .: Low but No Issue.
	Plant No. 1		Hydraulic Retention Time, HRT (hours): Range = 1.5 – 2.5, Typical = 2.0.	Plant No. 1
	No. of Tanks	Two (2)		Overflow Rate (Avg. Flow) = 13,600 m^3/day / 732 m^2 = 18.6 m^3/m^2•day .: Low but No Issue.Overflow Rate (Peak Flow) = 27,108 m^3/day / 732 m^2 = 37.0 m^3/m^2•day .: Low but No Issue.
	Surface area of each tank	366 m^2	Overflow Rate, Average Flow (m^3/m^2•day): Range = 30-50, Typical = 40	
	Total Plant No. 1 SA	732 m^2		
	Plant No. 2		Overflow Rate, Peak Hourly (m^3/m^2•day): Range = 80-120, Typical = 100	Plant No. 2
	No. of Tanks	Two (2)		Overflow Rate (Avg. Flow) = 10,880 m^3/day / 571 m^2 = 19.1 m^3/m^2•day .: Low but No Issue.
	SA of each Tank	286 m^2		
	Total Plant No. 2 SA	571 m^2		Overflow Rate (Peak Flow) = 21,686 m^3/day / 571 m^2 = 38.0 m^3/m^2•day .: Low but No Issue.
	Plant No. 3			Plant No. 3
	No. of Tanks	Two (2)		Overflow Rate (Avg. Flow) = 10,880 m^3/day / 541 m^2 = 20.1 m^3/m^2•day .: Low but No Issue.
	SA of each Tank	271 m^2		
	Total Plant No. 3 SA	541 m^2		Overflow Rate (Peak Flow) = 21,686 m^3/day / 541 m^2 = 40.1 m^3/m^2•day .: Low but No Issue.
	Plant No. 4			Plant No. 4
	No. of Tanks	Two (2)		Overflow Rate (Avg. Flow) = 19,040 m^3/day / 600 m^2 = 31.7 m^3/m^2•day .: No Issue.
	SA of each Tank	300 m^2		
	Total Plant No. 4 SA	600 m^2		Overflow Rate (Peak Flow) = 37,951 m^3/day / 600 m^2 = 63.3 m^3/m^2•day .: Low but No Issue.

Operation/ Process	Unit Capacity		Design Guideline	Comments
Aeration Tanks	No. of Aeration Tanks	Eight (8)	Aeration System Design Parameters (Treatment Process: Conventional Activated Sludge) (*Source*: MOE Guidelines, 1984, page 10-5.) Minimum Detention Time (hours, based on average flow conditions) = Six (6)	Detention Time = 26,402 m^3/ 54,400 m^3/day = 0.4853 day = 11.6 hours .: No Issue.
	Total Volume of all the Aeration Tanks	26,402 m^3		
	Plant No. 1			Plant No. 1 Detention Time = 4,346 m^3/ 13,600 m^3/day = 0.3196 day = 7.7 hours .: No Issue.
	No. of Tanks	Two (2)		
	Volume (each)	2,173 m^3		
	Total Volume	4,346 m^3		
	No. of Diffusers	2,675		
	Plant No. 2			Plant No. 2 Detention Time = 4,980 m^3/ 10,880 m^3/day = 0.4577 day = 11.0 hours .: No Issue.
	No. of Tanks	Two (2)		
	Volume (each)	2,490 m^3		
	Total Volume	4,980 m^3		
	No. of Diffusers	2,173		
	Plant No. 3			Plant No. 3 Detention Time = 4,076 m^3/ 10,880 m^3/day = 0.3746 day = 9.0 hours .: No Issue.
	No. of Tanks	Two (2)		
	Volume (each)	2,038 m^3		
	Total Volume	4,076 m^3		
	No. of Diffusers	2,173		
	Plant No. 4			Plant No. 4 Detention Time = 6,500 m^3/ 19,040 m^3/day = 0.3414 day = 8.2 hours .: No Issue.
	No. of Tanks	Two (2)		
	Volume (each)	6,500 m^3		
	Total Volume	13,000 m^3		
	No. of Diffusers	3,000		
Aeration Tank Blowers	Plant No. 1		Aeration Mixing Requirements (Diffused, Fine Bubble, Full Floor Coverage for uniform MLSS levels) (*Source*: MOE Guidelines, 1984, page	Plant No. 1
	No. of Blowers	Two (2)		Tank dimensions (each) = 30.0 m long, 15.75 m wide, 4.6 m SWD. CS Area of Tanks = 2*30m*15.75m = 945 m^2

Operation/ Process	Unit Capacity		Design Guideline	Comments
	Capacity (each)	7,646 Sm^3/hour	10-6.) Requirement = 0.61 $L/m^2 \bullet s$ (i.e. Volume of air per second per horizontal cross-sectional area of aeration tank)	Mixing Capability = 7,646 Sm^3/hour / 945 m^2 = 8.09 $m^3/m^2 \bullet$hour = 2.25 $L/m^2 \bullet s$.: Much more air available than required to meet the mixing requirement. No Issue.
	Plants No. 2 and 3			
	No. of Blowers	Three (3)		
	Capacity (each)	5,076 Sm^3/hour		
	Plant No. 4			Plant No. 4
	No. of Blowers	Two (2)		Tank dimensions (each) = 64.7 m long, 21.7 m wide, 4.4 m SWD. CS Area of Tanks = 2*64.7m*21.7m = 2,808 m^2
	Capacity (No. 1)	7,646 Sm^3/hour		
	Capacity (No. 2)	10,100 Sm^3/hour		Mixing Capability = 10,100 Sm^3/hour / 2,808 m^2 = 3.6 $m^3/m^2 \bullet$hour = 1 $L/m^2 \bullet s$.: More air available than required to meet the mixing requirement. No Issue.
Final Settling Tanks (Secondary Clarifiers)	Total Surface Area of the Secondary Clarifiers	3,545 m^2	Typical design information for secondary clarifiers for the activated-sludge process (*Source*: Metcalf & Eddy, 4th Ed. 2003, pages 396, 398.) Overflow Rate, Average Flow ($m^3/m^2 \bullet$day): Range = 16-28 Overflow Rate, Peak Flow ($m^3/m^2 \bullet$day): Range = 40-64 Surface Loading rate should not exceed 120 kg/m^2day (need to cite reference)	Overflow Rate (Avg. Flow) = 54,400 m^3/day / 3,545 m^2 = 15.3 $m^3/m^2 \bullet$day .: No Issue. Overflow Rate (Peak Inst. Flow) = 108,431 m^3/day / 3,545 m^2 = 30.6 $m^3/m^2 \bullet$day .: No Issue. Solids Loading Rate (Avg. Flow) = 82 kg/ $m^2 \bullet$day:No Issue* Solids Loading Rate (Peak Inst. Flow) = 107 kg/ $m^2 \bullet$day :No Issue
	Plant No. 1			Plant No. 1
	No. of Tanks	Two (2)		Overflow Rate (Avg. Flow) = 13,600 m^3/day / 1,125 m^2 = 12.1 $m^3/m^2 \bullet$day .: No Issue.
	SA of each Tank	563 m^2		
	Total Plant No. 1 SA	1,125 m^2		Overflow Rate (Peak Flow) = 27,108 m^3/day / 1,125 m^2 = 24.1 $m^3/m^2 \bullet$day .: No Issue. Solids Loading Rate (Avg. Flow) = 71 kg/ $m^2 \bullet$day:No Issue*

Operation/ Process	Unit Capacity		Design Guideline	Comments
				Solids Loading Rate (Peak Inst. Flow) = 102 kg/ m^2•day :No Issue
	Plant No. 2			<u>Plant No. 2</u>
	No. of Tanks	Two (2)		Overflow Rate (Avg. Flow) = 10,880 m^3/day / 542 m^2 = 20.1 m^3/m^2•day .: No Issue.
	SA of each Tank	271 m^2		Overflow Rate (Peak Flow) = 21,686 m^3/day / 542 m^2 = 40.0 m^3/m^2•day .: No Issue.
	Total Plant No. 2 SA	542 m^2		Solids Loading Rate (Avg. Flow) = 96 m^2•day:No Issue*
				Solids Loading Rate (Peak Inst. Flow) = 120 kg m^2•day :During peak flow conditions the clarifier for Plant no. 2 reaches design solids loading rates
	Plant No. 3			<u>Plant No. 3</u>
	No. of Tanks	Two (2)		Overflow Rate (Avg. Flow) = 10,880 m^3/day / 678 m^2 = 16.0 m^3/m^2•day .: No Issue.
	SA of each Tank	339 m^2		Overflow Rate (Peak Flow) = 21,686 m^3/day / 678 m^2 = 32.0 m^3/m^2•day .: No Issue.
	Total Plant No. 3 SA	678 m^2		Solids Loading Rate (Avg. Flow) = 76 kg/ m^2•day:No Issue*
				Solids Loading Rate (Peak Inst. Flow) = 96 kg/ m^2•day :No Issue
	Plant No. 4			<u>Plant No. 4</u>
	No. of Tanks	Two (2)		Overflow Rate (Avg. Flow) = 19,040 m^3/day / 1,200 m^2 = 15.9 m^3/m^2•day .: No Issue.
	SA of each Tank	600 m^2		Overflow Rate (Peak Flow) = 37,951 m^3/day / 1,200 m^2 = 31.6 m^3/m^2•day .: No Issue.
	Total Plant No. 4 SA	1,200 m^2		Solids Loading Rate (Avg. Flow) = 89 kg/ m^2•day:No Issue*
				Solids Loading Rate (Peak Inst. Flow) = 112 kg/ m^2•day :No Issue
Rotating Biological Contactors	No. of Rotating Biological Contactor Tanks	Four (4)	Typical design information for rotating biological contactors (*Source*: Metcalf & Eddy, 4th Ed. 2003,	Hydraulic Loading = 54,400 m^3/day / 440,000 m^2 = 0.124 m^3/m^2•day

Operation/ Process	Unit Capacity		Design Guideline	Comments
(RBCs)	No. of Contactors per Tank	Eight (8)	page 933.)	Hydraulic Retention Time = 2,028 m^3 / 54,400 m^3/day = 0.037 day = 0.89 hour
	Total no. of Contactors	Thirty-two (32)	Treatment Level: BOD removal and nitrification	.: The RBCs are undersized based on the typical design parameters provided in Metcalf & Eddy. However, it should be noted that it is intended that upstream nitrification is being integrated into the Stage 2 expansion or as part of the plant optimization.
	Tank Volume (each)	507 m^3	Hydraulic Loading = 0.03-0.08 m^3/m^2•day	
	Total Volume	2,028 m^3	Hydraulic Retention Time = 1.5-4 hours	
	Media area per contactor	13,750 m^2	Treatment Level: Separate nitrification	
	Media area per tank	110,000 m^2	Hydraulic Loading = 0.04-0.10 m^3/m^2•day	
	Total media area	440,000 m^2	Hydraulic Retention Time = 1.2-3 hours	
	Blowers			
	No. of Blowers	Three (3)		
	Type	Centrifugal		
	Capacity (each)	5.1 Nm^3/hour		
	Firm Capacity	10.3 Nm^3/hour		
Tertiary Filters	Filters Installed in 2000		"There are various types of effluent filtration systems which are available including: single, dual and mixed-media systems; shallow and deep bed systems; upflow and downflow filters; gravity and pressure systems; continuous and discontinuous operation filters, slow sand filters, etc. Due to the significant differences between the various pieces of equipment, it is impossible to fully cover all parameters in these guidelines." (*Source*: MOE Guidelines, 1984, page 13-1.)	
	No.	Two (2)		
	Type	Low Head		
	Area (each)	170 m^2		
	Previous Existing Filters			
	No.	Two (2)		
	Type	Low Head		
	Area (each)	263 m^2		
Chlorination	Chlorine Contact Tank		Disinfection: Hydraulic Retention Time (HRT) at average flow conditions, greater than thirty (30) minutes. HRT at peak flow conditions, greater than fifteen (15) minutes.	HRT (average flow) = 1,100 m^3/ 54,400 m^3/day = 0.0202 day = 0.4852 hours = 29.1 minutes.
	Type	Four (4) pass rectangular		HRT (peak flow) = 1,100 m^3/ 81,600 m^3/day = 0.0135 day = 0.3235 hours = 19.41 minutes.
	Volume	1,100 m^3		Meets design conditions under peak flow conditions but is

Operation/ Process	Unit Capacity	Design Guideline	Comments
			slightly below the design target during average flow conditions. *Note that chlorine is added upstream of the tertiary filters, which extends the hydraulic retention time for disinfection. Assuming a combined volume of approximately 400 m^3 for the filters and associated channels (based on a filter depth of 1 m and 50% of volume occupied by media, and an additional 50m^3 for associated channels upstream and downstream of filters) this results in a recalculation of the HRTs as follows: HRT (average flow) = 1,500 m^3/ 54,400 m^3/day = 0.0276 day = 0.66 hours = 39.7 minutes. HRT (peak flow) = 1,500 m^3/ 81,600 m^3/day = 0.0184 day = 0.441 hours = 26.47 minutes.

* Solids loading rate calculated using CH2M HILL's Pro2D model

Solids Train

Operation/ Process	Unit Capacity		Design Guideline	Comments
Primary Digestion	Four (4) @ 2,440m^3 each	9,760 m^3	15 day HRT (MOE Guidelines, 1984)	*HRT = 21 days *Assumes 100% of volume is available and digesters are cleaned out.
Secondary Digestion	One (1)	2,350 m^3	No standard requirement, secondary digestion is a site specific objective	5.2 days
Dewatering	BFP 1 – 9 L/s (12)** BFP 2 - 9 L/s (12) BFP 3 – 6.3 L/s (9.5) BFP 3 – 6.3 L/s (9.5)	30.6 L/s	Dewatering operations occur 5 days per week, daily operations not to exceed 24 hours per operating day.	Digested flow to dewatering = 518 m^3/d = 3,626 m^3/week Flow per day (5 days operating) = 725.2 m^3 = 725,200 L Operation time = 725,200L/30.6 L/s = 6.6 h No issue

* HRT for digesters calculated as part of Digester Capacity Expansion Pre-Design (CH2M HILL, 2006)
** Numbers in brackets represent the installed capacity, actual operating capacity was used for calculations

Appendix C
Sewer Use By-Law Review

City of Guelph Sewer Use By-Law Review

PREPARED FOR: City of Guelph

PREPARED BY: CH2M HILL

DATE: August 14, 2007

The ob jective of this memorandum is to examine the City's current Sewer Use By-Law. The review includes an examination of the overall organization and content of the by-law and recommendations for additional information to be included.

City of Guelph Sewer Use By-Law Review

Overview

By-law Number (1996)-15202, enacted by the Corporation of the City of Guelph on July 16, 1996, and repealing By-law (1991)-13792 is a comprehensive by-law covering all aspects of sewer use control.

The overall **objectives** of the Guelph Sewer Use By-law can be identified as follows:

A. To prevent the introduction of pollutants into the Guelph WWTP that will interfere with its operation;

B. To prevent the introduction of pollutants into the Guelph Sewage Works that will pass through the WWTP inadequately treated, into receiving waters, or otherwise be incompatible with the WWTP;

C. To protect both Guelph Sewage Works personnel and the general public who may be affected by wastewater or residuals from the treatment of pollutants introduced into the sewer system;

D. To not impair the ability to reuse and recycle treated wastewater and residuals from the treatment of wastewater;

E. To provide for fees for the equitable distribution of the cost of operation, maintenance, and improvement of the Guelph Sewage Works; and

F. To enable the City of Guelph to comply with the conditions of its Certificate of Approval for Sewage Works, residual use and disposal requirements, and any other Federal or Provincial regulations to which the Guelph WWTP is subject.

The By-law shall apply to all Users of the Guelph Sewage Works. The By-law authorizes the issuance of individual wastewater discharge approvals; provides for monitoring, compliance, and enforcement activities; establishes administrative review procedures; requires User reporting; and provides for the setting of fees for the equitable distribution of costs resulting from the program established herein.

As it now exists, the City of Guelph By-law Number (1996)-15202 includes:

- The control of discharges of conventional and metal contaminants and toxic and hazardous substances to sanitary and storm sewers;
- Waste Survey reporting requirements;
- Overstrength Surcharge Compliance Agreements;
- Sampling and Analysis; and
- Spill control and reporting requirements.

The By-law also covers:

- The requirements for the preparation of Best Management Practices (BMP) Plans;
- Hauled Sewage Discharge Permit; and
- General and Specific Reporting Requirements for industrial dischargers.

Recommendations

We suggest some changes to the By-law based on other more recently updated Canadian sewer use by-laws (e.g. City of Ottawa, City of Toronto, Ontario Draft Model (1998), as follows:

1. Provision of a Table of Contents in the By-law to allow improved reader access.
2. Reorganization of the section Discharges To Sanitary Sewers to separate out Prohibited Substances from Restricted Substances. Expansion of the subsection on Restricted Substances to include organic compounds of concern to the environment, and where data exists, including organochlorines, endocrine disrupting substances and pharmaceuticals and those parameters which could impede the effective operation of the Wastwater Treatment Plant (WWTP), or adversely impact the effluents from the WWTP and/or the biosolids and other residuals resulting from the treatment of wastewater. We note that the City of Toronto By-law (2000) includes concentration limits for some 27 organic contaminants, while the City of Ottawa By-law (2003) includes concentration limits for some 53 organic contaminants. This list of Restricted Substances would be better located in a table for easier reference.

   This list of Restricted Substances should include parameters drawn from the Canadian Environmental Protection Act (CEPA) Schedule 1 Toxic Substances List or from the National Pollutants Release Inventory (NPRI) Appendix 1 _ NPRI Substances List for 2004 specific to Guelph's sewerage system. Concentration limits for these parameters can be based upon USEPA Best Available Treatment Technology limits and/or a review of other by-laws and relevant literature.

Prior to deciding which parameters should be included for control in an updated Guelph Sewer Use By-law, it is recommended that detailed sampling and complete characterization of the raw sewage quality should be carried out to identify parameters of concern specific to Guelph's sewerage system.

As mentioned above, there are several lists of organic compounds of concern that can be used as background information in preparing a specific list of Restricted Substances for Guelph's updated sewer use by-law. However, it ouwld be best if that list of Restricted Substances could be tailored to Guelph's demographics. Many of these compounds are found in everyday household products and are common to most municipal sewer systems. However, others are specific to a particular class of industries and their presence in the Guelph sewer system is dependent upon whether or not that particular industrial class is located in Guelph.

"Table 1 — Limits for Sanitary and Combined Sewers Discharge" copied from the City of Toronto's sewer use by-law is presented in Appendix A as an example list of Restricted Substances.

3. Reorganization of the section on Discharges to Storm Sewers to separate out Prohibited Substances and Restricted Substances. Expansion of the subsection on Restricted Substances to include organic contaminants of prime concern to the aquatic environment. The City of Toronto By-law (2000) may be used as a reference for establishing such parameters and concentrations. This list of Restricted Substances would also be better located in a table for easier reference. This section should also be reviewed to ensure that it is not contradicting with current provincial of federal regulations for aquatic protection. One option for this section would be to reference pertinent regulations within the By-law instead of quantified contaminant values.

4. Expansion and separate listing of surchargeable parameters for inclusion in Overstrength Surcharge Compliance Agreements. Surchargeable parameters are limited to those parameters for which the wastewater treatment processes are designed to effectively degrade or remove. The surchargeable parameters in Guelph's By-law Number (1996)-15202 are limited to: solvent extractable matter of mineral or synthetic origin; biochemical oxygen demand; and phosphorus. Other parameters that could be considered for inclusion as surchargeable include total suspended solids, total Kjeldahl nitrogen and phenolics. Based on a review of current by-laws there did not appear to be any that accept overstrength of ammonia or chlorides.

5. Review the section on Spill Control and Reporting. Consider sample wording included from the City of Vancouver's By-law found in Appendix B. Consideration should also be given to referencing compliance provincial and federal regulations in regards to spills to the natural environment.

6. The addition of a section requiring the installation of dental amalgam separators in dental offices. See Appendix C for sample wording from the City of Ottawa's Sewer Use By-law.

7. Completion of a thorough review of all fees and charges for sewer use to ensure a full cost recovery sewer rate structure with consideration of increasing block rates to encourage waste reduction.

8. The inclusion of a section on Flood/Overflow Control which would allow City staff to enter premises without notice for inspections, removal of blockages, maintenance, etc.

   The City should have the authority to enter private property in cases of flooding caused by something within that property boundary. There may also be storm sewer back flow prevention gates located on or accessible through private property which may require access.

9. The inclusion of a section of Control of Discharges from wells and rivers to Sanitary Sewers.

   There may be some industries which have private wells or which draw river water and then discharge that water after use, to the sewer system. Sample wording to this effect has been included from the City of Vancouver's Sewer Use By-law in Appendix D.

10. Expansion of the sections on Offences and Penalties including a new section on Enforcement Procedures which would relate on the procedures the City would follow in identifying, inspecting and in further investigating an offense prior to laying charges against that offense. If the City has a separate enformcement policy, that policy should be appropriately referenced in the By-law.

11. The City may also want to include a provision in the By-law which would allow and set out a procedure to recognize significant industrial users of the sewer system that have maintained an excellent record of compliance with rules and regulations for the previous calendar year. An example of such an award system is that of King County, Washington, where Winners receive their awards in April during King County Earth Month. Every other year the program's EnvirOvation Award winners are eligible to be nominated for a King County Green Globe Award.

12. The current By-law does not distinguish between inspections and investigations. A clarification of these terms and determination of proper usage within the By-law should be defined to ensure the City has proper enforcement capabilities.

US EPA Model Sewer Use-Ordinance

The USEPA Model Sewer Use Ordinance defers heavily to the categorical Pretreatment Standards and therefore has limited direct application to Ontario municipalities as no such Pretreatment Standards apply in Ontario legislation. The General Pretreatment Regulations identify specific pretreatment requirements of all industries which discharge to Publically Owned Treatment Works, and the Ordinance requires all municipalities to enforce such pretreatment requirements. In Canada, the practice is for municipalities to develop sewer use by-laws and programs which specify what industries are allowed to discharge to the publically owned sewage works, but leave it up to the incividual industries to determine how they are going to comply with the by-law.

CCME Draft Proposed Model Sewer Use By-law

The CCME Draft Proposed Model Sewer Use By-law is identified as a component or tool of CCME's proposed Canada-wide Strategy for the Management of Municipal Wastewater Effluent. "The strategy is being designed to apply to wastewater, from its source to the effluent released at the end of the discharge pipe. It would also address overflows from sanitary sewers and from sewers that combine sanitary waste and storm water (combined sewers). It would not address storm water discharged separate from a sanitary sewer system, nor would it address septic tanks."

The CCME recognizes that meeting the strategy will require long-term strategic planning and therefore it "proposes options for phasing the components over time". One option considered would not result in its application to low risk facilities for up to 20 to 30 years, "at a cost of between $8 and $13 billion". CCME admits that "successful implementation of the strategy would be dependent on an economic plan that includes sustainable funding".

The Draft Proposed Model Sewer Use By-law is considered as one of the "specific **source control activities** for environmental risk management". The objectives of the Draft Proposed Model Sewer Use By-law are to:

- Protect municipal staff and infrastructure
- Enable optimum wastewater system efficiency and use
- Prevent stormwater and clean water from entering the system
- Protect wastewater biosolids quality
- Protect the public and property
- Protect the environment

Development of the draft model was based upon several by-laws and model by-laws including the Model By-laws of Nova Scotia and Ontario, and the sewer use by-laws of several municipalities. It is prepared in 2 modules: Module 1 for communities that are primarily residential, and; Module 2 which outlines for industrial sewer use controls.

The CCME Draft Proposed Model Sewer Use By-law can certainly be considered as another effective reference and guidance tool should Guelph wish to update its Sewer Use By-Law.

Next Steps

It is recommended that the City of Guelph review their current by-law to ensure that it is consistent with current standards for Sewer Use By-laws.

Suggested Steps for Updating the Sewer Use By-law

1. Ensure that it is consistent with the changes in federal and provincial regulations which require that municipalities look at pollution prevention activities as a means of ensuring that wastewater treatment plant effluents meet receiving water requirements. Council and department policies must be aligned to ensure that activities around wastewater management are not in conflict. Consider the comments identified in this technical memorandum.
2. Ensure that the City's Enforcement By-law, currently in final stages of development, is referenced in the Sewer Use By-law once it has been endorsed by council.
3. Conduct a detailed review of all available information on the mature of industries and commercial establishments located in Guelph. This could include:

- Scott's or NAICS Indexes
- CEPA Schedule 1 Toxic Substances List
- NPRI Appendix 1 _ NPRI Substances List for 2004 specific to Guelph's sewerage system
- PWQOs
- City industrial compliance monitoring data
- WWTP influent, effluent and sludge analytical data (e.g. update of the Priority Pollutant Survey completed under COA)

4. Develop to the extent possible a list of control parameters specifically applicable to the City of Guelph.

5. Develop a comprehensive sewer use policy, bylaw and regulatory framework for the City of Guelph, through a detailed review of best practices in sewer-use control, and of recently updated, progressive sewer use bylaws from across North America. Recent changes in the approach to controlling discharges to the sewer system place greater emphasis on preventing than on treating certain contaminants. This applies to the quality of the discharges as well as to mass loading.

6. Review the costs of providing sewer use control services to ensure that the costs are fairly applied and that all users are paying their fair share. All who discharge to the system are stakeholders, and the City will have to decide how to engage the various stakeholders in the discussion around any proposed changes. Meaningful dialogue with the various stakeholders will be essential as the new/revised policies, regulatory framework and bylaw are developed.

7. It is suggested that the update of the By-law be carried out in two phases. The first phase would include developing draft policy requirements, proposed changes to the discharge parameters and control limits, preparing a revised regulatory approach for the various sectors, and discussing the changes with City staff to agree upon a method of communicating these changes to the stakeholders. In the second phase, after the stakeholders' input has been received, prepare a draft policy and regulatory approach, and revised sewer use bylaw with the City. The final report will incorporate the City's input, and will include a draft bylaw and implementation plan.

Appendix A
Sample List of Restricted Discharges
City of Toronto Sewer Use By-law

Taken from City of Toronto Sewer Use By-law No. 855-2002

Table 1 — Limits for Sanitary and Combined Sewers Discharge
[Amended 2002-10-31 by By-law No. 855-2002]
Parameter Limit (mg/L)

Biochemical oxygen demand 300	Chromium (total) 4
Benzene 0.01	Bis (2-ethylhexyl) Phthalate -0.012
Cyanide (total) 2	Cobalt (total) 5
Chloroform 0.04	Nonylphenols 0.02
Fluoride 10	Copper (total) 2
1,2-dichlorobenzene 0.05	Nonylphenol ethoxylates 0.2
Total Kjeldahl Nitrogen 100	Lead (total) 1
1,4-dichlorobenzene 0.08	Aldrin/dieldrin 0.0002
Oil and grease — animal and vegetable 150	Manganese (total) 5
Cis-1,2-dichloroethylene 4	Chlordane 0.1
Oil and grease — mineral and synthetic 15	Mercury (total) 0.01
Trans-1,3-Dichloropropylene - 0.14	DDT 0.0001
Phenolics (4AAP) 1.0	Molybdenum (total) 5
Ethyl benzene 0.16	Hexachlorobenzene 0.0001
Phosphorus (total) 10	Nickel (total) 2
Methylene chloride 2	Mirex 0.1
Suspended solids (total) 350	Selenium (total) 1
1,1,2,2-tetrachloroethane 1.4	PCBs 0.001
Aluminum (total) 50	Silver (total) 5
Tetrachloroethylene 1	3,3'-dichlorobenzidine 0.002
Antimony (total) 5	Tin (total) 5
Toluene 0.016	Hexachlorocyclohexane 0.1
Arsenic (total) 1	Titanium (total) 5
Trichloroethylene 0.4	Pentachlorophenol 0.005
Cadmium (total) 0.7	Zinc (total) 2
Xylenes (total) 1.4	Total PAHs 0.005
Chromium (hexavalent) 2	
Di-n-butyl phthalate 0.08	

Appendix B
Sample Accidental Discharge Wording
City of Vancouver Sewer Use By-law

Note: From City of Vacouver Sewer Use By-law No. 8093

ACCIDENTAL DISCHARGES

(1) A person who accidentally discharges prohibited substances into a public or private sewerage system, storm drainage system or watercourse must report the incident to the Inspector or the City Engineer.

(2) Any person handling or storing chemicals, chemical wastes or substances or materials identified in Section 3.3 must

(a) handle or store them in such a manner as to prevent the leakage or discharge of these chemicals, substances or materials from entering the sewerage system, drainage system, waterways or onto any land that will run, drain, seep or otherwise be discharged into the sewerage system, drainage system or any waterway,

(b) when required by the Inspector or the Fire Chief, construct containment barriers of sufficient height to contain the volume of material stored in the largest tank and of a type and design approved by the Inspector or the Fire Chief, - 17 –

(c) when required by the Inspector, install a shut-off valve on the outlet of the storm sump so that in an emergency the escape of prohibited wastes can be prevented from entering the sewerage or drainage systems, and

(d) in the event of a spill, turn off the shut-off valve on the outlet of the storm sump to prevent the escape of prohibited wastes into the sewer.

Appendix C
Sample Dental Amalgam Limits
City of Ottawa Sewer Use By-law

From City of Ottawa Sewer Use By-law No. 2003-514

DENTAL WASTE AMALGAM SEPARATOR

16. (1) The owner or operator of any premises in which dentistry is practiced, shall install, operate and properly maintain a certified amalgam separator on all fixtures to prevent the release of dental amalgam directly or indirectly to a sewer by no later than January 1, 2005, except where:

(a) The dental practice consists only of one of the following dental specialties, as defined in the Canada-wide Standard on Mercury for Dental Amalgam Waste:

(i) Orthodontics and Dentofacial Orthopedics;

(ii) Oral and Maxillofacial Surgery;

(iii) Oral Medicine and Pathology;

(iv) Oral and Maxillofacial Radiology;

(v) Periodontics; or

(b) The dental practice consists solely of visits by a mobile dental practitioner who prevents any dental amalgam from being released directly or indirectly to the sewage works.

(2) Despite subsection (1), any person operating a business from which dental amalgam is or will be discharged directly or indirectly to a sewer, at premises which are constructed or substantially renovated on or after the date that this by-law comes into force, shall install, operate and properly maintain dental amalgam separator(s) in any piping system which is connected directly or indirectly to a sewer.

Appendix D
Sample Discharge to Sanitary from Wells/Private Water
City of Vancouver Sewer Use By-law

From City of Vancouver Sewer Use By-law No. 8093

PRIVATE WELL/GROUNDWATER SYSTEMS

(1) City Engineer to Measure or Estimate Discharge Volumes

For each property which is served partially or exclusively by a private well, groundwater or other source of water separate from the City-owned water service pipe, and is connected directly or indirectly to a public sewer connection, the owner and occupier will pay on account of the wastewater discharged into the public sewer connection from such sources of water (and in addition to any other rates payable pursuant to this By-law or *Water Works By-law*), the Metered Property Rate set out in Part V of Schedule A of this By-law for each unit of wastewater discharged into the public sewer connection.

(2) City Engineer to Measure/Estimate

The City Engineer will measure or estimate the volume of wastewater discharged over each relevant interval for the purposes of determining the rate payable pursuant to this Section 7.4 and in such manner as the City Engineer deems appropriate.

(3) Metered Property Rates Apply

Subject to Sentence (4), the rates payable pursuant to Sentence (1) will be pro-rated, adjusted, paid, entered on the tax roll and be subject to late payment fees in the same manner as the meter rates payable pursuant to Section 7.3.

(4) City Engineer May Require Information/Meter Installation

Despite Sentence (3), the City Engineer may at any time

(a) using an Inspector, inspect the property and documentation of the owner and occupier as required to permit the City Engineer to measure or estimate the type and volume of wastewater discharged from the property,

(b) require the owner and occupier to submit a technical substantiation report certified by a Professional Engineer substantiating the type and volume of wastewater discharged from the property, and

(c) require the owner and occupier to install either or both an effluent meter on the public sewer connection or a water meter on the water service pipe and in any case on such terms and conditions as the Inspector or City Engineer may order,

and the City Engineer may utilize all or any combination of the information obtained pursuant to Clauses (a), (b) and (c) to measure or estimate the type and volume of wastewater discharged from the property.

Appendix D
Wastewater Reuse

Existing Water Reuse Guidelines

Table 1 summarizes the range of quality requirements as published in the US EPA *Guideline for Water Reuse* (EPA, 2004).

TABLE 1
Existing U.S. Water Reuse Guidelines

Application	Guidelines
Unrestricted urban reuse	Treatment – Secondary, filtration, disinfection BOD_5 – 5 – 30 mg/L TSS – 5 – 30 mg/L Turbidity – 2 NTU (avg) Fecal Coliform – ND – 20/100 mL (avg)
Restricted urban reuse	Treatment – Secondary, filtration, disinfection BOD_5 – 20 – 30 mg/L TSS - 5 – 30 mg/L Turbidity – 2 – 3 NTU (avg) Fecal Coliform - 23 – 200/100 mL (avg)
Agricultural food crops	Treatment – Secondary, filtration, disinfection BOD_5 – 5 – 30 mg/L TSS – 5 – 30 mg/L Turbidity – 2 – 3 NTU (avg) Fecal Coliform – ND – 200/100 mL (avg)
Agricultural non-food crops	Treatment – Secondary, filtration, disinfection BOD_5 – 5 – 30 mg/L TSS – 20 – 30 mg/L Turbidity – 2 – 3 NTU (avg) Fecal Coliform – 2.2 – 200/100 mL (avg)
Unrestricted recreational use[1]	Treatment – Secondary, filtration, disinfection BOD_5 – 5 – 30 mg/L TSS – 30 mg/L Turbidity – 2 – 3 NTU (avg) Fecal Coliform -2.2 – 20/100 mL (avg)
Restricted recreational use	Treatment – Secondary, filtration, disinfection BOD_5 – 20 – 30 mg/L TSS – 30 mg/L Turbidity – 2 NTU (avg) Fecal Coliform – ND – 200/100 mL
Environmental reuse[1]	Treatment – Secondary, filtration, disinfection BOD_5 – 5 – 20 mg/L TSS - 5 – 20 mg/L Total Ammonia – 2 mg/L Fecal Coliform -2.2/100 mL Total Phosporus – 1 mg/L
Industrial reuse[1]	Treatment – Secondary, filtration, disinfection BOD_5 – 20 mg/L TSS – 20 mg/L Turbidity - 3 NTU Fecal Coliform -23 – 200/100 mL
Groundwater recharge[1]	Treatment – Secondary, filtration, disinfection BOD_5 – 5

Application	Guidelines
	TSS – 5 - 10 mg/L Turbidity - 2 NTU (avg) Total Coliform -2.2/100 mL (avg) Total Nitrogen – 12 mg/L
Indirect potable reuse[1]	Treatment – advanced treatment, filtration, reverse osmosis, disinfection BOD_5 – 5 – 20 mg/L TSS – 5 mg/L Turbidity – 0.1 NTU Total Coliform – ND – 1/100 mL (avg) Total Nitrogen – 10 mg/L TOC – 10 mg/L (avg)

ND – non-detect
[1]In a number of states with water reuse guidelines, these reuse applications are not regulated

Reclaimed Wastewater Reuse in the City of Guelph: A Feasibility and Implementation Study

Executive Summary

The efficient and sustainable management of available water resources is critical in maintaining the quality and quantity for our water supplies. The City of Guelph relies solely on groundwater resources from Arkell Springs and other small wells, which are currently in being stressed. Although the City is currently exploring the addition of new water supply sources to support increasing demand, long-term projections indicate that population growth in the City could jeopardize the water supply unless more innovative reduction measures are established and implemented in the near future. One such measure that has been widely used around the world is the use of treated wastewater effluent. Utilizing small and medium scale reuse projects in the City of Guelph will both decrease the demand on the City's available potable water resources and decrease the amount of wastewater effluent being discharged into the river.

This Final Report examines the feasibility of wastewater reuse for the City of Guelph by providing background information regarding current population growth, watershed health, other jurisdictional practices and regulations, planning practices, and public wellbeing. Furthermore, it explores and evaluates several different water reuse alternatives, which include (1) Municipal works uses; (2) Park/landscape irrigation; (3) construction site dust control; (3) On-Site Wastewater Treatment Plant uses (4) Dual water systems; (5) Groundwater recharge; (6) Golf course irrigation; (7) Industrial applications. In addition, the Report includes an evaluation the City's wastewater quality, the development of regulatory guidelines, a public awareness strategy, and a preliminary financial analysis.

AquaTeam Solutions has identified both short- and long-term uses for the reclaimed wastewater. The short-term uses could be implemented within the next two years, and would account for 0.07 % (54 m^3/d) of the current wastewater discharge. These short-term uses are essential in attracting funding, interest, and awareness for reuse activities in the City of Guelph. The long-term solutions could be implemented within the next twenty years, and would account for 6 % (3,850 m^3/d) of the future wastewater discharge. These quantities represent a conservative estimate of potential reuse applications. With further investigation into industrial uses, and groundwater recharge, the City of Guelph could implement a more extensive strategy.

The current wastewater quality for reuse purposes is sufficient for the uses on areas restricted from the general public. In order to implement the other reuse alternatives that require higher quality wastewater, additional treatment will be required.

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1 INTRODUCTION

Water demand in the City of Guelph is increasing in conjunction with the current population growth and with commercial and industrial development. Furthermore, the cost of providing water is increasing as the City must purchase more land to supplement the stressed groundwater supplies. In recent years, climatic conditions, well interference and water quality influences have reduced the yield of the existing municipal water supply system (City of Guelph Environmental Services, 2003). In order to procure sustainable and managed growth in the City of Guelph, municipal officials must continue to implement innovative water saving practices, in addition to developing and enhancing new and existing water source alternatives.

Kasperson et al (1977) outline several managerial options for addressing water shortage concerns. The first option is to do nothing and suffer the inevitable long-term water shortage. This is not a preferred option since this alternative includes harm to public well-being and eventually the exhaustion of the water supply. The second option is to make better use of existing supplies by reducing water demand and water loss. This can be accomplished by installing water meters and increasing the price of water; options which have been found to persuade consumers to decrease their consumption from between 20 and 50 percent. Water restrictions during times of drought also help to decrease water demand and preserve water supplies. In addition, public education is also imperative to raise awareness of the water supply problems and to promote voluntary reduction in water demand. To mitigate losses of existing water supplies, water saving devices can be implemented in all sectors (residential, commercial, industrial, institutional) to reduce demand. Finally, reducing leakages within distribution systems will also contribute to water conservation (Kasperson et al, 1977).

The final approach outlined by Kasperson et al (1977) to meet future water supply needs is to increase the water supply. This option includes utilizing new surface water or groundwater sources, using better land management practices, cloud seeding, and wastewater reuse (Kasperson et al, 1977). Using treated wastewater for non-potable uses is one option which could significantly alleviate the long-term water shortage problems in the City of Guelph. This report examines the feasibility of reclaimed wastewater reuse in the City of Guelph by providing background information regarding current population growth, public concern, watershed health, and other jurisdictional practices and regulations. Furthermore, it explores and evaluates several different water reuse alternatives and presents an implementation strategy for the City of Guelph.

2 BACKGROUND

2.1 Planning for Reuse

Effective planning for wastewater reuse is not a simple task since it requires several key parties and stakeholders, each with different agendas, to come together for a collective goal. It is an interactive and iterative process that needs to be tailored to specific needs and objectives. Therefore, on a broad scale it is important to first consider the fundamental reasons and objectives for implementing a water reuse project, then to consider the project area, the potential market users of the area, and how to fund the plan. On a more detailed scale, Metcalf & Eddy outline seven important elements for consideration when planning for a reuse facility or system: (1) assessment of wastewater treatment and disposal needs, (2) assessment of water supply and demand, (3) assessment of water supply benefits based on water reuse potential, (4) analysis of reclaimed water market, (5) engineering and economic analyses, (6) implementation plan with financial analysis, and (7) a public information program (2003). A more thorough summary of these elements is included in Appendix C.

A different, yet equally effective approach is offered by Mantovani (2001) who suggests a three stage planning process that includes: (1) Conceptual planning, (2) preliminary feasibility, and (3) facilities planning. The figure on the following page is a detailed view of the process. *AquaTeam Solutions* has utilized several, but not all of these planning elements throughout the study process. Furthermore, many of the initial planning elements described above were included in the agenda and proceedings of the Wastewater Reuse Workshop hosted by the University of Guelph's School of Engineering (January, 2004).

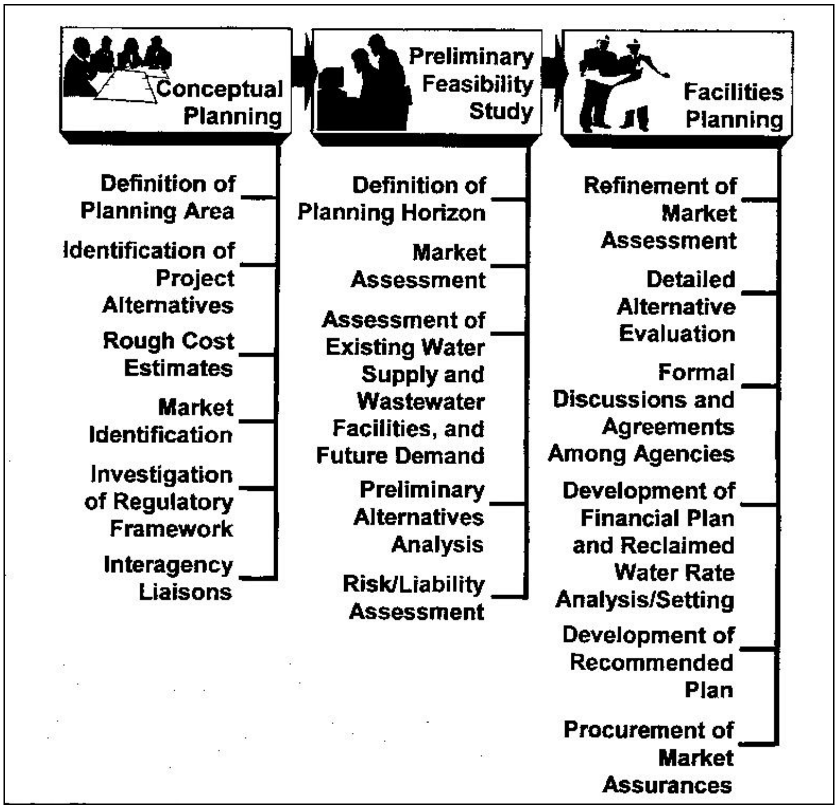

Figure 1: Project Planning Phases

Source: Management Practices for Non-Potable Reuse: Mantovani (2001).

2.2 Population growth and Municipal Works

According to the "City of Guelph Household & Population Projections 2001 – 2027" final report prepared by C.N. Watson and Associates, the population of Guelph will increase at an average rate of 1.72 % (City of Guelph, 2003). Using the 'medium growth scenario', the population is expected to increase from 109,450 to 157,200 persons between 2001 and 2027, while the cumulative population growth rate is expected to decline slightly from 2.18 % to 1.40 % over this same period. However, due to Guelph's proximity to the Golden Horseshoe, and the ever-expanding GTA, the final report suggests that higher growth rates may occur, causing the city's population to swell to 172,620 by the year 2027. Even though the growth rate is expected to decline over the next 27 years, the actual population increase must not be ignored when considering the necessary municipal services required to maintain sustainable urban growth, such as water supply and sewage treatment systems.

The "City of Guelph Official Plan" is a development strategy that provides policy direction for strategic, rather than impulsive, growth in the city. Some of the Plan's main intentions related to municipal services are:

- To guide the direction, location and scale of growth in order to ensure compact, orderly and sustainable development and to minimize the cost of municipal services and related infrastructure.

- To work towards achieving a moderate rate of population growth, which will represent an annual average population increase of 1.5% of the total City population.

- To prohibit fringe development on private services (except on existing lots of record) within the City in order to avoid sprawl, premature municipal servicing and potential negative impacts on the City's water resources and natural heritage features. (City of Guelph, 2003)

In terms of specific municipal service requirements, the Plan also addresses the following:

- The City will promote water protection and conservation through land use planning that maintains and enhances the aquatic ecosystems within and beyond the municipality.

- The City will require that all development proposals be considered in relation to their potential impacts on the quantity and quality of the City's water supply. (City of Guelph, 2003)

The final report further claims that the water supply enhancement strategy, which will include comprehensive water conservation measures, infrastructure rehabilitation, and new supply options, will be able to provide sufficient water capacity for a total population of 164,300 persons (City of Guelph, 2003). These policy measures are positive steps in the right direction; however, Guelph has been facing water supply problems recently. According to the "Guelph Waterworks 2002 Water Quality and Production Report", Guelph produced on average 53,662 m^3/d of drinking water with an additional 60,000 m^3 of water held temporarily in storage reservoirs for fire and peak demands. With the dry weather and drought conditions during the past few summers, daily consumption rose above the actual drought capacity of 63,000 m^3/d. In July 2002, the highest consumption rate recorded was 70,586 m^3/d, resulting in an immediate water ban. The report further states that "long term pumping can not be increased without exceeding the natural rate at which water is returned to the ground by precipitation" (City of Guelph Waterworks, 2003). Thus, it is evident that with the combination of population growth, and limitations on the city's water supply, reduction measures and source protection must be implemented to promote and ensure a sustainable supply for the future.

In terms of wastewater treatment, the City recognizes the adverse effects of discharging the treated wastewater into the Speed River. It is seeking to implement a wastewater treatment strategy that improves "industrial waste management practices, encourages wastewater reduction, and upgrades to the City's wastewater treatment facility to protect and improve the water quality of the Speed River" (City of Guelph, 2003). However, with the imminent population growth, the City's $18 million WWTP expansion is absolutely necessary to sustain up to the projected 137,100 person-capacity (or 64,000 m^3/d). The final report further maintains that with further expansion of the plant, population growth can extend to 154,000 which can treat up to the assimilative limit of the Speed River of 73,000 m^3/day.

2.3 Watershed Health and Water Supply

Any wastewater reclamation and reuse occurring in the City of Guelph will have an impact on the water balance for the surrounding area. Guelph is located in the Grand River watershed, which covers an area of approximately 6,965 km^2 and encompasses several major urban centres including Kitchener, Waterloo, Cambridge, and Brantford (Boyd, 2000). The watershed is under the jurisdiction of the Grand River Conservation Authority (GRCA), which is responsible for maintaining the health of the watershed. The Guelph Wastewater Treatment Plant (WWTP) currently discharges its effluent directly into the Speed River, a significant tributary in the Grand River system. At the point where it receives the effluent, the Speed River has a tributary area of approximately 593 km^2 (Water Survey of Canada, 1966).

The water supply for the City of Guelph is entirely reliant on groundwater. Groundwater extraction wells are located throughout the City; however the majority of the extraction takes place southeast of the City at Arkell Springs. Figure 2 shows the locations of all the extraction wells in the city and also the location of the Arkell Springs aquifer. Any reclaimed water that is reused in the City will clearly reduce the demand on these finite groundwater supplies. As previously mentioned, water usage in the City averages approximately 54,000 m^3/d. A reduction in this amount will increase the amount of groundwater contributing to base flow in the Speed River system. The recent City of Guelph Waterworks Report entitled: "Water Supply Strategy Class Environmental Assessment" identified the following issues and recommendations regarding Guelph's water supply:

- [there is] a gap between available supply and existing and future water demand.

- [Arkell Springs] has additional water supply capacity that is not currently being utilized. Detailed field investigations have confirmed that additional water can be extracted at the Arkell Spring Grounds without significant negative environmental impacts.

- It is recommended that the network of deep bedrock wells utilized in the recent hydrologic testing be recognized as a wellfield with an overall rated capacity of 20 cubic metres per minute. This would be an increase of 6.4 cubic metres per minute to the currently permitted water takings for the existing 3 production wells.

- The recognition of the deep bedrock wells (3 existing and 2 test wells) as a wellfield with a capacity of 20 cubic metres per minute will increase the City's available water supply by 9,200 cubic metres per day. This will greatly assist in the operation and maintenance of the City's municipal supply system, however it still remains necessary to actively pursue the reduction of water demand through conservation and Unaccounted For Water (UFW) control.

- In the long term, in order to continue to provide an adequate and sustainable supply of water, it will be necessary to develop additional groundwater supplies. (City of Guelph Environmental Services, 2003)

The average yearly amount of wastewater handled by the City's WWTP is approximately 54,000 m^3/d (City of Guelph Waterworks, 2003). Speed River flow data has been collected by the Water Survey of Canada at a gauging station located downstream of the Guelph WWTP since 1950. An analysis of data from the years 1998-2002 indicates an average daily flow of 375,000 m^3/d. Yearly minimums range from 90,000 to 105,000 m^3/d, and yearly maximums range from 1,572,000 to 2,955,000 m^3/d. The data and associated calculations have been provided in Appendix A. The limited fluctuation between observed minimum flows is due to the presence of the Guelph reservoir located upstream of the gauge, which was built to provide storage for flow augmentation during low-flow periods. The data shows that during the low flow times of the year (typically fall and early winter), the effluent flow from the treatment plant can comprise as much as 44% of the total river flow. Any reduction in the amount of treatment plant effluent contributing to the river will thus enhance the rivers ability to assimilate this water during low flow periods. The ability of the Speed River to accept wastewater effluent and pollutants without significant harm to plants, animals, and other water users is currently being studied by the GRCA. As mentioned previously, the assimilative capacity of the Speed River is approximately 73,000 m^3/d (City of Guelph, 2003).

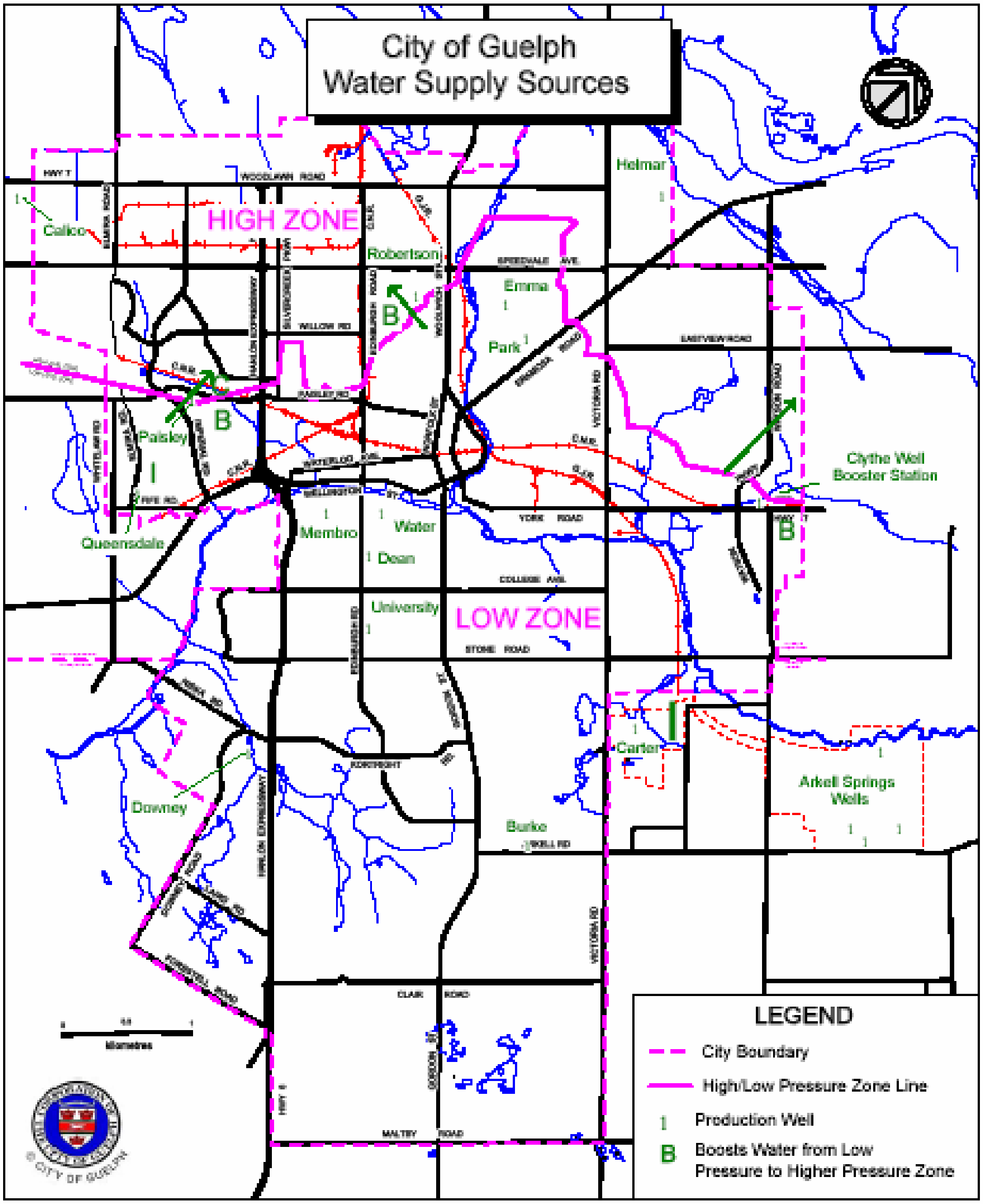

Figure 2: Location of Water Sources in the City of Guelph

Source: City of Guelph Waterworks, 2002

2.4 Guelph Wastewater Quality and Considerations

The City of Guelph WWTP is unique with respect to the type of treatment technologies it utilizes. Due to the sensitivity of the plant's receiving body (Speed River), the WWTP must adhere to stringent regulations governing its effluent quality; namely that the BOD_5 and TSS levels are both 20 mg/L. Therefore, the sewage entering the plant not only undergoes conventional treatment methods such as physical treatment, primary clarification, and secondary aeration and clarification, it also undergoes tertiary treatment that includes rotating biological contact chambers, filtration, chlorination, and dechlorination. Throughout this extensive process, the plant operators regularly test for numerous quality parameters at many of the treatment stages to ensure the necessary requirements are being met. Metcalf & Eddy identify several significant quality parameters found in wastewater, which are summarized in the table below:

Table 1: Classification of typical constituents found in wastewater

Classification	Constituent
Conventional	▪ Total Suspended Solids ▪ Colloidal solids ▪ Biochemical oxygen demand ▪ Chemical oxygen demand ▪ Total Organic Carbon ▪ Ammonia ▪ Nitrate ▪ Nitrite Total nitrogen ▪ Phosphorus ▪ Bacteria ▪ Protozoan cysts and oocysts ▪ Viruses
Nonconventional	▪ Refractory organics ▪ Volatile organic compounds ▪ Surfactants ▪ Metals ▪ Total Dissolved solids
Emerging	▪ Prescription and non-prescription drug ▪ Home car products ▪ Veterinary and human antibiotics ▪ Industrial and household products ▪ Sex and steroidal hormones ▪ Other endocrine disrupters

Source Wastewater Engineering Treatment and Reuse: Metcalf & Eddy (2003).

For the purposes of this study however, only the necessary wastewater quality parameters will be examined as they relate specifically to existing quality regulations for wastewater reuse. These parameters generally include pH, $cBOD_5$, TSS, turbidity, and fecal coliform. The following table summarizes these and other parameters from the Guelph WWTP as average monthly values, with the last row indicating the yearly average.

Table 2: City of Guelph Wastewater Quality Data - 2002

Average Month	pH	Temp.	DO	$cBOD_5$	COD	TSS	VSS	TDS	Fecal Coliform (E.coli)	
	Std	^oC	Mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	CFU/100mL	CFU/100mL
January	8.0	13.4	12.2	1.1	27.2	1.8	2.4	1295.6	no data	no data
February	8.1	12.8	8.9	1.5	no data	1.4	1.1	1331.5	no data	no data
March	8.0	13.2	9.3	1.3	27.3	1.6	1.1	1318.5	no data	no data
April	8.1	14.3	9.1	1.1	27.2	1.6	1.4	1231.2	40.5	23.0
May	8.1	15.8	9.6	1.3	26.3	1.3	1.1	1217.0	12.8	5.3
June	8.2	18.9	8.7	1.2	26.0	1.5	1.2	1222.5	9.0	13.5
July	8.2	21.8	8.7	2.1	29.6	1.9	1.4	1234.8	26.8	26.8
August	8.3	22.9	7.8	0.7	24.3	1.9	1.4	1301.2	154.4	106.6
September	8.1	22.4	8.5	1.0	26.7	4.2	2.6	1291.3	76.0	85.2
October	8.0	19.8	9.3	1.6	32.0	2.6	1.7	1313.2	16.7	9.3
November	7.9	17.4	7.7	2.1	40.0	3.2	1.7	1259.5	no data	no data
December	7.9	15.4	9.8	0.8	33.0	3.6	1.6	1271.5	no data	no data
Ave. Year	**8.1**	**17.3**	**9.1**	**1.3**	**29.0**	**2.2**	**1.6**	**1274.0**	**48.0**	**38.5**

Most of the tested values have consistent data ranges, however it is important to note that the recorded data for *E. Coli* ranges from 0.0 to 560.0 CFU/100mL. Although this appears to be a large range, 62% of the recorded values are below 30 CFU/100mL. With planned upgrades occurring in the near future, it is expected that the *E. Coli* levels will become more consistent.

2.5 Wastewater Reuse Categories

Reclaimed water refers to wastewater that has been treated by the Guelph WWTP, and has been collected for suitable reuse back into the community. For reclaimed water to be reused in any application, it must have received treatment to a level suitable for that specific use.

The ability to use reclaimed water in the City of Guelph depends directly upon the quality of the wastewater effluent. The Canadian Council of Ministers of the Environment (CCME) outlines four main wastewater reuse categories based upon the quality of water required for specific end uses (Marsalek, 2002). Some of these specific methods will be analyzed in the report in terms of potential water reuse practices in City of Guelph and have been identified by Mantovani (2001).

2.5.1 Direct and Indirect Potable Water Reuse

The first category outlined by the CCME is potable reuse, which represents the highest water quality. Direct potable reuse involves directly blending reclaimed wastewater from the treatment plant into the potable water supply system. Indirect potable reuse involves the augmentation of potable water supplies with highly treated reclaimed water. The American National Research Council concluded in a 1998 report that:

> Indirect potable reuse of reclaimed water is viable, but that direct potable reuse is not, largely due to uncertainty regarding health effects. The potential human health risk of indirect potable reuse necessitates a thorough, project specific assessment (including contaminant monitoring, health and safety testing and system reliability evaluation), and it should only be considered as a last resort in communities in which all other water conservation and non-potable reuse efforts have been examined. (Marsalek, 2002)

Some communities practice what Marsalek (2002) calls “unplanned indirect potable reuse”, which is the use of stream or river water that has wastewater effluent being discharged upstream. Although unplanned reuse is practiced in communities in the Grand River Watershed, actual direct and indirect reuse will not likely be implemented for the foreseeable future due to the extremely high water quality requirements needed to ensure public safety, and thus will not be investigated any further in this study.

2.5.2 Unrestricted-access Urban and Recreational Water Reuse

The second water reuse category is unrestricted urban and recreational use. The reclaimed wastewater must be of high quality since “unrestricted” refers specifically to no restrictions on body contact with water that has been treated to this level (Mantovani, 2001). Several types of urban water reuse practices that could potentially be used in the City of Guelph include the irrigation of parks and sports fields, fire protection, decorative fountains, and in-building uses such as toilet flushing and air conditioning.

2.5.3 Restricted-access Urban and Recreational Water Reuse

The third water reuse category is restricted-access urban and recreational. This category restricts exposure to the reclaimed wastewater. In the City of Guelph, this category could include the potential for landscape irrigation, municipal works uses, dust control, and other applications where the activities or the areas affected are restricted from the general public.

2.5.4 *Industrial Water Reuse*

The final category for reclaimed water reuse is the industrial water reuse and recycling sector. Due to the diverse industries present in the City of Guelph, the industrial sector presents a viable option for reclaimed wastewater reuse as it meets economic and public safety concerns. Typical reclaimed water uses that have potential in City industries include aggregate washing, concrete making, equipment washing, cooling towers, stack scrubbing, boiler feed, process water, and construction uses.

2.6 Wastewater Reuse in Other Jurisdictions

Using the precedents and guidance from other jurisdictions that have previously implemented wastewater reuse, the implementation reuse plan in Guelph is highly possible. Marsalek (2002) notes that regions of the world such as Australia and the southern United States have well-established standards governing the practice of wastewater reuse. The driving forces for reuse in other regions vary. The pressures of urban growth, the limitations of receiving water bodies, or the reality of water scarcity in arid areas are possible reasons for considering wastewater reuse. Water experts around the world agree that the implementation of wastewater reuse will be a major challenge in the 21st century.

Currently, wastewater reuse is mainly practiced in areas that have the most stressed water resources. This includes arid areas like the Middle East, Australia, and the southwest United States, but also in more temperate, but densely populated European countries. The following examples illustrate that wastewater reclamation and reuse is already being practiced on a large scale all around the globe.

Australia

The main reason for water problems in Australia is low annual rainfall and increasing water consumption. 80 % of the country has annual rainfall less than 600 mm per year (Waller, 1998). About 11 % of the country's total urban wastewater is reused, with the majority in dry regions such as South Australia and Queensland (Marsalek, 2002). The following are wastewater reuse examples from Australia as identified by Waller (1998).

- A power station in New South Wales satisfies 95 % of its water requirements from reclaimed wastewater. In this situation, the cost of demineralizing water in the plant is reduced because dissolved solids concentrations in the reclaimed water are less than in the public supply.

- Primary treated wastewater in Perth is further treated and reused for cooling water and other industrial uses in a demonstration project. In this area, limited groundwater supplies are considered to be a possible constraint to future industrial development.
- A newly constructed suburb of Sydney (Rouse Hill) will be equipped with the first dual water supply in Australia. The expected 235,000 persons living in the new development will use the recycled water for landscape irrigation, car washing, toilets, and other non-potable uses. The system incorporates a tertiary treatment plant, several reservoirs, and mains that have been sized for fire flow.

Japan

Wastewater reuse measures were adopted to address water shortage problems resulting from limited land space and high population density (Waller, 1998). Programs of reclamation and reuse are mainly targeted at non-potable uses in dual distribution systems (EPA, 1992). In 1986 it was estimated that Japan used approximately 3,100 L/s of reclaimed wastewater. Reuse applications in Japan are identified below.

- 40 % of reclaimed water is used in non-potable dual systems, mainly for toilet flushing in multi-family, office, and school buildings. Large buildings being retrofitted for water service are especially targeted (EPA, 1992). In Tokyo, the use of reclaimed wastewater is mandatory in buildings with a floor area greater than 30,000 m^2 (Waller, 1998)
- Industrial uses account for 29 % of wastewater reuse (EPA, 1992). Deterioration of river quality and declining groundwater levels led to the use of sand filtered secondary effluent by paper mills (Waller, 1998).
- Stream flow augmentation and irrigation account for 27 % of total wastewater reuse (EPA, 1992). A stream restoration program in Tokyo was initiated with wastewater being added to a dried up irrigation channel (Waller, 1998).

California

The history of wastewater reuse in the state of California began in 1890 when untreated wastewater was used for agricultural irrigation (Recycled Water Task Force (RWTF), 2003). Since 1912, wastewater standards have been established and improved to protect public health.

The prime motivation for reclamation and reuse in California is to avoid the dependence on external supplies in certain areas of water scarcity. The rise of reuse practices in the state has been dramatic. "The first comprehensive state-wide estimate of water reuse of municipal wastewater was made in 1970, when 175 thousand acre-feet of recycled water were used. In 2000, this amount had increased to 402 thousand acre-feet. The recycled water was supplied by 234 wastewater treatment plants and delivered to over 4,800 sites" (RWTF, 2003).

The majority of reclaimed wastewater usage is for agricultural (48 %) and landscape (20 %) irrigation (RWTF, 2003). California also has significant experience in groundwater recharge using reclaimed wastewater, with 12 % of the total usage diverted for aquifer replenishment and 3 % used for seawater intrusion barriers. There are many examples of reuse applications in the state, as outlined below (from Waller, 1998):

- The City of Avalon has a non-potable distribution system in parts of the city for toilet flushing and fire protection. The use of reclaimed water arose from problems associated with salt water usage, originally utilized in the dual distribution system. The system uses a lower pressure than the potable system for safety reasons.
- Treated wastewater from Lake County is transported via a 75 km pipeline to a geothermal steam field, where it is artificially recharged to be used for electricity generation. The steam field generates 70 MW of electricity, of which 6 MW is used for delivery of the wastewater.
- Los Angeles County operates 6 water reclamation plants used for the sale of reclaimed wastewater to Los Angeles and other cities in the region. There is a need for reuse as the predicted population increases in the greater Los Angeles area will not be served by the existing water supply. Current uses of water produced at these facilities are groundwater recharge (60 %) and agricultural irrigation (22 %).

Florida

Although Florida is a water rich state, there is a need for water reuse. The population is 80 % coastal, which creates problems of freshwater availability, and saltwater intrusion (Marsalek, 2002). The state has a Mandatory Reuse Program, which requires the designation of areas of either existing or potential water supply problems. These areas are required to reuse reclaimed water from domestic wastewater treatment facilities unless it is unfeasible (Marsalek, 2002).

Florida's intensive reuse program resulted in over 50 % of the state's total wastewater treatment capacity being reused (Marsalek, 2002). The following examples illustrate water reuse in Florida (from Waller, 1998):

- In the Boca Raton region, water use restrictions were not enough to adequately handle the daily demand of over 1500 L/cap. Treated wastewater was originally pumped to the ocean but was recognized as an alternative source for irrigation. A 57 ML/d reclamation facility will reduce water demands in the region.
- Walt Disney World makes use of all treated wastewater for direct non-potable reuse as well as groundwater recharge. Some on-site uses include irrigation, fire protection, wash down of streets and sidewalks, water displays and cooling water.
- St. Petersburg provides a dual water supply system to over 7,000 homes and businesses. A 420 km network of reclaimed water piping supplies 80 ML/d to individual users. The system has limited the demand on the city's well field located 80 km from the city.

Canada

British Columbia and Alberta are the only provinces that have developed regulatory guidance for wastewater reuse. In British Columbia, uses include rangeland irrigation, silviculture applications, stream augmentation and toilet flushing (Marsalek, 2002). The City of Vernon successfully uses 100 % of its wastewater for irrigation of agricultural, silvicultural, and recreational lands, in a program that has been operational for over 20 years serving a population of 32,000 (Waller, 1998).

The province of Alberta has supported the use of treated wastewater for irrigation purposes, which currently demand over 70 % of Alberta's water resources (Marsalek, 2002). Current allowable uses for wastewater reuse are "golf courses; municipal parkland and boulevards; forested woodlots under special approval consideration; and agriculture lands used for pasture, forage, coarse grains, turf, and oil seeds. Any other crops to be considered must be first supported by scientific based studies that ensure no risk to human health or the environment" (Marsalek, 2002).

In Nova Scotia, a demonstration project has been initiated that reuses wastewater effluent from a wastewater treatment lagoon for a wetland refuge (Waller, 1998). The created wetlands have the added benefit of providing some measure of tertiary treatment, reducing coliform, suspended solids, BOD and phosphorus by up to 99 %.

2.7 Wastewater Reuse Regulations and Guidelines in Other Jurisdictions

The regulatory challenges of implementing wastewater reuse in the City of Guelph are quite complex. Developing reuse regulations involves defining treatment levels and setting numerical quality limits. Unfortunately, wastewater reuse is rare in Canada compared to other countries such as the United States, and as such, the development of design guidelines is more difficult. There are also no existing regulations in Ontario, so it is necessary to review the regulations of other jurisdictions that have been reusing wastewater at many levels for several years or decades.

The regulatory system in the United States is a multi-tiered structure of federal, state, and local regulations and codes of practice. At the federal level, permits are required from the National Pollutant Discharge Elimination System (NPDES) program for reuse projects where wastewater is discharged into the environment (Mantovani, 2001). However these permits are issued and authorized by state agencies and further federal regulatory involvement is limited. The CCME outlines the U.S. Environmental Protection Agency's (EPA) role in wastewater reuse:

> The main national definitive document remains the EPA's Guidelines for Water Reuse, which addresses an exhaustive list of water reuse practices, and includes case examples. The current document provides considerable information related to water reuse requirements and water reclamation processes, including a summary of state regulatory requirements and EPA recommendations. It is a guidance document that allows individual states to set their own standards….Additional research effort in the U.S. is being directed at assessing the possible implications of trace amounts of pharmaceuticals, disinfection by-products, brominated fire retardants and other organic compounds being detected in reclaimed water. (Marsalek, 2002)

At the state level, specific agencies regulate the issuance of the necessary permits for wastewater reuse. Thirty-five states have regulations for wastewater reuse. The "Management Practices for Nonpotable Water Reuse" report summarizes the regulatory requirements for six of these states in Table 5-1, including Arizona, California, Florida, Hawaii, Nevada, and Washington. The earliest, and one of the most comprehensive sets of regulations, are those from California within the California Code of Regulations (CCR). Title 22 in the CCR identifies specific uses, and provides corresponding numerical limits on pH, total coliform limits, and general treatment levels. California has the oldest and most comprehensive set of standards in the United States. Their regulations have been adopted and enhanced by Hawaii's 1993 "Guidelines for the Treatment and

Use of Reclaimed Water" in terms of overall detail for specific uses. Some of the California, Hawaii, and U.S. EPA guidelines and regulations are included in Appendix B.

There are currently no national guidelines or standards governing wastewater reuse in Canada. On the provincial level, British Columbia and Alberta are the only provinces that have regulations, while other provinces allow individual wastewater reuse projects on a case by case basis. In the Canadian context, the British Columbia Ministry of Water, Land and Air Protection has developed regulations governing water reuse through the Municipal Sewage Regulation (MSR). Enacted in 1999, the MSR sets criteria for municipal wastewater treatment, water reuse, and disposal of treated effluent. The MSR stipulates two categories for reuse: unrestricted and restricted public access. The supported "Code of Practice for the Use of Reclaimed Water" was later published to act as a reference document and to support the regulatory requirements in the MSR (Marsalek, 2002). In Alberta, wastewater reuse is regulated under the Province's Environmental Protection Enhancement Act (EPEA), which includes the issuance of approvals administered through the Alberta Department of the Environment. The authorization process for wastewater irrigation reuse in Alberta involves wastewater quality evaluation, land suitability, system design considerations and the issuance of approval (Marsalek, 2002).

It is expected that since there are no regulations or guidelines governing wastewater reuse in Ontario, the process will likely be slow for approving reuse in the City of Guelph. With time, the Province of Ontario will be able to develop standards and regulations for wastewater reuse, with the aid of other jurisdictions that currently have regulations and are able to rely on decades of research and experience. For the basis of this study, a combination of the most comprehensive regulations is recommended in order to assess some of the initial feasibility parameters for reuse.

2.8 Public Concern and Risk Assessment

In areas where wastewater reuse is rare, the public is generally opposed to the idea of reuse systems since it lacks the necessary knowledge about the concepts. Therefore, it is expected that there will be strong reluctance towards wastewater reuse for high-risk activities that may involved direct contact. No program utilizing wastewater reuse can be implemented without public acceptance and, as Baumann (1978) stresses, acceptance is the largest obstacle to the adoption of reuse systems.

According to Environment Canada (2002), "Canadians are uninformed about the significance of groundwater to many environmental issues. This lack of understanding is a significant hindrance to governments in taking effective action to address groundwater issues". Thus, public concern over water supply issues, and possible solutions, such as wastewater reuse practices must be a high priority for the City of Guelph. The City should continue to conduct public awareness programs that fully explain the difficulty in keeping up with future water demands and the consequence of excessive groundwater withdrawal. Awareness about the local supply problem and its severity will encourage a positive opinion about reclaimed water use as an alternative water supply source (Mantovani, 2001).

Most of the opposition is due to concern over the risks to human health with exposure to reclaimed water. Therefore, the City must clarify that the reuse of wastewater effluent at the required treatment levels is not detrimental to public health. It is important to understand all the risks involved and the management strategies to alleviate these risks. According to Baumann et al (1978), public acceptance is encouraged by understanding the technological characteristics of water treatment. Mantovani (2001) explains that the public must understand the quality of reclaimed water and how it will be used in the community. Public acceptance decreases with the increase in human contact to reclaimed water. The water must meet appropriate standards for uses involving human exposure.

However, before informing the public it is necessary to establish risk assessment and management practices to reduce the possibility of human health effects due to wastewater contact. Metcalf and Eddy (2003) identify an extensive risk assessment strategy that includes: (1) Hazard Identification, (2) Exposure Assessment, (3) Dose-Response Assessment, (4) Risk Characterization, (5) Risk Management, and (6) Ecological Risk Assessment. With the proposed short and long-term reuse alternatives, as outlined in Section 3.1 or this report, *AquaTeam Solutions* believes that the development of such a strategy is essential for gaining public approval.

It is also imperative that positive feedback is offered to the public by the experts that evaluate reuse options (Kasperson et al, 1977). Because these experts are relied upon for advice, the endorsement from these officials can reinforce public approval. The City should focus on past successes to promote confidence in public health officials, politicians, professionals and the concerned residents of Guelph. The consistent support of all influential parties that make decisions will facilitate the adoption of reuse systems.

Another factor influencing public approval is the public's confidence in public utilities and wastewater reuse technology (Mantovani, 2001). The reuse systems must integrate designs that make use of appropriate safety guidelines. The facilities that adopt the reuse technology must be equipped with reliable monitoring and fail-safe systems in addition to employing adequately trained personnel (Kasperson et al, 1977).

2.9 Constraints and Criteria

The following constraints and performance criteria have been identified for the design process. The constraints include: (1) ensuring that current public health and safety standards are met; (2) each part of the solution must be feasible and based on current and emerging technologies; (3) due to confidentiality issues, the level of detail of certain strategies will be limited. The performance criteria include: (1) the strategy must be an economically feasible solution; (2) a solution that has the potential for general public acceptance; (3) a solution that minimizes changes to the current city infrastructure, as well as leaving future possibilities for infrastructure improvement; and (4) a solution that reaches environmentally realistic targets.

3 RESULTS

3.1 Alternative Uses

There are a number of solutions to be considered in a strategy for the reuse of reclaimed wastewater in the City of Guelph. Each possible solution falls under one of the reuse quality categories outlined by the CCME (2002). These possible reclaimed wastewater reuse practices will be presented and discussed below.

A number of the solutions to be evaluated are easily implemented in Guelph and are recommended to be put into practice in the short term (0-2 years). These include:

- Municipal works uses
- Downtown flowerbed irrigation

- On-site WWTP irrigation
- Construction site dust control

Some of the more extensive water reuse solutions will not be as easy to apply in Guelph. These solutions will require infrastructure, regulatory approval, and public acceptance. Reuse practices to be evaluated for implementation in Guelph in the long-term (> 2 years) include:

- Industrial uses
- Park/golf course irrigation
- Residential dual water systems
- Groundwater recharge
- On-site WWTP permeate for polymer make-up

3.1.1 Municipal Works Uses

A relatively large water user in the City of Guelph is the Waterworks department, which is responsible for City infrastructure. Main water uses within the department include street cleaning and sewer flushing. Information relating to the practice of water use in the works department was collected via informal telephone conversations with staff at the City of Guelph.

Street cleaning in Guelph is an activity completed during the spring, summer and fall months. Water demands for this use fluctuate slightly but general usage is approximately 10,000 L/day. Water quality requirements for street cleaning fall into the restricted-access urban reuse category as access to the water and street cleaning equipment is restricted from the general population.

Sewer flushing is an ongoing activity that operates year round. Periodic cleaning of the sewers with high volumes of water is required in order to prevent the build-up of sediment and other residues. The flushing is currently carried out with water pumped into a truck from various fire hydrants across the City. Water demand for this use is roughly 24,000 L/day. As access to sewers and flushing equipment is limited to City maintenance personnel, the water quality requirements for this use fall into the restricted access urban reuse category.

Water reuse for street cleaning and sewer flushing is an easily implemented solution that should be considered in Guelph in the immediate future.

3.1.2 Park/landscape irrigation

During the summer months (June through September), irrigation of the City's numerous parks, flowerbeds, and hanging baskets is carried out to maintain their integrity. Information relating to the practice of water use in the parks department was collected via informal telephone conversations with parks staff at the City of Guelph.

A mobile watering truck is currently used to water flower beds and hanging pots in the downtown area. During hot and dry summer periods, the truck will use nearly 15,000 L/day. The water used is collected from non-potable water well. As the water will be used in high pedestrian traffic areas, the water must be of a higher quality. Water quality requirements for this use fall into the unrestricted access urban reuse category.

There are also a number of parks and sports facilities that are currently irrigated, which are scattered throughout the entire city. The irrigation systems for these parks and fields are currently connected to the municipal water supply system. During the summer months these facilities are irrigated approximately once a week.

There are many other facilities in the city that are not currently irrigated. Due to the considerable new infrastructure requirements that would be necessary to service all locations with reclaimed water, it is proposed that only certain parks along limited routes be considered. The primary purpose of the mains will not be for the park facilities, but for larger wastewater reuses (industrial, residential dual water supply, groundwater recharge), which are also identified in this report. Figure 3 presents the locations of parks and sports facilities in the City that are proposed to be irrigated with reclaimed wastewater.

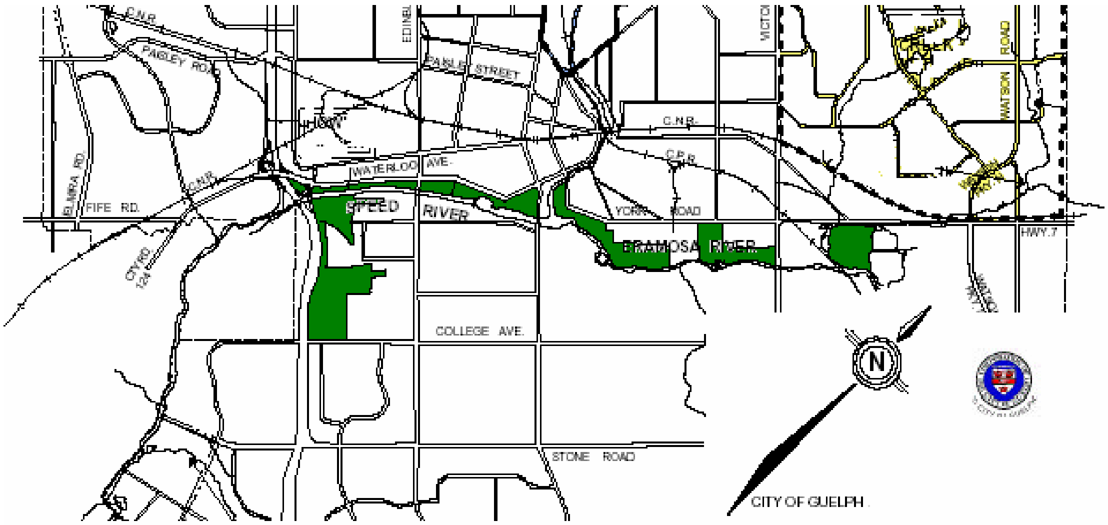

Figure 3: Park and Sport Facility Irrigation Areas

The amount of water applied to each separate facility is variable. For the purpose of estimation of total water quantity it will be assumed that 13 mm will be applied at each location once each week. The water demand for this use will be approximately 19 m^3/day per hectare of irrigated area. The areas identified on Figure 3 comprise an area of approximately 50 ha, which relates to a total water demand of 950 m^3/day from June to September.

As human contact with this irrigation water is likely, water quality requirements for this use should fall into the unrestricted access urban reuse category.

3.1.3 Construction Site Dust Control

Construction projects use potable water from hydrants to control the dust that arises from excavation and other construction activities. The outcome of increased development and infrastructure replacements due to population growth results in an opportunity to use reclaimed wastewater for dust control.

Typically the amount of water applied is inadequate and public complaints arise from the high amounts of dust. For a typical sewer replacement project an estimated 400 m^3 of potable water is required. If an abundant source of water is provided for dust control, residents of the City may support the use of reclaimed water to mitigate dust control issues. The economic benefits from using reclaimed water for dust control depend largely on the price of potable water. If the price of potable water increases contractors would be more likely to use reclaimed water for economic benefits. An average of 4 infrastructure replacement projects is initiated each year. Based on this average, approximately 1600 m^3 of reclaimed wastewater would be required to provide dust control from June to September each year.

As construction workers will be exposed to dust control areas, the water must be of a higher quality. Water quality requirements for this use fall into the unrestricted access urban reuse category.

3.1.4 On-Site WWTP uses

Pending the approval of the City of Guelph's Green Municipal Enabling Funds (GMEF) application for the study of wastewater reuse, one of the initial feasibility steps for the implementation of the reclaimed water is onsite use at the WWTP. The plan proposed by Mr. Wayne Key, Manager of Wastewater Services, for onsite wastewater reuse includes two innovative plans. The first plan involves a test and control plot at the WWTP that will be used to assess the effects of using effluent water on grass and other plants for surface irrigation. The plots will yield comparative results of effluent water and potable water on the soil and grass. The proposed irrigated grass area is located at the west end of the plant and covers and area of 4,000 m^2, which would require approximately an average of 8 m^3 of water on an irrigation day.

The second plan involves using permeate generated from the Membrane Biological Reactor (MBR) unit, which will soon be installed at the plant. If this permeate is of sufficient quality (specified by the WWTP), it could be used for a portion of the polymer make-up for the dewatering process at the plant, which requires a daily water volume of approximately 400 m^3. It is expected that through these initial, small-scale projects the City of Guelph and the Province of Ontario may begin to fully assess and evaluate larger projects in the City.

3.1.5 Dual water systems

As was observed from the analysis of jurisdictions around the world, dual water systems for residential use are a viable water reuse option. We also note that the City of Guelph is anticipating steady population growth over the coming decades. A City population growth forecast predicts an increase from 110,000 persons in 2001 to 157,000 persons in 2027 (Kraeling, 2003). The forecast also suggests average housing unit construction rates for certain periods up to 2027.

As the implementation of residential dual water systems in Guelph would be very difficult for the foreseeable future, due to regulatory approval, public acceptance, it is not anticipated that this practice could be implemented within the next 10 years. However, if this practice was to be initiated in the next 10 years, it could be utilized in areas of the City where the majority of future growth is expected to occur. As illustrated on Figure 4, these areas include the Eastview Community area and the South Guelph area.

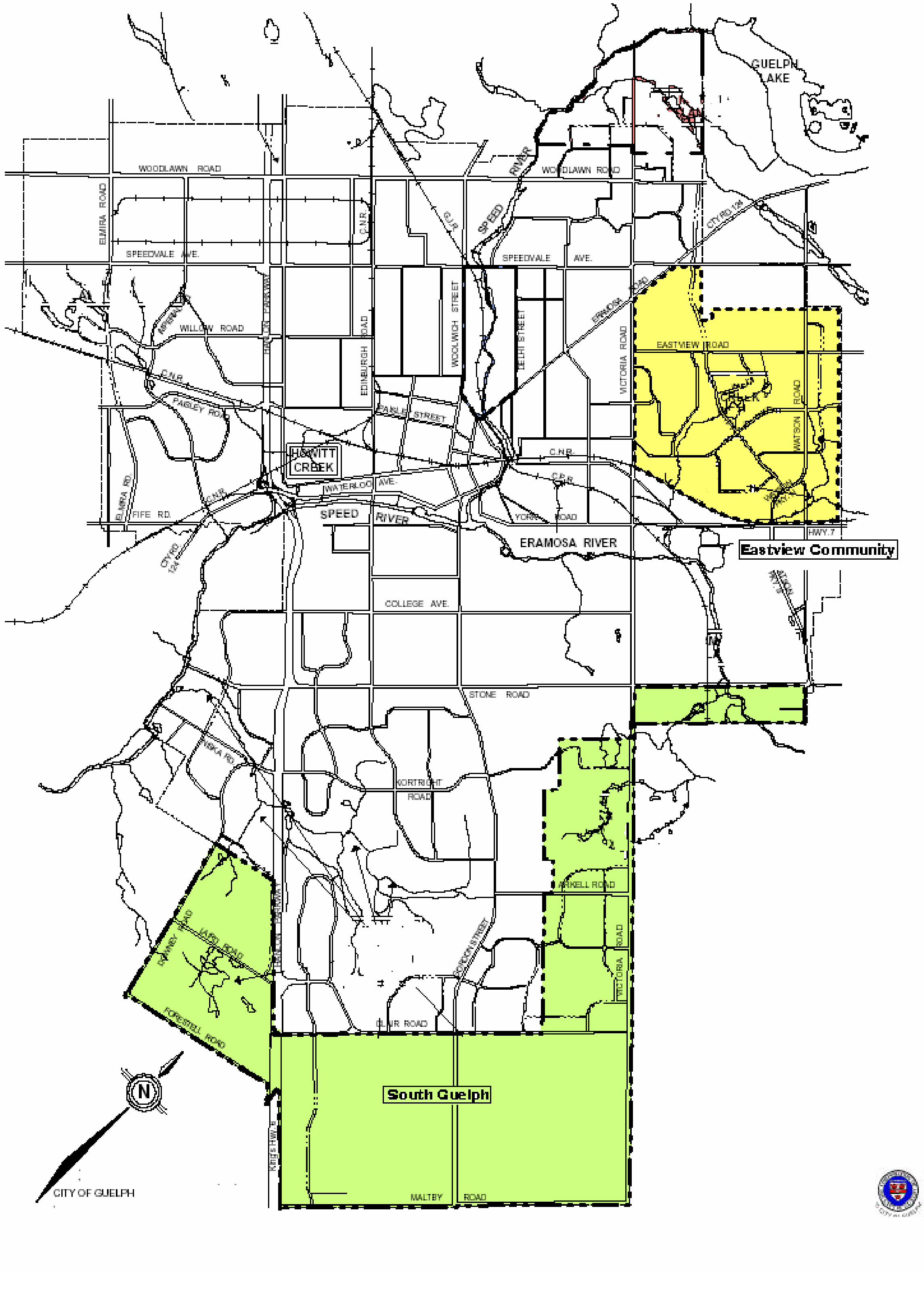

Figure 4: Eastview Community and South Guelph Development Areas

Recent Environment Canada (2003) water use statistics set Canadian residential water use at 350 L/ca/day. Using a typical usage pattern from Waller (1998), non-potable uses (toilet flushing, irrigation) within the home can account for about 40% of total usage. If the housing statistics predicted by the current City population forecast are used, the period after 2014 will average 650 units per year (Kraeling, 2003). This includes an average household size of 2.6 persons (City of Guelph, 2004).

An estimate for residential dual water system demand can be found from the above data for the period after 2014. Assuming that water usage does not change and housing development proceeds as forecasted, demand for reclaimed wastewater will amount to approximately 240,000 L/day or 87,600 m^3/year. This amount will increase by the same amount (87,600 m^3/year) annually as more housing units are included in the system.

Some human contact with water in the dual distribution system is expected. Therefore, water quality requirements for this use should fall into the unrestricted access urban reuse category.

3.1.6 Groundwater Recharge

The use of reclaimed water to recharge groundwater aquifers occurs in two main categories: surface spreading or percolation, and direct injection. Although the possibility of using either of these methods is low in Guelph, they are mentioned nonetheless as future alternatives should the quality of the wastewater effluent improve to the proper standards. From the "Proceedings of the International Symposium on Efficient Water Use in Urban Areas" Asano mentions four water quality factors that are significant in groundwater recharge:

> (1) microbiological quality, (2) total mineral content (total dissolved solids), (3) presence of toxicant of the heavy metal type, and (4) the concentration of stable organic substances….which each present a wide spectrum of technical and health challenges that must be carefully evaluated. (Asano, 2000)

Surface spreading involves the percolation of wastewater from infiltration basins into the unsaturated groundwater zone. Asano (2000) states that "with the right hydrogeological conditions for recharge, wastewater reclamation can be implemented relatively simply by the soil-aquifer treatment (SAT) process….[wherein] the necessary treatment can be obtained by the filtration process as the wastewater percolates through the soil". Asano (2000) further affirms that pre-treatment processes for the SAT should include at least primary treatment methods that do not leave high algal concentrations in the recharge water, and that the recharge process should be managed to avoid intrusion into the native groundwater by keeping the distance between infiltration basins and wells at least 50-100 m.

Direct subsurface recharge involves the injection of highly treated wastewater directly into a well-confined aquifer. This type of recharge occurs where the groundwater aquifer is deep or if surface spreading is impractical either spatially or economically (Asano, 2000). Asano (2000) also maintains that both the flow path and residence time of the recharged water are increased when extraction wells are distanced far apart to ensure the proper mixing of the recharged water and the other aquifer contents.

Since groundwater recharge in the vicinity of Guelph using the current wastewater effluent could jeopardize or affect the City's water supply, it is unlikely that this method of wastewater reuse will be implemented. Hence, a thorough analysis of the final effluent from the WWTP is necessary as an initial basis of comparison for any further consideration of groundwater recharge using reclaimed wastewater.

3.1.7 Golf Course Irrigation

The use of reclaimed water to irrigate golf courses is popular throughout the United States. Arizona, California, Hawaii, Nevada, South Carolina, and Texas all have recognized experience with reclaimed water use. The State of Florida is a national leader in the United States for using reclaimed water for golf course irrigation. In 2001, 419 golf courses accounted for 19 % of the reclaimed water use in the state and these golf courses used on average 980,000 L/d of reclaimed wastewater (Florida Department of Environmental Protection, 2002). The use of reclaimed water for golf course irrigation is vital in arid regions of water scarcity and lofty water restrictions.

In the City of Guelph, the Ministry of the Environment has asked a golf course to voluntarily reduce their water consumption by 20 %. This course uses approximately 1,100,000 L/d during the summer months. This golf course currently has an 18,927,000-litre irrigation pond on site, and is currently building a 37,854,000-litre pond to help meet their water demand and deal with short term water restrictions. The opportunity for using reclaimed wastewater in Guelph for golf course irrigation is evident. Not only will using the reclaimed wastewater meet the 20 %

voluntary reduction requested by the Ministry of the Environment, the reclaimed wastewater will provide a lasting water source to irrigate, even in drought conditions.

Public interaction with irrigation water on a golf course can be high. Therefore, the reclaimed water must be of superior quality. Water quality requirements for this use fall into the unrestricted access urban reuse category. As extraction wells are located throughout the City, the quality of reclaimed water is essential for ensuring the protection of these groundwater sources, regardless of filtering capacity of soil. On-site monitoring equipment should be used to ensure that soil, water, and air quality parameters are within acceptable regulations and guidelines. Public acceptance is critical for the use of reclaimed water. If public acceptance is minimal, economical ramifications for the golf course will result. Educating and informing the public about the success and safety of reclaimed water golf course irrigation in the United States is imperative both to the advancement of reclaimed water use and maintaining the integrity of the golf courses in the City of Guelph.

The golf courses in the City of Guelph are located a considerable distance from the WWTP. As a result, the cost to implement the infrastructure to ensure a continuous supply of reclaimed water to the golf courses will be high. However, adequate allocation of the value of environmental and commercial benefits may outweigh the costs of the infrastructure. Economical study of the implementation of infrastructure to golf courses in the City will determine the feasibility of such a project.

The golf course under discussion will not be named for confidentiality reasons. However, the 1,100,000 L/d water demand will be included in the long term implementation strategy for the City. The transition to reclaimed wastewater as a water source is a long term (> 2 years) alternative that will require a transition period to become fully implemented.

3.1.8 Industrial Applications

According to Environment Canada (1999), industry accounts for approximately 16 % of municipal water use in Canada. Figure 5 was taken from Environment Canada’s 1996 industrial water use survey report and displays the five main water users in Canada.

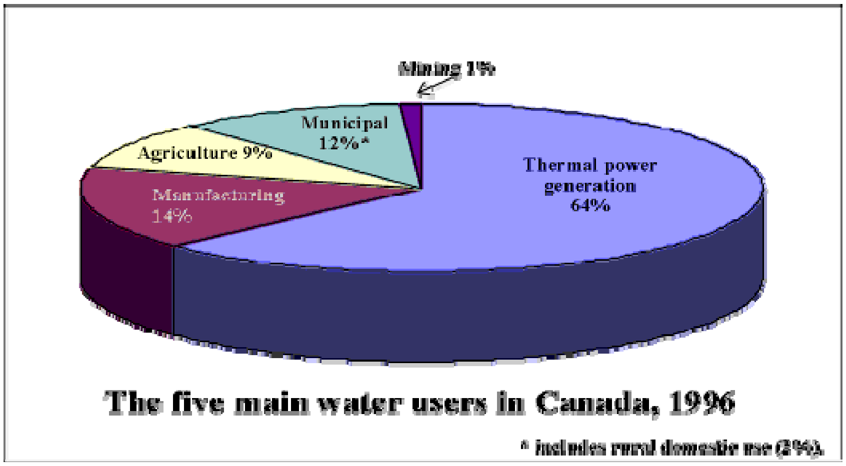

Figure 5: Industrial Water Use in Canada

Source: http://www.ec.gc.ca/water/images/manage/effic/a6f1e.htm

Baumann et al (1978) emphasize that, "withdrawal use of water by industry will decrease mainly because of cooling water recirculation". The 1996 Industrial Water Use Survey indicated that recycling rates vary among industry. However, the report also reveals that water recycling allowed manufacturing companies to reduce water intake by 17 % (Scharf et al, 2002). "The use of reclaimed water for cooling tower makeup is the most widely accepted use for reclaimed water in the United States after landscape irrigation. Wijesinghe, Kaye, and Fell (1996) showed that secondary effluent as makeup water is a technically feasible reuse alternative" (Mantovani, 2001).

In Canada, industry engages in more water reuse than any other major water-using sector (Marsalek, 2002). There is a great opportunity for increased water efficiency with very little threat to human health. The CCME (2002) outlines three issues that concern wastewater recycling for industrial uses. The first identifies that there is a need for policies and incentives to support water recycling in industry. Change and progress is facilitated by supporting government policies. In addition, companies are hesitant when new technologies are costly to implement. There is a need for programs that demonstrate these types of water reuse systems and that provide adequate field tests. Additionally, reuse may be more attractive if blocks of several industries nearby each other contribute to the implementation of these water systems. Finally, and most significantly, water recycling may produce poor air quality that is detrimental to staff. Hence there is a significant need for research and technology and monitoring that will guarantee the elimination of this problem prior to recirculation.

The City of Guelph industrial sector has abundant potential to decrease the amount of water withdrawal by recycling wastewater effluent for cooling. For example, a manufacturing company that is located in the City has a cooling system that consumes up to 5500 L/d (Company XYZ, 2004). With the use of appropriate technologies to convert this system into one which uses treated wastewater effluent, this company can significantly reduce the amount of water it withdraws from Guelph's groundwater supplies. Private industry also has the advantage of coping with less public concern because it has the ability to keep their operations confidential and in-house. Therefore it would be easier for a company to achieve the proper permits and implement the changes more rapidly. If the City was to offer incentives for this type of change, more companies would be attracted to applying the alternative reuse technology. There is an industrial block located in the north-western section of the city. These companies should be encouraged by the City of Guelph to share this technology. This would allow the companies to share the expenses of installing a new system into practice and it would also contribute to the increase in water use efficiency. Water quality requirements for this use will fall into the industrial water reuse category.

3.2 Alternative Evaluation

Table 2 below presents a brief evaluative summary of the alternative design strategies. Each short and long-term strategy is evaluated based on public acceptance, implementation cost, and public contact. As shown in Table 3, the short-term strategies can be implemented with relative ease compared to the long-term strategies that are more difficult to implement. In particular, sewer flushing and on-site applications are potential solutions that can be employed in the near future whereas groundwater recharge is an application that will encounter opposition.

Table 3: Alternative Strategy Evaluation

	Short-term Public Acceptance Anticipated		High Implementation Cost		Public Contact	
	yes	no	yes	no	yes	no
Short-Term Strategies						
Sewer Flushing	x			x		x
On-Site WWTP Applications	x			x		x
Street Cleaning		x		x	x	
Dust Control		x		x	x	
Long-Term Strategies						
Dual Residential Systems		x	x		x	
Industrial Applications		x	x		x	
Golf Course Irrigation		x	x		x	
Groundwater Recharge		x	x		x	

3.3 Implementation Strategy

Each of the alternative strategies presented has a different implementation timeframe. Some of the options will also have to be coordinated with others as they will share common infrastructure. The following section outlines the overall master plan for the City. The implementation of the strategy is dependant upon the necessary quality requirements being met for each individual option. Discussion of the quality requirements and the adequacy of the WWTP effluent can be found in Section 3.4 of this report. The following discussion presents alternatives to be implemented within the next 0 to 2 years or Type 1 applications, and alternatives to be implemented in the next 2 to 20 years or Type 2 applications.

3.3.1 Type 1 Applications

The practices that are short term applications include: street cleaning, sewer flushing, downtown City flowerbed irrigation, and dust control.

Table 4 indicates the amount of reclaimed wastewater to be allocated to each proposed use.

Table 4: Water use allocation, 0 – 2 years

Water Use Alternative	Daily Demand m^3/day	Seasonal Usage?	Proportion of year needed	Yearly Demand m^3/year
Street Cleaning	10	Y	2/3	2,433
Sewer Flushing	24	N	1	8,760
Flowerbed Irrigation	15	Y	1/3	1,825
Dust Control	4	Y	1/3	535
Total	54			13,600

Note that some of the uses are only utilized during certain seasons of the year. The demand for reclaimed wastewater is at its peak during the summer months, when water is required for all uses.

All of the short term uses can be serviced by water trucks that collect water at a pumping station located at the WWTP. The fact that there are no infrastructure requirements for these uses makes them very easy to implement. As a first step for wastewater reuse in the City, it is recommended that these practices be implemented immediately. The success of any long-term plans for major reuse in the City will require that the public grow comfortable with the short-term practices.

The peak daily demand of 54 m^3/d represents 0.1% of the total wastewater being treated on an average day at the WWTP (54,000 m^3/d). It is obvious that to maximize the value of the reclaimed wastewater, some larger water users in the City should also incorporate reclaimed wastewater into their supply system.

3.3.2 Type 2 Applications

Using reclaimed wastewater to satisfy larger water uses throughout the City will be difficult due to cost, infrastructure requirements, and the need for public acceptance. Practices that are long-term applications include: park/sports facilities irrigation, golf course irrigation, industrial uses, and residential dual water systems. Groundwater recharge will not be considered for the proposed strategy as it will not be implemented in the foreseeable future. Table 5 indicates the amount of reclaimed wastewater to be allocated to each proposed use.

Table 5: Water use allocation, 2 - 20 years

Water Use Alternative	Daily Demand m^3/day	Seasonal Usage?	Proportion of year needed	Yearly Demand m^3/year
Park/Sport Facilities Irrigation[i]	950	Y	1/3	115,583
Golf Course Irrigation[ii]	1100	Y	1/3	133,833
WWTP uses[iii]	400	N	1	146,000
Dual Water Supply[iv]	240	N	1	87,600
Total	2690			483,000

i – Daily demand based on areas shown on Figure 3
ii – Daily demand based on single course meeting all water requirements
iii- Daily demand based on requirements for water treatment processes
iv – Dual water supply based on future development. Demand will increase from annual by 240 m^3/d

Quantities for industrial use have not been included in Table 4 due to the difficulty of determining potential users. Water quality and quantity requirements will vary significantly between the type and size of industry, making it difficult to quantify any possible allocation. However, potential users should be identified and approached in any area that has proposed reclaimed water infrastructure.

Figure 3 presented the locations of the parks to be irrigated by reclaimed water. Figure 4 presented the main areas of future residential development, which are proposed to be serviced by a dual water system. In order to satisfy these proposed uses, some distribution infrastructure is required. One alternative for locations of the main distribution pipes with is presented on Figure 6, which also illustrates the proposed parkland irrigation areas and dual water distribution areas. These reclaimed water mains will also serve to provide more accessible locations for the Type 1 applications.

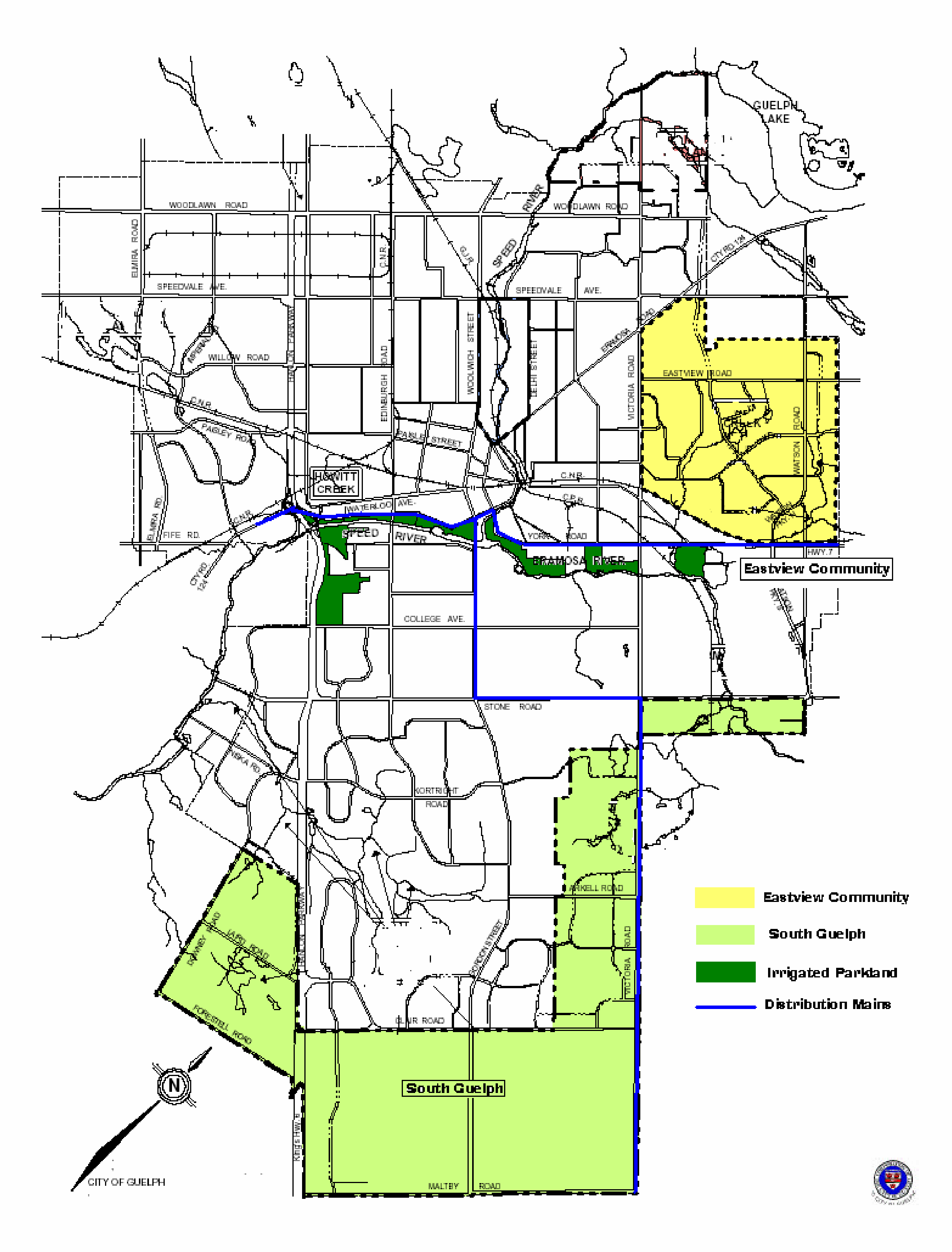

Figure 6: Master Plan for Reclaimed Wastewater Distribution System

The proposed locations for the distribution pipes were chosen for a number of reasons. The upcoming infrastructure replacement project on Wellington Street will be installing new services along Wellington Street until it crosses Gordon Street. This project will provide the opportunity to install reclaimed wastewater distribution pipes, with the intent of extending the network (as shown on Figure 6) when development proceeds as expected.

3.3.3 Staging

The implementation of the long-term applications will be staged along with infrastructure and residential development. It has been assumed that full implementation of the irrigation system will not be possible until 2009. Implementation of the residential dual water system will not occur until 2014. Table 6 summarizes the annual demand expected over the next 20 years, which is also presented graphically in Figure 7.

Table 6: Long-term Reclaimed Water Demand

Annual Demand (m^3/y)	2004	2009	2014	2019	2024
Type 1 applications[i]	13,600	14,811	16,129	17,564	19,128
Type 2 applications[ii]	0	395,416	430,612	468,941	510,681
Dual water system[iii]	0	0	87,600	438,000	876,000
Total	13,600	410,200	534,300	924,500	1,405,800

i–Based on data presented in, increasing at the expected average annual population growth rate of 1.72%.
ii – Based on data presented in, increasing at the expected average annual population growth rate of 1.72%.
iii – Based on an increase of 87,600 m^3/d each year starting in 2014.

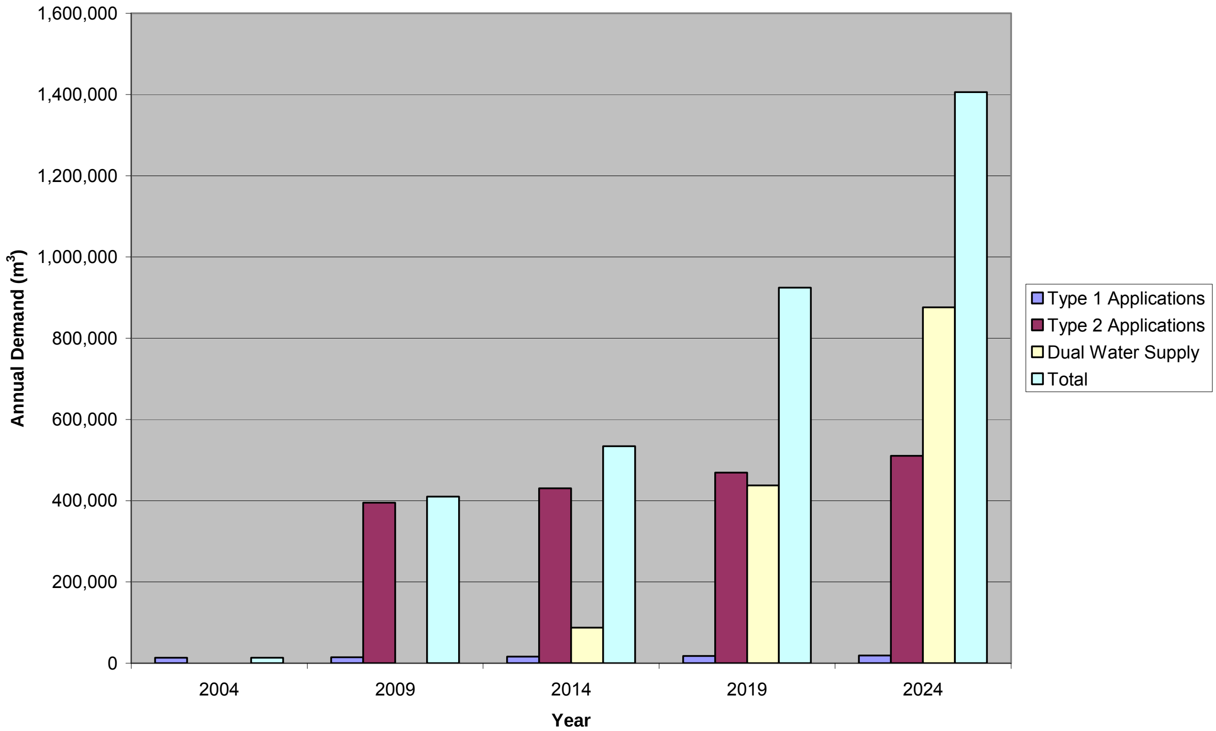

Figure 7: Long Range Reclaimed Wastewater Usage

As previously indicated, these numbers do not include allocations for industrial usage or groundwater recharge. For planning purposes these options should be considered in more detail before construction of any distribution infrastructure. The total proposed usage of reclaimed wastewater for 2004 in the City will average 37 m^3 or 0.07 % of wastewater effluent production (current daily production of 54,000 m^3 wastewater effluent). Projections for the year 2024 include a total proposed usage of 3,850 m^3/d or 6 % of wastewater effluent production (based on projected production of 64,000 m^3 wastewater effluent).

3.4 Proposed Water Quality Regulations

As mentioned in Section 2.6, there are currently no regulations or guidelines for wastewater reuse in Ontario. Therefore, before the implementation of a reuse plan in the City of Guelph, it is necessary to establish guidelines using recommendations from other jurisdictions. It is important to identify which of the alternatives in this report can be implemented with the current wastewater effluent, and which require a higher quality effluent. In the Canadian context, the reuse regulations developed in British Columbia and Alberta are realistic and comprehensive with respect to the broad range of quality reuse guidelines available throughout the world. In the

CCME report on water reuse, Marsalek (2003) suggests that "[the available] provincial documents on reuse could serve well as models for other provinces, which may need to develop their own regulations". Thus, *AquaTeam Solutions* suggests that the City of Guelph and the MOE consider the use of these existing provincial regulations as a basis for building guidelines in Ontario. Table 7 below summarizes the current British Columbia regulations which are subsequently used as a comparison to the existing wastewater quality at the Guelph WWTP, shown in Table 8.

Table 7: Permitted Uses and Standards for Reclaimed Water

Permitted Uses	Treatment Requirements	Effluent Requirements
Unrestricted Public Access – agricultural, recreational and urban uses	Secondary, with chemical addition, filtration, disinfection and emergency storage	- BOD5 ≤ 10 mg/L - Turbidity ≤ 2 NTU - Fecal coliform ≤ 2.2/100 mL - pH = 6-9 - plus general considerations
Restricted Public Access – agricultural, urban/recreational, construction, industrial and environmental uses	Secondary, with disinfection	- BOD5 ≤ 45 mg/L - Total suspended solids ≤ 45 mg/L - Fecal coliform ≤ 200/100 mL - pH = 6-9 - plus general considerations

Source: CCME Report: Marsalek, 2003.

Table 8: Comparison of Current Guelph Wastewater with British Columbia Regulations

	Wastewater Quality				
Category	BOD_5 (mg/L)	Turbidity (NTU)	TSS (mg/L)	pH	Fecal Coliform (CFU/100mL)
Guelph Wastewater Treatment Plant	1.3	0.3-5	2.2	6.9-8.5	43.3
Unrestricted urban and recreational	≤10	≤2	n/a	6-9	2.2
Restricted-access urban, restricted recreational	≤45	n/a	≤45	6-9	200

As it appears in the table above, all of the listed quality parameters are met for both reuse categories expect for the fecal coliform levels in the unrestricted urban and recreational category. Table 9 on the following page demonstrates a summary of which particular uses can be implemented based on the current wastewater quality.

Table 9: Reuse Alternatives implementable under current wastewater quality

	Implementable under current wastewater quality	
Proposed Use:	**Yes**	**No**
Sewer Flushing	x	
Street Cleaning	x	
Construction and Dust Control	x	
On-Site WWTP Irrigation	x	
Downtown Flowerbed Irrigation		x
Park/Sports Field Irrigation		x
Gold Course Irrigation		x
Dual-Water Supply		x
Groundwater Recharge		x
On-Site WWTP Polymer Make-up		x

3.5 Preliminary Financial Analysis

Along with public considerations, one of the most important factors affecting the implementation of a wastewater reuse plan is cost. With many Canadian municipalities facing budgetary constraints, any proposed reuse plan will have to be economically feasible, and offer the possibility of economic benefits in the future. Metcalf & Eddy (2003) differentiate between economic and financial analyses: "Economic analysis is focused on the value of the resources in vested in a project to construct and operate it, measured in monetary terms….and evaluates water reclamation in the context of the impacts on society. The financial analysis is focused on the perceived costs and benefits of a project from the view points of the [various project] participants….[It also focuses] on the local ability to raise money from project revenues, government grants, loans, and bonds to pay for the project". It is important to specifically examine if the City of Guelph can successfully implement a reuse plan based on its current financial resources and the potential for provincial and federal funding.

3.6 Public Education and Promotion

Mantovani (2001) emphasizes the importance of using various verbal and written communication outlets to convey the idea of water reuse. It is important to explain the concept of reclaimed water and why the project is needed. The public must also understand that the reclaimed water is safe for use.

Mantovani (2001) states that the most common way to convey the concept of water reuse to the public is to hold presentations, hearings and workshops. These meetings convey information to a select group of people on a person to person basis. They may be used to target certain groups, such as customers and experts, before the general public. They are effective when assessing the process of reclamation and addressing the concerns the public may have about this process. However, it is difficult to reach a large audience using this method of communication.

Mantovani (2001) also suggests that information about reuse can be supplied to the public through printed public information, news releases and websites. Printed information can provide the public with facts and answers to common questions about reuse. News releases and websites can be used to educate large audiences and to update information on a regular basis.

4 CONCLUSION

Based on the findings presented in this report, the City of Guelph should consider new and innovative ways of reducing water consumption in order to provide long-term sustainable growth. This report specifically addresses one such method of reduction: reclaimed wastewater usage. Standard strategies taken from other jurisdictions are discussed and evaluated in a regulatory, social, and environmental context and directly relate to the conditions in the City of Guelph. *AquaTeam Solutions* has presented both short- and long-term wastewater reuse alternatives that can be implemented in the City of Guelph. The short-term solutions that could be implemented within the next two years include construction site dust control, municipal works uses, on-site WWTP irrigation, and downtown flowerbed irrigation. The long-term solutions that could be implemented within broader time frame include industrial cooling and processing, park and golf course irrigation, a municipal dual water system, dewatering polymer make-up at the WWTP, and groundwater recharge. Each of the strategies fall into certain usage categories that have specific water quality requirements. Although these strategies help to alleviate the pressure on the City's water supply, the public acceptance of the wastewater reuse options is essential before any of the alternatives can be fully implemented.

5 RECOMMENDATIONS

In terms of individual alternatives, a more detailed implementation plan for each option should be conducted pending regulatory approval. In addition to the reuse alternatives presented, industrial applications and groundwater recharge options require further investigation. Each reclaimed wastewater reuse option should be coordinated with an overall master plan for the City of Guelph. The master plan should identify the main infrastructure requirements that are necessary to put each reclaimed wastewater reuse practice into operation. Furthermore a full risk assessment and management strategy should be implemented to ensure a high level of public safety vis-à-vis the proposed wastewater reuse practices for the City.

As mentioned in this report, a public education campaign is a vital component of this wastewater reuse strategy. *AquaTeam Solutions* is recommending that public consultation and city-wide news campaign be conducted to educate the public about wastewater reuse. Furthermore, the economic implications of both the short- and long-term reuse strategies should be evaluated fully in order to allocate the appropriate municipal budgetary funding.

Finally, it will be necessary to address the concerns of regulatory agencies such as the Ontario Ministry of the Environment and interested parties such as the Grand River Conservation Authority, in order for the proposed wastewater plan to implemented in the City of Guelph.

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Appendix E
Evaluation and Prioritization Results

Draft Prioritization Results – Guelph WWTMP Evaluation

Alternative	Criteria 1 **Practicality – Given Existing Conditions in Guelph** Alternative provides the opportunity to take advantage of the City's existing infrastructure and is within the City's ability to implement (technically, financially, regulatory).	Criteria 2 **Sustainability – Consistent with the City's Strategic Plan** Alternative contributes to a solution that protects community and environmental health and well being for current and future residents of the City of Guelph	Criteria 3 **Efficiency – Consistent with Responsible Municipal Management** Alternative achieves the intended use and has the potential to meet or exceed Ontario's regulatory requirements and standards.	Priority Assignment
Planning Alternatives				
Do Nothing/Limit Growth	**NO** – It is recognized that the City of Guelph will be growing, the extent to which is being examined through the City's Growth Management Strategy. It is not practical to consider that growth will not occur.	**NO** – Does not consider potential future residents of Guelph	**NO** – Does not reflect the province's Places to Grow requirements.	**Zero "Yes"** – Will not proceed to detailed evaluation
Source Control/Non-expansion Alternatives				
Water Conservation Initiatives	**YES –** The practicality of water conservation has been shown through the positive results of ongoing initiatives.	**YES –** Water conservation promotes sustainability from both the potential for a decrease in wastewater generation as well as a decrease in the demand for the water supply	**YES –** If successful, water conservation initiatives can defer the need for capital spending.	**Three "Yes"** – As a program or policy based alternative, this option will be carried forward for integration into the Master Plan strategy.
Inflow and Infiltration (I/I) Control	**YES –** Reducing I/I to the wastewater collection system is something that the City can practically implement.	**YES –** Decreasing extraneous flows reaching the WWTP, in particular during wet weather events, can allow for improved operation of the WWTP.	**YES –** Reducing potential peak flows to the WWTP can assist in reliably achieving effluent requirements.	**Three "Yes"** – As a program or policy based alternative, this option will be carried forward for integration into the Master Plan strategy.
Sewer Use By-Law	**YES –** The City has shown that they can effectively implement the sewer use by-law	**YES –** Decreasing organic loads to the WWTP can allow for improved operation of the facility.	**YES –** The past work with local industry has resulted in reducing loading to the WWTP, this is one of the factors being examined in the potential rerating which may allow the City to continue to reach effluent requirements while deferring capital expenditures.	**Three "Yes"** – As a program or policy based alternative, this option will be carried forward for integration into the Master Plan strategy.
Plant Optimization (Re-rating)	**YES –** Plant optimization may involve modifications to current WWTP operations which is within the City's ability to implement.	**YES –** The plant optimization will can be achieved while protecting both the community and environmental health.	**YES –** Optimization of the WWTP can be achieved to meet regulatory requirements to demonstrate reliability.	**Three "Yes"** – As a program or policy based alternative, this option will be carried forward for integration into the Master Plan strategy.
Discharge Location Alternatives				
Existing WWTP Discharge to Speed River	**YES –** This takes advantage of the City's existing wastewater infrastructure which is located at the site.	**YES –** The City has demonstrated that they are able to manage impacts to the Speed at the existing facility.	**YES –** Based on initial investigations it has been shown that the Policy 2 receiver requirements can be met at the existing site.	**Three "Yes"** – This option will be carried forward for detailed evaluation
Grand River Discharge	**NO** – A discharge to the Grand River would be outside of the City's urban boundaries making implementation not practical.	**NO** – The GRCA has indicated that it would not be environmentally beneficial to discharge to the Grand River which would not have the ability to assimilate the discharge.	**NO** – As there is limited assimilative capacity in the Grand River it is not anticipated that the MOE would approve a new discharge.	**Zero "Yes"** – Will not proceed to detailed evaluation
Guelph Lake Discharge	**NO** – A new discharge does not best utilize the City's existing infrastructure.	**NO** – The GRCA has indicated that there would be no environmental benefits from this option, as the assimilative capacity of the Speed River has been reached. In addition, the proximity to recreational water users, may pose a greater potential to impact the community. This option may interfere with future water supply sources as Guelph Lake was cited as a potential option for future drinking water supply.	**YES** – It is anticipated that this option would able to be implemented and approved. Further investigation and analysis is required to confirm this.	**One "Yes"** – Will not proceed to detailed evaluation
Lake Erie Discharge	**NO** – This option does not practically use the City's existing infrastructure and is outside of the municipal boundaries.	**NO** – Further study would be required to determine the potential impact of removing the volume of effluent now being discharged to the Speed River. This alternative is not consistent with the	**NO** – Approvals are expected to be difficult and would likely require significant study and analysis across several municipal jurisdictions.	**Zero "Yes"** – Will not proceed to detailed evaluation

Alternative	**Criteria 1** **Practicality – Given Existing Conditions in Guelph** Alternative provides the opportunity to take advantage of the City's existing infrastructure and is within the City's ability to implement (technically, financially, regulatory).	**Criteria 2** **Sustainability – Consistent with the City's Strategic Plan** Alternative contributes to a solution that protects community and environmental health and well being for current and future residents of the City of Guelph	**Criteria 3** **Efficiency – Consistent with Responsible Municipal Management** Alternative achieves the intended use and has the potential to meet or exceed Ontario's regulatory requirements and standards.	**Priority Assignment**
		City's Strategic Plan.		
Effluent Reuse				
Urban Reuse	**YES –** Urban reuse is possible using the existing treatment processes with some additional treatment, storage and conveyance infrastructure.	**YES –** This alternative could be sustainable in the long term by beneficially reusing some of the treated effluent.	**YES –** Restricted urban reuse (irrigation) has been approved in other areas of Ontario for use on golf courses or areas where access can be controlled.	**Three "Yes"** – Further study is required on this option, therefore the option will be carried forward as a study program/City initiative to be integrated into the Master Plan strategy.
Groundwater Recharge	**YES** – Groundwater recharge would require a number of additional treatment processes to implement, and it could be implemented by the City.	**NO** – There are no non-potable groundwater aquifers within the Guelph area and discharge to a potable aquifer could result in increased potential health risks.	**NO** – There are currently no approved effluent recharge projects in Ontario and it is not within the current regulatory framework to be able to implement.	**Zero "Yes"** – Will not proceed to detailed evaluation
Treatment Location Alternatives				
Existing WWTP Site	**YES –** Treatment at the existing location best utilizes existing infrastructure.	**YES –** The existing site is already designated for this use and does not require new greenspace.	**YES –** The site is designated for this use and meets all regulatory requirements.	**Three "Yes"** – This option will be carried forward for detailed evaluation
Satellite Treatment Plant Site(s) Located at New Discharge location(s)	**NO** – This option does not take advantage of the City's existing infrastructure.	**NO** – A new satellite facility may require the conversion of greenspace for municipal use. In addition the only alternate discharge location noted would be Guelph Lake which is in proximity to a major recreational area.	**YES** – Depending on the location of a new satellite facility rezoning may be required, but could be done under current regulatory processes.	**One "Yes"** – Will not proceed to detailed evaluation
Satellite Treatment Plant Site at Strategic Locations with Effluent Pumped to Existing WWTP Outfall	**NO** – This option does not take advantage of the City's existing infrastructure.	**NO** – Would require the construction of new conveyance infrastructure to convey flows to existing outfall. This could cause major disturbances to the community or to existing greenspace. In addition, a new satellite facility may require the conversion of greenspace for municipal use.	**YES** – Depending on the location of a new satellite facility rezoning may be required, but could be done under current regulatory processes.	**One "Yes"** – Will not proceed to detailed evaluation
Treatment Technology Alternatives				
Conventional Physical/Biological Treatment	**YES –** The City could implement a conventional treatment plant utilizing existing infrastructure.	**NO** – Conventional/biological treatment on its own would not be able to achieve the required effluent requirements to not impair environmental health.	**NO** – Conventional/biological treatment on its own would not be able to achieve the required effluent requirements.	**One "Yes"** – Will not proceed to detailed evaluation
Natural Treatment Systems	**NO –** Natural treatment systems require a large area of land which is not available in proximity to the WWTP and could not practically treat the wastewater flow volumes that are projected.	**NO** – Natural treatment systems are not able to achieve the required effluent requirements to not impair environmental health.	**NO** – Natural treatment systems are not able to achieve required effluent requirements.	**Zero "Yes"** – Will not proceed to detailed evaluation
Advanced Treatment Technologies				
Nitrification Technologies	**YES –** Nitrification technologies could be implemented with existing infrastructure.	**NO –** Nitrification treatment on its own would not be able to achieve the required effluent requirements to not impair environmental health.	**NO –** Nitrification treatment on its own would not be able to achieve the required effluent requirements. Nitrification technologies could help to achieve ammonia limits, but would not be able to lower the phosphorous and suspended solids to the required level.	**One "Yes"** – Will not proceed to detailed evaluation
Membrane Bioreactors	**YES** – The City could implement membrane technology while utilizing the existing infrastructure.	**YES** – Membrane technologies can provide a high quality effluent to minimize impact on the environment.	**YES** – Membrane technologies can achieve the required future effluent targets for ammonia phosphorous and suspended solids.	**Three "Yes"** – This option will be carried forward for detailed evaluation

Alternative	**<u>Criteria 1</u>** **Practicality – Given Existing Conditions in Guelph** Alternative provides the opportunity to take advantage of the City's existing infrastructure and is within the City's ability to implement (technically, financially, regulatory).	**<u>Criteria 2</u>** **Sustainability – Consistent with the City's Strategic Plan** Alternative contributes to a solution that protects community and environmental health and well being for current and future residents of the City of Guelph	**<u>Criteria 3</u>** **Efficiency – Consistent with Responsible Municipal Management** Alternative achieves the intended use and has the potential to meet or exceed Ontario's regulatory requirements and standards.	**Priority Assignment**
Tertiary Membrane Bioreactors	**YES** – The City could implement membrane technology while utilizing the existing infrastructure. The application of this technology at full-scale is currently limited, with full-scale facilities currently in design stage. The City should remain up to date on progress of this technology.	**YES** – Membrane technologies can provide a high quality effluent to minimize impact on the environment.	**YES** – Membrane technologies can achieve the required future effluent targets for ammonia phosphorous and suspended solids.	**Three "Yes"** – This option will be carried forward for detailed evaluation
Tertiary Membrane Filtrations	**YES** – The City could implement membrane technology while utilizing the existing infrastructure.	**YES** – Membrane technologies can provide a high quality effluent to minimize impact on the environment.	**YES** – Membrane technologies can achieve the required future effluent targets for phosphorous and suspended solids. With this membrane technology nitrification and denitrification will still be required in the secondary treatment processes.	**Three "Yes"** – This option will be carried forward for detailed evaluation
Emerging Wastewater Treatment Technologies				
Reverse Osmosis (RO)	**YES** – The City could implement reverse osmosis at the existing site while utilizing existing infrastructure.	**YES** – RO can be used to achieve better than the required effluent values when used as a polishing stage for membrane technology.	**YES** – RO can be used to achieve better than the required effluent values when used as a polishing stage for membrane technology. This technology may become more common in wastewater applications if there are changes in future regulatory requirements, or based on intended end use.	**Three "Yes"** – This option will be carried forward for detailed evaluation
Activated Carbon	**YES** – The City could implement activated carbon at the existing site while utilizing existing infrastructure.	**YES** – Activated carbon can be used to achieve better than the required effluent values when used as a polishing stage for membrane technology.	**YES** – Activated carbon can be used to achieve better than the required effluent values when used as a polishing stage for membrane technology. This technology may become more common in wastewater applications if there are changes in future regulatory requirements, or based on intended end use.	**Three "Yes"** – This option will be carried forward for detailed evaluation
Ozone	**YES** – The City could implement ozone at the existing site while utilizing existing infrastructure.	**YES** – ozone is a disinfection technology that can be used to achieve better than the required effluent values when used as a polishing stage for current disinfection technologies.	**YES** – Ozone can be used to achieve better than the required effluent values when used as a polishing stage current disinfection technologies. This technology may become more common in wastewater applications if there are changes in future regulatory requirements, or based on intended end use.	**Three "Yes"** – This option will be carried forward for detailed evaluation

EVALUATION RESULTS SUMMARY AND SENSITIVITY ANALYSIS

Discharge Locations

		Sensitivity Scenarios						PAC Scenario #1												PAC Scenario #2					
		Equal Weighting	Technical Priority	Natural Priority	Social Priority	Economic Priority	Double Engergy	Bob Bell	Georgia Simms	M. Anderson	Andrew Lambden	Dan	Dorothy Remmer	Jamie Ford	Marion Plaunt	Gerry Wheeler	Paul McLennan	Lloyd Longfield	Ian Smith	Bob Bell	Georgia Simms	M. Anderson	Andrew Lambden	Dorothy Remmer	Jamie Ford
Existing Outfall	Technical	25	70	10	10	10	25	30	10	10	0	25	25	0	30	5	20	10	20	25	0	10	10	10	0
	Natural	22	8.6	60	8.6	8.6	22	30	39	43	86	22	64.5	43	34	39	34	26	25.8	30	77	34	60	34	21.5
	Social	22	8.7	8.7	60.9	8.7	22	17	8.7	17	0	22	0	22	17	39	17	17	26.1	22	8.7	8.7	8.7	35	21.8
	Economic	21	8.3	8.3	8.3	58.1	21	12	29	17	0	21	0	21	8.3	4.2	17	33	16.6	12	0	33	8.3	8.3	41.5
	Total/100	89	95.6	87	88	85	89	90	86	87	86	89	90	86	90	87	88	86	89	89	86	86	87	88	85

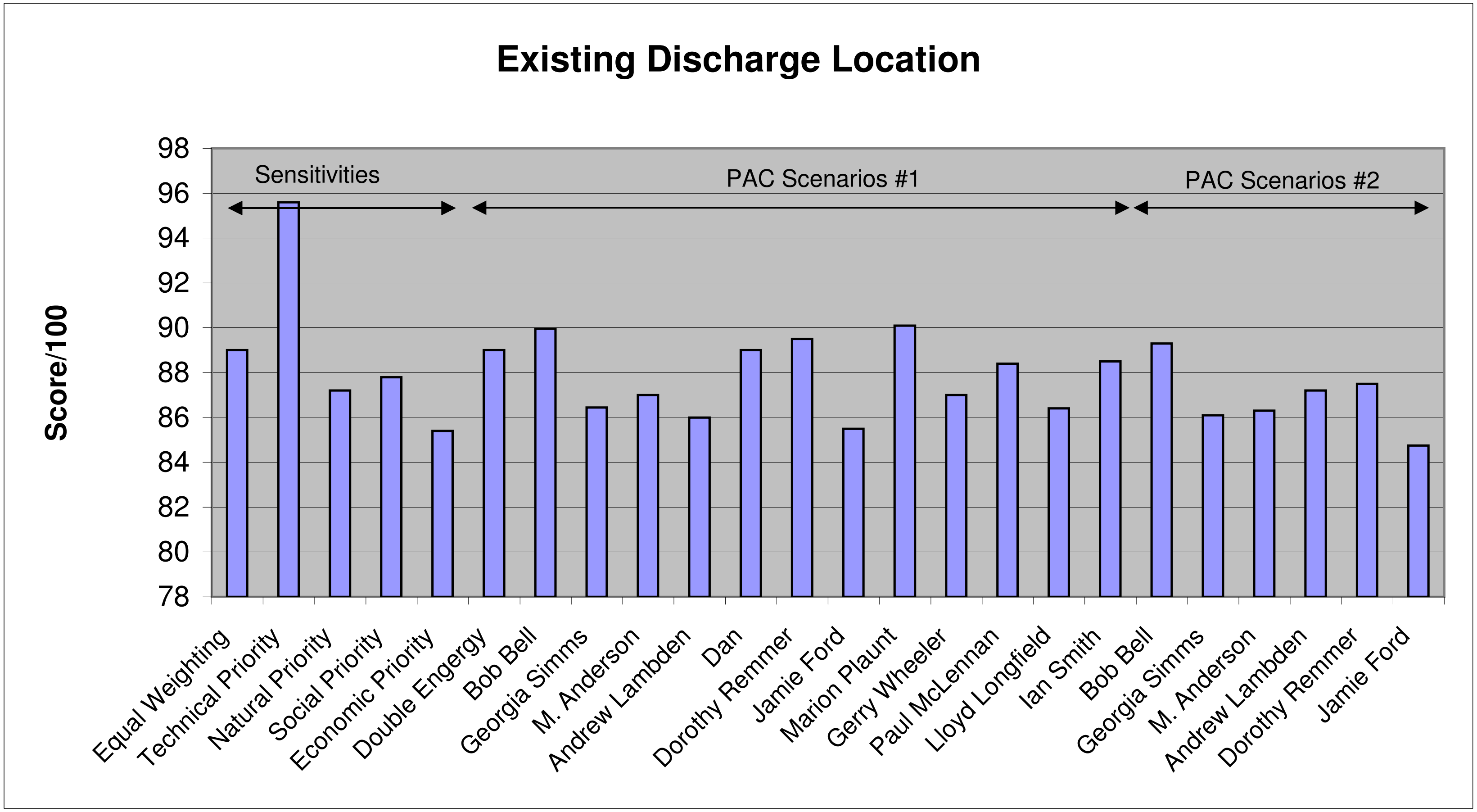
Treatment Locations

		Sensitivity Scenarios						PAC Scenario #1												PAC Scenario #2					
		Equal Weighting	Technical Priority	Natural Priority	Social Priority	Economic Priority	Double Engergy	Bob Bell	Georgia Simms	M. Anderson	Andrew Lambden	Dan	Dorothy Remmer	Jamie Ford	Marion Plaunt	Gerry Wheeler	Paul McLennan	Lloyd Longfield	Ian Smith	Bob Bell	Georgia Simms	M. Anderson	Andrew Lambden	Dorothy Remmer	Jamie Ford
Existing WWTP	Technical	22	61.6	8.8	8.8	8.8	22	26	8.8	8.8	0	22	22	0	26	4.4	18	8.8	17.6	22	0	8.8	8.8	8.8	0
	Natural	22	8.6	60	8.6	8.6	22	30	39	43	86	22	64.5	43	34	39	34	26	25.8	30	77	34	60	34	21.5
	Social	20	8	8	56	8	20	16	8	16	0	20	0	20	16	36	16	16	24	20	8	8	8	32	20
	Economic	25	10	10	10	70	25	15	35	20	0	25	0	25	10	5	20	40	20	15	0	40	10	10	50
	Total/100	89	88.2	87	83	95	89	88	91	88	86	89	87	88	87	84	88	91	87	87	85	91	87	85	92

EVALUATION RESULTS SUMMARY AND SENSITIVITY ANALYSIS

Treatment Technologies (Advanced)

		Sensitivity Scenarios						PAC Scenario #1												PAC Scenario #2					
		Equal Weighting	Technical Priority	Natural Priority	Social Priority	Economic Priority	Double Engergy	Bob Bell	Georgia Simms	M. Anderson	Andrew Lambden	Dan	Dorothy Remmer	Jamie Ford	Marion Plaunt	Gerry Wheeler	Paul McLennan	Lloyd Longfield	Ian Smith	Bob Bell	Georgia Simms	M. Anderson	Andrew Lambden	Dorothy Remmer	Jamie Ford
MBR	Technical	16	45.5	6.5	6.5	6.5	16	20	6.5	6.5	0	16	16.3	0	20	3.3	13	6.5	13	16	0	6.5	6.5	6.5	0
	Natural	20	8	56	8	8	20	28	36	40	80	20	60	40	32	36	32	24	24	28	72	32	56	32	20
	Social	22	8.7	8.7	60.9	8.7	22	17	8.7	17	0	22	0	22	17	39	17	17	26.1	22	8.7	8.7	8.7	35	21.8
	Economic	9.3	3.7	3.7	3.7	25.9	9.3	5.6	13	7.4	0	9.3	0	9.3	3.7	1.9	7.4	15	7.4	5.6	0	15	3.7	3.7	18.5
	Total/100	67	65.9	75	79	49	67	70	64	71	80	67	76	71	73	80	70	63	71	72	81	62	75	77	60
Tertiary Membrane	Technical	22	61.6	8.8	8.8	8.8	22	26	8.8	8.8	0	22	22	0	26	4.4	18	8.8	17.6	22	0	8.8	8.8	8.8	0
	Natural	20	8	56	8	8	20	28	36	40	80	20	60	40	32	36	32	24	24	28	72	32	56	32	20
	Social	22	8.7	8.7	60.9	8.7	22	17	8.7	17	0	22	0	22	17	39	17	17	26.1	22	8.7	8.7	8.7	35	21.8
	Economic	13	5.3	5.3	5.3	37.1	13	8	19	11	0	13	0	13	5.3	2.7	11	21	10.6	8	0	21	5.3	5.3	26.5
	Total/100	77	83.6	79	83	63	77	80	72	77	80	77	82	75	81	82	78	71	78	80	81	71	79	81	68
Tertiary Nitrifying MBR	Technical	13	37.1	5.3	5.3	5.3	13	16	5.3	5.3	0	13	13.3	0	16	2.7	11	5.3	10.6	13	0	5.3	5.3	5.3	0
	Natural	20	8	56	8	8	20	28	36	40	80	20	60	40	32	36	32	24	24	28	72	32	56	32	20
	Social	22	8.7	8.7	60.9	8.7	22	17	8.7	17	0	22	0	22	17	39	17	17	26.1	22	8.7	8.7	8.7	35	21.8
	Economic	21	8.3	8.3	8.3	58.1	21	12	29	17	0	21	0	21	8.3	4.2	17	33	16.6	12	0	33	8.3	8.3	41.5
	Total/100	76	62.1	78	83	80	76	74	79	79	80	76	73	83	74	82	77	80	77	75	81	79	78	80	83



Existing Discharge Location
Score/100
98
96
94
92
90
88
86
84
82
80
78
Sensitivities
PAC Scenarios #1
PAC Scenarios #2
Equal Weighting
Technical Priority
Natural Priority
Social Priority
Economic Priority
Double Engergy
Bob Bell
Georgia Simms
M. Anderson
Andrew Lambden
Dan
Dorothy Remmer
Jamie Ford
Marion Plaunt
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Georgia Simms
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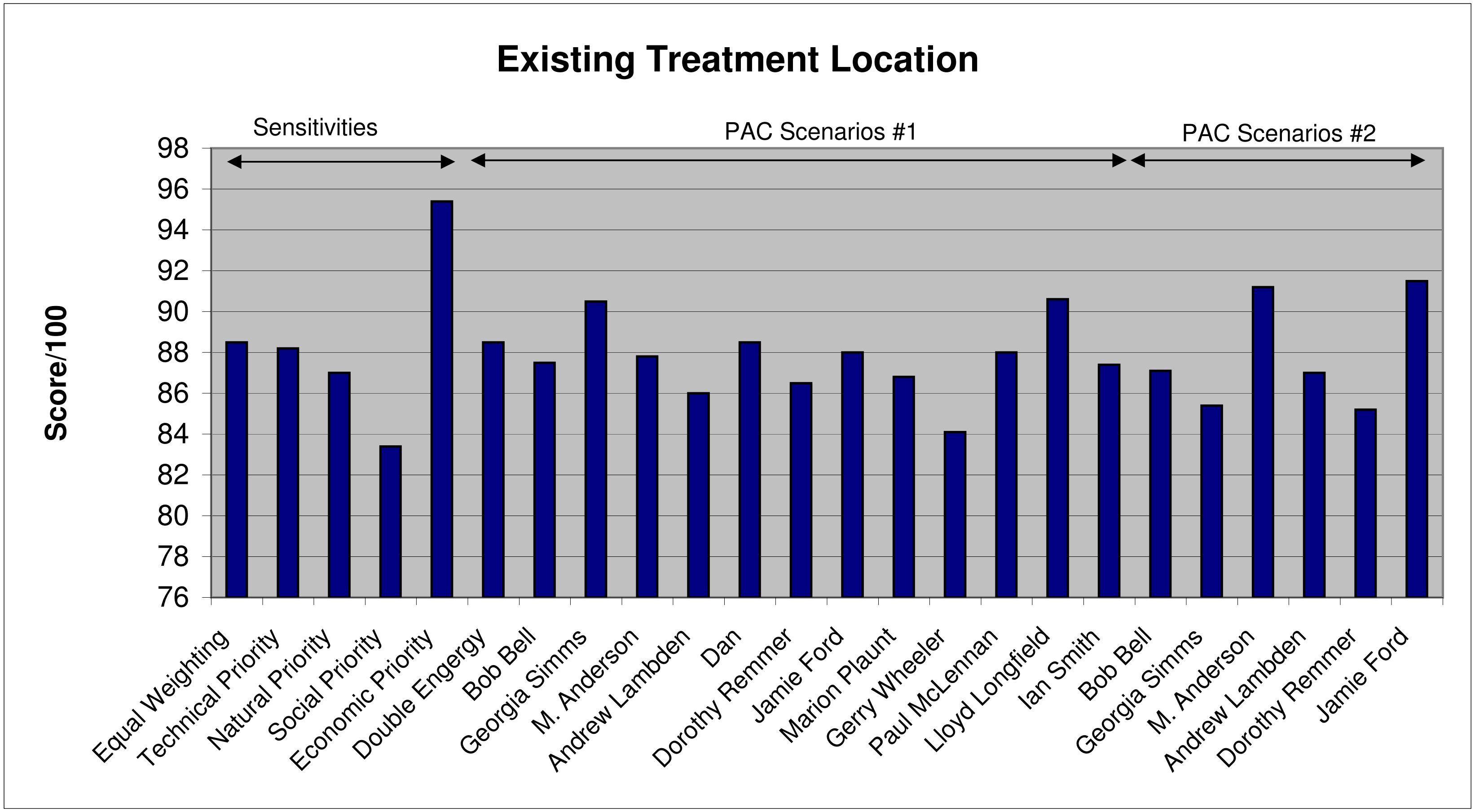
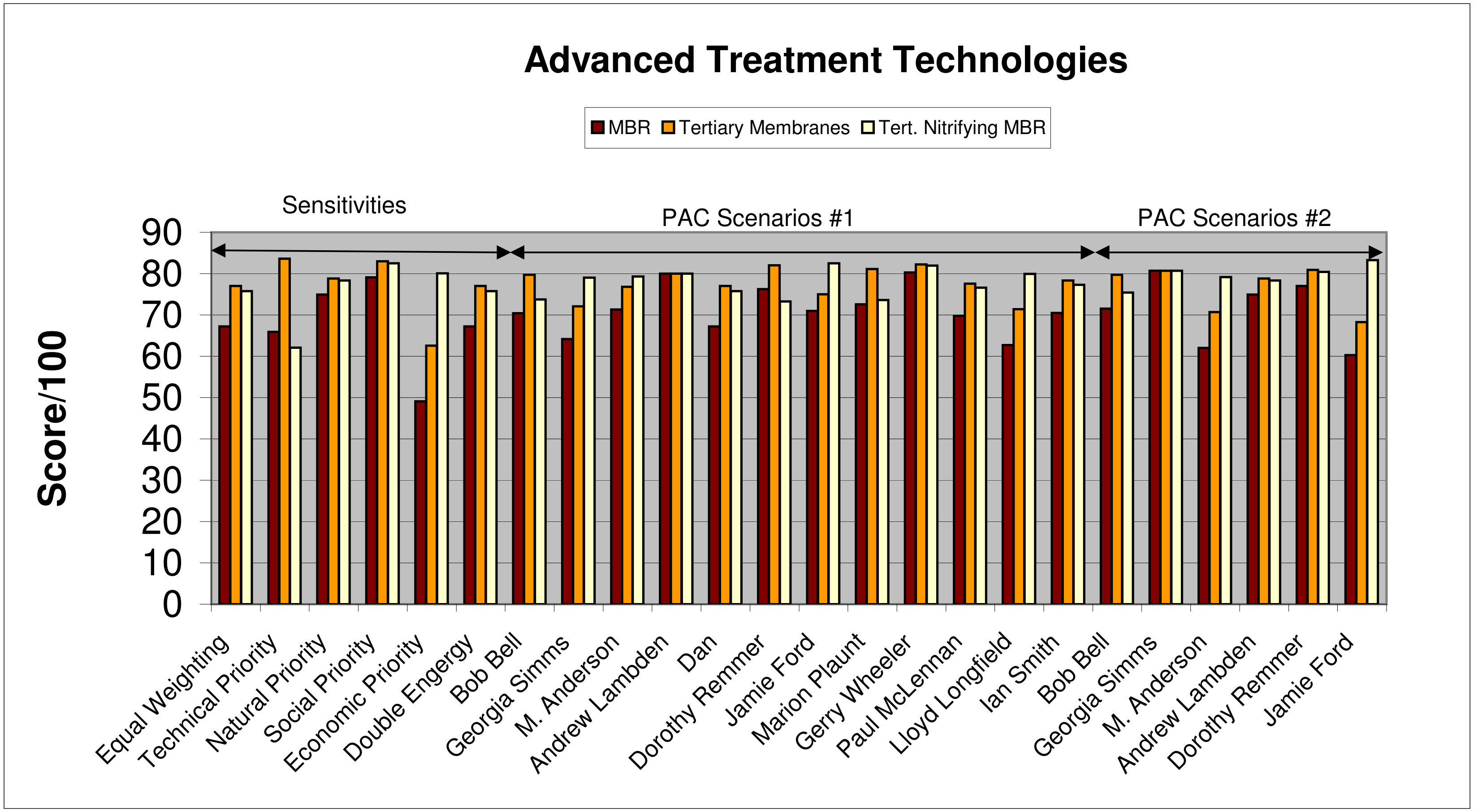

Existing Treatment Location
Sensitivities
PAC Scenarios #1
PAC Scenarios #2
Score/100
98
96
94
92
90
88
86
84
82
80
78
76
Equal Weighting
Technical Priority
Natural Priority
Social Priority
Economic Priority
Double Engergy
Bob Bell
Georgia Simms
M. Anderson
Andrew Lambden
Dan
Dorothy Remmer
Jamie Ford
Marion Plaunt
Gerry Wheeler
Paul McLennan
Lloyd Longfield
Ian Smith
Bob Bell
Georgia Simms
M. Anderson
Andrew Lambden
Dorothy Remmer
Jamie Ford



Advanced Treatment Technologies
MBR
Tertiary Membranes
Tert. Nitrifying MBR
Sensitivities
PAC Scenarios #1
PAC Scenarios #2
Score/100
90
80
70
60
50
40
30
20
10
0
Equal Weighting
Technical Priority
Natural Priority
Social Priority
Economic Priority
Double Engergy
Bob Bell
Georgia Simms
M. Anderson
Andrew Lambden
Dan
Dorothy Remmer
Jamie Ford
Marion Plaunt
Gerry Wheeler
Paul McLennan
Lloyd Longfield
Ian Smith
Bob Bell
Georgia Simms
M. Anderson
Andrew Lambden
Dorothy Remmer
Jamie Ford

EXISTING DISCHARGE - EVALUATION

Evaluation Category	Definition	Impact Measure	Score	Comments
Technical Environment				
Performance Record	The ability of the alternative to perform with a high degree of reliability and predictability in both process operations and effluent quality	**10** – the alternative includes proven technology with a high degree of reliable performance **5** – the alternative includes newer technology with growing record of demonstrated performance reliability **1** – the alternative includes innovative technology with limited performance record and unconfirmed reliability – requires further testing/demonstration to determine feasibility for Guelph	10	The existing outfall has historically performed with a high degree of reliability
Ability to meet treatment capacity requirements (Short-, Medium-, Long-term)	The ability of the alternative to provide the wastewater treatment requirements for short-medium- and/ or long-term needs	**10** – the alternative can provide short- , med- and long- term treatment requirements **5** – the alternative can provide short- and may provide medium-term requirements **1** – the alternative may only provide long-term requirements	10	The existing outfall appears to have sufficient capacity to accommodate future flows. An investigation of the outfall should be performed to determine if any maintenance upgrades are required.
Ease of Implementation	The ability of the alternative to be implemented with minimal disruption to existing wastewater treatment operations; minimal need to require system modifications	10 – the alternative can be implemented with no disruption to existing service 5 – the implementation of the alternative may result in minor disruptions to existing service 1 – the implementation of the alternative may require significant or periodic disruptions to existing service	10	As the outfall appears to have sufficient capacity, maintenance upgrades, if required, should be able to be performed without disruptions to the existing service.
Regulatory Constraints	The ability of the alternative to be approved with minimal, if any, conditions	**10** – the alternative can be readily approved **5** – The alternative can be approved with minimal conditions **1** – the alternative can be approved with significant or onerous conditions	10	Approval for work within a water way would be required if work is required on the outfall. This approval should be readily approvable.
		Average Score out of 10	10	

EXISTING DISCHARGE - EVALUATION

Evaluation Category	Definition	Impact Measure	Score	Comments
Natural Environment				
Surface Water Quality	The potential for the Speed River to assimilate the WWTP effluent within regulatory requirements.	**10** - The alternative will provide a high degree of protection to the water quality of the Speed River all year and treated effluent can be readily assimilated **5** – The alternative will provide a high degree of protection to the water quality of the Speed River for most of the year and treated effluent may require seasonal discharge conditions to meet assimilation requirements. **1** – The alternative may present a threat to the water quality of the Speed River during low flow periods and there may be significant restrictions to treated effluent discharge conditions.	10	Based on initial calculations, the Speed River appears to have sufficient capacity to assimilate additional flows at this location, with the use of the more stringent effluent limits proposed.
Ground Water Quality and Supply	The potential for the alternative to avoid sensitive groundwater resources for the City of Guelph and to protect overall groundwater quality and quantity	**10** – the alternative provides the greatest level of protection to sensitive groundwater resources and to the overall groundwater quality and quantity **5** – the alternative provides an acceptable level of protection to sensitive groundwater resources and to overall groundwater quality and quantity. may require careful monitoring and over the long term to maintain protection. Contingency measure may be required. **1** – the alternative poses unacceptable risks to the protection sensitive groundwater resources and to the overall quality and quantity of groundwater	10	There should not be any impact to groundwater resources with the discharge at the current location.
Terrestrial Habitats and Corridors	The potential for the alternative to avoid negative impacts to terrestrial habitats and corridors	**10** – the alternative will avoid terrestrial habitats and corridors **5** – the alternative may require special measures to protect terrestrial habitats and corridors **1** - the alternative will result in an unacceptable loss of terrestrial habitats and corridors	10	The existing discharge should not impact terrestrial habitats or corridors.
Aquatic Habitats and Fisheries	The potential for the alternative to protect or enhance aquatic habitats and fisheries	**10** – the alternative will protect aquatic habitats and fisheries and has the potential to provide enhancements **5** – the alternative may require special measures to protect aquatic habitats and fisheries **1** - the alternative will result in an unacceptable loss of aquatic habitat and fisheries	5	With the future flows, modifications to the outfall, such as diffusers may be required to mitigate impacts to the aquatic environment.
Air Quality	The potential for the alternative to minimize any increase GHG emissions	**10** – the alternative will make a significant contribution to the City's goal to reduce GHG emissions **5** – the alternative will not make a measurable contribution to the City 's goal to reduce GHG emissions **1** – the alternative may increase GHG emissions	5	This alternative will not have an impact on GHG emissions
Flood Plain	The potential for the alternative to maintain the existing flood plain and flood volume capacity in the Speed River	**10** – the alternative will maintain the existing flood plan and flood volume capacity **5** – the alternative will require specials measures to maintain the existing flood plain and flood volume capacity **1** – the alternative will result in an unacceptable loss of floodplain and will require significant measures to replace lost flood volume capacity	10	Maintaining the existing discharge should not have an impact on the flood plain.
Wetlands	The potential for the alternative to protect and maintain wetlands	**10** – the alternative will avoid wetlands **5** – the alternative may require special measures to maintain wetland protection **1** – the alternative will result in an unacceptable threat to wetlands	10	Maintaining the existing discharge should not have an impact on any wetlands.
		Average Score out of 10	8.6	

EXISTING DISCHARGE - EVALUATION

Evaluation Category	Definition	Impact Measure	Score	Comments
Social Environment				
Land Use Compatibility	The potential for the alternative to support the City of Guelph Growth Management Strategy recommendations	**10** – the alternative is consistent with and strongly supports the City's Growth Management Strategy recommendations **5** – the alternative requires special measures to be consistent with the City's Growth Management Strategy Recommendations **1** – the alternative is not consistent with the City's Growth Management Strategy	10	The existing discharge has sufficient capacity to handle flows which may be generated by future growth.
Community Growth Requirements	The potential for the alternative to be implemented as needed for short-, medium- and long-term community needs	**10** – the alternative can be in service to meet short- , medium and long-term scheduling requirements **5** – the alternative can be in service to meet medium- and long-term scheduling requirement but may not meet short term service schedule requirements **1** – the alternative may only meet long-term servicing requirements	10	As there are no major construction required with maintaining the existing discharge, it will be in service to accommodate any future growth scheduling.
Occupational Health and Safety	The potential for the alternative minimize risks to occupational health and safety	**10 –** there are no unacceptable risks to occupation health and safety 5 – there are minor risks to occupation health and safety that can be properly managed 1 – there are significant risks to occupation health and safety which require significant training and or risk management plans to minimize risks to acceptable levels	10	No major modifications are being proposed for the outfall and therefore there should be no unacceptable risks to staff..
Community Health and Safety	The potential for the alternative to minimize risk to community health and safety	**10 –** there are no unacceptable risks to community health and safety 5 – there are minor risks to community health and safety that can be properly managed 1 – there are significant risks to community health and safety which require significant measures and risk management plans to minimize risks to acceptable levels	10	No major modifications are being proposed for the outfall and therefore there should be no unacceptable risks to the community.
Urban Design Requirements and Aesthetics	The potential for the alternative to support the City's design standards and community aesthetics	**10** – the alternative is consistent with and supports the City's design standards and community aesthetics **5** – the alternative requires special measures to be consistent with the City's design standards and community aesthetics **1** – the alternative is not consistent with the City's design standards and community aesthetics	10	There should not be any aesthetic impact from maintaining the existing discharge.
Community Energy Plan	The potential for the alternative to produce energy for community use	**10 –** alternative can provide a significant amount of energy for community use in addition to meeting the demands of the WWTP 5 – the alternative can provide a moderate amount of energy for community use in addition to meeting the demands of the WWTP 1- the alternative can provide a limited or minimal amount of energy for community use in addition to meeting the demands of the WWTP.	1	This alternative does not provide any energy to the community.
Heritage and Cultural Resources	The potential for the alternative to avoid heritage and cultural resources	**10** – the alternative will avoid heritage and cultural resources **5**- the alternative may require special measures to protect heritage and cultural resources **1** – the alternative may pose unacceptable risk to heritage and cultural resources	10	Maintaining the existing discharge should not impact any cultural resources.
		Average Score out of 10	8.7	

EXISTING DISCHARGE - EVALUATION

Evaluation Category	Definition	Impact Measure	Score	Comments
Economic Environment				
Capital Costs	The relative costs of land, equipment, and facilities when compared to other alternatives.	**10** – the alternative has the lowest capital costs relative to other alternatives **5** – the alternative is in the mid range of capital costs relative to other alternatives **1** – the alternative has the highest capital costs relative to other alternatives	10	As no capacity upgrades are required, the capital costs should be minimal.
Life Cycle Costs	The relative life-cycle costs (including Operation/Maintenance, Depreciation/Replacement) when compared to other alternatives	**10** – the alternative has the lowest lifecycle costs relative to other alternatives **5** – the alternative is in the mid range of lifecycle costs relative to other alternatives **1** – the alternative has the highest lifecycle costs relative to other alternatives	10	Based on the findings from an inspection of the outfall, some maintenance may be required. - Costs anticipated to be relatively inexpensive
Funding Availability	The potential for the alternative to be eligible for funding from provincial or federal programs	**10** – the alternative is eligible for existing provincial and/or federal funding **5** – the alternative in not eligible for existing funding programs but may be eligible for anticipated future funding programs **1** – the alternative is not eligible for existing for anticipated future programs	5	If upgrades to the outfall are required, this may be eligible for future funding.
		Average Score out of 10	8.3	

EXISTING WWTP - EVALUATION

Evaluation Category	Definition	Impact Measure	Score	Comments
Technical Environment				
Performance Record	The ability of the alternative to perform with a high degree of reliability and predictability in both process operations and effluent quality	**10** – the alternative includes proven technology with a high degree of reliable performance **5** – the alternative includes newer technology with growing record of demonstrated performance reliability **1** – the alternative includes innovative technology with limited performance record and unconfirmed reliability – requires further testing/demonstration to determine feasibility for Guelph	10	The existing WWTP has performed with a high degree of reliability in this location.
Ability to meet treatment capacity requirements (Short-, Medium-, Long-term)	The ability of the alternative to provide the wastewater treatment requirements for short-medium- and/ or long-term needs	**10** – the alternative can provide short- , med- and long- term treatment requirements **5** – the alternative can provide short- and may provide medium-term requirements **1** – the alternative may only provide long-term requirements	10	The site is sufficient in size to accommodate future treatment processes over the long-term
Ease of Implementation	The ability of the alternative to be implemented with minimal disruption to existing wastewater treatment operations; minimal need to require system modifications	10 – the alternative can be implemented with no disruption to existing service 5 – the implementation of the alternative may result in minor disruptions to existing service 1 – the implementation of the alternative may require significant or periodic disruptions to existing service	5	To integrate new treatment processes with existing infrastructure, some minor disruptions may occur.
Regulatory Constraints	The ability of the alternative to be approved with minimal, if any, conditions	**10** – the alternative can be readily approved **5** – The alternative can be approved with minimal conditions **1** – the alternative can be approved with significant or onerous conditions	10	The existing WWTP site is already zoned for this type of application, therefore no new zoning approvals are required.
		Average Score out of 10	8.8	

EXISTING WWTP - EVALUATION

Evaluation Category	Definition	Impact Measure	Score	Comments
Natural Environment				
Surface Water Quality	The potential for the Speed River to assimilate the WWTP effluent within regulatory requirements.	**10** - The alternative will provide a high degree of protection to the water quality of the Speed River all year and treated effluent can be readily assimilated **5** – The alternative will provide a high degree of protection to the water quality of the Speed River for most of the year and treated effluent may require seasonal discharge conditions to meet assimilation requirements. **1** – The alternative may present a threat to the water quality of the Speed River during low flow periods and there may be significant restrictions to treated effluent discharge conditions.	10	Expanding at this site, with proper stormwater management, should have minimal impact on the Speed River.
Ground Water Quality and Supply	The potential for the alternative to avoid sensitive groundwater resources for the City of Guelph and to protect overall groundwater quality and quantity	**10** – the alternative provides the greatest level of protection to sensitive groundwater resources and to the overall groundwater quality and quantity **5** – the alternative provides an acceptable level of protection to sensitive groundwater resources and to overall groundwater quality and quantity. may require careful monitoring and over the long term to maintain protection. Contingency measure may be required. **1** – the alternative poses unacceptable risks to the protection sensitive groundwater resources and to the overall quality and quantity of groundwater	10	Expanding at this site, with proper stormwater management ensuring a post-construction water balance, should have minimal impact on groundwater resources.
Terrestrial Habitats and Corridors	The potential for the alternative to avoid negative impacts to terrestrial habitats and corridors	**10** – the alternative will avoid terrestrial habitats and corridors **5** – the alternative may require special measures to protect terrestrial habitats and corridors **1** - the alternative will result in an unacceptable loss of terrestrial habitats and corridors	10	The land at the existing WWTP is already quite disturbed, therefore there impacts to terrestrial habitats and corridors is not anticipated, as it would be with a new land development.
Aquatic Habitats and Fisheries	The potential for the alternative to protect or enhance aquatic habitats and fisheries	**10** – the alternative will protect aquatic habitats and fisheries and has the potential to provide enhancements **5** – the alternative may require special measures to protect aquatic habitats and fisheries **1** - the alternative will result in an unacceptable loss of aquatic habitat and fisheries	10	Expanding at this site, with proper stormwater management, should have minimal impact on the Speed River and its associated aquatic habitat.
Air Quality	The potential for the alternative to minimize any increase GHG emissions	**10** – the alternative will make a significant contribution to the City's goal to reduce GHG emissions **5** – the alternative will not make a measurable contribution to the City 's goal to reduce GHG emissions **1** – the alternative may increase GHG emissions	5	Utilizing the land at the existing WWTP should not contribute to GHG emissions.
Flood Plain	The potential for the alternative to maintain the existing flood plain and flood volume capacity in the Speed River	**10** – the alternative will maintain the existing flood plan and flood volume capacity **5** – the alternative will require specials measures to maintain the existing flood plain and flood volume capacity **1** – the alternative will result in an unacceptable loss of floodplain and will require significant measures to replace lost flood volume capacity	5	GRCA requirements for maintaining the existing flood plain will be adhered to with any future development at the existing site.
Wetlands	The potential for the alternative to protect and maintain wetlands	**10** – the alternative will avoid wetlands **5** – the alternative may require special measures to maintain wetland protection **1** – the alternative will result in an unacceptable threat to wetlands	10	There are no wetlands on the existing site.
		Average Score out of 10	8.6	

EXISTING WWTP - EVALUATION

Evaluation Category	Definition	Impact Measure	Score	Comments
Social Environment				
Land Use Compatibility	The potential for the alternative to support the City of Guelph Growth Management Strategy recommendations	**10** – the alternative is consistent with and strongly supports the City's Growth Management Strategy recommendations **5** – the alternative requires special measures to be consistent with the City's Growth Management Strategy Recommendations **1** – the alternative is not consistent with the City's Growth Management Strategy	10	The existing WWTP location has sufficient space to accommodate additional treatment processes which may be required with future growth.
Community Growth Requirements	The potential for the alternative to be implemented as needed for short-, medium- and long-term community needs	**10** – the alternative can be in service to meet short- , medium and long-term scheduling requirements **5** – the alternative can be in service to meet medium- and long-term scheduling requirement but may not meet short term service schedule requirements **1** – the alternative may only meet long-term servicing requirements	10	As no procurement of land or rezoning is required to construction at the existing WWTP site, this area will be availble to accommodate any future schedules.
Occupational Health and Safety	The potential for the alternative minimize risks to occupational health and safety	**10 –** there are no unacceptable risks to occupational health and safety **5** – there are minor risks to occupation health and safety that can be properly managed **1** – there are significant risks to occupation health and safety which require significant training and or risk management plans to minimize risks to acceptable levels	10	There are currently no unnacceptable risks to staff at the existing WWTP and therefore no unacceptable risks are anticipated with future expansions at the site.
Community Health and Safety	The potential for the alternative to minimize risk to community health and safety	**10 –** there are no unacceptable risks to community health and safety **5** – there are minor risks to community health and safety that can be properly managed **1** – there are significant risks to community health and safety which require significant measures and risk management plans to minimize risks to acceptable levels	10	The existing WWTP site is completely fenced in and gated to minimize any risk to the community.
Urban Design Requirements and Aesthetics	The potential for the alternative to support the City's design standards and community aesthetics	**10** – the alternative is consistent with and supports the City's design standards and community aesthetics **5** – the alternative requires special measures to be consistent with the City's design standards and community aesthetics **1** – the alternative is not consistent with the City's design standards and community aesthetics	5	Based on potential residential expansion along Wellington Road, some measures may be required, through landscaping or other means, to reduced the aesthetic impact of any expansions at the existing site.
Community Energy Plan	The potential for the alternative to produce energy for community use	**10 –** alternative can provide a significant amount of energy for community use in addition to meeting the demands of the WWTP **5** – the alternative can provide a moderate amount of energy for community use in addition to meeting the demands of the WWTP **1**- the alternative can provide a limited or minimal amount of energy for community use in addition to meeting the demands of the WWTP.	1	Expanding at the existing site will not provide any energy for community use. Although, the existing cogeneration systems at the site provide energy for the WWTP, minimizing the amount of energy that needs to be taken from the grid.
Heritage and Cultural Resources	The potential for the alternative to avoid heritage and cultural resources	**10** – the alternative will avoid heritage and cultural resources **5**- the alternative may require special measures to protect heritage and cultural resources **1** – the alternative may pose unacceptable risk to heritage and cultural resources	10	The existing WWTP site is previously disturbed and therefore it is not anticipated that any cultural resources remain there.
		Average Score out of 10	8	

EXISTING WWTP - EVALUATION

Evaluation Category	Definition	Impact Measure	Score	Comments
Economic Environment				
Capital Costs	The relative costs of land, equipment, and facilities when compared to other alternatives.	**10** – the alternative has the lowest capital costs relative to other alternatives **5** – the alternative is in the mid range of capital costs relative to other alternatives **1** – the alternative has the highest capital costs relative to other alternatives	10	No land procurement costs are associated with expanding at this site. Exanding at the site also allows use of facilties for future expansions.
Operation and Maintenance Costs	The relative Operation/Maintenance costs when compared to other alternatives	**10** – the alternative has the lowest O&M costs relative to other alternatives **5** – the alternative is in the mid range of O&M costs relative to other alternatives **1** – the alternative has the highest O&M costs relative to other alternatives	10	Due to the age of the treatment processes at the existing site, some upgrades will be required. These costs would still be incurred regardless of the location of additional capacity.
Funding Availability	The potential for the alternative to be eligible for funding from provincial or federal programs	**10** – the alternative is eligible for existing provincial and/or federal funding **5** – the alternative in not eligible for existing funding programs but may be eligible for anticipated future funding programs **1** – the alternative is not eligible for existing for anticipated future programs	10	Funding for expansion at the existing facility has been approved in the recent past and it is anticipated that any future expansion may be eligible for similar funding.
		Average Score out of 10	10	

MEMBRANE BIOREACTOR - EVALUATION

Evaluation Category	Definition	Impact Measure	Score	Comments
Technical Environment				
Performance Record	The ability of the alternative to perform with a high degree of reliability and predictability in both process operations and effluent quality	**10** – the alternative includes proven technology with a high degree of reliable performance **5** – the alternative includes newer technology with growing record of demonstrated performance reliability **1** – the alternative includes innovative technology with limited performance record and unconfirmed reliability – requires further testing/demonstration to determine feasibility for Guelph	5	While relatively new to Canada, membrane technology has been constructed and is operating at a number of facilities in the United States.
Ability to meet treatment capacity requirements (Short-, Medium-, Long-term)	The ability of the alternative to provide the wastewater treatment requirements for short- medium- and/ or long-term needs	**10** – the alternative can provide short- , med- and long- term treatment requirements **5** – the alternative can provide short- and may provide medium-term requirements **1** – the alternative may only provide long-term requirements	10	Membrane technolgy is able to achieve the proposed effluent limits required to discharge future flows to the Speed River.
Ease of Implementation	The ability of the alternative to be implemented with minimal disruption to existing wastewater treatment operations; minimal need to require system modifications	**10** – the alternative can be implemented with no disruption to existing service **5** – the implementation of the alternative may result in minor disruptions to existing service **1** – the implementation of the alternative may require significant or periodic disruptions to existing service	1	MBRs require integration into the existing plant processes, requiring treatment trains to be taken offline during parts of construction. Implementing this technology would require planning and temporary solutions for maintaining existing operations.
Regulatory Constraints	The ability of the alternative to be approved with minimal, if any, conditions	**10** – the alternative can be readily approved **5** – The alternative can be approved with minimal conditions **1** – the alternative can be approved with significant or onerous conditions	10	This treatment technology should be readily approved through the Ministry of the Environment.
		Average Score out of 10		6.5

MEMBRANE BIOREACTOR - EVALUATION

Evaluation Category	Definition	Impact Measure	Score	Comments
Natural Environment				
Surface Water Quality	The potential for the Speed River to assimilate the WWTP effluent within regulatory requirements.	**10** - The alternative will provide a high degree of protection to the water quality of the Speed River all year and treated effluent can be readily assimilated **5** – The alternative will provide a high degree of protection to the water quality of the Speed River for most of the year and treated effluent may require seasonal discharge conditions to meet assimilation requirements. **1** – The alternative may present a threat to the water quality of the Speed River during low flow periods and there may be significant restrictions to treated effluent discharge conditions.	10	This treatment technology can achieve stringent effluent quality limits and initial calculations have shown that the Speed River can assimilate future flows at these levels.
Ground Water Quality and Supply	The potential for the alternative to avoid sensitive groundwater resources for the City of Guelph and to protect overall groundwater quality and quantity	**10** – the alternative provides the greatest level of protection to sensitive groundwater resources and to the overall groundwater quality and quantity **5** – the alternative provides an acceptable level of protection to sensitive groundwater resources and to overall groundwater quality and quantity. may require careful monitoring and over the long term to maintain protection. Contingency measure may be required. **1** – the alternative poses unacceptable risks to the protection sensitive groundwater resources and to the overall quality and quantity of groundwater	10	The treatment processes for an MBR will take the place of the existing secondary clarifiers with some expansion to existing aeration tanks. Therefore no impact is anticipated to groundwater resources.
Terrestrial Habitats and Corridors	The potential for the alternative to avoid negative impacts to terrestrial habitats and corridors	**10** – the alternative will avoid terrestrial habitats and corridors **5** – the alternative may require special measures to protect terrestrial habitats and corridors **1** - the alternative will result in an unacceptable loss of terrestrial habitats and corridors	10	The treatment processes for an MBR will take the place of the existing secondary clarifiers with some expansion to existing aeration tanks. Therefore no impact is anticipated to terrestrial resources.
Aquatic Habitats and Fisheries	The potential for the alternative to protect or enhance aquatic habitats and fisheries	**10** – the alternative will protect aquatic habitats and fisheries and has the potential to provide enhancements **5** – the alternative may require special measures to protect aquatic habitats and fisheries **1** - the alternative will result in an unacceptable loss of aquatic habitat and fisheries	10	This treatment technology can achieve stringent effluent quality limits. Initial runs of the Grand River Similiation Model show that at these achieveable effluent limits, downstream dissolved oxygen levels are improved.
Air Quality	The potential for the alternative to minimize any increase GHG emissions	**10** – the alternative will make a significant contribution to the City's goal to reduce GHG emissions **5** – the alternative will not make a measurable contribution to the City 's goal to reduce GHG emissions **1** – the alternative may increase GHG emissions	1	MBRs are high pressure membrane systems and higher energy as compared to conventional treatment is required. Depending on the electrical power source supplying the grid, this could indirectly lead to increased GHG emissions.
Flood Plain	The potential for the alternative to maintain the existing flood plain and flood volume capacity in the Speed River	**10** – the alternative will maintain the existing flood plan and flood volume capacity **5** – the alternative will require specials measures to maintain the existing flood plain and flood volume capacity **1** – the alternative will result in an unacceptable loss of floodplain and will require significant measures to replace lost flood volume capacity	5	The treatment processes for an MBR will take the place of the existing secondary clarifiers with some expansion to existing aeration tanks and will require the construction of a membrane facility. Minimal impact is anticipated to the floodplain.
Wetlands	The potential for the alternative to protect and maintain wetlands	**10** – the alternative will avoid wetlands **5** – the alternative may require special measures to maintain wetland protection **1** – the alternative will result in an unacceptable threat to wetlands	10	There are no wetlands at the existing WWTP, therefore this technology will avoid wetlands.
		Average Score out of 10	8	
Social Environment				

MEMBRANE BIOREACTOR - EVALUATION

Evaluation Category	Definition	Impact Measure	Score	Comments
Land Use Compatibility	The potential for the alternative to support the City of Guelph Growth Management Strategy recommendations	**10** – the alternative is consistent with and strongly supports the City's Growth Management Strategy recommendations **5** – the alternative requires special measures to be consistent with the City's Growth Management Strategy Recommendations **1** – the alternative is not consistent with the City's Growth Management Strategy	10	This technology can achieve effluent quality required to accommodate future growth.
Community Growth Requirements	The potential for the alternative to be implemented as needed for short-, medium- and long-term community needs	**10** – the alternative can be in service to meet short- , medium and long-term scheduling requirements **5** – the alternative can be in service to meet medium- and long-term scheduling requirement but may not meet short term service schedule requirements **1** – the alternative may only meet long-term servicing requirements	10	This technology can be implemented in stages, allowing it to meeting short-, medium and long-term scheduling requirements.
Occupational Health and Safety	The potential for the alternative minimize risks to occupational health and safety	**10 –** there are no unacceptable risks to occupation health and safety 5 – there are minor risks to occupation health and safety that can be properly managed 1 – there are significant risks to occupation health and safety which require significant training and or risk management plans to minimize risks to acceptable levels	10	This technology has been successfully implemented at other WWTPs with no unacceptable risks to operations staff.
Community Health and Safety	The potential for the alternative to minimize risk to community health and safety	**10 –** there are no unacceptable risks to community health and safety **5** – there are minor risks to community health and safety that can be properly managed **1** – there are significant risks to community health and safety which require significant measures and risk management plans to minimize risks to acceptable levels	10	The existing WWTP site is completely fenced in and gated to minimize any risk to the community.
Urban Design Requirements and Aesthetics	The potential for the alternative to support the City's design standards and community aesthetics	**10** – the alternative is consistent with and supports the City's design standards and community aesthetics **5** – the alternative requires special measures to be consistent with the City's design standards and community aesthetics **1** – the alternative is not consistent with the City's design standards and community aesthetics	10	The treatment processes required for MBRs would be constructed away from any point where visual aesthetics to the community would be impacted.
Community Energy Plan	The potential for the alternative to produce energy for community use	**10 –** alternative can provide a significant amount of energy for community use in addition to meeting the demands of the WWTP **5** – the alternative can provide a moderate amount of energy for community use in addition to meeting the demands of the WWTP 1- the alternative can provide a limited or minimal amount of energy for community use in addition to meeting the demands of the WWTP.	1	This alternative will not provide any energy for community use.
Heritage and Cultural Resources	The potential for the alternative to avoid heritage and cultural resources	**10** – the alternative will avoid heritage and cultural resources **5**- the alternative may require special measures to protect heritage and cultural resources **1** – the alternative may pose unacceptable risk to heritage and cultural resources	10	The construction of MBRs would be within the boundaries of the existing WWTP which is already previously disturbed, therefore no impact to cultural resources is anticipated.
		Average Score out of 10	8.7	

MEMBRANE BIOREACTOR - EVALUATION

Evaluation Category	Definition	Impact Measure	Score	Comments
Economic Environment				
Capital Costs	The relative costs of land, equipment, and facilities when compared to other alternatives.	**10** – the alternative has the lowest capital costs relative to other alternatives **5** – the alternative is in the mid range of capital costs relative to other alternatives **1** – the alternative has the highest capital costs relative to other alternatives	5	The conceptual costing estimate for design and construction of MBRs at the Guelph WWTP to 144 MLD is $229 M.* These costs would be incurred in stages, during staged upgrades.
Operation and Maintenance Costs	The relative Operation/Maintenance costs when compared to other alternatives	**10** – the alternative has the lowest O&M costs relative to other alternatives **5** – the alternative is in the mid range of O&M costs relative to other alternatives **1** – the alternative has the highest O&M costs relative to other alternatives	1	Membrane technology requires more energy than conventional treatment. MBRs have the highest energy costs of the membrane alternatives.
Funding Availability	The potential for the alternative to be eligible for funding from provincial or federal programs	**10** – the alternative is eligible for existing provincial and/or federal funding **5** – the alternative in not eligible for existing funding programs but may be eligible for anticipated future funding programs **1** – the alternative is not eligible for existing for anticipated future programs	5	Funding for expansion at the existing facility has been approved in the recent past and it is anticipated that any future expansion may be eligible for similar funding.
		Average Score out of 10	3.7	

*The above costs do not account for additional costs associated with ancillary systems and processes such as conveyance to the plant, headworks, disinfection, solids stabilization, and solids handling

TERTIARY MEMBRANE FILTRATION - EVALUATION

Evaluation Category	Definition	Impact Measure	Score	Comments
Technical Environment				
Performance Record	The ability of the alternative to perform with a high degree of reliability and predictability in both process operations and effluent quality	**10** – the alternative includes proven technology with a high degree of reliable performance **5** – the alternative includes newer technology with growing record of demonstrated performance reliability **1** – the alternative includes innovative technology with limited performance record and unconfirmed reliability – requires further testing/demonstration to determine feasibility for Guelph	10	Non-nitfrifying tertiary filtration is a proven technology which has been demonstrated at a number of facilities.
Ability to meet treatment capacity requirements (Short-, Medium-, Long-term)	The ability of the alternative to provide the wastewater treatment requirements for short- medium- and/ or long-term needs	**10** – the alternative can provide short- , med- and long- term treatment requirements **5** – the alternative can provide short- and may provide medium-term requirements **1** – the alternative may only provide long-term requirements	10	Membrane technolgy is able to achieve the proposed effluent limits required to discharge future flows to the Speed River.
Ease of Implementation	The ability of the alternative to be implemented with minimal disruption to existing wastewater treatment operations; minimal need to require system modifications	**10** – the alternative can be implemented with no disruption to existing service **5** – the implementation of the alternative may result in minor disruptions to existing service **1** – the implementation of the alternative may require significant or periodic disruptions to existing service	5	As compared to MBRs, the integration of membrane filters would cause less potential disruptions to service. With this alternative less demolition of existing facilities is required. In addition, less membranes are required in for tertiary filtration.
Regulatory Constraints	The ability of the alternative to be approved with minimal, if any, conditions	**10** – the alternative can be readily approved **5** – The alternative can be approved with minimal conditions **1** – the alternative can be approved with significant or onerous conditions	10	This treatment technology should be readily approved through the Ministry of the Environment.
		Average Score out of 10	8.8	

TERTIARY MEMBRANE FILTRATION - EVALUATION

Evaluation Category	Definition	Impact Measure	Score	Comments
Natural Environment				
Surface Water Quality	The potential for the Speed River to assimilate the WWTP effluent within regulatory requirements.	**10** - The alternative will provide a high degree of protection to the water quality of the Speed River all year and treated effluent can be readily assimilated **5** – The alternative will provide a high degree of protection to the water quality of the Speed River for most of the year and treated effluent may require seasonal discharge conditions to meet assimilation requirements. **1** – The alternative may present a threat to the water quality of the Speed River during low flow periods and there may be significant restrictions to treated effluent discharge conditions.	10	This treatment technology can achieve stringent effluent quality limits and initial calculations have shown that the Speed River can assimilate future flows at these levels.
Ground Water Quality and Supply	The potential for the alternative to avoid sensitive groundwater resources for the City of Guelph and to protect overall groundwater quality and quantity	**10** – the alternative provides the greatest level of protection to sensitive groundwater resources and to the overall groundwater quality and quantity **5** – the alternative provides an acceptable level of protection to sensitive groundwater resources and to overall groundwater quality and quantity. may require careful monitoring and over the long term to maintain protection. Contingency measure may be required. **1** – the alternative poses unacceptable risks to the protection sensitive groundwater resources and to the overall quality and quantity of groundwater	10	Overal this treatment process will require additional treatment footprints when compared to MBRs. Pre-construction water balance should be maintained through expansion design.
Terrestrial Habitats and Corridors	The potential for the alternative to avoid negative impacts to terrestrial habitats and corridors	**10** – the alternative will avoid terrestrial habitats and corridors **5** – the alternative may require special measures to protect terrestrial habitats and corridors **1** - the alternative will result in an unacceptable loss of terrestrial habitats and corridors	10	The existing WWTP is previously disturbed and therefore expansion of any technology in this location is not anticipated to impact terrestrial resources.
Aquatic Habitats and Fisheries	The potential for the alternative to protect or enhance aquatic habitats and fisheries	**10** – the alternative will protect aquatic habitats and fisheries and has the potential to provide enhancements **5** – the alternative may require special measures to protect aquatic habitats and fisheries **1** - the alternative will result in an unacceptable loss of aquatic habitat and fisheries	10	This treatment technology can achieve stringent effluent quality limits. Initial runs of the Grand River Similiation Model show that at these achieveable effluent limits, downstream dissolved oxygen levels are improved.
Air Quality	The potential for the alternative to minimize any increase GHG emissions	**10** – the alternative will make a significant contribution to the City's goal to reduce GHG emissions **5** – the alternative will not make a measurable contribution to the City 's goal to reduce GHG emissions **1** – the alternative may increase GHG emissions	1	Membrane filtration requires high pressure resulting in higher energy as compared to conventional treatment is required. Depending on the electrical power source supplying the grid, this could indirectly lead to increased GHG emissions.
Flood Plain	The potential for the alternative to maintain the existing flood plain and flood volume capacity in the Speed River	**10** – the alternative will maintain the existing flood plan and flood volume capacity **5** – the alternative will require specials measures to maintain the existing flood plain and flood volume capacity **1** – the alternative will result in an unacceptable loss of floodplain and will require significant measures to replace lost flood volume capacity	5	Membrane filtration will likely require the construction of some facilities within the floodplain. Measures will be taken to ensure that the flood lain is maintained.
Wetlands	The potential for the alternative to protect and maintain wetlands	**10** – the alternative will avoid wetlands **5** – the alternative may require special measures to maintain wetland protection **1** – the alternative will result in an unacceptable threat to wetlands	10	There are no wetlands at the existing WWTP, therefore this technology will avoid wetlands.
		Average Score out of 10	8	
Social Environment				

TERTIARY MEMBRANE FILTRATION - EVALUATION

Evaluation Category	Definition	Impact Measure	Score	Comments
Land Use Compatibility	The potential for the alternative to support the City of Guelph Growth Management Strategy recommendations	**10** – the alternative is consistent with and strongly supports the City's Growth Management Strategy recommendations **5** – the alternative requires special measures to be consistent with the City's Growth Management Strategy Recommendations **1** – the alternative is not consistent with the City's Growth Management Strategy	10	This technology can achieve effluent quality required to accommodate future growth.
Community Growth Requirements	The potential for the alternative to be implemented as needed for short-, medium- and long-term community needs	**10** – the alternative can be in service to meet short- , medium and long-term scheduling requirements **5** – the alternative can be in service to meet medium- and long-term scheduling requirement but may not meet short term service schedule requirements **1** – the alternative may only meet long-term servicing requirements	10	This technology can be implemented in stages, allowing it to meeting short-, medium and long-term scheduling requirements.
Occupational Health and Safety	The potential for the alternative minimize risks to occupational health and safety	**10 –** there are no unacceptable risks to community health and safety 5 – there are minor risks to occupation health and safety that can be properly managed 1 – there are significant risks to occupation health and safety which require significant training and or risk management plans to minimize risks to acceptable levels	10	This technology has been successfully implemented at other WWTPs with no unacceptable risks to operations staff.
Community Health and Safety	The potential for the alternative to minimize risk to community health and safety	**10 –** there are no unacceptable risks to community health and safety **5** – there are minor risks to community health and safety that can be properly managed **1** – there are significant risks to community health and safety which require significant measures and risk management plans to minimize risks to acceptable levels	10	The existing WWTP site is completely fenced in and gated to minimize any risk to the community.
Urban Design Requirements and Aesthetics	The potential for the alternative to support the City's design standards and community aesthetics	**10** – the alternative is consistent with and supports the City's design standards and community aesthetics **5** – the alternative requires special measures to be consistent with the City's design standards and community aesthetics **1** – the alternative is not consistent with the City's design standards and community aesthetics	10	The treatment processes required for MBRs would be constructed away from any point where visual aesthetics to the community would be impacted.
Community Energy Plan	The potential for the alternative to produce energy for community use	**10 –** alternative can provide a significant amount of energy for community use in addition to meeting the demands of the WWTP **5** – the alternative can provide a moderate amount of energy for community use in addition to meeting the demands of the WWTP 1- the alternative can provide a limited or minimal amount of energy for community use in addition to meeting the demands of the WWTP.	1	This alternative will not provide any energy for community use.
Heritage and Cultural Resources	The potential for the alternative to avoid heritage and cultural resources	**10** – the alternative will avoid heritage and cultural resources **5**- the alternative may require special measures to protect heritage and cultural resources **1** – the alternative may pose unacceptable risk to heritage and cultural resources	10	The construction of membrane filtration would be within the boundaries of the existing WWTP which is already previously disturbed, therefore no impact to cultural resources is anticipated.
		Average Score out of 10		8.7

TERTIARY MEMBRANE FILTRATION - EVALUATION

Evaluation Category	Definition	Impact Measure	Score	Comments
Economic Environment				
Capital Costs	The relative costs of land, equipment, and facilities when compared to other alternatives.	**10** – the alternative has the lowest capital costs relative to other alternatives **5** – the alternative is in the mid range of capital costs relative to other alternatives **1** – the alternative has the highest capital costs relative to other alternatives	1	The conceptual costing estimate for design and construction of conventional tertiary membranes at the Guelph WWTP to 144 MLD is $259 M.* These costs would be incurred in stages, during staged upgrades.
Operation and Maintenance Costs	The relative Operation/Maintenance costs when compared to other alternatives	**10** – the alternative has the lowest O&M costs relative to other alternatives **5** – the alternative is in the mid range of O&M costs relative to other alternatives **1** – the alternative has the highest O&M costs relative to other alternatives	10	While membrane technologies generally have higher energy requirements as compared to conventional treatment, tertiary membrane filtration requires less energy than MBRs as more solids are removed through the conventional processes.
Funding Availability	The potential for the alternative to be eligible for funding from provincial or federal programs	**10** – the alternative is eligible for existing provincial and/or federal funding **5** – the alternative in not eligible for existing funding programs but may be eligible for anticipated future funding programs **1** – the alternative is not eligible for existing for anticipated future programs	5	Funding for expansion at the existing facility has been approved in the recent past and it is anticipated that any future expansion may be eligible for similar funding.
		Average Score out of 10	5.3	

*The above costs do not account for additional costs associated with ancillary systems and processes such as conveyance to the plant, headworks, disinfection, solids stabilization, and solids handling

TERTIARY NITRIFYING MBR - EVALUATION

Evaluation Category	Definition	Impact Measure	Score	Comments
Technical Environment				
Performance Record	The ability of the alternative to perform with a high degree of reliability and predictability in both process operations and effluent quality	**10** – the alternative includes proven technology with a high degree of reliable performance **5** – the alternative includes newer technology with growing record of demonstrated performance reliability **1** – the alternative includes innovative technology with limited performance record and unconfirmed reliability – requires further testing/demonstration to determine feasibility for Guelph	1	This technology has been pilot tested at a number of locations, but has not been operated at a full scale.
Ability to meet treatment capacity requirements (Short-, Medium-, Long-term)	The ability of the alternative to provide the wastewater treatment requirements for short- medium- and/ or long-term needs	**10** – the alternative can provide short- , med- and long- term treatment requirements **5** – the alternative can provide short- and may provide medium-term requirements **1** – the alternative may only provide long-term requirements	10	Membrane technolgy is able to achieve the proposed effluent limits required to discharge future flows to the Speed River.
Ease of Implementation	The ability of the alternative to be implemented with minimal disruption to existing wastewater treatment operations; minimal need to require system modifications	**10** – the alternative can be implemented with no disruption to existing service **5** – the implementation of the alternative may result in minor disruptions to existing service **1** – the implementation of the alternative may require significant or periodic disruptions to existing service	5	As compared to conventional MBRs, the integration of tertiary MBRs would cause less potential disruptions to service. With this alternative less demolition of existing facilities is required. In addition, less membranes are required in for tertiary filtration.
Regulatory Constraints	The ability of the alternative to be approved with minimal, if any, conditions	**10** – the alternative can be readily approved **5** – The alternative can be approved with minimal conditions **1** – the alternative can be approved with significant or onerous conditions	5	This treatment technology is relatively new and may have some additional requirements for approval with the Ministry of the Environment.
		Average Score out of 10	5.3	

TERTIARY NITRIFYING MBR - EVALUATION

Natural Environment				
Surface Water Quality	The potential for the Speed River to assimilate the WWTP effluent within regulatory requirements.	**10** - The alternative will provide a high degree of protection to the water quality of the Speed River all year and treated effluent can be readily assimilated **5** – The alternative will provide a high degree of protection to the water quality of the Speed River for most of the year and treated effluent may require seasonal discharge conditions to meet assimilation requirements. **1** – The alternative may present a threat to the water quality of the Speed River during low flow periods and there may be significant restrictions to treated effluent discharge conditions.	10	This treatment technology can achieve stringent effluent quality limits and initial calculations have shown that the Speed River can assimilate future flows at these levels.
Ground Water Quality and Supply	The potential for the alternative to avoid sensitive groundwater resources for the City of Guelph and to protect overall groundwater quality and quantity	**10** – the alternative provides the greatest level of protection to sensitive groundwater resources and to the overall groundwater quality and quantity **5** – the alternative provides an acceptable level of protection to sensitive groundwater resources and to overall groundwater quality and quantity. may require careful monitoring and over the long term to maintain protection. Contingency measure may be required. **1** – the alternative poses unacceptable risks to the protection sensitive groundwater resources and to the overall quality and quantity of groundwater	10	The treatment processes for an MBR will take the place of the existing secondary clarifiers with some expansion to existing aeration tanks. Therefore no impact is anticipated to groundwater resources.
Terrestrial Habitats and Corridors	The potential for the alternative to avoid negative impacts to terrestrial habitats and corridors	**10** – the alternative will avoid terrestrial habitats and corridors **5** – the alternative may require special measures to protect terrestrial habitats and corridors **1** - the alternative will result in an unacceptable loss of terrestrial habitats and corridors	10	The treatment processes for an MBR will take the place of the existing secondary clarifiers with some expansion to existing aeration tanks. Therefore no impact is anticipated to terrestrial resources.
Aquatic Habitats and Fisheries	The potential for the alternative to protect or enhance aquatic habitats and fisheries	**10** – the alternative will protect aquatic habitats and fisheries and has the potential to provide enhancements **5** – the alternative may require special measures to protect aquatic habitats and fisheries **1** - the alternative will result in an unacceptable loss of aquatic habitat and fisheries	10	This treatment technology can achieve stringent effluent quality limits. Initial runs of the Grand River Similiation Model show that at these achieveable effluent limits, downstream dissolved oxygen levels are improved.
Air Quality	The potential for the alternative to minimize any increase GHG emissions	**10** – the alternative will make a significant contribution to the City's goal to reduce GHG emissions **5** – the alternative will not make a measurable contribution to the City 's goal to reduce GHG emissions **1** – the alternative may increase GHG emissions	1	MBRs are high pressure membrane systems and higher energy as compared to conventional treatment is required. Depending on the electrical power source supplying the grid, this could indirectly lead to increased GHG emissions.
Flood Plain	The potential for the alternative to maintain the existing flood plain and flood volume capacity in the Speed River	**10** – the alternative will maintain the existing flood plan and flood volume capacity **5** – the alternative will require specials measures to maintain the existing flood plain and flood volume capacity **1** – the alternative will result in an unacceptable loss of floodplain and will require significant measures to replace lost flood volume capacity	5	The treatment processes for an MBR will take the place of the existing secondary clarifiers with some expansion to existing aeration tanks and will require the construction of a membrane facility. Minimal impact is anticipated to the floodplain.
Wetlands	The potential for the alternative to protect and maintain wetlands	**10** – the alternative will avoid wetlands **5** – the alternative may require special measures to maintain wetland protection **1** – the alternative will result in an unacceptable threat to wetlands	10	There are no wetlands at the existing WWTP, therefore this technology will avoid wetlands.
		Average Score out of 10	8	

TERTIARY NITRIFYING MBR - EVALUATION

Social Environment				
Land Use Compatibility	The potential for the alternative to support the City of Guelph Growth Management Strategy recommendations	**10** – the alternative is consistent with and strongly supports the City's Growth Management Strategy recommendations **5** – the alternative requires special measures to be consistent with the City's Growth Management Strategy Recommendations **1** – the alternative is not consistent with the City's Growth Management Strategy	10	This technology can achieve effluent quality required to accommodate future growth.
Community Growth Requirements	The potential for the alternative to be implemented as needed for short-, medium- and long-term community needs	**10** – the alternative can be in service to meet short- , medium and long-term scheduling requirements **5** – the alternative can be in service to meet medium- and long-term scheduling requirement but may not meet short term service schedule requirements **1** – the alternative may only meet long-term servicing requirements	10	This technology can be implemented in stages, allowing it to meeting short-, medium and long-term scheduling requirements.
Occupational Health and Safety	The potential for the alternative minimize risks to occupational health and safety	**10 –** there are no unacceptable risks to occupation health and safety 5 – there are minor risks to occupation health and safety that can be properly managed 1 – there are significant risks to occupation health and safety which require significant training and or risk management plans to minimize risks to acceptable levels	10	This technology has been successfully implemented at other WWTPs with no unacceptable risks to operations staff.
Community Health and Safety	The potential for the alternative to minimize risk to community health and safety	**10 –** there are no unacceptable risks to community health and safety **5** – there are minor risks to community health and safety that can be properly managed **1** – there are significant risks to community health and safety which require significant measures and risk management plans to minimize risks to acceptable levels	10	The existing WWTP site is completely fenced in and gated to minimize any risk to the community.
Urban Design Requirements and Aesthetics	The potential for the alternative to support the City's design standards and community aesthetics	**10** – the alternative is consistent with and supports the City's design standards and community aesthetics **5** – the alternative requires special measures to be consistent with the City's design standards and community aesthetics **1** – the alternative is not consistent with the City's design standards and community aesthetics	10	The treatment processes required for MBRs would be constructed away from any point where visual aesthetics to the community would be impacted.
Community Energy Plan	The potential for the alternative to produce energy for community use	**10 –** alternative can provide a significant amount of energy for community use in addition to meeting the demands of the WWTP **5** – the alternative can provide a moderate amount of energy for community use in addition to meeting the demands of the WWTP 1- the alternative can provide a limited or minimal amount of energy for community use in addition to meeting the demands of the WWTP.	1	This alternative will not provide any energy for community use.
Heritage and Cultural Resources	The potential for the alternative to avoid heritage and cultural resources	**10** – the alternative will avoid heritage and cultural resources **5**- the alternative may require special measures to protect heritage and cultural resources **1** – the alternative may pose unacceptable risk to heritage and cultural resources	10	The construction of MBRs would be within the boundaries of the existing WWTP which is already previously disturbed, therefore no impact to cultural resources is anticipated.
		Average Score out of 10	8.7	

TERTIARY NITRIFYING MBR - EVALUATION

Economic Environment				
Capital Costs	The relative costs of land, equipment, and facilities when compared to other alternatives.	**10** – the alternative has the lowest capital costs relative to other alternatives **5** – the alternative is in the mid range of capital costs relative to other alternatives **1** – the alternative has the highest capital costs relative to other alternatives	10	The conceptual costing estimate for design and construction of Tertiary Nitrifying MBRs at the Guelph WWTP to 144 MLD is $216 M and is the least expensive of the three options.* These costs would be incurred in stages, during staged upgrades.
Operation and Maintenance Costs	The relative Operation/Maintenance costs when compared to other alternatives	**10** – the alternative has the lowest O&M costs relative to other alternatives **5** – the alternative is in the mid range of O&M costs relative to other alternatives **1** – the alternative has the highest O&M costs relative to other alternatives	10	Similar to traditional tertiary membrane filtration, tertiary nitrifyiing membrane filtration requires less energy than MBRs as more solids are removed through the conventional processes.
Funding Availability	The potential for the alternative to be eligible for funding from provincial or federal programs	**10** – the alternative is eligible for existing provincial and/or federal funding **5** – the alternative in not eligible for existing funding programs but may be eligible for anticipated future funding programs **1** – the alternative is not eligible for existing for anticipated future programs	5	Funding for expansion at the existing facility has been approved in the recent past and it is anticipated that any future expansion may be eligible for similar funding.
		Average Score out of 10	8.3	

*The above costs do not account for additional costs associated with ancillary systems and processes such as conveyance to the plant, headworks, disinfection, solids stabilization, and solids handling

Appendix F
Future Expansion Considerations

Guelph WWTMP - Infrastructure Recommendations

PREPARED FOR: City of Guelph

PREPARED BY: CH2M HILL

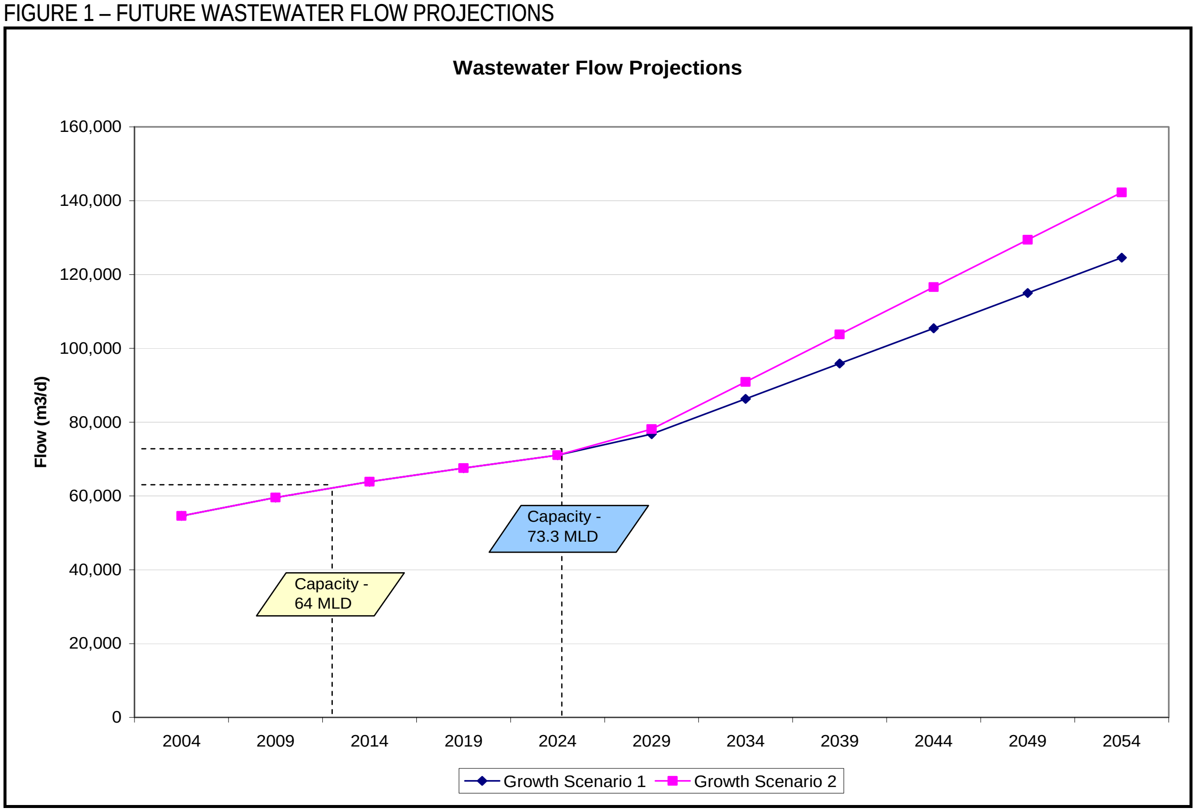
DATE:

Introduction

The purpose of this memorandum is to discuss the recommendations for future treatment upgrades and expansions at the Guelph WWTP. The discussions on recommended infrastructure components have been divided into three time frames; short term (2008 – 2020), mid-term (2021 – 2031) and long-term (2032 – 2054).

The initial timing for recommended upgrades is based on current projections for future flows which are shown in Figure 1. The flows are best estimates at this point in time and it is recognized that they are likely to change in the future based on changes in rate of population and industry growth as well as with impacts of the City's water conservation and inflow and infiltration programs.

FIGURE 1 – FUTURE WASTEWATER FLOW PROJECTIONS



The recommendations which are outlined within the subsequent sections are based on best information available at the time of this Master Plan. Studies that are being recommended as part of this Master Plan along with changes in available technology and/or regulatory conditions will likely impact some of the recommendations in the future. Therefore all recommendations and flow projections will be reviewed during each update of the Master Plan which is to occur every five years.

Short-term (2008 – 2020)

Based on current projections flows during this timeframe will not exceed 73.3 MLD. As previously indicated recommendations to upgrade the WWTP to 73.3 MLD have already been examined and approved under a previous Class EA process and will not be re-examined under this Master Plan.

It is important to note that the City is completing an optimization study at the Guelph WWTP. This study is investigating opportunities with the existing infrastructure to determine whether additional capacity can be realized through operational modifications. If it is found that the existing WWTP can reliably operate at flows higher than its current rated average day flow capacity, then an addendum to the previous Class EA will need to be completed and approved. Based on current projections, a plant expansion will be required at the WWTP by 2014. If an expansion is required, it is recommended that design of the facility be commenced a minimum of three years in advance of the upgrade being required which would be in 2011. If required, it is recommended that any piloting of equipment should be commenced immediately.

Based on the findings of the optimization study, it is possible that 73.3 MLD may be achieved through optimization or that a new Plant 5 will be required or a combination of the two may be considered.

Mid-term (2021 – 2031)

Based on current flow projections, the approved capacity of 73.3 MLD will be reached by approximately 2024. Prior to the capacity being reached, an expansion to the existing facility must be designed and constructed. Prior to the commencement of the design of the expansion, a Schedule C Class Environmental Assessment will need to be completed and approved. It is recommended that the Schedule C Class EA be started a minimum of six years in advance of the treatment facility being required.

Recommended Capacity and Estimated Effluent Limits

By 2031, the estimate average daily flows reaching the Guelph WWTP will be approximately 85 MLD. The estimate effluent limits for the WWTP at this flow rate have been summarized in Table 1.

TABLE 1
Potential Effluent Limits at 85 MLD

Parameter	Effluent Limit (mg/L)	
	Winter	Summer
TSS	6	6
$cBOD_5$	3	3
Ammonia	1	0.8
Total Phosphorus	0.4	0.2
Nitrates	4.4	4.4

Treatment Technologies

Based on the evaluation completed as part of the master planning process, the integration of membrane technologies is being recommended to achieve long term future effluent limits. Two membrane technologies are being carried forward for further investigation and include tertiary membrane filtration and tertiary membrane bioreactors (MBRs). It may be possible for the first expansion beyond 73.3 MLD to utilize conventional treatment technologies while still achieving the estimated effluent limits described.

Selection of the preferred expansion alternative will need to consider a number of different factors including operating and capital costs, the ability to achieve future effluent quality, the ease at which the alternative can be implemented, the state of the technology and the impact of pending regulatory requirements including nitrates. Each of the three expansion options are described below. Considerations for each option are summarized at the end of this memorandum inTable 5 and should be investigated in further detail at the Class EA stage for the expansion and during subsequent updates of the master plan prior to proceeding with the design of the expansion. The following section describes each of the treatment expansion options.

Tertiary MBR

For this expansion a tertiary MBR would be constructed in a manner such that significantly more capacity could be realized from Plants 1-3. The following provides a description of the concept and overall treatment scheme for the Guelph WWTP:

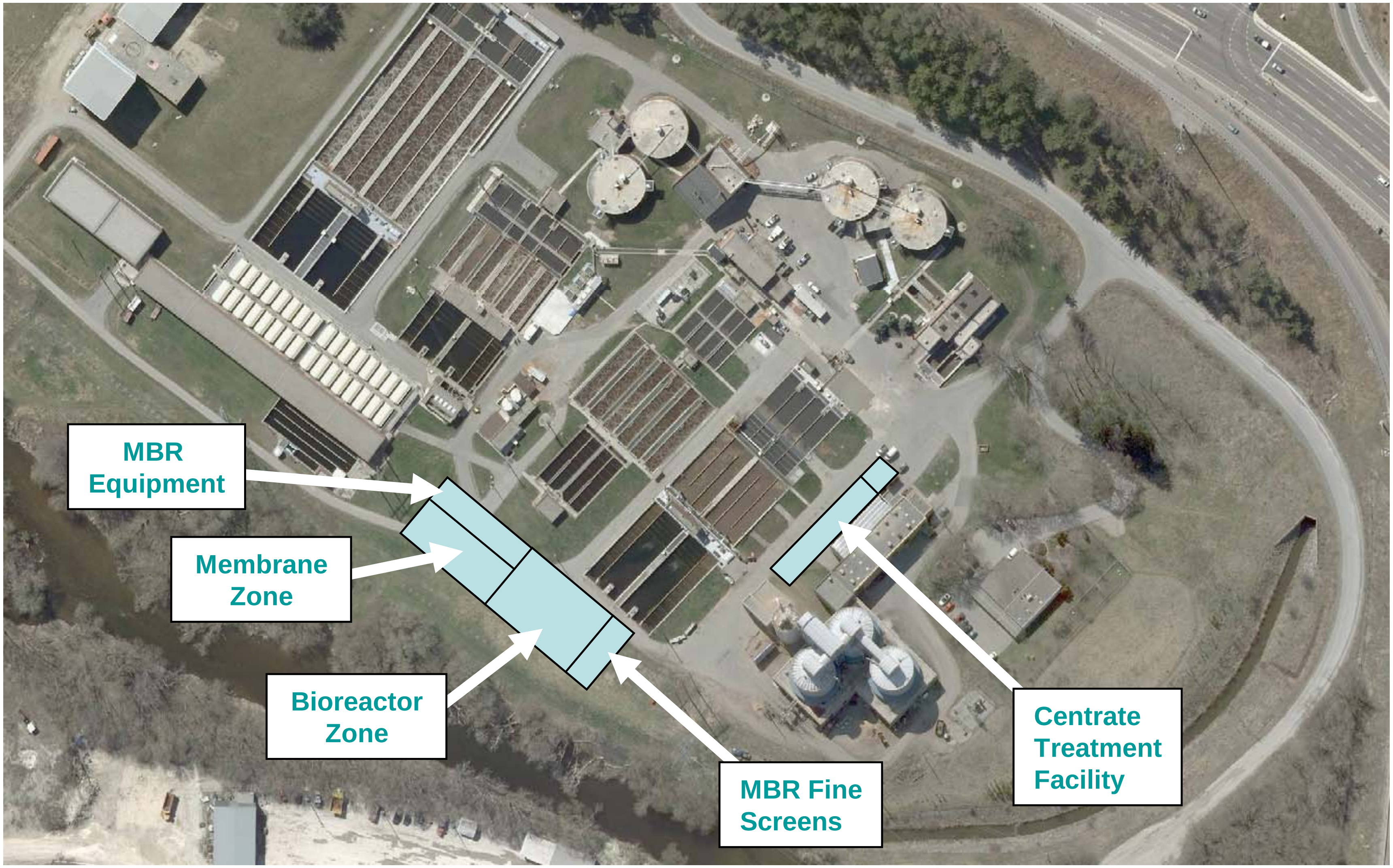
- Plant 1 would be operated at a very low solids retention time (SRT), perhaps 2-3 days, so that it does not nitrify. Operating in this manner effectively allows Plant 1 to be re-rated to 28 MLD, and this is primarily due to the relatively large secondary clarifiers of this treatment train.
- A tertiary nitrifying MBR (TMBR) would be implemented to treat the secondary effluent from Plant 1. This membrane plant would be designed and operated at a long SRT (i.e. perhaps 15 days) to ensure reliable nitrification.
- The waste sludge from the TMBR, which is rich in nitrifying bacteria, would be directed to the Plant 2 and Plant 3 activated sludge system, thereby allowing nitrification to take place at significantly lower solids retention times and MLSS concentrations. In doing so,

it is believed that Plants 2 and 3 can be re-rated to a capacity of 15 MLD and 14 MLD, respectively.

- Due to the lower wastewater strength in recent years, it is believed that Plant 4 could be re-rated to a capacity of 28 MLD.
- Based on the above (i.e. Plant 1 = 28 MLD, Plant 2 = 15 MLD, Plant 3 = 14 MLD, Plant 4 = 28 MLD), it is believed that an overall liquid train capacity of 85 MLD can be achieved.
- It is highly recommended that a separate centrate treatment facility be implemented to remove nitrogen associated with this ammonia-rich recycle stream. Centrate treatment facilities have been shown to be much more energy efficient and sustainable than treating the centrate in the mainstream facility, especially where stringent effluent nitrate concentrations are required, as will be the case in the future at Guelph.
- The existing sand filters would be retained to filter secondary effluent from Plants 2-4.

Figure 2 on the following page provides a site plan of the expansion with the TMBR concept.

FIGURE 2 – GUELPH WWTP EXPANSION TO 85 MLD - TERTIARY MBR ALTERNATIVE



Because the concept of tertiary nitrifying MBRs is relatively new, it is strongly recommended that the concept undergo detailed computer simulation study and pilot testing to confirm the additional capacity that could be realized. Pilot testing of the centrate treatment system is also recommended.

Conventional Expansion with Tertiary Membrane Filtration

In this process scheme, the existing secondary treatment facilities would be operated in a similar manner to the existing facility (i.e. designed and operated to nitrify); however, flows in excess of the capacity of the existing sand filter facility would be treated using membrane filtration.

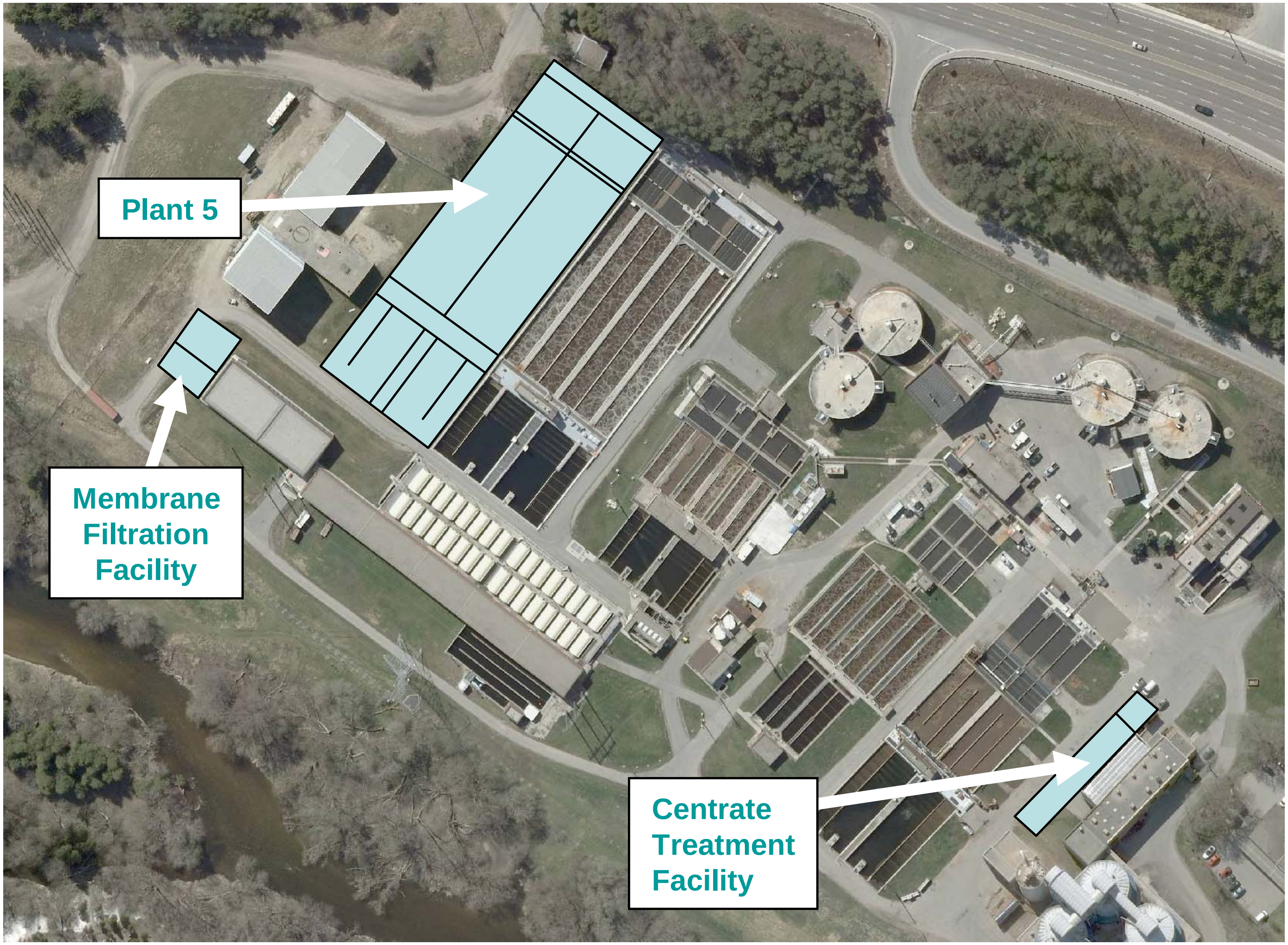
The following provides a description of the concept and overall treatment scheme for the Guelph WWTP:

- The existing Plants 1-3, which currently provide partial nitrification followed by tertiary rotating biological contactors for supplemental nitrification, would have to be de-rated to provide complete nitrification. The reason is that the RBC technology can <u>not</u> be relied upon to achieve effluent ammonia concentrations below 1 mgN/L, which will be required in the future.
- More specifically to the above, Plant 1, 2, and 3 would have to be de-rated to capacities of 13 MLD, 8 MLD, and 8 MLD, respectively, to allow complete nitrification and partial nitrate removal, the latter of which will also be required in the near future.
- Due to the lower wastewater strength in recent years, it is believed that Plant 4 could be re-rated to a capacity of 28 MLD. In doing so, the total capacity of Plants 1-4 would be 57 MLD (i.e. Plant 1 = 13 MLD, Plant 2 = 8 MLD, Plant 3 = 8 MLD, Plant 4 = 28 MLD).
- To achieve the total capacity of 85 MLD, a 28 MLD Plant 5 (i.e. similar to Plant 4) would be implemented.
- A membrane filtration facility would be implemented to treat the majority of flows from Plant 5.
- It is highly recommended that a separate centrate treatment facility be implemented to remove nitrogen associated with this ammonia-rich recycle stream. Centrate treatment facilities have been shown to be much more energy efficient and sustainable than treating the centrate in the mainstream facility, especially where stringent effluent nitrate concentrations are required, as will be the case in the future at Guelph.
- The existing sand filters would be retained to filter secondary effluent from Plants 1-4.

Pilot testing would likely be recommended during the membrane procurement phase. Pilot testing of the centrate treatment system is recommended.

Figure 3 on the following page provides a site plan of the expansion with this concept.

FIGURE 3 – GUELPH WWTP EXPANSION TO 85 MLD – CONVENTIONAL EXPANSION WITH MEMBRANE FILTRATION ALTERNATIVE



Conventional Expansion with Additional Sand Filtration

This expansion alternative is very similar to the expansion alternative that includes membrane filtration, except that a sand filtration expansion is implemented.

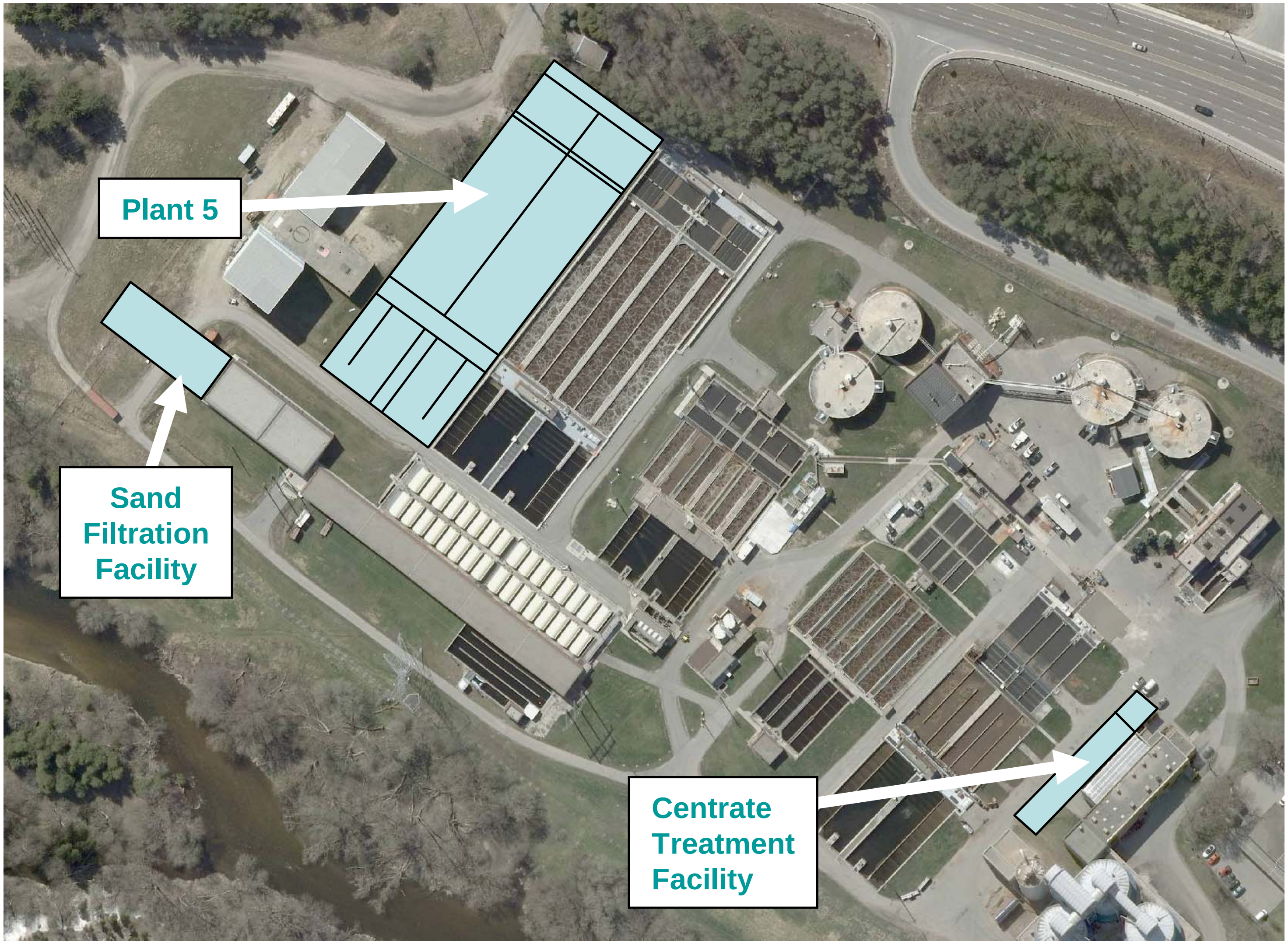
The following provides a description of the concept and overall treatment scheme for the Guelph WWTP:

- The existing Plants 1-3, which currently provide partial nitrification followed by tertiary rotating biological contactors for supplemental nitrification, would have to be de-rated to provide complete nitrification. The reason is that the RBC technology can not be relied upon to achieve effluent ammonia concentrations below 1 mgN/L, which will be required in the future.
- More specifically to the above, Plant 1, 2, and 3 would have to be de-rated to capacities of 13 MLD, 8 MLD, and 8 MLD, respectively, to allow complete nitrification and partial nitrate removal, the latter of which will also be required in the near future.
- Due to the lower wastewater strength in recent years, it is believed that Plant 4 could be re-rated to a capacity of 28 MLD. In doing so, the total capacity of Plants 1-4 would be 57 MLD (i.e. Plant 1 = 13 MLD, Plant 2 = 8 MLD, Plant 3 = 8 MLD, Plant 4 = 28 MLD).
- To achieve the total capacity of 85 MLD, a 28 MLD Plant 5 (i.e. similar to Plant 4) would be implemented.
- A new sand filtration facility would be implemented to treat the majority of flows from Plant 5.
- It is highly recommended that a separate centrate treatment facility be implemented to remove nitrogen associated with this ammonia-rich recycle stream. Centrate treatment facilities have been shown to be much more energy efficient and sustainable than treating the centrate in the mainstream facility, especially where stringent effluent nitrate concentrations are required, as will be the case in the future at Guelph.

The existing sand filters would be retained to filter secondary effluent from Plants 1-4.

Figure 4 on the following page provides a site plan of the expansion with this concept.

FIGURE 4 – GUELPH WWTP EXPANSION TO 85 MLD – CONVENTIONAL EXPANSION WITH SAND FILTRATION ALTERNATIVE



Capacity Summary

The following table provides a summary of the capacity assumptions for each of the liquid train modules for each scenario as well as a summary of the new liquid train infrastructure required for the expansion to 85MLD. It should be noted that no allocation has been provided for any needed upgrades to the headworks facility, disinfection, or biosolids handling/stabilization.

TABLE 2
Summary of Capacity Expansion to 85 MLD

Plant	Tertiary MBR	Conventional with Sand Filter Expansion	Conventional with Membrane Filtration
Plant 1	28 MLD	13 MLD	13 MLD
Plant 2	15 MLD	8 MLD	8 MLD
Plant 3	14 MLD	8 MLD	8 MLD
Plant 4	28 MLD	28 MLD	28 MLD
Plant 5	-	28 MLD	28 MLD
Total Capacity	**85 MLD**	**85 MLD**	**85 MLD**
Infrastructure Required for Expansion	• New MBR and equipment • Connecting channels and piping • Aeration system upgrades to Plant 2&3 • New centrate treatment facility	• New Plant 5 • Tertiary sand filter expansion • Connecting channels and piping	• New Plant 5 • Filtration expansion with membranes • Connecting channels and piping

Capital and Operating Cost Comparison

Capital and operating cost estimates for the three expansion alternatives was carried out to facilitate a comparison. Capital costs estimates include facility costs (e.g. process mechanical, structural, electrical, HVAC, and architectural) and engineering. In addition, provisions have been allowed for typical contractor mark-up, contractor overhead, bonds, insurance, and mobilization/demobilization. Costs are based on 2008 dollars and have not been escalated. These estimates should be considered to be Class 5 based on the definition provided by the AACE. Table 3 summarizes the capital cost estimates for each alternative.

TABLE 3
Capital Cost Estimates for Expansion Alternatives

Alternative	Capital Cost Estimate *
Tertiary MBR	$ 59.5 M
Conventional Expansion with Sand Filters	$ 56.7 M
Conventional Expansion with Membrane Filters	$ 62.5 M

* Cost Estimates include 15% for engineering, and 25% for the combined costs of contractor markup, overhead, bonds, insurance, and mobilization/demobilization.

As shown, the capital cost for the three alternatives are within 10% of each other.

The operating cost comparison between the alternatives has been limited to the expected annual energy costs associated with secondary and tertiary treatment. Energy costing estimates included the following items:

- Aeration energy associated with biological oxidation (BOD removal, endogenous decay, and nitrification) for activated sludge;
- Plant 1, when operated at a low SRT for BOD removal only in combination with the TMBR, an aeration credit for lower endogenous decay was provided;
- Both energy associated with process air (for nitrification) and air scour were accounted for in the estimates;
- Energy associated with return activated sludge (RAS) pumping from activated sludge, which is assumed to be at a rate of 100% of the average day raw sewage flow to the treatment train;
- Energy associated with recycle pumping for the TMBR system, assumed to be at 400% of the average day raw sewage flow to the treatment train;
- Secondary effluent pumping to existing and expanded sand filters;
- Energy associated with sand filtration;
- Energy associated with permeate pumping from TMBR and membrane filtration.

The following assumptions were made in energy cost estimating:

- Energy cost = $0.09 per kWh;
- Mechanical and electrical efficiency based on 70% and 95%, respectively for pumps and blowers;
- Fine bubble aeration for process air requirements in secondary treatment and TMBR. Coarse bubble aeration for membrane scouring for TMBR and membrane filtration.

Table 4 summarizes the annual energy cost estimates for each alternative.

TABLE 4
Annual Energy Cost Estimates for Expansion Alternatives

Alternative	Annual Energy Cost Estimate
Tertiary MBR	$ 505 K
Conventional Expansion with Sand Filters	$ 460 K
Conventional Expansion with Membrane Filters	$ 460 K

The annual costs associated with regular maintenance and operations for the three alternatives are relatively comparable. Variance can be found in the annual allocations required for equipment replacement. The estimated costs to be allocated for replacement are summarized in Table 5. The reasons for the variance include the frequency of replacement as well as the estimated quantity of equipment that needs to be replaced.

TABLE 5
Annual Maintenance Cost Estimates for Expansion Alternatives Based on Equipment Replacement Costs

Alternative	Annual Replacement Cost Estimate
Tertiary MBR	$ 216 K
Conventional Expansion with Sand Filters	$ 70 K
Conventional Expansion with Membrane Filters	$ 125 K

A summary of the considerations for the various alternatives is included in Table 6. It is recommended that for the City to gain a better understanding of the advanced treatment technologies that visits are taken to facilities that are successfully operating these processes. Examples of full scale WWTPs operating tertiary MBRs and tertiary membrane filtration include Traverse City, Michigan and Gwinnette County, Georgia respectively.

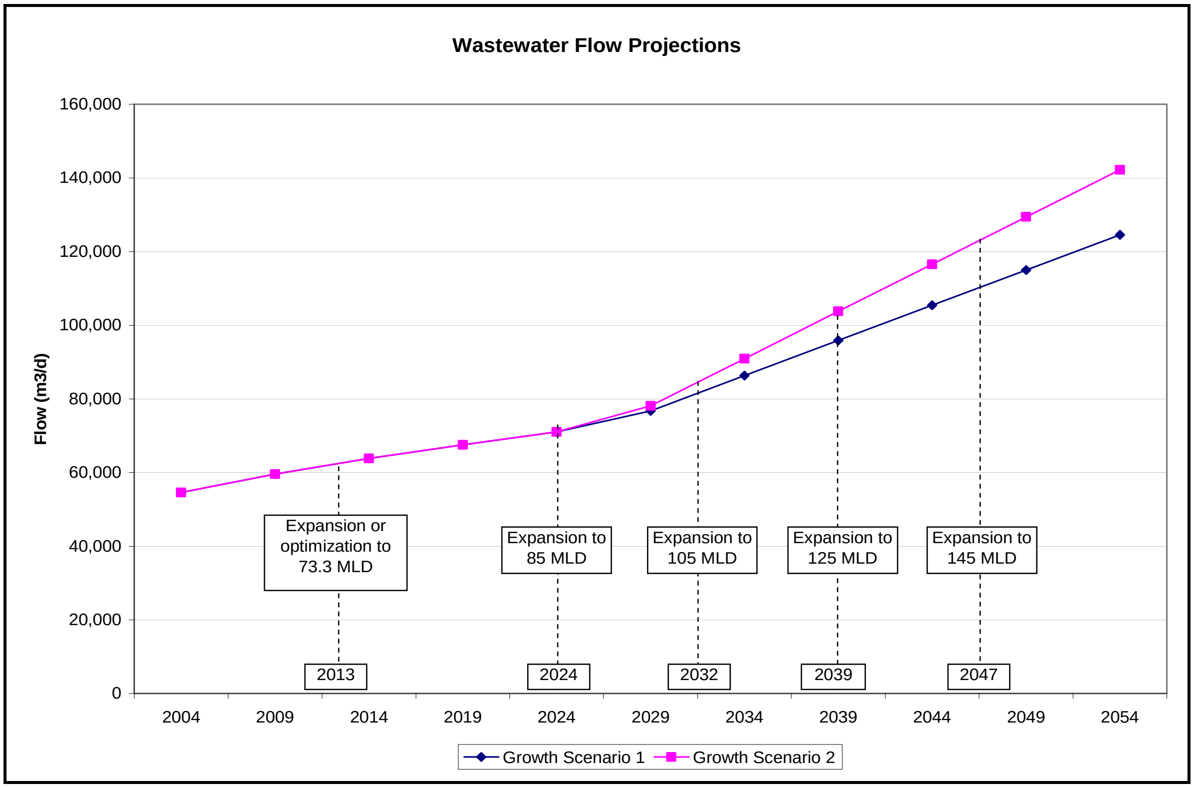
TABLE 6
Summary of Considerations for Future Expansion

Consideration	Tertiary Membrane Treatment		Conventional Tertiary Treatment (new Plant 5 or 6)
	Tertiary MBR	Tertiary Membrane Filtration	
Effluent Quality	Similar to membrane filtration	Similar to TMBR	Inferior to membrane based systems. Ultimately will require conversion to membranes to achieve effluent requirements.
Ease of Implementation	Relatively easy	Relatively easy	Relatively easy
State of Technology	Several facilities of similar size (> 10 MLD), although not specifically in TMBR mode (although two stage activated sludge is well established)	Many facilities of similar size (> 30 MLD)	Established
Impact of Future Regulatory Requirements	Capable of meeting future requirements.	Capable of meeting future requirements	Likely not capable of meeting future requirements with sand filtration.

Long-term (2031 – 2054)

The review and evaluation of treatment alternatives indicated that at this time tertiary membrane technology is the preferred method of achieving long term effluent limits beyond 2031. It is recognized that by this time treatment technologies will likely change and that flow rate estimates will also likely vary. Consideration was given to the timing and quantity of expansions that would be required, based on current knowledge, to achieve treatment of flows to 144 MLD. Consideration was given to staged treatment expansions from 2031 to 2054 to provide a total treatment capacity of 144 MLD at the Guelph WWTP. Modular expansions of 20 MLD were assumed and Figure 6 shows the estimated timing of each of the expansions beyond 2031.

FIGURE 6 – TIMELINE FOR LONG-TERM EXPANSIONS



A conceptual plan view showing what the footprint of the Guelph WWTP may look like in 2054 is shown in Figure 7. It is recognized that these alternatives will be reviewed and revisited with each of the update to the Treatment Master Plan.

FIGURE 7 – CONCEPTUAL FOOTPRINT OF GUELPH WWTP IN 2054

Appendix G
Public Advisory Committee Material

Guelph Wastewater Treatment Master Plan

Public Advisory Committee Meeting #1
Draft Meeting Summary

September 27, 2007

City of Guelph

This meeting summary is intended to provide an overview of the Public Advisory Committee (PAC) meeting held as part of the Guelph Wastewater Treatment Master Plant. This summary captures the key discussion points from PAC Meeting #1 held on September 27, 2007. It is not intended as a verbatim transcript.

If there are any questions or concerns regarding the content of this summary please contact the City's project manager or the project consultants:

Kiran Suresh Project Manager Wastewater Services City Hall, 59 Carden Street Guelph, ON N1H 3A1 kiran.suresh@guelph.ca	CH2M HILL Project Consultants 300 – 72 Victoria St. S. Kitchener, ON N2G 4Y9 GuelphWWTMP@ch2m.com

City of Guelph Wastewater Treatment Master Plan

Public Advisory Committee (PAC) Meeting #1

September 27, 2007

Cutton Club, 190 College St. East, Guelph

4:30p.m. to 6:30 p.m.

Key Meeting Topic: Master Planning Purpose and Process

Draft Agenda:

1. Welcome and Introductions
2. Purpose Statement
3. Study Area
4. Master Plan Process
   - Steps in the Planning Process
   - Evaluation Criteria and Methodology Overview
   - Preliminary List of Alternative Solutions
5. Consultation Plan
   - Plan Components and Key Contacts
6. Role of PAC and PAC Chair
7. Public Information Centre #1
   - Purpose and Expectations
8. Key Issues
9. Next Steps/Next Meeting

Guelph Wastewater Treatment Master Plan – PAC Meeting #1

Meeting Attendants

The following individuals attended PAC Meeting #1

PAC Members	
Don Drone	Chair
Ian Smith	Chamber of Commerce
Doan Bellman	Sleeman Breweries
James Ford	Community-at-Large
Khosrow Farahbakhsh	University of Guelph
Laura Murr	Green Plan Steering Committee
Dorothy Remmer	Green Plan Steering Committee
Paul McLennan	Guelph Developers Association
Steering Committee Members	
Janet Laird	Director of Environmental Services
Cameron Walsh	Manager of Wastewater Services
Kiran Suresh	Project Manager, Wastewater Services
Gerard Wheeler	Optimization Specialist, Wastewater Services
Tim Robertson	Supervisor Operations, Wastewater Services
Paul Kraehling	Senior Policy Planner
Laurie Watson	Communications Co-ordinator
Mark Anderson	Grand River Conservation Authority
Ministry of the Environment	
Scott Gass	Ministry of the Environment
Consultant Team	
Warren Saint	Project Manager
Diana Vangelisti	Communications and EA Specialist
Pam Law	Project Engineer

Presentation

The following section provides a summary of the presentation that was given at the PAC meeting. The summary is intended as a general overview. A copy of the power point presentation is available for download from the City's project website (www.guelph.ca).

Welcome and Introduction

Janet Laird welcomed all PAC members and other attendants and thanked them for being involved with the study. A copy of the City's 2007 Strategic Plan was distributed to all PAC members. Presented with the Strategic Plan was the City's new vision statement "The city that makes a difference".

Meeting Agenda and Guidelines

The meeting chair, Don Drone, went through the meeting agenda and guidelines. He also expressed the appreciation for PAC members for giving their time to the study.

Master Plan Purpose and Mission Statement

Cameron Walsh introduced the project's purpose and mission statement:

Master Plan Purpose:

To develop a 50-year Wastewater Treatment Plan to provide direction for wastewater infrastructure planning, investment and implementation to the year 2055

Mission Statement:

In keeping with the City of Guelph's strategic plan, community vision, corporate responsibility, core values, and demonstrated commitment to environmental stewardship, develop a comprehensive master plan that addresses the long-term wastewater treatment servicing needs of the community over the next 50-year planning horizon.

Study Area

Diana Vangelisti introduced the general study area which is captured by the City boundaries with a contribution of flow from the Village of Rockwood. The study area provides context for the Master Plan

Warren Saint provided a brief overview of the existing Wastewater Treatment Plant (WWTP) including treatment processes. It was indicated that the current WWTP is currently operating at a capacity of 64 MLD. It is expected to reach this capacity around 2012. The next stage expansion, approved as part of the 1998 Class Environmental Assessment, will increase the capacity to 73.3 MLD.

Questions and Responses

Question (Q): What are the main factors limiting expansion to the WWTP?

Response (R): During dry conditions, the effluent from the WWTP is approximately equal in volume to the flow in the Speed River just upstream of the plant, therefore a high quality effluent is required. With each capacity expansion, the ammonia in the wastewater is required to be nitrified to a greater degree.

Q: Isn't phosphorous an issue?

R: Phosphorous is being treated through chemical addition and biological treatment. Effluent quality is better than the limits set in the MOE Certificate of Approval under which the plant operates for all parameters, including phosphorus. However, the ability of the WWTP to achieve increasingly stringent phosphorus limits as the plant expands is a concern which may require modifications to operations or processes.

Q: Would Best Management Practices (BMPs) impact the capacity at the WWTP?

R: Capital funds are in place for upgrades to the WWTP, but BMPs, source control and plant optimization are being looked at to extend the period before expansion is required.

Q: Would reducing flows coming to the plant extend the capacity?

R: The flows received at the plant are currently around 470 Litres per capita per day (Lpcd), which has been reduced from the 540 Lpcd the City experienced approximately 10 years ago. Water conservation has been successful in reducing per capita flows as has corrective measures to reduce inflow and infiltration (I/I) into the sewer system. Additionally, with the help of industry initiatives, organic loading to the plant has decreased as well. The City recognizes there are still opportunities to improve water efficiency, I/I and overstrength industrial discharges.

Master Planning Process

Other City of Initiatives

Diana Vangelisti demonstrated how the Wastewater Treatment Master Plan (WWTMP) is linked with the City's other master planning exercises; Growth Management Strategy, Water and Wastewater Master Servicing Plan, Water Supply Master Plan, Biosolids Management Master Plan, Stage 2 expansion – Class EA Update.

Class Environmental Assessment (EA)

The WWTMP is being done under the prescribed Class EA process for Master Plans. This requires the completion of Phases 1 and 2 of the Class EA decision-making process.

Methodology Overview

Diana described how the specific approach to the WWTMP fits within the Class EA context.

Consultation Program

Diana explained the importance of the consultation component as part of the master planning process. The various stakeholders involved, including roles and responsibilities were described.

PAC membership and roles

Diana explained how members of the PAC are from organizations and community sectors that represent the Guelph community. The role of the PAC in the planning process was explained. The role of the PAC is to provide input throughout the planning process including the following components:

- The Scope and Challenge Statements
- Key issues and context for the Master Plan decision process
- Wastewater Treatment service alternatives
- Class EA evaluation methodology and decision criteria
- Consultation activities
- Related Master Plan issues and items as identified through the study

PAC Meeting Outlines

Four PAC meetings are planned for this process and the intent of each meeting was shown.

Meeting	Purpose	Intended Outcome
PAC Meeting#1 September 2007	To provide a Project Introduction, present the Study Process and identify key issues	Understanding of roles and endorsement of study process Identification of key issues moving forward
PAC Meeting #2 November 2007	Presentation of existing and future conditions and discussion of alternatives, evaluation process and impacts of consultation efforts to date.	Endorsement of Alternatives for evaluation Endorsement of evaluation methodology Feedback on PIC #1
PAC Meeting #3 January 2008	Presentation of evaluation outcomes and discussion of recommended MP components	Endorsement of evaluation outcomes and MP recommendations Feedback on messaging for PIC#2
PAC Meeting #4 February 2008	Discuss Draft Report	Endorsement of overall MP and Implementation

Steering Committee

The Steering Committee is made up of numerous staff who are involved in decision making process. Two main contacts for communication to the Steering Committee are the City and Consultant Project Managers.

What is an "Alternative"

The definition of an alternative from the Municipal Class EA document was presented.

Preliminary List of Alternatives

A very high level of types of alternatives to be examined was presented. They were grouped into the following categories; planning alternatives (growth/do nothing), treatment locations, discharge locations, treatment technologies.

Questions and Responses

Comment (C): Conservation should be included as an alternative.

Q: Under treatment technology, the question should be asked, "what would you treat?" Where would you get the best results from? Targeting entire treatment train or side streams (high load) or source treatment?

R: Will be looking at BMPs – water conservation, pretreatment, source control, I/I control. BMPs are continuing and ongoing and will be looked at as part of the WWTMP.

Q: Should the WWTP discharges to Speed River be reviewed on a hydraulic loading and mass loading basis?

R: The City is working with the GRCA to look at assimilative capacity of Speed River which requires the inputs from the WWTP on both a hydraulic and mass loading basis. The City is also working with GRCA to develop a more comprehensive monitoring program in the vicinity of the WWTP outfall to get a better understanding of Speed River limitations.

C: Should look at improving the water quality in the Speed River. There are concerns over stormwater run off and leachate run off. This study should look at what else is being put into the river. Should look at this as a whole system.

R: The City will be looking at the inputs of the WWTP on the Speed River as the focus of this master plan. The City is an active member the Water Managers of the Grand, which is a multi-municipality committee who work collectively with the GRCA on water quality issues within the Grand River Watershed.

Q: Which other WWTPs discharge to the Speed River?

R: The GRCA responded that Guelph and a small plant in Cambridge (Hespler) discharge into the Speed.

Q: How much information will be provided as "homework"? What type of information will be provided to the PAC for aid in the decision making process.

R: Information on the alternatives and the proposed evaluation criteria will be provided. Presentation material describing the advantages and benefits/impacts for each alternative will be included. This information will be provided to PAC in advance of the next meeting and PAC members are encouraged to read it.

Q: If there are any questions in regards to technical topics, can these be emailed?

R: Yes, comments/questions can be provided to the City's Project Manager (Kiran.Suresh@guelph.ca).

Public Information Centre (PIC) #1

The purpose and objectives of PIC #1 were described. The purpose and anticipated outcomes are as follows:

- Purposes:
  - To outline the objectives of the Wastewater Treatment Master Plan;
  - To describe the decision making process that will be followed to develop this plan; and
  - Receive comments, suggestions, and questions
- Expectations/Outcomes:
  - Share information to generate awareness and develop an overall understanding of the project
  - Respond to questions about the Master Planning process
  - Receive comments on issues related to wastewater treatment to be addressed through the decision-making process

The PIC is tentatively set for the week of October 22nd. Advertisement will be in local paper and on website and through mailing list.

Questions and Responses

Q: Would it help to have a summary of initiatives that have improved operations at the plant (water conservations etc.) at the PIC?

R: Information on previous initiatives at the WWTP can be included in the PIC.

Q: The City's Community Energy plan should be considered. Can this be integrated into MP.

R: This is an ongoing initiative (cogeneration and energy reduction at the plant). This can be included as a summary of initiatives the City is undertaking.

Tracking Key Issues

The issues tracking radar screen is a means of tracking key issues, adding new issues as they arise and can be used to develop solutions.

Key issues noted so far:

From Water Supply Master Plan (WSMP)
- Water efficiency
- Effluent reuse

From the Growth Management Strategy
- Growth projections are being examined under the Growth Management Strategy. The WWTMP will not to discuss or re-calculate the growth projections, rather the WWTMP will use projections adopted from WSMP.

Questions and Responses

Q: Can we link the effluent reuse to solid waste management initiatives?

R: Effluent reuse refers to the liquid effluent. A biosolids master plan has been completed which deals with the management of biosolids. There are not any direct links that can be made between this project and the solid waste management initiative.

Q: Alternatives – What about our sewer use by-law? Toronto has a more stringent bylaw. Are we going to be looking at the bylaw?

R: We will be reviewing the by-law in comparison to model MOE bylaws and EPA bylaws.

Comment (C): The City noted that when looking at effluent reuse, the potential negative impacts of removing effluent from the Speed River must be examined.

Q: Is this because of flow targets for the Speed River?

R: There are flow targets for the Speed River, GRCA regulates this flow through Guelph Reservoir. There may be impacts if significant flows from the WWTP were removed from the Speed as part of reuse alternatives, and if this was the case, the impacts should be determined.

Q: The committee should adopt a vision of looking at this project from a bigger context. For example, effluent from the WWTP is used by down stream water users and is therefore a form of water reuse.

R: It is acknowledged that effluent from the WWTP is used by other municipalities and industries along the watershed. The City also participates in the Water Managers of the Grand working group. The City has been working with the GRCA on further studies on the Speed River and funds other initiatives in the watershed.

Q: Is the Ministry looking at harmonizing effluent limits in Certificates of Approval?

C: The ministry is in the process of examining harmonizing formats, testing and reporting and requirements; however effluent limits are site specific.

Additional Questions and Comments

After the formal presentation, additional questions and comments were discussed in regards to the project. The following summarizes these discussions.

Q: What will be The City's process for responding to issues/comments from the Public?

R: As part of traceability all comments and questions related to the WWTMP will be compiled and responses provided. At the PIC an information brief will be provided with key points as well as a comment sheet. The information brief, as well as a summary of any comments received will be posted to the City's website. The comments, as well as any comments received through mail or email, will be consolidated and inputted into the radar screen. Each specific comment will be inputted into a matrix and a response, and action if applicable, will be provided. The comments will be reviewed and incorporated into the decision making process. Comments can be received at any time during the study.

C: Public engagement should be encouraged.

R: Public engagement will be encouraged through the following means:
- Accessibility of City staff
- Responding readily to questions/comments
- Commonly asked questions and responses made available
- Promotion of the PICs
- Provision of material on the City website

Q: Would it be possible for the PAC to get a tour of the plant?

R: A tour will be arranged for PAC members.

Q: Can Steering Committee (SC) be open to the public?

R: These meetings can be made open. PAC members will be informed about these meetings when scheduled.

Q: Can minutes from SC be posted?

R: Yes

Q: When is the PIC?

R: The first PIC is tentatively scheduled for the week of October 22nd. Exact date, time and location will be provided.

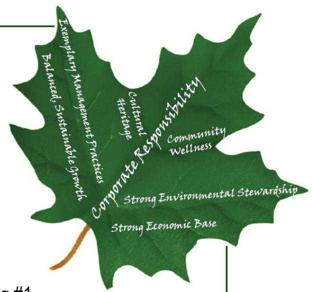
Q: Can the PAC get information on the state of the river?

R: The Grand River Conservation Authority just put out a report to the Board on the state of the river. A copy can be provided through GRCA.

Next Meeting

Next meeting of the PIC is tentatively scheduled for November 8th. Proposed time 8:30 a.m.

City of Guelph Wastewater Treatment Master Plan



PAC Meeting #1

September 27, 2007

CH2MHILL

City of Guelph – Strategic Plan

CH2MHILL

City of Guelph 2007 Strategic Plan

City of Guelph 2007 Strategic Plan — *Approved August 13, 2007*

VISION

TO BE THE CITY THAT MAKES A DIFFERENCE

Acting locally and globally to improve the lives of residents, the broader community and the world.

MISSION

TO ACHIEVE EXCELLENCE THROUGH LEADERSHIP, INNOVATION, PARTNERSHIPS AND COMMUNITY ENGAGEMENT

URBAN DESIGN & SUSTAINABLE GROWTH	PERSONAL AND COMMUNITY WELL-BEING	ECONOMIC OPPORTUNITY	ARTS, CULTURE AND HERITAGE	GOVERNMENT & COMMUNITY INVOLVEMENT	NATURAL ENVIRONMENT
Goal 1: An attractive, well-functioning and sustainable city	**Goal 2:** A healthy and safe community where life can be lived to the fullest	**Goal 3:** A diverse and prosperous local economy	**Goal 4:** A vibrant and valued arts, culture and heritage identity	**Goal 5:** A community-focused, responsive and accountable government	**Goal 6:** A leader in conservation and resource protection/enhancement
STRATEGIC OBJECTIVES:	STRATEGIC OBJECTIVES:	STRATEGIC OBJECTIVES:	STRATEGIC OBJECTIVES:	STRATEGIC OBJECTIVES:	STRATEGIC OBJECTIVES:
1.1 A distinct community identity with leading edge, city-wide urban design policies 1.2 Municipal sustainability practices that become the benchmark against which other cities are measured 1.3 A Local Growth Management Strategy that effectively guides where and how future growth will take place 1.4 A sustainable transportation approach that looks comprehensively at all modes of travel to, from and within the community 1.5 The downtown as a place of community focus and destination of national interest 1.6 A balanced tax assessment ratio	2.1 A complete community with services and programs for children, youth and adults of all ages 2.2 Diverse housing options and health care services to meet the needs of current and future generations 2.3 The most physically and socially active residents in Canada 2.4 The lowest crime rate and best emergency services record of any comparable-sized Canadian city 2.5 Comprehensive life-long learning opportunities 2.6 A well-connected and accessible community that values diversity, multiculturalism, volunteerism and philanthropy	3.1 Thriving and sustainable local employment opportunities 3.2 One of Ontario's top five and Canada's top ten places to invest 3.3 The highest ratio of any southern Ontario city of people who live and work in the same community 3.4 Fair tax policies and streamlined processes across all levels of government 3.5 A diverse and skilled local workforce 3.6 The city as a tourist destination of choice	4.1 A designated cultural capital of Canada 4.2 Numerous opportunities for artistic appreciation, expression and development 4.3 Highest per capita use of city libraries, museums and cultural facilities among any comparable Canadian city 4.4 Intact and well managed heritage resources 4.5 Capitalize on our cultural and heritage assets to build economic prosperity, quality of life and community identity	5.1 The highest municipal customer service satisfaction rating of any comparable-sized Canadian community 5.2 A consultative and collaborative approach to community decision making 5.3 Open, accountable and transparent conduct of municipal business 5.4 Partnerships to achieve strategic goals and objectives 5.5 A high credit rating and strong financial position 5.6 Organizational excellence in planning, management, human resources and people practices; recognized as a top employer in the community 5.7 The highest per capita municipal election voter turnout of any city in Ontario	6.1 Coordinated management of parks, the natural environment and the watershed 6.2 Less total greenhouse gas emissions for the City as a whole compared to the current global average 6.3 A safe and reliable local water supply 6.4 Less waste per capita than any comparable Canadian city 6.5 Less energy and water per capita use than any comparable Canadian city 6.6 A biodiverse City with the highest tree canopy percentage among comparable municipalities

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Meeting Agenda

Key Meeting Topic: Master Planning Purpose and Process

1.	Welcome and Introductions	Janet Laird
2.	Meeting Agenda, Guidelines	Don Drone
3.	Purpose/Mission Statements	Cameron Walsh
4.	Study Area	CH2M HILL
5.	Master Plan Process	CH2M HILL
6.	Consultation Plan	CH2M HILL
7.	Role of PAC and PAC Chair	CH2M HILL
8.	Public Information Centre #1	CH2M HILL
9.	Key Issues	CH2M HILL
10.	Next Steps/Next Meeting	All

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Meeting Guidelines

- Please arrive prepared
- Please turn off Cell Phones and pagers
- Respect the speaker
- Listen to understand
- Focus on *this* study
- Agree to disagree
- Work through the Chair

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Master Plan Purpose

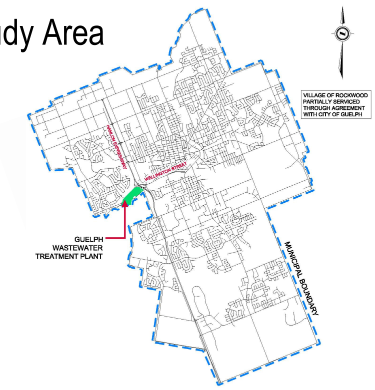
To develop a 50-year Wastewater Treatment Plan to provide direction for wastewater infrastructure planning, investment and implementation to the year 2055.

CH2MHILL

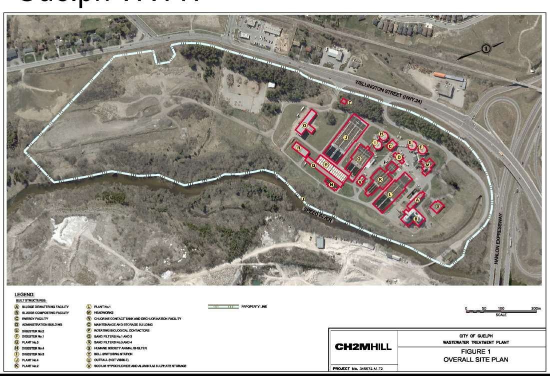
Mission Statement

In keeping with the City of Guelph's strategic plan, community vision, corporate responsibility, core values, and demonstrated commitment to environmental stewardship, develop a comprehensive master plan that addresses the long-term wastewater treatment servicing needs of the community over the next 50-year planning horizon.

Study Area

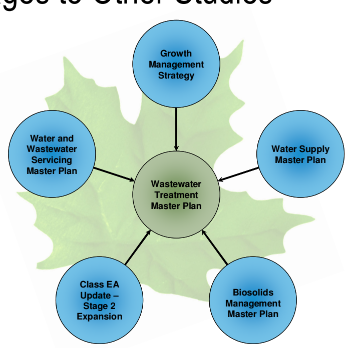


Guelph WWTP

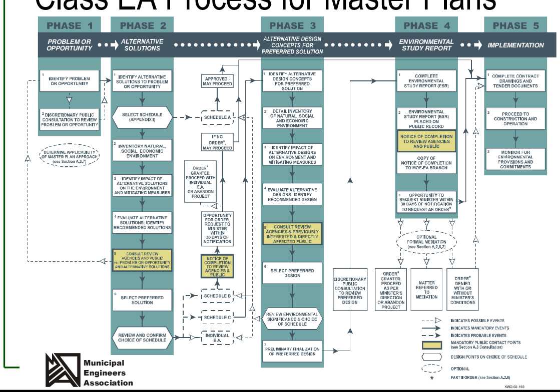


The Master Planning Process

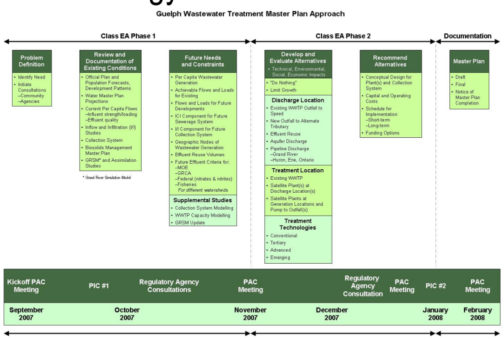
Linkages to Other Studies



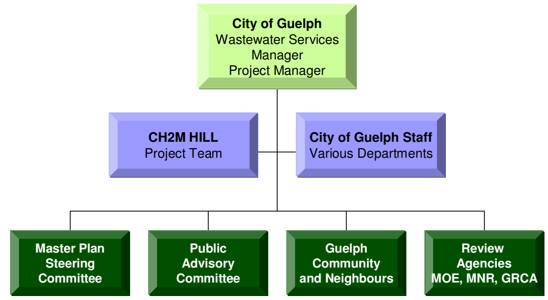
Class EA Process for Master Plans



Methodology Overview



Consultation Program Structure



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PAC Membership

Community Sector	Representative
Business/Industry (2)	Doan Bellman (Sleeman Breweries) Ian Smith (Chamber of Commerce)
Development	Paul McLennan (Guelph Developers Association)
Academia	Khosrow Farahbakhsh (University of Guelph)
Agriculture	Gary Nelson (Federation of Agriculture)
Environment (2)	Dorothy Remmer, Laura Murr (Green Plan Steering Committee)
Community-at-Large (2)	James Ford, Hugh Whitely
Council	Bob Bell
Chair	Don Drone

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Role of the PAC

The Public Advisory Committee (PAC) is responsible for providing advice and feedback to the Wastewater Treatment Master Plan project team at key milestone points over the course of the study including the following Master Plan components:

– The Scope and Challenge Statements
– Key issues and context for the Master Plan decision process
– Wastewater Treatment service alternatives
– Class EA evaluation methodology and decision criteria
– Consultation activities
– Related Master Plan issues and items as identified through the study

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PAC Meeting Outline

Meeting	Purpose	Intended Outcome
PAC Meeting#1 September 2007	To provide a Project Introduction, present the Study Process and identify key issues	Understanding of roles and endorsement of study process Identification of key issues moving forward
PAC Meeting #2 November 2007	Presentation of existing and future conditions and discussion of alternatives, evaluation process and impacts of consultation efforts to date.	Endorsement of Alternatives for evaluation Endorsement of evaluation methodology Feedback on PIC #1
PAC Meeting #3 January 2008	Presentation of evaluation outcomes and discussion of recommended MP components	Endorsement of evaluation outcomes and MP recommendations Feedback on messaging for PIC#2
PAC Meeting #4 February 2008	Discuss Draft Report	Endorsement of overall MP and Implementation

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Steering Committee Membership

Manager Wastewater Services	Cameron Walsh
Director of Environmental Services	Janet Laird
Project Manager, Wastewater Services	Kiran Suresh
Optimization Specialist, Wastewater Services	Gerard Wheeler
Supervisor Operations, Wastewater Services	Tim Robertson
Manager of Infrastructure Planning, Design and Construction	Don Kudo
City Engineer, Engineering Services	Richard Henry
Manager Waterworks	Peter Busatto
Director, Community Design and Development Services	Jim Riddell
Senior Policy Planner, Community Design and Development Services	Paul Kraehling
Senior Communications Officer, Corporate Communications	Tara Sprigg
Communications Coordinator, Corporate Communications	Laurie Watson
Senior Water Quality Supervisor, Grand River Conservation Authority	Sandra Cooke
Water Quality Engineer, Grand River Conservation Authority	Mark Anderson
CH2M HILL Project Manager	Warren Saint
CH2M HILL Environmental Assessment/Communications	Diana Vangelisti
CH2M HILL Engineering Support	Pam Law

*Supported by various CH2M HILL team members

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Steering Committee

Role:

- Responsible for advising on the master plan decision process and related technical activities and issues.
- Members will be expected to review project information provided in advance of meetings and to be prepared to actively participate in meetings.
- Committee members are to represent the interests of their respective organization.

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Regulatory Agencies

- Participate in the decision-making process at key milestones
- Provide comments on draft recommendations and strategy components
- Support Master Plan Strategy and facilitate approvals through implementation

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Alternative Solutions - Definition

Alternative Solution:

Means *feasible* alternative ways of solving an identified problem (deficiency) or addressing an opportunity, from which a *preferred solution* is selected.

Note: Includes the "Do Nothing" alternative

Source: Municipal Class Environmental Assessment June 2000

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Preliminary Alternative Solutions

- "Do Nothing"
- Limit Growth

Discharge Location

- Existing WWTP Outfall to Speed River
- New Outfall to Alternate Tributary
- Effluent Reuse
- Aquifer Discharge
- Pipeline Discharge:
  - –Grand River
  - –Huron, Erie, Ontario

Treatment Location

- Existing WWTP
- Satellite Plant(s) at Discharge Location(s)
- Satellite Plants at Generation Locations and Pump to Outfall(s)

Treatment Technologies

- Conventional
- Tertiary
- Advanced
- Emerging

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Public Information Centre #1

- Purposes:
  - To outline the objectives of the Wastewater Treatment Master Plan;
  - To describe the decision making process that will be followed to develop this plan; and
  - Receive comments, suggestions, and questions

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Public Information Centre #1 (cont'd)

- Expectations/Outcomes:
  - Share information to generate awareness and develop an overall understanding of the project
  - Respond to questions about the Master Planning process
  - Receive comments on issues related to wastewater treatment to be addressed through the decision-making process

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Tracking Key Issues

- Radar Screen:
  - Intended as a tool to track key issues that influence the progress of the Master Plan
  - Radar screen issues will require traceable activity to demonstrate resolution
  - Useful as a tool for communications with stakeholders

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Key Issues

From the Water Supply Master Plan
- Water Efficiency
- Effluent Reuse

From Growth Management Strategy
- Population Projections confirmed

From Water & Wastewater Servicing
- Integrate treatment & servicing solutions

Other Issues?

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Next Steps

- Advance description of alternatives
- Public Information Centre #1
- Review comments from PIC#1 and make appropriate adjustments and modifications to the study process
- Prepare Package for PAC Meeting #2

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Next PAC Meeting

Key Meeting Topic: Alternatives and Evaluation

- November 2007 (tentative)
- Agenda Package two weeks prior

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Guelph Wastewater Treatment Master Plan

Public Advisory Committee Meeting #2
Draft Meeting Summary

January 22, 2008

City of Guelph

This meeting summary is intended to provide an overview of the Public Advisory Committee (PAC) meeting held as part of the Guelph Wastewater Treatment Master Plan. This summary captures the key discussion points from PAC Meeting #2 held on January 22, 2008. It is not intended as a verbatim transcript.

If there are any questions or concerns regarding the content of this summary please contact the City's project manager or the project consultants:

Kiran Suresh
Project Manager
Wastewater Services
City Hall, 59 Carden Street
Guelph, ON N1H 3A1
kiran.suresh@guelph.ca

CH2M HILL
Project Consultants
300 – 72 Victoria St. S.
Kitchener, ON N2G 4Y9
GuelphWWTMP@ch2m.com

City of Guelph Wastewater Treatment Master Plan

Public Advisory Committee (PAC) Meeting #2

January 22, 2008

Guelph Wastewater Treatment Plant, 530 Wellington Street W.

8:30 am to 12:00 pm

Key Meeting Topic: Conditions, Alternatives, Evaluation

Draft Agenda:

1. Welcome
2. Plant Tour
3. Meeting Agenda, Guidelines
4. Review #1 Meeting Summary
5. Existing Conditions
6. Future WW Requirements
7. Alternatives
8. Evaluation Methodology
9. Consultation To-Date
10. Next Steps/Next Meeting

Guelph WWTMP – PAC Meeting #2

Meeting Attendants - The following individuals attended PAC Meeting #2

PAC Members	
Don Drone	Chair
Ian Smith	Chamber of Commerce
Doan Bellman	Sleeman Breweries
James Ford	Community-at-Large
Khosrow Farahbakhsh	University of Guelph
Laura Murr	Green Plan Steering Committee
Dorothy Remmer	Green Plan Steering Committee
Paul McLennan	Guelph Developers Association
Hugh Whiteley	Community-at-Large
Gary Nelson	Federation of Agriculture
Robert Bell	City Councillor
Steering Committee Members	
Janet Laird	Director of Environmental Services
Cameron Walsh	Manager of Wastewater Services
Kiran Suresh	Project Manager, Wastewater Services
Gerard Wheeler	Optimization Specialist, Wastewater Services
Tim Robertson	Supervisor Operations, Wastewater Services
Paul Kraehling	Senior Policy Planner
Laurie Watson	Communications Co-ordinator
Mark Anderson	Grand River Conservation Authority
CH2M HILL Consultant Team	
Warren Saint	Project Manager
Diana Vangelisti	Communications and EA Specialist
Pam Law	Project Engineer
Additional Public Members	
Andrew Lambden	Guelph Developers Association

Presentation

The following section provides a summary of the presentation that was given at the PAC meeting. The summary is intended as a general overview. A PDF copy of the power point presentation is available for download from the City's project website (www.guelph.ca).

Welcome and Introduction

Cameron Walsh welcomed all PAC members and other attendees and thanked them for attending the meeting.

Meeting Agenda and Guidelines

The meeting chair, Don Drone, went through the meeting agenda and guidelines. Due to the inclement weather, the tour of the wastewater treatment plant was postponed. PAC members were invited to contact Kiran Suresh to arrange a tour another time if they were interested or, time permitting, there could be a plant tour at the next PAC meeting.

Master Plan Purpose and Mission Statement

Diana Vangelisti reviewed the project's purpose and mission statement:

Master Plan Purpose:

To develop a 50-year Wastewater Treatment Plan to provide direction for wastewater infrastructure planning, investment and implementation to the year 2054

Mission Statement:

In keeping with the City of Guelph's strategic plan, community vision, corporate responsibility, core values, and demonstrated commitment to environmental stewardship, develop a comprehensive master plan that addresses the long-term wastewater treatment servicing needs of the community over the next 50-year planning horizon.

Class EA Methodology Overview

Diana Vangelisti reviewed where we are in terms of the overall study process. The planning process is approximately at the midpoint. The long list of alternatives has been developed and the evaluation methodology outlined.

Questions and Responses

Question (Q): What was the level of interest in the first Public Information Centre (PIC)?

Response (R): There was a moderate level of public interest in the first PIC. For an initial PIC outlining project process and objectives, the number of people attending was good.

Q: How will the PAC "steer" the project?

R: PAC involvement is an important part of the decision making process and now, especially, is an important time to provide comments. The role of the PAC is to review the long list of alternatives, see if anything is missing or if something shouldn't be included and also to review the evaluation methodology and criteria and comment on whether they are appropriate for Guelph and this study.

Existing Conditions

Virtual Tour

Cameron Walsh provided a "virtual tour" of the plant using the aerial photograph from the presentation. He gave a brief overview of the process from the headworks to the final effluent. A summary of the tour is as follows:

Liquid Treatment

1. Headworks – all wastewater flows collected by the sewer system arrive at the Headworks of the WWTP. The pumps in the Headworks lifts the wastewater so it can flow by gravity through the initial phases of treatment. Preliminary treatment consisting of screening and grit removal also occur in the Headworks to remove material which can have negative impacts on downstream plant equipment and processes.
2. Primary Clarifier – slows down the wastewater allowing a significant amount of solids to settle out.
3. Aeration tanks – biologically breaks down fine suspended and dissolved in the wastewater. This is done primarily by bacteria (bugs) that are cultured in the aeration tanks.
4. Secondary Clarifiers – like the primary clarifier, this step removes organic and inorganic matter through settling including the bugs from the aeration tank.
5. Rotating Biological Contactors (RBCs) – another biological removal process, but the bugs in this process are specifically adapted for the removal of ammonia.
6. Filtration – the filtration step is a polishing step to remove some additional solids.
7. Chlorination – the effluent is disinfected using chlorine.
8. Dechlorination – the effluent is dechlorinated prior to discharge to the river to provide a non-toxic effluent, as chlorine can be toxic to aquatic environments.

Solids Treatment

1. Digesters - solids removed through the various processes in the plant are sent to the digesters. While in the digesters, volatile solids are consumed in an anaerobic process and the mass of solids is reduced by approximately one third.
2. Dewatering - digested solids are sent to dewatering to remove some of the liquid. The dewatering process raises the solids content from about 3% to approximately 25%. This

makes the product easier to transport as it now takes up less volume. The product is now referred to ask dewatered cake.

3. Lystek - the final process for the solids is the proprietary Lystek process which allows the dewatered cake to have the viscosity of liquid, while taking up the same volume. This makes the product easier to pump and store.

Questions and Responses

Q: Is metals content in the solids a problem for land application?

R: The highest metals in the solids produced at the WWTP are copper and zinc. But these metals are still within the acceptable range for land application. Currently under the guidelines for agricultural land application, nutrients are the limiting factor.

Q: Where is the greatest opportunity for improvement at the WWTP.

R: In recent years there has been a significant decrease in loading from industrial contributors. The City is looking at opportunities for operational improvements in the existing treatment processes now that the influent loading has been reduced.

Q: Is suspended particulate a problem in the outfall

R: The WWTP is operating within the guidelines for suspended solids. The GRCA indicated that there is essentially no impact from the WWTP in terms of solids and at certain times of the year, such as a spring melt, the concentration of suspended solids in the river is greater than the suspended solids in the effluent.

WWTP Capacities

It was described that the current WWTP has a rated capacity of 64 MLD. The average amount of wastewater currently reaching the WWTP is 54 MLD. Through a separate Class EA process completed in 1998, the City has approval to expand the plant to a rated capacity of 73.3 MLD.

Questions and Responses

Q: Were there any terms and conditions put on the approval of the expansion to 73.3 MLD?

R: There were discussions with the Ministry during the Class EA, but any terms and conditions for the WWTP will be included in the Certificate of Approval that will be issued for the expanded facility. Commitments summary from the Class EA Update can be forwarded.

Current Initiatives

Current initiatives underway at the WWTP include:

- Plant optimization – The City is reviewing opportunities to increase the current rated capacity of the WWTP
- Digester expansion – Digester No. 5 is currently under construction and will add approximately 25% more primary digester capacity

- Biosolids storage – The conceptual design of a biosolids storage facility is being completed to allow greater flexibility in land application operations
- WAS (Waste Activates Sludge) thickening demonstration to increase the efficiency of the anaerobic digesters
- Lystek demonstration – to achieve greater flexibility in solids transport and storage

Questions and Responses

Q: What initiatives are being done to in terms of the Community Energy Plan?

R: The City is currently upgrading the cogeneration system which will use methane from the WWTP processes to power engines and provide electricity for the facility. Energy efficient options are also considered as part of design alternatives.

Future Requirements

Flow Projections

Flow projections to 2054 were presented. The projections were based on population projections developed for the Water Supply Master Plan.

Questions and Responses

Q: Do the projections include Rockwood?

R: Flow projections from Rockwood have been included as stipulated under the current Memorandum of Understanding between the Village of Rockwood and the City of Guelph.

Q: Does the project account for water conservation initiatives? Will that eliminate the need for an expansion?

R: The Wastewater Treatment Master Plan flow projections presented are based on the projections in the Water Supply Master Plan (WSMP) and future flow projections for planning purposes are based on current per capita sewage generation rates. This is a conservative approach for capital forecasting. Consistent with the approach in the WSMP, the potential impact of water conservation will be examined and noted in this study. An effective water conservation program can defer the expansion of existing infrastructure. The effectives of the water conservation on per capita sewage generation can be confirmed through updates to this master plan. It was noted that previous water efficiency initiatives initiated by the City have contributed to a decrease in the wastewater generation rate have deferred the need to expand the WWTP to 73.3 MLD.

Q: How much can water use be reduced before it becomes a problem at the WWTP?

R: Less water in the collection system will lessen the amount of dilution in the sewage, increasing the concentration or strength of the wastewater arriving at the WWTP. With the decrease in loadings from industrial users, the strength of the incoming wastewater has also decreased to around 160 mg/L of organics, the plant can effectively treat up to 220 mg/L and increase in wastewater strength due to water conservation should not be a problem.

Comment (C): There needs to be a shift in thinking from looking at infrastructure being the only way to sustain growth. It needs to be recognized that sustainable growth can be achieved through conservation.

Q: What is the collection system rated for? Conservation could also impact collection system capacity.

R: The capacity of the existing infrastructure is being examined as part of the Water and Wastewater Master Servicing Plan, which is currently underway.

C: It should be noted that areas sited for growth are prime agricultural land.

Future Effluent Requirements

Potential future compliance limits were presented. It was explained that the Speed River is a Policy 2 receiver, as designated by the Ministry of the Environment. This means that any additional flows that are discharged to the river must result in no net increase, or where possible a decrease in mass loading. Loading is measured in kg/d and is determined by multiplying the concentration limits in mg/L by the flow limits in MLD. To go beyond the approved flow and effluent limits for 73.3 MLD, the effluent quality from the Guelph WWTP must be improved. It was explained that effluent limits in the winter are slightly higher because plant respiration is decreased and therefore phosphorus doesn't have as significant of an impact and ammonia toxicity decreases with colder receiver temperatures.

Questions and Responses

Q: Were there any conditions put on stormwater management through approval of expansion?

R: Conditions for stormwater management are not included in the WWTP Certificate of Approval. The City is working to improve upstream water quality conditions.

Q: Will the impact of climate change be considered when examining future impacts?

R: The approach to calculating the downstream impact of the effluent discharge is to use historical low flow conditions. This uses the lowest weekly average flow from the last 20 years. These values will be re-evaluated every five years for subsequent updates and will reflect changes to the flows in the river including potential impacts of climate change.

Q: Has the potential for a semi-closed system, where wastewater from new developments is taken off the system through a combination of grey water reuse and on site treatment?

R: Alternatives have focused mostly on municipal scale initiatives; this has been noted and will be captured in the WWTMP.

C: It was noted that future development may also have an impact on baseflow in the Speed River, as impervious areas are covered over, stormwater may not infiltrate the soil and discharge gradually to the Speed, but instead may come in peak flows during the storm event.

R: In response to the above comment, it was noted that new developments employ a storm detention pond that holds stormwater for 24 hours and releases it gradually to the rivers.

Q: Are a lot of “pump and dumps”(septic clean outs) being brought to the plant? Has there been an increase in this volume over the years?

R: Septage received is not a large volume of the overall flows received at the WWTP. The volume has not appeared to increase over the last little while. The City tracks volumes received.

Q: Is the City aware of downstream water takers that have a Permit to Take Water (PPTW)? This may have an impact on assimilative capacity.

R: The City is not aware of all of the downstream users that have PTTW. They are aware of some takers, such as the local golf courses that do take water for irrigation purposes.

Note added after meeting: Assimilative capacity of the river system is calculated using flows immediately upstream of the WWTP effluent. Downstream water takers would not have an impact on the assimilative capacity.

Q: Has the City talked to any large water users such as industry to implement closed systems with water reuse to reduce the water going to the sewer system?

R: Currently industrial users are not a major flow contributor, approximately 5% of the average overall flows received at the WWTP.

Q: How does a Policy 2 designation relate to the Ministry of Natural Resources (MNR) water way designation?

R: There is not a direct link between the two designations. The MNR classifies the Speed River as a warm water fish habitat which is used to determine the Provincial Water Quality Objective (PWQO) for dissolved oxygen. A Policy 2 receiver is designated to receiving water bodies are not currently meeting Provincial Water Quality Objectives (PWQOs).

C: MOE is reviewing PWQOs for nitrates. This should be noted as something to consider with future expansions. Current Canadian Council of Ministers of the Environment (CCME) recommendation for nitrate levels is 2.9 mg/L

Q: What about chlorides?

R: There is currently no effluent compliance limits for chloride, but the plant does monitor this parameter. The main source of chlorides is from water softeners and it is not treatable through the WWTP.

Q: Has the potential decommissioning of the quarry dewatering been considered in the effluent calculations?

R: River flows upstream of the quarry discharge are used to determine assimilative capacity and do not consider the additional flows from the quarry.

Q: What is the mean loading upstream?

R: Upstream concentrations and flows can be provided.

Alternatives

The alternatives have been grouped into five main categories:

- Planning alternatives
- Source control/non-expansion alternatives
- Discharge location alternatives
- Treatment location alternatives
- Treatment technology alternatives

Planning Alternatives

The two planning alternatives of “Do nothing” and “Limit growth” were presented.

C: Janet Laird indicated that the master planning studies should look at how much population can be sustainably accommodated. The findings from the master planning initiatives, including this master plan, the Water Supply Master Plan and the Water and Wastewater Master Service Plan will determine the amount of growth Guelph can accommodate. Council passed a resolution to this effect. Wording in the TMs and the WWTMP report should be modified to reflect this.

Source Control/Non-expansion Alternatives

The following source control/non-expansion alternatives were presented and discussed:

- Water conservation initiatives
- Inflow and infiltration control
- Sewer use by-law
- WWTP optimization

Questions and Responses

Q: How does Guelph’s inflow and infiltration (I/I) compare to other municipalities?

R: The I/I being seen at the Guelph WWTP is typical when compared to other municipalities.

Q: What is being done with surcharge agreements?

R: Industry producing overstrength effluent are required to decrease the strength of their discharge as much as they can before entering into a surcharge agreement. Surcharge agreements are only available to industries that were in Guelph before the by-law was produced. Any new industry must meet by-law limits.

C: The water conservation targets do not look very aggressive.

R: The City has been working over a period of several years to decrease water usage and have seen positive results in reduction in per capita use. The target reductions sited are on top of the reductions that the City has already obtained.

Q: Are there specific targets for I/I reduction?

R: This study is working with Public Works and the Water and Wastewater Master Servicing Plan to develop targets.

Discharge Location Alternatives

Potential discharge locations were examined. Through initial investigations it was found that there should be sufficient assimilative capacity in the Speed River at the current WWTP outfall to accommodate flows to 2054. There is potential to reuse a portion of the effluent for a varied number of applications.

Based on comments from the GRCA, there are currently no other locations within the Grand River watershed where further assimilative capacity would be available. The Lake Erie discharge was found to not be feasible for the City of Guelph through the Water Supply Master Plan.

Comments

C: Direct reuse has been implemented in Australia, Singapore and Virginia and should be included as an alternative.

C: There are likely no non-potable aquifers within the City boundaries, so recharge to a non-potable aquifer may not be possible.

C: The MOE doesn't currently permit direct reuse or recharge.

C: It was noted that there may be a limit as to how much effluent discharge can be removed from the River as it provides beneficial downstream impacts.

C: Guelph Lake could be considered as an alternate discharge location.

C: Wetlands should be considered for a discharge location or a treatment alternative

Treatment Location Alternatives

Three options for general treatment locations were presented. These included expansion at the existing WWTP site, a satellite plant with a new discharge location or a satellite treatment plant at a new location with the effluent pumped to the existing WWTP outfall. Based on initial investigations indicating that there are no alternate discharge locations, the satellite plant with a new discharge location does not appear feasible.

Comments

C: A satellite plant at a discharge location would be possible if Guelph Lake was found to be a potential discharge.

C: It was noted in response to a comment regarding the potential for privately owned treatment works which would serve a development and provide grey water for uses in that development, that the MOE requires municipalities to sign agreements with private operators of treatment facilities indicating that the municipality is responsible for the facility if it fails.

Treatment Technology Alternatives

The treatment technologies were divided into three categories for discussion. This included conventional physical/biological, advanced and emerging technologies. The existing WWTP is a conventional physical/biological plant with tertiary treatment. For the next expansion to 73.3 MLD, advanced treatment will be required for nitrification. Beyond 73.3 MLD, more advanced technology will be required. A technology that is currently being implemented for wastewater treatment that achieves higher quality effluent is membrane technology. New technologies are emerging and are being applied at small scale for wastewater effluent which will be reuse. These technologies include reverse osmosis, ozone and activated carbon.

Comments

C: It was noted that the University of Guelph has been pilot testing membrane bioreactors as well as tertiary membrane at the WWTP for the last 18 months. In addition, some pilot testing has been done on reverse osmosis. The study team will look at this information.

Evaluation Methodology

Proposed methodology would include a two-stage process. An initial screening process followed by a detailed evaluation. Evaluation criteria were provided to the PAC for review and comment.

Questions, Comments and Responses

C: Using feasibility to screen out alternatives is not appropriate. Alternatives should not just be discarded as over the 50 year planning horizon the discarded alternative could become desirable.

R: The initial screening approach will be revised to indicate that no alternatives will be discarded, but will be placed on a radar screen to be reinvestigated with subsequent WWTMP updates.

Q: Why was equal weighting chosen for each of the categories?

R: Equal weighting is the starting point based on the assumption at each category (technical, natural, social and economic environments) is equally valued, a sensitivity analysis will be performed to see how different weightings impact the relative ranking of alternatives.

C: More appropriate categories would be human health, natural environment, energy use and community consciousness.

R: These categories and criteria will be incorporated into the criteria.

C: There are no specific criteria for energy or green house gases.

R: Energy is picked up under cost and green house gases under air impacts, but it will be examined to see if a separate criterion would be appropriate.

C: It was commented that the useful shelf life of a master plan is about 10 years. There needs to be an overall water management master plan that integrates the various water, wastewater and stormwater planning activities.

R: It is the City's intent to update the water and wastewater master plans concurrently so that they are integrated.

Next Meeting

The next meeting will be held mid to end of March. Date to be confirmed through e-mail.

City of Guelph Wastewater Treatment Master Plan

PAC Meeting #2
January 22, 2008

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City of Guelph – Strategic Plan

CH2MHILL

City of Guelph 2007 Strategic Plan

City of Guelph 2007 Strategic Plan — *Approved August 13, 2007*

VISION

TO BE THE CITY THAT MAKES A DIFFERENCE

Acting locally and globally to improve the lives of residents, the broader community and the world.

MISSION

TO ACHIEVE EXCELLENCE THROUGH LEADERSHIP, INNOVATION, PARTNERSHIPS AND COMMUNITY ENGAGEMENT

URBAN DESIGN & SUSTAINABLE GROWTH	PERSONAL AND COMMUNITY WELL-BEING	ECONOMIC OPPORTUNITY	ARTS, CULTURE AND HERITAGE	GOVERNMENT & COMMUNITY INVOLVEMENT	NATURAL ENVIRONMENT
Goal 1: An attractive, well-functioning and sustainable city	**Goal 2:** A healthy and safe community where life can be lived to the fullest	**Goal 3:** A diverse and prosperous local economy	**Goal 4:** A vibrant and valued arts, culture and heritage identity	**Goal 5:** A community-focused, responsive and accountable government	**Goal 6:** A leader in conservation and resource protection/enhancement
STRATEGIC OBJECTIVES:	STRATEGIC OBJECTIVES:	STRATEGIC OBJECTIVES:	STRATEGIC OBJECTIVES:	STRATEGIC OBJECTIVES:	STRATEGIC OBJECTIVES:
1.1 A distinct community identity with leading edge, city-wide urban design policies 1.2 Municipal sustainability practices that become the benchmark against which other cities are measured 1.3 A Local Growth Management Strategy that effectively guides where and how future growth will take place 1.4 A sustainable transportation approach that looks comprehensively at all modes of travel to, from and within the community 1.5 The downtown as a place of community focus and destination of national interest 1.6 A balanced tax assessment ratio	2.1 A complete community with services and programs for children, youth and adults of all ages 2.2 Diverse housing options and health care services to meet the needs of current and future generations 2.3 The most physically and socially active residents in Canada 2.4 The lowest crime rate and best emergency services record of any comparable-sized Canadian city 2.5 Comprehensive life-long learning opportunities 2.6 A well-connected and accessible community that values diversity, multiculturalism, volunteerism and philanthropy	3.1 Thriving and sustainable local employment opportunities 3.2 One of Ontario's top five and Canada's top ten places to invest 3.3 The highest ratio of any southern Ontario city of people who live and work in the same community 3.4 Fair tax policies and streamlined processes across all levels of government 3.5 A diverse and skilled local workforce 3.6 The city as a tourist destination of choice	4.1 A designated cultural capital of Canada 4.2 Numerous opportunities for artistic appreciation, expression and development 4.3 Highest per capita use of city libraries, museums and cultural facilities among any comparable Canadian city 4.4 Intact and well managed heritage resources 4.5 Capitalize on our cultural and heritage assets to build economic prosperity, quality of life and community identity	5.1 The highest municipal customer service satisfaction rating of any comparable-sized Canadian community 5.2 A consultative and collaborative approach to community decision making 5.3 Open, accountable and transparent conduct of municipal business 5.4 Partnerships to achieve strategic goals and objectives 5.5 A high credit rating and strong financial position 5.6 Organizational excellence in planning, management, human resources and people practices; recognized as a top employer in the community 5.7 The highest per capita municipal election voter turnout of any city in Ontario	6.1 Coordinated management of parks, the natural environment and the watershed 6.2 Less total greenhouse gas emissions for the City as a whole compared to the current global average 6.3 A safe and reliable local water supply 6.4 Less waste per capita than any comparable Canadian city 6.5 Less energy and water per capita use than any comparable Canadian city 6.6 A biodiverse City with the highest tree canopy percentage among comparable municipalities

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Master Plan Purpose

To develop a 50-year Wastewater Treatment Plan to provide direction for wastewater infrastructure planning, investment and implementation to the year 2055.

CH2MHILL

Mission Statement

In keeping with the City of Guelph's strategic plan, community vision, corporate responsibility, core values, and demonstrated commitment to environmental stewardship, develop a comprehensive master plan that addresses the long-term wastewater treatment servicing needs of the community over the next 50-year planning horizon.

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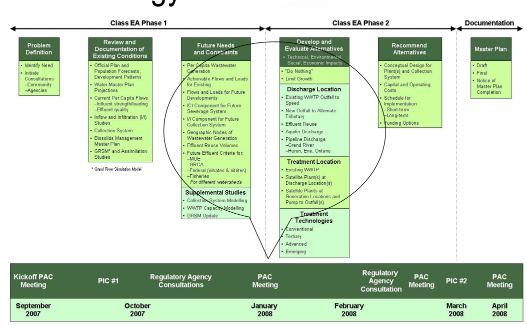
Methodology Overview



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Meeting Agenda

Key Meeting Topics: Conditions, Alternatives, Evaluation

1. Welcome — Janet Laird
2. Plant Tour — Cam Walsh
3. Meeting Agenda, Guidelines — Don Drone
4. Review #1 Meeting Summary — Don Drone
5. Existing Conditions — CH2M HILL
6. Future WW Requirements — CH2M HILL
7. Alternatives — CH2M HILL
8. Evaluation Methodology — CH2M HILL
9. Consultation To-Date — CH2M HILL
10. Next Steps/Next Meeting — All

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Meeting Guidelines

- Please arrive prepared
- Please turn off Cell Phones and pagers
- Respect the speaker
- Listen to understand
- Focus on *this* study
- Agree to disagree
- Work through the Chair

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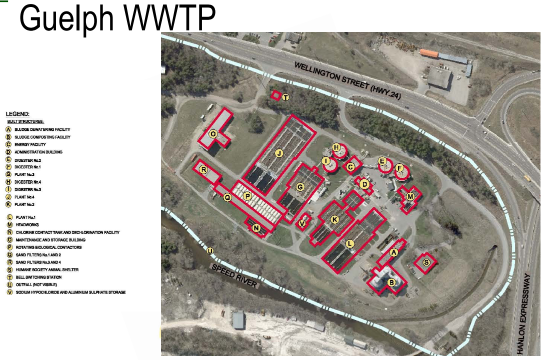
Guelph WWTP



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Existing Conditions

Plant Capacities

- WWTP operating at 54 MLD
- Capacity for 64 MLD and approved to 73.3 MLD

Initiatives Underway

- Plant optimization
- Digester expansion
- Biosolids storage
- WAS thickening demo
- Lystek demo

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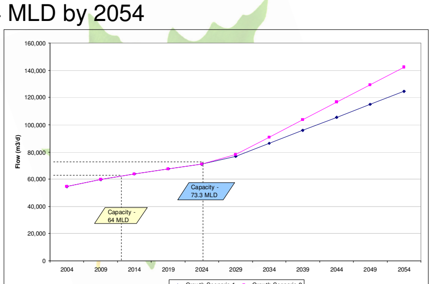
Future Requirements

- 144 MLD by 2054



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Future Effluent Requirements (Summer)

	Concentration Limits (mg/L)			Load Limits (kg/d)		
	64 MLD	73.3 MLD	144 MLD	64 MLD	73.3 MLD	144 MLD
TSS	10	8	2	640	586	288
cBOD5	-	-	2	-	-	288
TOD	22	16.5	-	1,408	1,210	-
Ammonia	-	1	0.5	-	73	72
Total Phosphorus	.38	0.3	0.1	24	22	14

Note: The Speed River is a Policy 2 Receiver for Unionized Ammonia, Total Phosphorous and Dissolved Oxygen

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Future Effluent Requirements (Winter)

	Concentration Limits (mg/L)			Load Limits (kg/d)		
	64 MLD	73.3 MLD	144 MLD	64 MLD	73.3 MLD	144 MLD
TSS	10	8	2	640	586	288
cBOD5	7.4	4	2	473	293	288
TOD	-	-	-	-	-	-
Ammonia	3.4	1.5	0.75	218	110	108
Total Phosphorus	0.7	0.5	0.15	46	37	22

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Alternative Solutions - Definition

Alternative Solution:

Means *feasible* alternative ways of solving an identified problem (deficiency) or addressing an opportunity, from which a *preferred solution* is selected.

Note: Includes the "Do Nothing" alternative

Source: Municipal Class Environmental Assessment June 2000

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Preliminary Alternative Solutions

- "Do Nothing"
- Limit Growth

Source Control Alternatives
- Water Conservation
- Inflow and Infiltration
- Sewer Use By-Law
- Optimization

Discharge Location
- Existing WWTP Outfall to Speed River
- New Outfall to Alternate Tributary
- Effluent Reuse
- Aquifer Discharge
- Pipeline Discharge:
  - –Grand River
  - –Huron, Erie, Ontario

Treatment Location
- Existing WWTP
- Satellite Plant(s) at Discharge Location(s)
- Satellite Plants at Generation Location and Pump to Outfall(s)

Treatment Technologies
- Conventional
- Advanced
- Emerging

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Planning Alternatives

- Do Nothing
  - Not consistent with City's Strategic Plan and Growth Strategy
  - Useful as baseline for comparison
- Limit Growth
  - The City has already identified growth requirements for infrastructure
  - This alternative is inconsistent with City's Strategic Plan

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Source Control Alternatives

- "Non-Expansion" alternatives
- Options to control and/or reduce wastewater generation at source
- Extends life of existing infrastructure
- May defer timing of future expansions
- Several options available for Guelph

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Water Conservation Initiatives*

- From WSMP:
  - 10% reduction by 2010, 20% by 2025
  - from 13% to 10% of unaccounted for water by 2010
- Some initiatives may reduce wastewater volumes at source, others may not

*Source Control Alternatives

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Inflow and Infiltration Control*

- measures to prevent groundwater and stormwater from entering the sanitary sewer system
- regular maintenance and repairs on the sewer system to eliminate "extraneous" flows
- user awareness programs

*Source Control Alternatives

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Sewer Use By-Law*

- regulates types and amount of discharges to the sewer system
- focus on major industries to reduce loadings
- targets TSS and BOD
- increase enforcement
- modifications to By-Law for effectiveness

*Source Control Alternatives

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WWTP Optimization (Re-Rating)*

- focus on "tankage" and equipment
- identifies performance or capacity limiting "bottlenecks"
- study is underway:
  - optimum performance of equipment and staff resources and skills
  - if optimized operations possible, C of A amendment needed

*Source Control Alternatives

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Discharge Location Alternatives

- Existing WWTP to the Speed River
  - Assimilative capacity to 144 MLD is available
  - mass balance calculations determined:
    - some improvement in unionized ammonia
    - significant improvement in Total Phosphorous
    - definite improvement in dissolved oxygen

    at 144 MLD compared to existing conditions
  - still need study on impacts of high flow hydraulic conditions and effluent temperature
  - continue monitoring with GRCA

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Effluent Reuse

- Appropriate diversion rates would need to be determined
- Options for effluent reuse
  - Urban reuse
  - Agricultural reuse
  - Recreational reuse
  - Environmental reuse
  - Industrial reuse
  - Groundwater reuse
  - Indirect potable reuse
- Considerations: source protection, EDCs

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Aquifer Recharge

- Non-potable Aquifer:
  - for disposal
  - minimum separation from potable sources
  - in brackish conditions provides barrier between salt water and potable sources
  - additional treatment needed prior to disposal
- Potable Aquifer:
  - more stringent quality requirements
  - relatively new with limited applications
  - effluent must pass through a soil zone first

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Alternate Discharge Location

- Grand River Discharge
  - no additional assimilative capacity available
  - other areas of watershed already stressed
- Lake Erie Discharge
  - beyond scope of a single municipality
  - planning, route selection, permitting potentially complicated, needs collaboration
  - Determined not to be feasible for the City of Guelph through WSMP

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Treatment Location Alternatives

- Existing WWTP
  - space is available for 144 MLD on western portion of the existing WWTP site
- Satellite Plant at new discharge location
  - WWTP maintained and upgraded
  - satellite facility to treat portion of future flows

  Not feasible: no alternative discharge locations

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Treatment Location Alternatives

- Satellite Plant using existing WWTP Outfall
  - existing WWTP maintained and upgraded
  - new facility in proximity of growth areas
  - wastewater could be diverted to new facility
  - effluent conveyed back to WWTP outfall
  - biosolids management required
  - additional operational requirements with 2 facilities

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Treatment Technology Alternatives

- Conventional Physical/Biological
  - physical removes solids
  - biological breaks down organic and inorganic components using bacteria
  - WWTP using conventional technology with tertiary treatment and chlorination/dechlorination of effluent
  - meets compliance limits to 64MLD
  - additional ammonia removal and nitrification for 73.3 MLD

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Advanced Treatment Technologies

- Nitrification Technologies
  - provides additional ammonia removal
  - further investigate appropriate removal technologies
- Membrane Bioreactors
  - able to achieve superior effluent quality
  - combination of filtration and biological treatment
  - equipment pilot testing achieves best results

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Emerging Treatment Technologies

- existing technologies now being applied to wastewater treatment
  - Reverse Osmosis: high pressure filtration
  - Activated Carbon: asborption/mass transfer
  - Ozone: controls odour, kills bacteria + viruses

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Evaluation Methodology

- Two-stage process:
  - Screening long list of alternatives:
    - planning alternatives
    - effluent discharge/reuse alternatives
    - treatment location alternatives
    - treatment technology alternatives
  - Detailed evaluation of short listed alternatives in each grouping
- Most preferred options will form the Master Plan Strategy

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Evaluation Criteria

- Screening:
  - Practicality
    - take advantage of existing infrastructure
    - within City's ability to implement
  - Sustainability
    - protects community and environment for existing and future residents
  - Efficiency
    - achieves intended use
    - meets or exceeds regulatory requirements

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Screening

- Practicality, Sustainability, Efficiency
- Must meet all criteria
- "Yes" means criteria can be met – PASS
- "No" means criteria cannot be met – FAIL
- Need all "Yes" to pass the screen

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Detailed Evaluation Criteria

- Criteria categories reflect principles of environmental planning:
  - technical environment
  - natural environment
  - social environment
  - economic environment
- Categories of criteria will be weighted equally

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Steps in the Methodology

Step1

Develop description of each alternative

Step 2

Develop Initial Costs Opinions with assumptions

Step 3

Apply Criteria to alternative and score

Scores totalled and normalized

Step 4

Develop Master Plan Strategy

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Consultation Activities

- PIC #1, October 24, 2007:
- Agency Discussions:
  - MOE – Future study requirements
  - GRCA - Assimilative Capacity of Speed
- PAC Meeting #1

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Next Steps

- Comments/Questions by January 29
- Confirm alternatives and evaluation
- Conduct evaluation (screening + detailed)
- Provide evaluation results to PAC
- Develop Preliminary Master Plan Strategy
- Prepare for PAC #3
- Prepare for PIC #2

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Next PAC Meeting

Key Meeting Topic: Evaluation Outcomes and MP Strategy

- TBD
- Agenda Package two weeks prior

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Guelph Wastewater Treatment Master Plan

Public Advisory Committee Meeting #3

Meeting Summary

May 22, 2008

345572_WB032008003KWO

This summary is intended to provide an overview of the Public Advisory Committee (PAC) workshop held as part of the Guelph Wastewater Treatment Master Plan. This summary captures the key discussion points from the meeting held on May 22, 2008. It is not intended as a verbatim transcript.

If there are any questions or concerns regarding the content of this summary please contact the City's project manager or the project consultants:

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City of Guelph Wastewater Treatment Master Plan

Public Advisory Committee (PAC) Workshop

May 22, 2008

Guelph Wastewater Treatment Plant, 530 Wellington Street W.

8:30 am to 12:00 pm

Key Meeting Topic: Evaluation Outcomes

Draft Agenda

1. Welcome
2. Review Workshop Summary
3. Review of Evaluation Process
4. Impact Assessment
5. Evaluation Outcomes
6. Sensitivity Scenarios
7. Recommended Components
8. Next Steps/Next Meeting

Guelph WWTMP – PAC Meeting #3

Meeting Attendants – The following individuals attended PAC Meeting #3

PAC Members	
Don Drone	Chair, Wellington Catholic DSB
Khosrow Farahbakhsh	University of Guelph
Dorothy Remmer	Green Plan Steering Committee
Paul McLennan	Guelph Developers Association
Lloyd Longfield	Chamber of Commerce
Robert Bell	City Councillor
Laura Murr	Green Plan Steering Committee
Hugh Whiteley	Community-at-Large
Steering Committee Members	
Janet Laird	Director of Environmental Services
Cameron Walsh	Manager of Wastewater Services
Kiran Suresh	Project Manager, Wastewater Services
Gerard Wheeler	Optimization Specialist, Wastewater Services
Paul Kraehling	Community Design and Development Services
Tim Robertson	Wastewater Services
Mark Anderson	Grand River Conservation Authority
CH2M HILL Consultant Team	
Warren Saint	Project Manager
Diana Vangelisti	Communications and EA Specialist
Pam Law	Project Engineer
Additional Public Members	
Andrew Lambden	Guelph Developers Association

Presentation

The following section provides a summary of the presentation that was given at the PAC workshop. The summary is intended as a general overview. A PDF copy of the power point presentation is available for download from the City's project website (www.guelph.ca).

Welcome and Introduction

Cameron Walsh welcomed all PAC members and other attendees and thanked them for attending the workshop.

Meeting Agenda and Guidelines

The meeting chair, Don Drone, went through the meeting agenda and guidelines. The purpose of the workshop was to spend more time discussing and confirming the alternatives that will be evaluated and also to review and confirm the revised evaluation methodology.

Master Plan Purpose and Mission Statement

Diana Vangelisti reviewed the project's purpose and mission statement:

Master Plan Purpose:

To develop a 50-year Wastewater Treatment Plan to provide direction for wastewater infrastructure planning, investment and implementation to the year 2054

Mission Statement:

In keeping with the City of Guelph's strategic plan, community vision, corporate responsibility, core values, and demonstrated commitment to environmental stewardship, develop a comprehensive master plan that addresses the long-term wastewater treatment servicing needs of the community over the next 50-year planning horizon.

Review of Methodology Overview

The process methodology was reviewed and showed that the process is progressing and is now at Meeting #3.

Review of Workshop Results

The diagram summarizing the results of the prioritization process was shown. This diagram was also provided in the material provided to the PAC in advance of the meeting. The diagram shows which alternatives moved directly into the strategy recommendations (programs/policies), which alternatives require more detailed evaluation (infrastructure based alternatives) and alternatives which require further study or future triggers before becoming part of the recommended strategy.

The sensitivity scenarios provided by PAC members were also reviewed.

Questions and Responses

Comment (C): It was commented that this plan does not reflect a plan for the 21st Century.

C: Parking of options does not allow these options to be easily integrated in the future, particularly if large investment is made in current infrastructure (i.e. existing plant). This does not give a fair chance to options such as a satellite facility.

Response (R): Even though this plan is forecasting 50 years out, it will be reviewed and revised every 5 years. The City hopes to converge their master planning processes and the next update would be 5 years from the completion of the Waster Supply Master Plan (3.5 years from now.

R: Some of the "parked" options would require partners moving forward to investigate possibilities. The City is not building treatment infrastructure in the next 5 years, which would give time for these options to be discussed and investigated.

C: It was noted that the prioritization exercise was not voted on by the PAC, but the results were given to the PAC for review and was also discussed at previous workshop.

C: Would like to see the City's Official Plan (OP) be modified to allow satellite treatment plants for new developments.

R: Because of a number of unknowns (economy of scale, regulatory requirements, environmental impacts), it is suggested that a feasibility study be recommended as part of this Master Plan.

C: The Master Planning Process should stir up imagination and think outside the box. The ideas in the "yellow box" (items on the radar screen from prioritization) should be brought more to the forefront

C: Large water users should be targeted for recirculation systems and cooling system to reduce the demand for water and keep water on site.

R: Janet Laird indicated that Wayne Galliher, from the City's Water Conservation Group, is working with large water users to target reduction. She also noted that programs and policies in the "light green box" (integrated directly into the strategy), such as plant optimization and examining urban reuse, are quite innovative.

R: Mark Anderson indicated that the GRCA is supportive of the direction that the City is taking in working on a comprehensive upstream and downstream water quality monitoring program and looking at opportunities for improvement.

Q: What is the City doing to invite lower industrial water users to the City?

R: Janet Laird responded that the Economic Development department is working hard to meeting goals of the Community Energy Plan and to ensure that high energy and water users are not being attracted to the city.

C: City should be moving towards an integrated water plan (including water, wastewater and stormwater management). The Region of Halton has a Water Master Plan that has integrated water and wastewater.

R: Based on the discussion around the group, in particular on water conservation and supply, it is recognized that there is connectivity between initiatives. Integrating the plans would be more easily done at the 5 year update point when all planning is on the same time frame.

C: During the time between now and the next update, recommendations/issues from the various planning processes should be looked at together.

C: The ability to maximize infrastructure needs to be considered.

C: There needs to be an integration with servicing and the potential impacts associated with extending service areas.

R: Cameron Walsh responded that within the City there is integration/discussion between departments, including water supply and servicing. Based on comments received, it appears that this integration has not been well communicated to the PAC to date. Cameron and Janet suggested a workshop be organized where City staff can discuss ongoing programs and initiatives such as plant optimization, water conservation and engineering services and community energy plan.

C: It was agreed that this information needed to be better communicated to the public.

C: Hugh Whiteley suggested wording for a declaration of Council in regards to water planning and decision making. Objectives for Water Management for City of Guelph:

1) To obtain a fully reliable, sustainable, high-quality water supply
2) To maintain the affordability of the water supply for all users
3) To meet requirements for energy conservation and energy efficiency in the operation of all water-management operations
4) To manage water supply and treatment of water (including treatment of stormwater and wastewater from buildings) to maintain and enhance

C: Need to look at connections to improve overall water quality.

Q: What is being forecasted for future effluent quality?

R: Emerging issues are on the radar screen and include Endocrine Disrupting Compounds (EDCs) and nitrates. The City has been working with the MOE and the GRCA to look at the impacts of the effluent from the WWTP, both now and based on future projections, on the quality of the Speed River.

Detailed Evaluation

The following summarizes the discussion on the detailed evaluation process and outcomes.

Existing Discharge

The existing discharge location was evaluated to look at potential impacts and consideration for mitigation measures. The scores overall were generally high, with consideration for some potential modifications that may need to be made to the outfall in the future.

Questions and Responses

Q: What would be the impact of doubling flows?

R: Could impact downstream geomorphology or local sediment/erosion. Modifications such as energy dissipation may be required in the future. This will require additional study and will be noted in the recommendations moving forward.

C: Discharge should be looked at in conjunction with reuse.

R: This will be considered as part of the reuse study recommended from this master plan.

Existing Treatment Location

The prioritization found that the existing treatment location would be preferred for future expansions. Consideration would have to be given to mitigate social impacts such as potential odour, noise, visual aesthetics and truck traffic as it is anticipated that future development will take place immediately across Wellington Road.

Questions and Responses

Q: Will future expansions require an amendment to the Certificate of Approval (CofA)

R: Yes future expansions beyond the approved 73.3 MLD would require a Schedule C Class EA to be completed and an amendment to the existing CofA.

Advanced Treatment Technologies

Since the last meeting, two additional applications of membrane technologies were examined. These included Tertiary Membrane Filtration and Tertiary Membrane Bioreactors (MBRs). A brief overview of these technologies was given. These technologies were evaluated with the conventional MBR option described previously.

The evaluation of the three alternatives found that the conventional MBR scored lower than the other two membrane options. This is partially due to the higher energy demand required for conventional MBR operation. Conventional MBR requires additional energy to keep membranes clean, as well more membranes are required for this technology.

Questions and Responses

Q: What type of process is used for phosphorous removal, chemical or biological?

R: It was noted that clarification would be provided following the meeting.
Note added following meeting: *Phosphorous removal in membrane processes can use either*

biological phosphorous (bio-P) or chemical removal or a combination of the both. The preferred method of removal can be examined further in subsequent design stages.

Q: What type of membranes are used at the Singapore plant?

R: ***Note added following meeting:*** *Singapore NEWater uses dual membrane technology. This consists of a combination of microfiltration and reverse osmosis followed by UV disinfection.*

Q: What type of capital costs would be associated with these treatment processes?

R: Capital cost estimates (Master planning level +50/-30%) were provided with the detailed evaluation material and range from $216 to $259 Million. These costs are for the membranes and modifications to existing treatment processes costs and do not account for additional costs associated with ancillary systems and processes such as conveyance to the plant, headworks, disinfection, solids stabilization, and solids management. The costs are estimated to reach the ultimate flow of 144 MLD over 50 years and would be incurred over multiple stages.

C: With innovative technology approaches, this would be appropriate for application to FCM funding.

Q: Can costing assumptions be provided?

R: Costing assumptions will be provided.

Q: What is the largest membrane facility in operation in the US?

R: ***Note added following meeting:*** *Currently the largest operating membrane facility is believed to be Traverse City Michigan at 64 MLD. However larger facilities are currently under design.*

Conclusions

These will be updated based on today's discussion:

Existing WWTP has ***already established impacts with minimal incremental impacts anticipated from future expansions.***

Future development anticipated north of Wellington Road and social impacts need to be considered – air quality, odour, noise , visual aesthetics and truck traffic.

Questions and Responses

Q: Are there examples of plants that are located in intense urban areas

R: Mid-Halton, located in Oakville, is close to residential developments and takes measure to reduce impacts on neighbours. The Guelph WWTP is completing baseline odour studies to assist in future odour identification and mitigation. The City of Barrie's WWTP is located in a highly visible area of the downtown with no screening to the waterfront area.

Q: Are there warning clauses on development applications in proximity to the WWTP?

R: Yes there are warning clauses placed on these applications for both the WWTP and for the Dolime facility.

Master Plan Recommendations

The City has strong programs and policies that should continue and develop (I/I control, water efficiency, optimization, sewer use by-law).

In the near term wastewater should be treated at the existing WWTP using the existing outfall.

Tertiary membrane technology should be implemented to meet ***or exceed*** stringent water quality requirements for the Speed River. In addition, this technology provides the best quality water for ***future reuse applications.***

Radar screen of strategy options to be further developed and refined for future triggers.

Questions and Responses

Q: When would membrane technologies be required?

R: Not until at least 2020. As new technologies are discovered or refined, the recommendations from the master plan can be modified.

R: The implementation plan will show integration of studies, initiatives, programs and policies and the potential impact on shifting of the recommended schedule will be noted.

C: Master planning costs should be broken down on more of a human scale, i.e. cost per person per year.

C: Reuse will need to look at a balance on the river. Current modeling demonstrates that effluent water provides downstream benefits in the Speed River, however, if reuse can supply a current upstream water taker (i.e. golf courses) with effluent water, then the beneficial impact would increase.

C: Need to also consider emergency planning, i.e. for climate change adaptation.

Q: What are other communities doing for Master Planning?

R: Where growth is happening – master planning is happening. What is unique for Guelph is the more sensitive receiving water body and the high quality of effluent that is already being discharged to the river. The City has been innovative in wastewater treatment over the last hundred years.

Q: What is the plan for disinfection?

R: The City recently completed a Pollution Prevention Plan to Environment Canada which recommended optimizing the existing chlorination/de-chlorination system to maximize existing infrastructure.

C: Energy at the plant needs to be put in perspective, again on a more human scale and also discuss potential off-setting.

R: This can include the cogeneration system at the WWTP that is being put back online to offset energy usage.

Next Steps

Workshops to be held to discuss other City initiatives

Evaluation outcomes are to be refined and finalized. Based on the PAC discussion, there City and consultant team will further develop the radar screen options so as to provide a broader perspective for the master plan recommendations. It was recognized that there needs to be stronger links presented from the WWTP Master Plan to other city initiatives and programs. It was also recognized that the master plan must provide the opportunity for “creativity” moving forward so that a more wholistic approach to planning can be fostered.

Implementation considerations to be developed (including integrating “yellow box” options).

Implementation schedule to be developed.

PIC #2

Master Plan Strategy recommendations to be confirmed

Draft Master Plan to be completed

PAC meeting #4

Timing for this is in the fall.

City of Guelph Wastewater Treatment Master Plan

PAC Meeting #3
May 22, 2008

CH2MHILL

Master Plan Purpose

To develop a 50-year Wastewater Treatment Plan to provide direction for wastewater infrastructure planning, investment, and implementation to the year 2054.

CH2MHILL

Mission Statement

In keeping with the City of Guelph's strategic plan, community vision, corporate responsibility, core values, and demonstrated commitment to environmental stewardship, develop a comprehensive master plan that addresses the long-term wastewater treatment servicing needs of the community over the next 50-year planning horizon.

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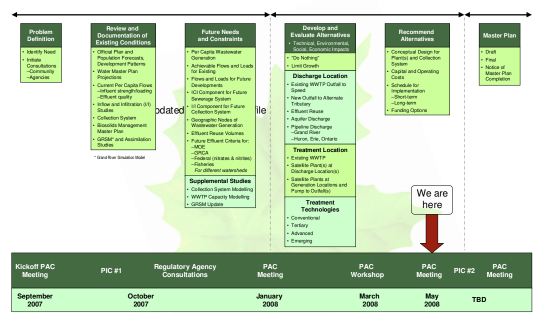
Methodology Overview



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Meeting Agenda

Workshop Topics: Evaluation Outcomes

1.	Welcome	Cam Walsh
2.	Review Workshop Summary	Don Drone
3.	Review of Evaluation Process	CH2M HILL
4.	Impact Assessment	CH2M HILL
5.	Evaluation Outcomes	CH2M HILL
6.	Sensitivity Scenarios	CH2M HILL
7.	Recommended Components	CH2M HILL
8.	Next Steps/Next Meeting	All

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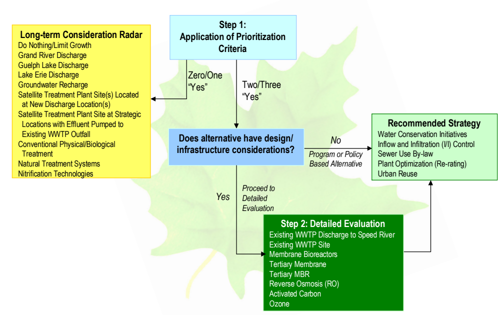
Prioritization Results



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Weighting Scenarios

	Base Scenarios					
	Equal Weighting	Technical Priority	Natural Priority	Social Priority	Economic Priority	Double Energy
Technical	25	**70**	10	10	10	25
Natural	25	10	**70**	10	10	25
Social	25	10	10	**70**	10	25
Economic	25	10	10	10	**70**	25
Total	100	100	100	100	100	100

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PAC Sensitivity Scenarios

	PAC Scenario #1											
	Bob Bell	Georgia Simms	Mark Anderson	Andrew Lambden	Cameron Walsh	Dorothy Remmer	Jamie Ford	Marion Plaunt	Gerry Wheeler	Paul McLennan	Lloyd Longfield	Ian Smith
Technical	30	10	10	0	25	25	0	30	5	20	10	20
Natural	35	45	50	100	25	75	50	40	45	40	30	30
Social	20	10	20	0	25	0	25	20	45	20	20	30
Economic	15	35	20	0	25	0	25	10	5	20	40	20
Total	100	100	100	100	100	100	100	100	100	100	100	100

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PAC Sensitivity Scenarios

	PAC Scenario #2					
	Bob Bell	Georgia Simms	Mark Anderson	Andrew Lambden	Dorothy Remmer	Jamie Ford
Technical	25	0	10	10	10	0
Natural	35	90	40	70	40	25
Social	25	10	10	10	40	25
Economic	15	0	40	10	10	50
Total	100	100	100	100	100	100

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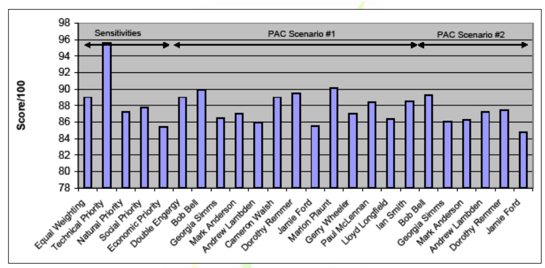
Existing Discharge Location (Outfall)



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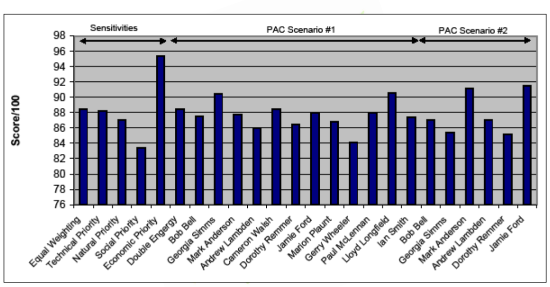
Existing Treatment Location



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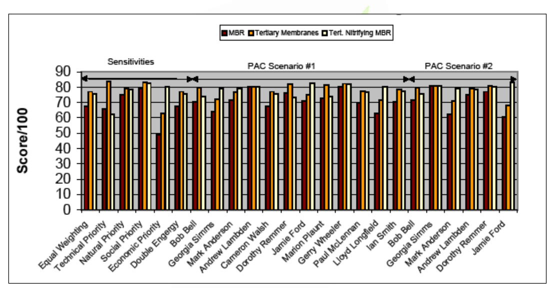
Advanced Treatment Technologies (3)



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Evaluation Conclusions

- Existing outfall is operating with minimal impacts (consistently high scores)
- Existing WWTP has minimal impacts – social impacts noted – conditions for future site development and landscape plan
- Advanced Technologies:
  - Tertiary Technologies stronger than Conventional MBR in overall score

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Master Plan Recommendations

For the planning period to 2054:

- Strong programs and policies will continue:
  - I/I control, water efficiency, optimization, sewer use by-law, urban reuse
- WW will be treated at existing WWTP using existing outfall to Speed River
- Tertiary technology choice to meet stringent quality requirements for Speed River
- Radar screen of strategy options to further develop and refine for future triggers

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Considerations for Implementation

- Staged Implementation Plan:
  - Stage 1 – 2031
  - Stage 2 – beyond 2031
- On-going performance of programs and policies
  - Water Efficiency, I/I Control
- Optimization Efforts
- Actual Community Growth

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Next Steps

- Finalize Evaluation Outcomes
- Develop Implementation Schedule
- Prepare for PIC #2
- Confirm Master Plan Strategy Recommendations
- Prepare Draft Master Plan document
- Prepare for PAC Meeting #4

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Next PAC Meeting

Key Meeting Topic: Master Plan Draft Report

Fall 2008

TBD

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Thank You.

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Guelph Wastewater Treatment Master Plan

Public Advisory Committee Workshop

Draft Workshop Summary

March 20, 2008

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This summary is intended to provide an overview of the Public Advisory Committee (PAC) workshop held as part of the Guelph Wastewater Treatment Master Plan. This summary captures the key discussion points from the workshop held on March 20, 2008. It is not intended as a verbatim transcript.

If there are any questions or concerns regarding the content of this summary please contact the City's project manager or the project consultants:

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City of Guelph Wastewater Treatment Master Plan

Public Advisory Committee (PAC) Workshop

March 20, 2008

Guelph Wastewater Treatment Plant, 530 Wellington Street W.

8:30 am to 12:00 pm

Key Meeting Topic: Evaluation of Alternatives

Draft Agenda

1. Welcome
2. Review #2 Meeting Summary
3. Revised Alternatives Description
4. Revised Evaluation Methodology
5. Prioritization Results
6. Sensitivity Scenarios
7. Next Steps/Next Meeting

Guelph WWTMP – PAC Workshop

Meeting Attendants – The following individuals attended PAC Workshop

PAC Members	
Don Drone	Chair, Wellington Catholic DSB
Ian Smith	Chamber of Commerce
James Ford	Community-at-Large
Dorothy Remmer	Green Plan Steering Committee
Paul McLennan	Guelph Developers Association
Lloyd Longfield	Chamber of Commerce
Robert Bell	City Councillor
Steering Committee Members	
Cameron Walsh	Manager of Wastewater Services
Kiran Suresh	Project Manager, Wastewater Services
Gerard Wheeler	Optimization Specialist, Wastewater Services
Marion Plaunt	Manager, Policy, Planning and Urban Design
Mark Anderson	Grand River Conservation Authority
CH2M HILL Consultant Team	
Warren Saint	Project Manager
Diana Vangelisti	Communications and EA Specialist
Additional Public Members	
Andrew Lambden	Guelph Developers Association
Georgia Simms	University of Guelph, Guelph Water Management Group

Presentation

The following section provides a summary of the presentation that was given at the PAC workshop. The summary is intended as a general overview. A PDF copy of the power point presentation is available for download from the City's project website (www.guelph.ca).

Welcome and Introduction

Cameron Walsh welcomed all PAC members and other attendees and thanked them for attending the workshop.

Meeting Agenda and Guidelines

The meeting chair, Don Drone, went through the meeting agenda and guidelines. The purpose of the workshop was to spend more time discussing and confirming the alternatives that will be evaluated and also to review and confirm the revised evaluation methodology.

Master Plan Purpose and Mission Statement

Diana Vangelisti reviewed the project's purpose and mission statement:

Master Plan Purpose:

To develop a 50-year Wastewater Treatment Plan to provide direction for wastewater infrastructure planning, investment and implementation to the year 2054

Mission Statement:

In keeping with the City of Guelph's strategic plan, community vision, corporate responsibility, core values, and demonstrated commitment to environmental stewardship, develop a comprehensive master plan that addresses the long-term wastewater treatment servicing needs of the community over the next 50-year planning horizon.

Review of Meeting #2 Summary

Kiran Suresh read email comments that were submitted by Hugh Whitely who was not available to attend the workshop. Comments will be reviewed and Meeting #2 Summary will be revised and reissued.

Revised Alternatives Descriptions

Based on the discussion from Meeting #2 the description of the Alternatives solutions were enhanced to provide further clarification and explanation. Specifically, the options for effluent reuse were revised to provide context for this alternative and to identify options appropriate for the City of Guelph.

A revised Technical Memorandum was distributed prior to the workshop.

Revised Evaluation Methodology

Based in the discussion at Meeting #2, the evaluation methodology was revised. The methodology will no longer include a "screening" effort that would have resulted in alternatives being removed from the evaluation process based on not meeting essential criteria. Rather the methodology will remain a two step process and the screening will now be replaced with a "prioritization" effort. The essential Prioritization criteria will remain the three questions discussed in Meeting #2. Now the response to the questions will place the alternative in one of three groups. Alternatives the meet one or none of the criteria will be placed on a radar screen for long term consideration. The radar screen will allow the City to continue to monitor alternatives as they evolve and include any and all that may be suitable for the City at some time in the future. Those alternatives that meet two or three criteria and are considered programs or policies that do not have infrastructure design requirements will be placed with the group of alternatives that will be included in the master plan strategy. Those alternatives that meet two or three of the criteria and have infrastructure design components will proceed to detailed evaluation.

Prioritization Results

The prioritization results were reviewed and discussed with no changes to the results. Accordingly, the PAC was able to confirm the prioritization of alternatives. A summary graphic of the prioritization results was distributed at the workshop and is appended to this summary.

Sensitivity Scenarios

As part of the detailed evaluation exercise, a sensitivity analysis will be conducted to determine if the evaluation results are influenced by a change in the relative weighting of the criteria categories.

The proposed evaluation criteria were revised based on the discussion outcomes of Meeting #2. The criterion for Community Energy Plan was placed in the Social Environment Category. There was discussion on whether it might be better located in the Technical Environment to more accurately evaluate the energy saving and benefits. The team will review this suggestion and revise based on discussions with the City.

PAC members were asked to provide two sensitivity scenarios using a worksheet. The exercise was to assign a weighting to each criteria category to reflect a perspective of the community. The baseline evaluation will be conducted with the evaluation criteria holding equal weight. The sensitivity analysis will run each scenario submitted by PAC members, and a composite PAC scenario based on averages. The results will be presented at PAC Meeting #4.

Miscellaneous Discussions

In response to an enquiry whether the public could participate in the collection of water quality samples from the Speed River, Mark Anderson responded that sample collection doesn't lend itself to a public process as in order for the sampling to be defensible, it has to be collected with recorded scientific methodology.

In response to a question regarding the potential effects of climate change on the Grand River System, Mark Anderson noted that:

1. Under some climate change scenarios, the Guelph area will receive increased rainfall, although it may be of decreased frequency and greater intensity.
2. As the Speed River is a regulated flow, there is buffering capacity to partially offset some of the potential extreme effects of climate change.
3. If flows in the receiver decrease, effluent from the Guelph WWTP will become even more important to the Grand River System.

It was noted that although MOE does not have an official policy on direct potable reuse or indirect potable reuse through aquifer recharge, their position based on previous discussions with them during the 1997 Class EA, was that it was not an approach they would support.

Based on a suggestion that when roads are reconstructed, pipes for non-potable use be installed, it was agreed that reuse potential should be studied, planned and engineered prior to the installation of a conveyance system.

It was noted that Grey Water Reuse was captured under the water conservation initiatives, however, this would be expanded to provide more detail. The City noted that ultimately the responsibility for the operation of these systems falls back to the City if they are not properly maintained and operated, which is a concern with the City.

A discussion occurred based on a comment that the City should achieve higher than the minimum standards for effluent quality, and should approach high quality river water standards. It was noted that producing increasingly pure water quality is very expensive from an equipment cost perspective and requires greater and greater amounts of energy which can damage the environment in other ways.

A discussion occurred based on a comment that development charges should be decreased for those developments that incorporate water conservation and reuse measures into the design of the units and therefore do not utilize as much of the water and wastewater capacity as more traditional construction. It was noted that this could be considered under water conservation initiatives.

It was requested that the evaluation of the alternatives be considered in the context of the Community Energy Plan (CEP) and suggested that it should be considered as a separate evaluation category. It was noted that the alternatives could undergo a separate sensitivity analyses using CEP as a filter or lens.

It was noted that denitrification will likely be an effluent requirement in the future and it should be considered when assessing future effluent requirements.

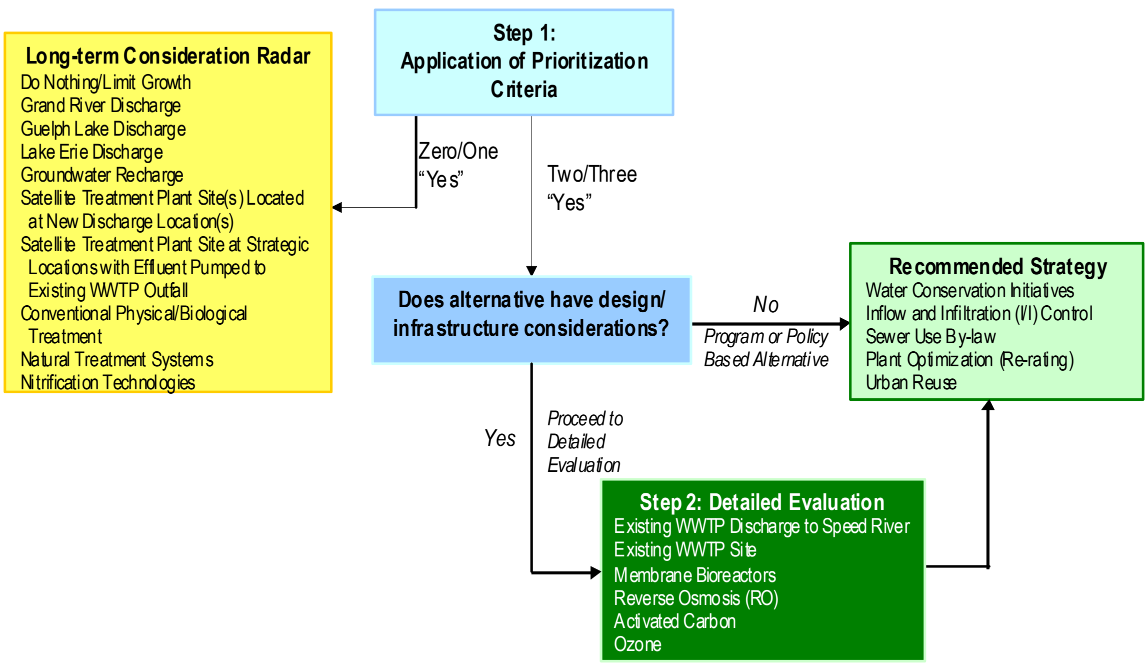
It was suggested that biological phosphorus removal should be considered as a treatment alternative.

Next Meeting

The next meeting (Meeting #3) is scheduled for April 29, 2008.

Prioritization Results Summary

Draft Prioritization Results Summary – Guelph WWTMP Evaluation



City of Guelph Wastewater Treatment Master Plan

PAC Workshop
March 20, 2008

CH2MHILL

Master Plan Purpose

To develop a 50-year Wastewater Treatment Plan to provide direction for wastewater infrastructure planning, investment and implementation to the year 2054.

CH2MHILL

Mission Statement

In keeping with the City of Guelph's strategic plan, community vision, corporate responsibility, core values, and demonstrated commitment to environmental stewardship, develop a comprehensive master plan that addresses the long-term wastewater treatment servicing needs of the community over the next 50-year planning horizon.

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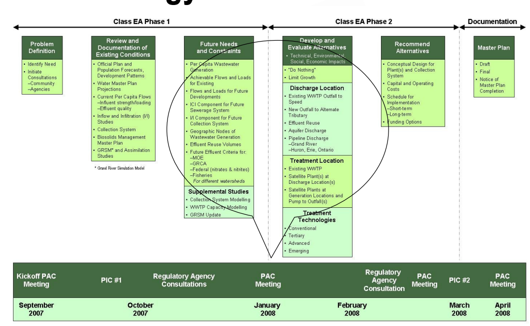
Methodology Overview



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Meeting Agenda

Workshop Topics: Evaluation of Alternatives

1.	Welcome	Cam Walsh
2.	Review #2 Meeting Summary	Don Drone
3.	Revised Alternatives Description	CH2M HILL
4.	Revised Evaluation Methodology	CH2M HILL
5.	Prioritization Results	CH2M HILL
6.	Sensitivity Scenarios	CH2M HILL
7.	Next Steps/Next Meeting	All

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Revised Alternative Solutions

- "Do Nothing"
- Limit Growth

Source Control Alternatives
- Water Conservation
- Inflow and Infiltration
- Sewer Use By-Law
- Plant Optimization

Discharge Location
- Existing WWTP Outfall to Speed River
- Grand River Discharge
- Guelph Lake Discharge
- Lake Erie Discharge
- Effluent Reuse:
  - Urban Reuse
  - Groundwater Recharge

Treatment Location
- Existing WWTP
- Satellite Plant(s) at New Discharge Location(s)
- Satellite Plant(s) Located at New Location (s), effluent pumped to WWTP Discharge Location

Treatment Technologies
- Conventional
- Advanced
- Emerging

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Evaluation Methodology

- Two-stage process:
  - Prioritizing long list of alternatives:
    - Planning alternatives
    - Effluent discharge/reuse alternatives
    - Treatment location alternatives
    - Treatment technology alternatives
  - Detailed evaluation of alternatives requiring physical infrastructure
- Most preferred options will form the Master Plan Strategy

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Evaluation Criteria

- Prioritization:
  - Practicality
    - Take advantage of existing infrastructure
    - Within City's ability to implement
  - Sustainability
    - Protects community and environment for existing and future residents
  - Efficiency
    - Achieves intended use
    - Meets or exceeds regulatory requirements

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Prioritization

Number of "Yes"	Prioritization
Zero or 1	Hold on radar screen for future consideration over the long term
2	Shows promise and may require further study – likely program or initiative that does not require infrastructure – integrate into Master Plan Strategy
3	Feasible for implementation at anytime, may have infrastructure requirements needing detailed evaluation

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Prioritization Summary

Source Control/Non-expansion Alternatives				
Water Conservation Initiatives	YES	YES	YES	Integrate into Master Plan Strategy
Inflow and Infiltration (I/I) Control	YES	YES	YES	Integrate into Master Plan Strategy
Sewer Use By-Law	YES	YES	YES	Integrate into Master Plan Strategy
Plant Optimization (Re-rating)	YES	YES	YES	Integrate into Master Plan Strategy

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Prioritization Summary

Discharge Location Alternatives				
Existing WWTP Discharge to Speed River	YES	YES	YES	Advance to Detailed Evaluation
Grand River Discharge	NO	NO	NO	Hold on Radar for long-term consideration
Guelph Lake Discharge	NO	NO	YES	Hold on Radar for long-term consideration
Lake Erie Discharge	NO	NO	NO	Hold on Radar for long-term consideration

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Prioritization Summary

Effluent Reuse				
Urban Reuse	YES	YES	YES	Integrate into Master Plan Strategy
Groundwater Recharge	YES	NO	NO	Hold on Radar for Long-term Consideration

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Prioritization Summary

Treatment Location Alternatives				
Existing WWTP Site	YES	YES	YES	Advance To Detailed Evaluation
Satellite Treatment Plant Site(s) Located at New Discharge Location(s)	NO	NO	YES	Hold on Radar for long-term consideration
Satellite Treatment Plant Site at Strategic Locations with Effluent Pumped to Existing WWTP Outfall	NO	NO	YES	Hold on Radar for long-term consideration

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Prioritization Summary

Treatment Technology Alternatives				
Conventional Physical/ Biological Treatment	YES	NO	NO	Hold on Radar for Long-term Consideration
Natural Treatment Systems	NO	NO	NO	Hold on Radar for Long-term Consideration
Advanced Treatment Technologies				
Nitrification Technologies	YES	NO	NO	Hold on Radar for Long-term Consideration
Membrane Bioreactors	YES	YES	YES	Advance to Detailed Evaluation
Emerging Wastewater Treatment Technologies				
Reverse Osmosis (RO)	YES	YES	YES	Advance to Detailed Evaluation
Activated Carbon	YES	YES	YES	Advance to Detailed Evaluation
Ozone	YES	YES	YES	Advance to Detailed Evaluation

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Detailed Evaluation Criteria

- Criteria categories reflect principles of environmental planning:
  - Technical environment
  - Natural environment
  - Social environment
  - Economic environment
- Categories of criteria will be weighted equally

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Criteria Modifications

Added:

- Occupational Health and Safety
- Community Health and Safety
- Community Energy Plan

(Social Environment Category)

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Steps in the Methodology

Step1
- Develop description of each alternative

Step 2
- Develop Initial Cost Opinions with assumptions

Step 3
- Apply Criteria to alternative and score
- Scores Tallied and normalized
- Sensitivity Analysis

Step 4
- Develop Master Plan Strategy

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Sensitivity Analysis

- To see if strategy components score differently based on weighted criteria categories
- Evaluation done with equally weighted categories
- Are there different scenarios that should be considered?

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Sensitivity Scenarios

Options for the Evaluation of Alternatives			
Criteria Categories	**Baseline Evaluation**	**Scenario 1**	**Scenario 2**
Technical Environment	25%		
Natural Environment	25%		
Social Environment	25%		
Economic Environment	25%		
Total	100%		

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Next Steps

- Final and Confirm Evaluation Process
- Confirm Sensitivity Scenarios
- Conduct Evaluation (screening + detailed)
- Provide Evaluation Results to PAC
- Develop Preliminary Master Plan Strategy
- Prepare for PAC #4
- Prepare for PIC #2

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Next PAC Meeting

Key Meeting Topic: Evaluation Outcomes and MP Strategy

Date TBD

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Thank You.

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Guelph Wastewater Treatment Master Plan

Public Advisory Committee Workshop

Workshop #2 Summary

July 3, 2008

This summary is intended to provide an overview of the Public Advisory Committee (PAC) workshop held as part of the Guelph Wastewater Treatment Master Plan. This summary captures the key discussion points from the workshop held on July 3, 2008. It is not intended as a verbatim transcript.

If there are any questions or concerns regarding the content of this summary please contact the City's project manager or the project consultants:

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City of Guelph Wastewater Treatment Master Plan

Public Advisory Committee (PAC) Workshop #2

July 3, 2008

Guelph Wastewater Treatment Plant, 530 Wellington Street W.

9:00 am to 11:30 pm

Key Meeting Topic: Other City Initiatives

Draft Agenda

1. Introduction and Purpose
2. Growth Management Strategy
3. Water Conservation
4. Water and Wastewater Servicing Master Plan
5. Optimization of the Wastewater Treatment Process

Guelph WWTMP – PAC Workshop #2

Meeting Attendants – The following individuals attended the PAC Workshop

PAC Members	
Don Drone	Chair, Wellington Catholic DSB
Laura Murr	Green Plan Steering Committee
Dorothy Remmer	Green Plan Steering Committee
Khosrow Farahbakhsh	University of Guelph
Lloyd Longfield	Chamber of Commerce
Robert Bell	City Councillor
Hugh Whiteley	Community Member
Doan Bellman	Sleeman Breweries Ltd.
Steering Committee Members	
Cameron Walsh	Manager of Wastewater Services
Kiran Suresh	Project Manager, Wastewater Services
Gerard Wheeler	Optimization Specialist, Wastewater Services
Mark Anderson	Grand River Conservation Authority
Colin Baker	City of Guelph
Paul Kraehling	Community Design and Development
Laurie Watson	City of Guelph Communications
Wayne Galliher	Water Conservation and Efficiency
Don Kudo	City of Guelph Engineering
CH2M HILL Consultant Team	
Warren Saint	Project Manager
Diana Vangelisti	Communications and EA Specialist
Pam Law	Project Engineer
Additional Public Members	
Andrew Lambden	Guelph Developers Association

Presentations

Four separate presentations were made by staff from the City of Guelph. The following section provides a summary of each of the presentations that was given at the PAC workshop. The summary is intended as a general overview. A PDF copy of the power point presentations is available for download from the City's project website (www.guelph.ca).

Introduction and Purpose

Cameron Walsh provided an introduction. Workshop is a result of discussions from last meeting. Is an opportunity to share information on other initiatives and how the processes can be integrated moving forward. Intent is to identify key elements that will feed into the Guelph WWTMP.

City representatives presenting include:

- Growth Management Strategy – Paul Kraehling
- Water Conservation – Wayne Galliher
- Water and Wastewater Servicing Master Plan – Don Kudo
- Optimization of the Wastewater Treatment Process – Gerry Wheeler

The following provides a summary of the presentations, full presentations are available on the project website.

Growth Management Strategy (GMS)

Paul Kraehling presented context on the GMS including a timeline of events:

- 2005 - Terms of Reference
- 2006 - Background Work
- 2007 - Public Engagement & Options
- 2008 - Recommendations and Implementation

The GMS process included extensive consultation which included workshops, project partner and stakeholder meetings, open houses and surveys. All material from the strategy is available on the project website www.guelph.ca/gms.

The purpose of the GMS is to address the objectives & implications of the provincial growth plan for our area.

Plan is to be completed by June 2009. Plan is required to accommodate 169,000 people by 2031, which would translate to approximately 54,000 additional people coming to the City. The number will go into the Official Plan and will be revisited in 2010 – 2011 by the province. These are legislated timelines for revisiting these values down the road.

Council approval came June 23, 2008 and the City is now starting an update of the Official Plan.

Growth Management Strategy considered employment opportunities, growth locations and forms, affordable housing considerations, corporate boundary expansions and health care needs.

Questions and Responses

Question (Q): Is the limiting factor municipal infrastructure?

Response (R): One of the elements that limited the growth was the limitations of the municipal infrastructure including assimilative capacity and limitations of technology. There were other elements that fed in as well such as land allocation, density intensification and annexation.

Q: How has the university been integrated into the planning projections?

R: University has not been factored into the numbers by the province, this is just permanent residents. This has to be factored into infrastructure planning.

Q: How does this impact the 50 year planning timeline?

R: We can use this number and project an annual projection beyond 2031, for instance 1.5% per year. And this number will be revisited and refined. It is an iterative projection which will be readjusted.

Q: Can the council resolution letter supporting the growth strategy be forwarded?

R: Letter is on the website and the link will be forwarded. *(Note added following meeting: Council resolution letter can be found at the following link http://guelph.ca/uploads/PBS_Dept/planning/documents/Guelph%20Growth%20Management/council%20resolution_june23_08.pdf)*

Comment (C): Feel that historical growth rates (2%) should be projected forward for a conservative estimate, to accommodate potential growth.

R: The City feels that they need to control growth to be able to plan for future infrastructure and timing and budget allocation. The Places to Grow actually has faster growth projections than what has been seen in the past. 1.5% is an accelerated growth pattern when compared to historical growth.

Q: Was there time during the process to use a different perspective to see what end result would be? For example to come up with an "idealized Guelph" and see what the population projections would be in this ideal society and what the infrastructure requirements would be to get there?

R: A long term vision approach was considered, looking out 100 years, but it was decided that the Growth Management Strategy would go to 2031.

Q: Did projections consider growth without increase water takings.

R: Water conservation and potential implications was looked at in the Water Supply Master Plan.

Q: How was the natural heritage strategy considered?

R: Growth Plan takes into account the natural features to come up with developable land.

Q: In the Business Park in the greenbelt?

R: Greenfield is Places to Grow language which includes areas outside of the built area as of June 2006 and does not reflect greenbelt areas.

Q: Have other municipalities done similar work here to reduce the growth projections laid out by the province.

R: There are other municipalities who want more growth and others that want less. The results of those discussions with the province are unknown.

Water Conservation

Wayne Galliher provided a background on the progress of the Water Conservation and Efficiency program within the City.

Everything completed within the City to date has been done within framework of the Water Conservation & Efficiency Study completed in 1999. The Guelph Water Supply Master Plan identified conservation as an important component of water supply in Guelph and as a result, the current update to the City Longterm Water Conservation & Efficiency Strategy has been undertaken to evaluate and identify the preferred programs.

There has been a 7.8% decrease in annual water consumption from 2001. It is understood that this is based primarily on residential reduction.

Elements of the Water Conservation & Efficiency Program include:

- Royal flush toilet rebate program – program has completed approximately 5,600 Residential, Multi-Residential and ICI based rebates to date since 2003.
- Smart wash pilot rebate program – pilot program has completed 500 rebates since February 2008 – program now closed.
- ICI water capacity buyback – program provides Engineering Services to larger water users for detailed water audits and associated incentives for capital water efficiency retrofits to reach greater water efficiencies. The University of Guelph was the first program participant in 2007. The University completed fixture retrofits in 7 high volume public buildings and reached a savings of 312 m^3/d.
- Outside Water Use Program – introduced in 2001 and has seen significant seasonal water and peak day water savings. Guelph currently has one of the lowest peak day factors in the province at approximately 1.3
- City of Guelph Facility Water Retrofits – water efficiency retrofits completed within City public facilities. Current facilities water efficiency retrofits include washroom retrofits at Victoria Road Recreation Centre(2007), Centennial Arena (2008) and Exhibition Area (2008).
- Landscape assessment program – new in 2008, pilot program provides complementary landscape visits to help achieve greater outdoor water efficiency. A target of 500 complimentary home visits available in 2008.
- Public education and outreach

- 2008 Guelph Water Conservation Awards – New in 2008, a series of community conservation awards have bee introduced to recognize community leaders in water conservation and efficiency. There are three awards in total: residential, business and community/education.

The 2008 Water Conservation & Efficiency Strategy Update reduction targets are:

- Reduction of 10% (8,000 m3/day) by 2010
- Reduction of 15% (12,000 m3/day) by 2015
- Reduction of 20% (16,000 m3/day) by 2025

Upcoming Events for the Update:

- PIC #1 – August 12, 2008
- Newspaper and web media campaigns to promote PIC and study resources
- Anticipated Study completion Fall 2008

Questions and Responses

Q: Has the City set goals for new buildings for water conservation

R: City has set goals for LEEDs designation for new City buildings, building things right the first time, these will include opportunities for rainwater and grey water.

Q: What about new residential buildings? Will there be savings in the development bylaw if developers install water efficient elements?

R: Through the Development Charges (DC) bylaw the City is looking at funding water conservation efforts. It is a great opportunity moving forward. The City is looking to see what policies can be put in place to encourage this further. In terms of greywater reuse, an application has been put into fund a pilot program with 30 new homes and examine the social feasibility of residential grey water systems, evaluate potential savings associated with the technology, and evaluate the feasibility of grey water reuse within further residential planning applications.

C: A large portion of the reductions shown on the graph of residential per capita water use may be as a result of new construction with low flush toilets. Andrew Lambden noted that his company has installed dual flush toilets in all of developer business buildings. The City should mandate dual flush toilets.

R: The City understands that the dual flush toilets work well and through the strategy update we will pursue what policy and incentive opportunities may be present to mandate dual flush toilet installation at the time of new home construction. Public consultation to date through the ongoing Strategy Update has shown that people are willing to put in these types of fixtures if they pay for themselves within a short period of time.

C: The City needs to set more aggressive goals to demand more water conservation. The City needs to look at what is possible and set a goal with this in mind.

R: There is great opportunity there and the City will see what can be done through policies and promotions.

C: There is good opportunity for benchmarking both energy and water conservation together. Economic development has had to turn businesses away based on high water demand and the impact on infrastructure. Need to set up additional benefits and incentives to businesses to attract more businesses and jobs to the community.

R: Given the limitations on water supply, industry that uses a lot of water take away potential capacity for residential growth. With this limitation many high water users may not choose to locate to the City based on availability of water resources required. The City is looking at setting targets based on a volume of water per area of land to plan for sustainable business growth. As detailed information regarding process water use is not presented by perspective businesses when evaluating the City as a potential site for operations there is not a great opportunity to discuss potential reductions in water use with prospective high volume industries. Generally industries will decide quickly if a City has capacity for the proposed business and provide little information regarding end use at the time of inquiry.

R: Guelph has done a remarkable job in getting to where they are today. They have utilized a lot of the low hanging fruit to significantly reduce demand to date. The future targets take into account more aggressive water conservation approaches to come up with future goals.

Water and Wastewater Servicing Master Plan (W&WWSMP)

Don Kudo presented findings from the W &WWSMP which is nearing completion. Don's presentation focused on the wastewater conveyance side of the study. Overall, the study is a 25 year plan, but presentation is focusing on the next 10 years.

The project was split into 3 phases:

Phase I - System Optimization

Phase II – Master Plan

Phase III – Asset Management

There has been two Public Information Centres and a report will be going to committee next week for endorsement of report.

Don outlined assumptions used to develop implementation plans to 2031 including integration with other City plans such as the Water Supply Master Plan and the Growth Management Strategy.

An outline of the existing system was presented and deficiencies found included I/I issues in some areas of the City and sanitary sewers in poor condition in certain areas.

Alternative solutions which were examined were described and the preferred alternatives were presented.

Preferred solutions included:

- I/I reduction and re-use opportunities
- Improvements to Existing System - New Trunk Sewers: Preferred Alternative
  - Optimization:

  - *Addresses deficiencies in existing system and poor structural condition of older trunk sewers*
  - *Can be phased in with road improvements and watermain installation*
  - *Increase in diameter of main trunk sewers reduces upgrades upstream in system*
  - *Further storage could be implemented to minimize peak to Average Flow ratios*

- Intensification*:*
  - *Results in major upgrades through core of City and east-west trunk sewers*

- New growth:
  - *New sewers to accommodate growth can be implemented within existing gravity system*

- Lowest capital cost

Preferred alternatives were shown graphically and are to be phased in over the next 25 years. The near term 0 - 5 year timeline focused on improvements to York trunk sewer as well as the Stevenson trunk sewer.

Capacity constraints were shown on a map and were based on intensification projections.

The proposed studies table outlined projects in the 0 – 10 year timeline. 25 year recommendations are estimated at $107 million. The City is looking at the possibility of reuse and the installation of a "purple pipe" to convey wastewater effluent. An allowance has been made for integrating this with trunk upgrades. The recommendation is to move forward in looking at purple pipe. This correlates with recommendation for feasibility study from WWTMP to look at market and considerations for effluent reuse.

Equalization tank needs to be confirmed ($8,000,000). Need to confirm if money can't be spent better reducing I/I in the system.

Moving forward the City will be looking at integration of master planning processes.

Questions and Responses

C: When looking at purple pipe, need to look at cost off-sets including savings from water supply or water being taking from Speed River for golf courses.

Q: What is the temperature of wastewater in pipes?

R: Approximately 20 ^{o}Cin Summer and 12^{o}C in Winter.

Q: What is being done with direct point discharges to the river for stormwater?

R: Will be addressed through a stormwater master plan. This process is just getting started and will be looking at older areas of the City which were constructed prior to legislated requirements and will look at opportunities for retrofit.

Q: Out of the $107 million, will the City look at how that would be impacted by constant demand?

R: The estimates were made on the demands determined in the Water Supply Master Plan which reviewed water conservation.

C: University just finished a study on heat recovery from sewers. Also, the relationship between water reuse and baseflow in the Speed River shows that there is a relationship with reuse and stormwater management. The stormwater management study needs to include improvements in infiltration which could improve baseflows in the Speed River which could decrease the quality requirement of the effluent from the wastewater treatment plant due to an increase in the river baseflow. Need to consider infiltration improvements, not just improving direct discharges. Places elsewhere are looking at on-site management of stormwater.

Optimization of the Wastewater Treatment Process

Gerry Wheeler provided an overview of the wastewater optimization study currently underway at the WWTP. He outlined that the reasons for optimization and highlighted a key feature which is to maximize "Human Infrastructure" to ensure sustainability.

The differences in traditional service approach and the approach being taken by the City was presented. This is a more sustainable approach which maximizes human resources to address issues, not just a traditional infrastructure solution. There is a more intensive focus on skills development.

If cause and effects relationships are not recognized, may not be getting the most out of the facility. Example showed that managing sludge volumes in the plant can result in lower ammonia in the effluent. By monitoring additional data points, the WWTP can see more cause and effect relationships.

Gerry pointed out that although the entire plant is rated at 64,000, the City needs to look at the four treatment plants individually to determine bottlenecks and improve the overall capacity. The four have similar treatment in terms of technology but are different in size. Additional complexity is added as each of the four plants have two separate treatment modules (East/West) resulting in 8 trains to operate.

The current facility is operating at 55,000 m^3/d with a rated capacity of 64,000 m^3/d. The current study is looking at how much capacity can be realized at the existing facility by addressing bottlenecks. It is dependant on successful resolution of current limitations.

Capital funding has been set aside for an expansion upgrade to 73.3 MLD, but the City is first looking at maximizing existing infrastructure prior to committing to an expansion. Need to optimize both the liquid and solids components at the plant.

Optimizing human capabilities may take longer than your traditional design and construction approach and requires patience and tenacity. Currently 14 studies are ongoing at the WWTP following the procedures developed by the City.

<u>Questions and Responses</u>

Q: Is Plant 4 the most recent plant? What is the difference in the products coming out of each of the plants?

R: In studying each of facilities, they are finding anomalies. For example the City has found that Plant 1 is harder to operate than Plant 4 to achieve the same effluent. By monitoring

Plant 1, it was found that weir optimization improved operation. For Plants 1 - 3 there is an additional polishing step (Rotating Biological Contactors, (RBCs) that is required to achieve the same effluent as Plant 4. After the RBCs, all 4 plants have similar effluent and undergo tertiary filtration.

C: The program follows the US EPA's optimization approach. This was first looked at starting in the 1970s. In the 1990s this approach transitioned to Ontario. The City is taking the time to scrutinize how things are operated and maintained.

Q: For funds collected through development charges how will this money be used for wastewater if infrastructure upgrades are not required?

R: The City needs to go through a number of studies and investigations and permits prior to an optimization rerating occurring and may require an addendum to the EA that was completed for the expansion of the WWTP. If rerating and optimization is successful development charges money would still be used, but would be deferred for use at a later time.

Q: Is the composting facility likely to remain indefinitely?

R: Composting utilization is limited in Ontario and the process is maintenance insensitive. The Composting process was reviewed through the Biosolids Management Master Plan (BMMP). Currently, the City is running an innovative technology as a pilot with the implementation of Lystek. This process produces a high quality product which transforms the physical characteristics of dewatered biosolids through the application of heat and caustic addition, so that it has the properties of a liquid and is of greater benefit to agricultural end users. This is currently the preferred solution moving forward and the current plans are to decommission the composting facility.

Schedule moving forward

The following schedule was outlined for the remainder of the project:

Activity	Anticipated Timeframe
Draft Master Plan for City Review	Mid-August
Draft Master Plan to PAC	Mid-September
PAC Meeting #4	1^{st} week in October
PIC #2	1^{st} week in November
Report for filing	1^{st} week in December

Local Growth Management Strategy - 2031 Growth Plan for Guelph

Wastewater Master Plan
Public Advisory Committee
July 3, 2008

Making a Difference

Outline

- Background
- Council Committee Consideration & Adoption – Spring 2008
- Recommendations Overview & Next Steps

The Growth Planning Context

In order to prepare a growth plan for the next 25 years, the following steps were completed:

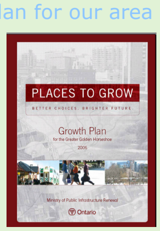
- 2005 - Terms of Reference
- 2006 - Background Work
- 2007 - Public Engagement & Options
- 2008 - Recommendations and Implementation

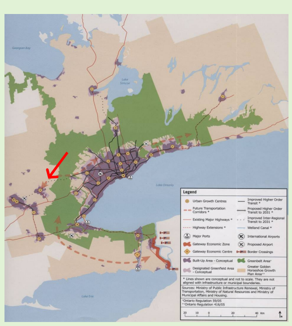
Consultation

- Opportunities for significant public engagement
  - Kick off symposium
  - Community survey and public focus groups
  - 28 workshops (stakeholder groups, public)
  - Open houses and questionnaires
- On-going discussion with key partners, e.g. surrounding municipalities, PIR Ministry
- Full documentation available at guelph.ca/gms
- Council consideration – Committee (April 10, 2008), Council approval (June 23, 2008)
- Official Plan update underway

Purpose for Growth Plan

•To address the objectives & implications of the provincial growth plan for our area





Purpose for Growth Plan (continued)

•To outline a local growth management plan to respond to the objectives of the Provincial Growth Plan but with consideration to the values of Guelph citizens

Foundational Elements

Basic questions on growth to address. . .
- How much?
- Rate of growth?
- Basic types of growth?
- Location and form of growth?

Recommendations Summary – Guelph's Local Growth Management Strategy

Recommendation 1 - How much growth?

- Plans are required to accommodate 169,000 people by 2031; represents approximately 54,000 additional people coming to the City

Recommendation 2 – Rate of Growth?

- A steady forecasted population increase at 1.5% per year over the 25 year long term planning horizon should be used

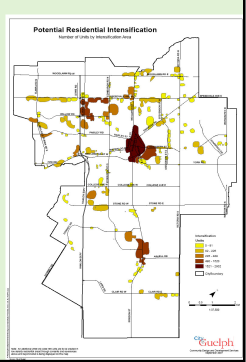
Recommendation 3 – Employment Growth Forecasts?

A) Planned opportunities to provide an additional 31,000 jobs by the year 2031

B) Current 'Employment Lands Strategy' being prepared will detail job requirements for Guelph, i.e. location of new development opportunities

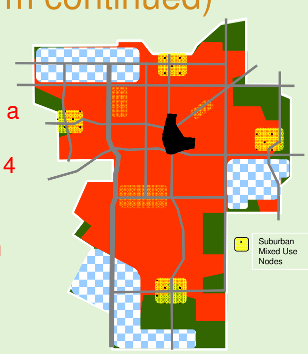
Recommendation 4 – Where & What Form will Future Growth Be?

A) Residential intensification development opportunities should be planned in 'nodes and corridors' and the 'urban growth centre' (downtown)



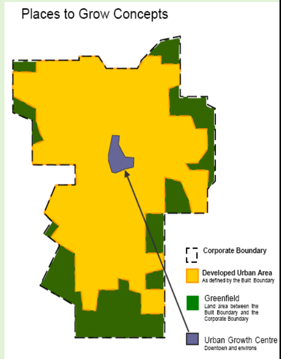
Recommendation 4 (Growth Location & Form continued)

B) Residential intensification will also be planned as a component of the development of the 4 suburban 'Mixed Use' Nodes in the current Official Plan



Recommendation 4 (Growth Location & Form continued)

C) Higher residential development densities will be planned on the remaining ‘Greenfield’ suburban development lands based on implementation of Community Energy Plan

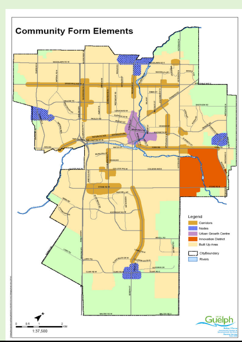


Recommendation 4 (Growth Form continued)

D) The provision of affordable housing within the City will be planned in accordance with the Affordable Housing Strategy

Recommendation 5 – Need for Corporate Boundary Expansions?

- **Based on the overall growth forecast and the other recommendations of the Growth Strategy, a boundary expansion to the City’s Corporate Limits is not required at this time**



New Council Recommendation 6 – Consideration of Growth Impacts on the Health Care Needs of Guelph Citizens

- The Province to be asked to address the health care needs in the City.

Other Implementational Elements (2008)

- Completion of Urban Design Action Plan, i.e. identification of details of intensification urban form objectives for ‘nodes and corridors’ and the downtown (urban growth centre)
- Downtown Secondary Plan – implementation of Urban Growth Centre directions
- York District Plan – important future employment area in the city
- Community Energy Plan implementation
- Natural Heritage Study completion
- South Guelph ‘Reserve Lands’ planning framework for the future

Implementation (continued)

- Financial implications via DC By-law update, new City budgets
- Completion of community survey, i.e. planning poll of new initiatives
- Community ‘hard services’ assessment
- Community ‘soft services’ infrastructure assessment

Next Steps

- Completion of Phase IV (implications & costing) work of the Growth Management Project
- Work to feed into the preparation of an updated City Official Plan by June 2009

City of Guelph Water Conservation and Efficiency Program

Wastewater Treatment Master Plan

Public Advisory Committee Workshop

July 3, 2008

Guelph water
Ours to conserve. Ours to protect. Ours to enjoy.

Making a Difference

Presentation Topic Overview

- City of Guelph WC & E Background
- 2008 City of Guelph WC & E Program Overview
- 2008 Guelph WC & E Strategy Update
- Question and Answer Period

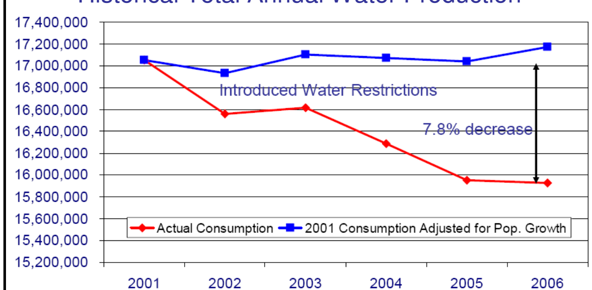
Conservation Program Background

- City of Guelph: One of the Canada's largest communities reliant solely on groundwater – significant pop. growth
- Water Conservation & Efficiency Study (1999)
  -framework for conservation initiatives to date
- Outside Water Use Program (2001)
- Guelph Water Supply Master Plan (2006)
  - Conservation Top Priority
  – Plan recognizes conservation as source of Water Supply
- City of Guelph 2007 Strategic Plan:

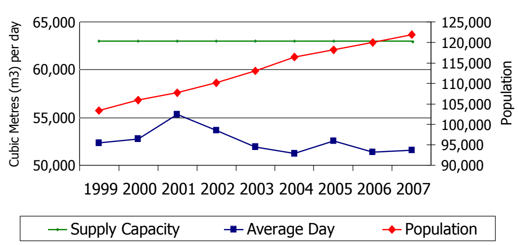
  Goal 6: Natural Environment – A leader in conservation and resource protection/enhancement;

  Objective 6.5: "Use less energy and water per capita than any Comparable Canadian City"

Historical Total Annual Water Production



Historical Average Day Water Production



Royal Flush Toilet Rebate Program

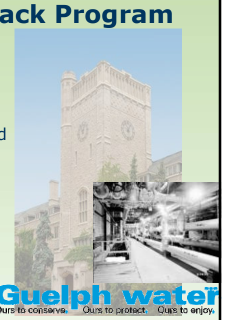
- Program introduced in 2003
- Rebates provided for the replacement of 13L/flush toilets with approved water efficient models - \$40 ULF, \$60 HET & Dual Flush
- Rebates available for residential, multi-res, and ICI
- Toilet replacement can save approximately 15% of residential water demands
- Over 5600 rebates processed to date (476 m^3/day)

Smart Wash Pilot Rebate Program

- City of Guelph and Guelph Hydro partnership
- Pilot Program - 500 rebates available ($100/rebate)
- Front-loading, ENERGY STAR rated models
- Can save approximately 70 litres of water per day*
- Launched Feb 1, 2008
- 500 rebates reached June 25, 2008 – program now closed

ICI Water Capacity Buyback Program

- Program introduced in 2007 for large IC&I Water Users to help promote further water use efficiencies.
- Program provides engineering services for detailed water use facility audits and water reduction based incentives in achieving greater efficiency
- One time incentive of $300/m^3/day
- Water savings quantified through pre and post monitoring.
- 2007 University of Guelph building retrofits = 312 m^3/day in savings



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Outside Water Use Program

- Introduced in 2001
- Ability to implement outdoor water use restrictions under environmental and operational thresholds.
- Program levels tied to changes in the Province of Ontario Low Water Response Procedure
- Significant seasonal water and peak day water savings attributed to program

Guelph water
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City of Guelph Facility Water Retrofits

- Water retrofits completed within washroom facilities of high volume City public buildings.
- Leading by Example
- Water Savings + Public Education
- Retrofit sites to date include:
  - -Victoria Road Rec. Centre
  - -Exhibition Arena
  - -Centennial Area

Guelph water
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Landscape Assessment Program

- Pilot Program – 500 complementary home visits available
- Visits focus on site specific suggestions for water efficient landscape design, plant selection and proactive maintenance best practices to mitigate effects of drought and impacts of common turf pests.
- For more information visit: www,guelph.ca/healthylandscapes

healthy landscapes

Public Education and Outreach

- Waterloo/Wellington Children's Groundwater Festival Partner
- GIRC Outdoor Water Efficiency Workshop Series (2007/2008)
- Water Conservation Breakfast Workshop
- Green Impact Guelph Initiative
- Instant rebate promotions at area retailers
- Active presence at Community Events and Initiatives

Guelph water
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2008 Guelph Water Conservation Awards

- Newly Introduced in Feb 2008
- Set of Recognition of awards for community leaders in water conservation and efficiency.
- 3 Award Categories:
  1) Residential
  2) Business
  3) Community/Educational
- Awards Submissions due December 19, 2008.

Guelph water
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2008 Water Conservation & Efficiency Strategy Update

- Update to City of Guelph 1999 WC & E Study
- City of Guelph Council Endorsed Water Supply Master Plan in 2006. Master Plan identified the following water conservation time based targets:
  - Reduction of 10% (8,000 m3/day) by 2010
  - Reduction of 15% (12,000 m3/day) by 2015
  - Reduction of 20% (16,000 m3/day) by 2025
- Strategy Update to evaluate alternatives in meeting conservation targets and develop a comprehensive community based water conservation and efficiency plan for all of the City's sectors

2008 Water Conservation & Efficiency Strategy Update – Continued

Study to Include:

- Residential & ICI Water Demand Analysis
- Evaluation of Distribution System Water Loss
- Water Demand Supply Forecast
- Identification/Evaluation of Programs, Policies and Resources
- Development of Implementation Strategy and Water Loss Mitigation Action Plan
- Public Consultation and Feedback
  - -Residential Focus Groups
  - -Residential Telephone Research Survey (400 homes)
  - -Public Advisory Committee
  - -Public Information Centres and Workshops

2008 Water Conservation & Efficiency Strategy Update – Continued

Public Advisory Committee Composition:

"Sector"	# Representatives	May include these organizations, but not limited to…
Business/Industry	2	Chamber of Commerce to assist in identifying 1 large industrial water user and 1 large commercial user
Developers/Guelph Home Builders	1	Guelph Developers Association; Guelph Homebuilders Association
Environmental Interest	3	Friends of Guelph; Guelph Community Foundation; Guelph International Resource Centre, Green Impact Guelph, Guelph Environmental Leadership, Wellington Water Watchers
Plumbing	1	TBD
Agencies	1	Grand River Conservation Authority
Academia	2	University of Guelph
Residential Rate Payers	3	TBD

2008 Water Conservation & Efficiency Strategy Update – Progress Update

Study Milestones (to date):

- Study Consultant Team (RMSi) retained through RFP Process – February 2008
- City Council endorsed formation of Water Conservation Public Advisory Committee – April 22, 2008
- Residential Focus Groups – Completed April 22, 2008
- Residential Research Call Survey – Began June 23, 2008
- IWA Water Balances Audit Completed – June 25, 2008

2008 Water Conservation & Efficiency Strategy Update – Upcoming Events

- First Public Advisory Committee Meeting – August 12, 2008
- Initial Study Public Information Centre planned for late August/Early September 2008. Guelph Residents, business and area stakeholders are encouraged to attend and provide valued input and feedback.
- Newspaper and web media campaign planned to promote public information centres and study resources.
- Final Water Conservation and Efficiency Strategy Update and Strategy Recommendation will be brought to City Council for endorsement following completion.
- Anticipated Study Completion: Fall 2008

Thank you!

Wayne Galliher, A.Sc.T.
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Environmental Services
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Phone: 519-822-1260 x2106

Guelph water
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City of Guelph

Water and Wastewater Servicing Master Plan Study

WWTP PAC

July 3, 2008

EarthTech

Making a Difference

Agenda

Description

1) Master Plan Study Overview
   - Status
   - Assumptions
2) Wastewater Conveyance System
   - Existing System and Alternatives
   - Proposed Implementation Plan - overview
   - 0 -10 year plan – proposed undertakings

Master Plan Status

- Commenced in June 2006
- Phase I System Optimization
- Phase II Master Plan
- Phase III Asset Management
- Two Public Information Centres
- CDES Committee Report (July 11, 2008)

Assumptions in Developing Implementation Plans to 2031

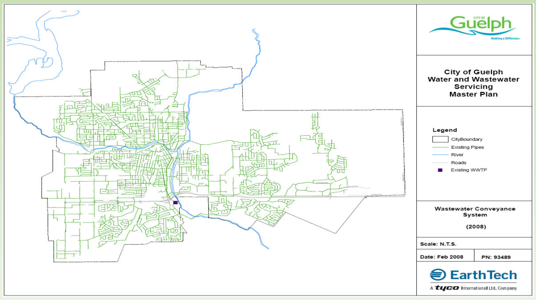
- Implementation of new water supply facilities are assumed to follow the WSMP schedule.
- Prioritization of required upgrades references asset management inventory.
- Watermain and sanitary sewer replacements to be coordinated with road reconstruction projects
- Infrastructure required within 25 years
- Infrastructure shown in new development areas will be subject to EA and planning approvals (e.g. Provincial review of adequacy of current policies/legislation to protect the Paris Galt Moraine)
- Timeline for capital works is pending completion of Local Growth Management Strategy (LGMS); for this plan, assumed growth priorities in first 10 years include:
  - continued growth in approved development areas of south end
  - development of York district area (Ontario Reformatory lands)
  - intensification in downtown core (drainage to York trunk sewer)

Wastewater Conveyance System

Existing Wastewater Conveyance System

- Primarily gravity system
- City's Wastewater Treatment Plant at Wellington Road, west of Hanlon Expressway
  - Discharges to Speed River
- Deficiencies in existing system:
  - Inflow/Infiltration – is a significant issue in some areas identified through flow monitoring
  - Sanitary sewers in some areas are in structurally poor condition
- Increase in population due to intensification will require significant upgrades
- Increase in population in new areas require servicing

Existing Wastewater Conveyance System



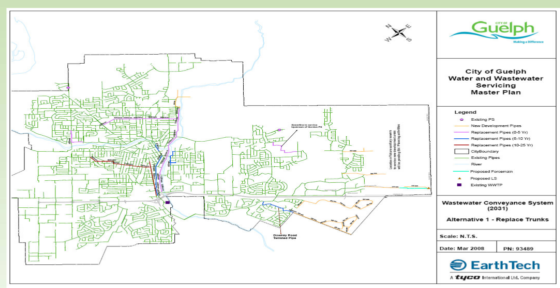
Identification of Alternative Solutions: Wastewater Conveyance System

A.	Do Nothing: Status quo	• The "Do Nothing" alternative represents what would likely occur if none of the alternative solutions were implemented.
B.	Limit Community Growth	• Reduce future sanitary collection system needs by limiting the extent, density, type and/or location of future residential, industrial, commercial and institutional growth in the City.
C.	I/I Reduction and Re-Use Alternatives	•Implement reuse of grey water and implement inflow/infiltration reduction options.
D.	Improvements to Existing System: New Trunk Sewers	•Alt Solution 1. - Replace main trunk sewers (with storage options) •Alt Solution 2. - Interceptor: Consolidate main trunk sewers to York Trunk (with storage options) •Alt Solution 3. - Interceptor: Consolidate main trunk sewers to Speed River Trunk (with storage options)
E.	Improvements to Existing System: Pumping Station & Forcemain	•Alt Solution 4. - New main Pumping Station from York Trunk with Forcemain to WWTP

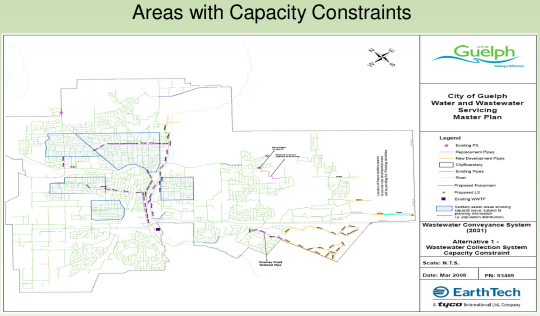
Preferred Alternative: Wastewater Conveyance System

- I/I Reduction and Re-use Opportunities
- Improvements to Existing System - New Trunk Sewers: Preferred Alternative
  - *Optimization:*
    - *Addresses deficiencies in existing system and poor structural condition of older trunk sewers*
    - *Can be phased in with road improvements and watermain installation*
    - *Increase in diameter of main trunk sewers reduces upgrades upstream in system*
    - *Further storage could be implemented to minimize peak to ADF ratio*
  - *Intensification:*
    - *Results in major upgrades through core of City and east-west trunk sewers*
  - *New growth:*
    - *New sewers to accommodate growth can be implemented within existing gravity system*
  - *Lowest capital cost*

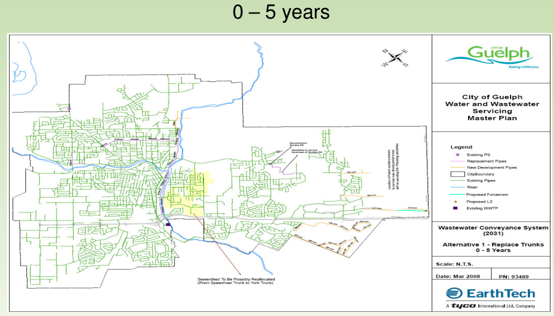
Wastewater Conveyance System: Preferred Alternative



Wastewater Conveyance System: Areas with Capacity Constraints



Wastewater Conveyance System: 0 – 5 years



Proposed Studies

Project no.	Project Description
WW-S-1	Camera and structural assessment of all major trunks: York; Speed; Waterloo; capacity review on Hanlon crossing to the WWTP
WW-S-2	Area I&I Studies
WW-S-3	Review opportunities for capturing energy (Via heat exchange) in new trunks
WW-S-4	Flow monitors at Arthur; York; Speed; Downey; South of Clair
WW-S-5	Asset Management
WW-S-6	Storm System Master Plan
WW-S-7	Wastewater Master Plan Update

Proposed Linear Infrastructure Upgrades: 0 – 10 years

Years	Project no.	Project Description	Budgetary Estimate	Class EA Schedule
Linear Infrastructure				
0 - 5	WW-I-1	*Replace existing York Trunk	$ 9,136,800	A
0 - 5	WW-I-2	*Replace Stevenson Trunk from York Trunk to Eramosa Rd	$ 3,414,150	A
0 - 5	WW-I-6	*Replace Arthur Trunk (Marlborough) from Emma to Kitchener	$ 2,277,450	A
0 - 5	WW-I-7	Speedvale Collector from Arthur Trunk to Metcalf	$ 915,300	A
0 - 5	WW-I-18	Wastewater effluent re-use "Purple Pipe" (allowance)	$ 5,000,000	A+/B
0 - 10	WW-I-11	river & Hanlon crossings (allowance); including relocation catchment area south of river discharging @river slightly west of Edinburgh	$ 3,375,000	A+ or B
0 - 10	WW-I-15	Syphon improvements	$ 6,000,000	A+/B
0 - 25	WW-I-16	Infrastructure improvements: manhole improvements; eliminate cross connections (dual functional manholes) etc	$ 5,000,000	A
0 - 25	WW-I-17	I/I reduction implementation program	$ 10,000,000	A
5 - 10	WW-I-9	*Replace Water St Collector	$ 861,300	A
5 - 10	WW-I-10	Downey Trunk	$ 1,620,000	A+ or B
5 - 10	WW-I-3	Replace Speed Trunk from East of Hanlon to Eramosa R.	$ 4,244,400	A

Proposed Facility Upgrades: 0 - 10 years

Years	Project no.	Project Description	Budgetary Estimate	Class EA Schedule
Facilities (Storage / P.S. etc)				
0 - 5	WW-F-1	*Decommission SPS on Gordon (after installation of sewer)	$ 2,700,000	A
0 - 10	WW-F-2	Improvements to lift stations & forcemains	$ 2,000,000	A
0 - 15	WW-F-3	Storage/Equalization (within trunks - York/Speed; at WWTP)	$ 8,000,000	A / B
0 - 5	WW-F-4	New SPS in South (ICI) - development south of Clair	$ 2,025,000	B
develop- ment	WW-F-5	Possible new SPS in South (ICI) - future development south of Clair	$ 2,025,000	B
driven	WW-F-6	Northwest SPS (allowance)	$ 2,025,000	B

City of Guelph Environmental Services Wastewater Services Division

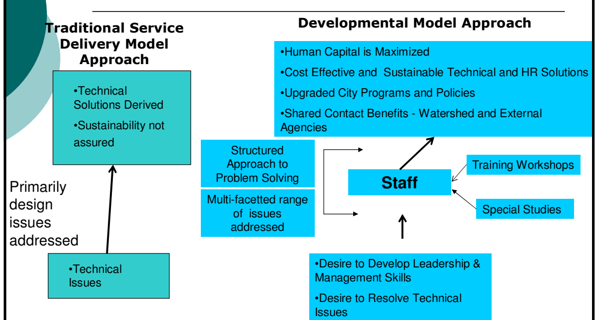
PAC Workshop
Wastewater Treatment and Capacity Demonstration

G. Wheeler, Optimization Program Facilitator
Environmental Services Department
Thursday July 3rd 2008

Why Optimize

- Improve performance
- Tap latent capacity of existing physical infrastructure
- Maximize City funds
- Maximize communications re City programs regarding strategic water resource management
- Develop skills and maximize our "Human Capital" to ensure sustainability for future generations
- Increased credibility and trust with MOE
- Achieve Better Risk Management,
  - i.e. professional and confident staff in charge of high capital value infrastructure

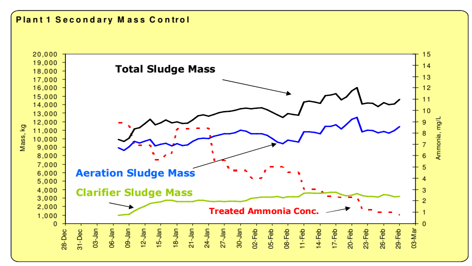
Fundamentally Different Approach to Program Delivery



G. Wheeler (Facilitation mode)

Some Desired Attributes of Developmental Approach:
Superior Problem Solving Capability

Enabling Cause and Effect Relationships to be Documented



Current Focus

- Optimizing the 4 liquid trains:
  - Focus on secondary treatment through optimized biological sludge mass control
  - Primary clarifier sludge mass control is also established.
  - However each of the 4 trains have East/West modules effectively requiring optimization of 8 liquids trains before the capacity demonstration is feasible,
    - i.e. process bottlenecks must be identified and removed before demonstration is appropriate

Capacity Demonstration

- Current facility flow rate is 55,000 m^3/d
- Current facility is rated at 63,000 m^3/d
- Design evaluations indicate design criteria are conservative at both current and rated flow rates
- Capacity demonstration is planned to confirm capacity of existing facility beyond current rating:

- If successful, planned capital expenditures can either be avoided or deferred

Future Focus

- Optimize the Solids Handling Train
  - Maximizing the liquid train can only be successful if bottlenecks in solids handling are likewise systematically identified and resolved

Human Infrastructure Development

- Daily commitment to skills development
  - Requires patience and tenacity
  - This commitment receives equal priority as technical aspects
- Several tools used to coach and develop human capabilities, i.e.
  - Special Studies, i.e.

Special Study Template

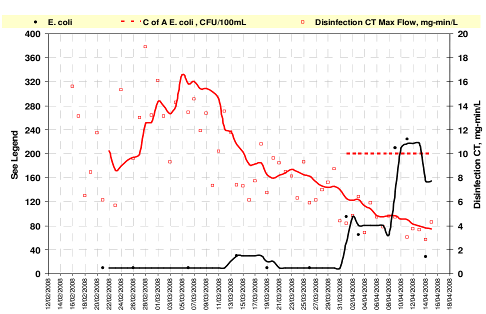
- **Study Topic:**
- **Date of Original Draft:**
- **Author:**
- **Hypothesis:**
- **Approach:**
- **Duration:**
- **Expected Results:**
- **Observations:**
- **Summary and Conclusions:**
- **Recommendations:**

Typical Result from Applying Study Approach:

Better Process Control

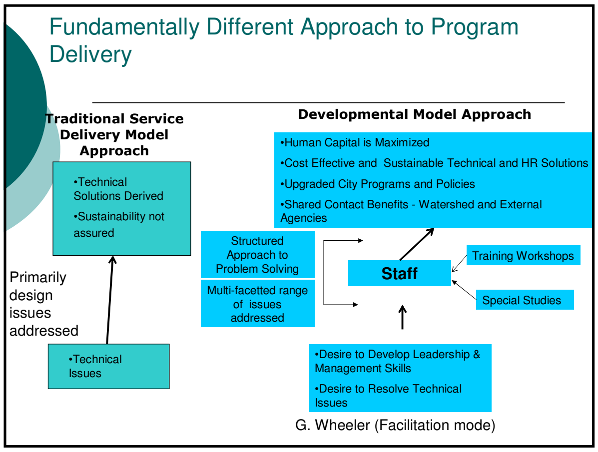
Cause and Effect Relationships are Documented

- Disinfection using CT



Sampling of Preliminary Staff Comments on Developmental Model Approach

- “This is a consistent way of performing studies on-site. This can lead to better communication and more effective professional relationships".......
- "The research approach is good, and reminds me of the hypothesis sheet I used to have to complete for my professor in science class"......
- “ The approach provides structure to my job in the solids handling area"......
- “These studies need to be performed on every plant and on different days. For example the raw sludge concentration does vary depending on the day of the week when pumping rates are different. I will pick different days to show you in the study".......
- "I can see from this study approach how a lot of stuff will be resolved"....
- "This is now going to be a new way of doing business" ....


Fundamentally Different Approach to Program Delivery
Traditional Service Delivery Model Approach
•Technical Solutions Derived
•Sustainability not assured
Primarily design issues addressed
•Technical Issues
Developmental Model Approach
•Human Capital is Maximized
•Cost Effective and Sustainable Technical and HR Solutions
•Upgraded City Programs and Policies
•Shared Contact Benefits - Watershed and External Agencies
Structured Approach to Problem Solving
Multi-facetted range of issues addressed
Staff
Training Workshops
Special Studies
•Desire to Develop Leadership & Management Skills
•Desire to Resolve Technical Issues
G. Wheeler (Facilitation mode)

Guelph Wastewater Treatment Master Plan

Public Advisory Committee Meeting #4

Meeting Summary

CITY OF Guelph
Making a Difference

November 20, 2008

345572_WB032008003KWO

This summary is intended to provide an overview of the Public Advisory Committee (PAC) workshop held as part of the Guelph Wastewater Treatment Master Plan. This summary captures the key discussion points from the meeting held on November 20, 2008. It is not intended as a verbatim transcript.

If there are any questions or concerns regarding the content of this summary please contact the City's project manager or the project consultants:

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CH2M HILL
Project Consultants
300 – 72 Victoria St. S.
Kitchener, ON N2G 4Y9
pam.law@ch2m.com

City of Guelph Wastewater Treatment Master Plan

Public Advisory Committee (PAC) Meeting #4

November 20, 2008

Guelph Wastewater Treatment Plant, 530 Wellington Street W.

1:30 to 4:30 pm

Key Meeting Topic: Master Plan Recommendations

Draft Agenda

1. Welcome
2. Introduction
3. Review of Recommendations
4. Implementation Plan/Schedule
5. Costing Estimates
6. Additional Comments
7. Next Steps

Guelph WWTMP – PAC Meeting #4

Meeting Attendants – The following individuals attended PAC Meeting #4

PAC Members	
Don Drone	Chair, Wellington Catholic DSB
Dorothy Remmer	Green Plan Steering Committee
Paul McLennan	Guelph Developers Association
Lloyd Longfield	Chamber of Commerce
Robert Bell	City Councillor
Laura Murr	Green Plan Steering Committee
Hugh Whiteley	Community-at-Large
James Ford	Community-at-Large
Steering Committee Members	
Cameron Walsh	Manager of Wastewater Services
Kiran Suresh	Project Manager, Wastewater Services
Gerard Wheeler	Optimization Specialist, Wastewater Services
Tim Robertson	Supervisor Operations, Wastewater Services
Paul Kraehling	Senior Policy Planner
CH2M HILL Consultant Team	
Warren Saint	Project Manager
Diana Vangelisti	Communications and EA Specialist
Pam Law	Project Engineer
Additional Public Members	
Andrew Lambden	Guelph Developers Association

Presentation

The following section provides a summary of the presentation that was given at the PAC workshop. The summary is intended as a general overview. A PDF copy of the power point presentation is available for download from the City's project website (www.guelph.ca\wastewater).

Welcome and Introduction

Don Drone welcomed all PAC members and other attendees and thanked them for being part of the PAC and recognized the importance of their involvement in the project. .

Master Plan Purpose and Mission Statement

Diana Vangelisti reviewed the project's purpose and mission statement:

Master Plan Purpose:

To develop a 50-year Wastewater Treatment Plan to provide direction for wastewater infrastructure planning, investment and implementation to the year 2054

Mission Statement:

In keeping with the City of Guelph's strategic plan, community vision, corporate responsibility, core values, and demonstrated commitment to environmental stewardship, develop a comprehensive master plan that addresses the long-term wastewater treatment servicing needs of the community over the next 50-year planning horizon.

Master Plan Recommendations

The Master Plan recommendations described in the draft report, were divided into three categories; studies, programs/policies and infrastructure. The recommendations were reviewed in the meeting.

Studies

The following studies form part of the recommended strategy:

- Urban Reuse
- Facility Plan
- Energy Audit
- Satellite Treatment
- Climate Change Adaptation
- Sewer-Use By-Law Update

Questions and Responses

Comment (C): Does not believe the concept of re-use has been adequately defined properly in the report and considering current standards – in particular the recent developments in the USA. The background in the report is incorrect – both Brantford and Kitchener have practiced potable reuse – specifically indirect potable reuse and the term "inadvertent potable reuse" should not be used. Wishes to see the report include "potable" indirect reuse.

Response (R): The Master Plan will include the need to consider this option as part of the Re-Use Study recommendation. Specifically, the Terms of Reference for that study will need to include this item.

C: Ensure that the energy audit is not focused solely on electrical energy but also focuses on fossil fuels and renewables to address the impact of greenhouse gas emissions.

C: Looking at satellite treatment plants is not necessarily a relevant topic at the moment and no dollars need to be expended on this effort at this time.

C: The climate change adaptation study should use information produced through Source Water Protection efforts which are looking at watershed information on pattern of events that may occur. GRCA has this information. Suggested contacting Lori Minshall. for TOR on Source Water Protection. Utilizing this information should decrease the cost of the study.

C: Update of the Sewer Use By-Law should be a high priority as the current seems out of date.

C: Concern was noted that a more stringent Sewer Use By-Law may incur unreasonable costs on industry. Therefore have to consider impacts on industry and include implementation periods.

Programs/Policies

The continuation of the City's ongoing programs was recommended:

- Water Conservation/Efficiency
- I/I Control
- Water Managers of the Grand

Infrastructure

Infrastructure recommendations were divided into three time frames:

- Short-term (2008 – 2020)
- Mid-term (2021-2031)
- Long-term (2032-2054)

A short term expansion to 73.3 MLD was approved through a previous Schedule C Class EA and would be achieved through optimization, a plant expansion or a combination of the two. It was recommended that advanced technology, such as membranes, be considered for expansions beyond 73.3 MLD.

Implementation

An implementation plan and cost opinions were provided for each of the recommendations described. These were integrated with previous projects identified by the City through previous studies or as required maintenance upgrades. It was reminded that the Master Plan would be reviewed and updated every five years and that the recommendations provided could change in the future.

Questions and Responses

C: It was noted that the administration building was missing from the implementation schedule and should be added.

C: It was noted that the projections did not take into account the impact that the economy might have on the community.

R: The master plan tables are not updated every year, but capital budgeting is revisited and updated annually.

C: The costs associated with the recommendations in the Master Plan should be prioritized and then Council should be advised on the costs.

Additional Comments and Questions

Questions and Responses

C: Recommendations should be included to improve education on wastewater

R: City staff currently have a very involved education program. A book on wastewater treatment has been produced and is distributed to class rooms. Staff from the WWTP also attend classrooms to provide education. Copies of the book were distributed.

C: Make a recommendation to the Development Charges (DC) Committee to not use the data, costs and recommendations in the Master Plan report until the report is finalized. This information has the potential to change tax regimes and incentives for conservation. The DC charges are artificially inflated. Wastewater flow rates are tracked by the traditional average flow so Energy Star items (for example) are taxed unfairly. Another example is the use of dual flush toilets that use 60% less water, yet are measured by the average numbers. There is a need to get rewording straight. The conservation portion of the Master Plan needs to be rewritten using numbers for growth rather than average flow.

C: If higher efficiency elements are confirmed then DC charges should be dropped. Conversely if elements do not meet the efficiency standard then DC charges should be increased.

C: Low energy houses cost less to operate, so there is a reward there.

R: Clarification was provided on how future flows were estimated. Uncommitted Reserve Capacity (URC) is a formula calculation dictated by the Provincial government. For Wastewater a 3 year average is used and for water a peak flow rate is used. These flow rates are used to determine how much wastewater or water demand is required per capita. For wastewater, the URC is the difference between current average flow rates and plant capacity plus the committed capacity determined from approved building permits and the type of dwelling to be built. The URC determines the amount of additional permits which can be issued and when the URC reaches 15% then planning for the next expansion is required. There is no flexibility in the current legislation to specifically increase the URC for buildings with conservation fixtures however, it was also noted that increased conservation measures result in additional capacity at the WWTP and increase the capacity available for development.

R: City staff explained the rationale when calculating development charges for using a budget number of $20M for the WWTP capacity increase to 73.3 MLD rather than the cost opinion of $30M contained in the Draft Master Plan. The City is prepared to take a risk that $30M will not be needed for capital expansion.

C: Asked for Council to be advised of data and any new information and, to revisit the DC rate in 1 year's time. Would prefer a freeze on DC until data is good. If capital projects are deferred then the DC should change to reflect this situation.

R: The DC report and recommendations can be revisited up to one year after they are confirmed. The recommendation for a Value Engineering exercise, planned for 2009 may produce results that may influence the DC charges.

C: It was suggested that cost block incentives be considered – for example using a m^3 avoidance cost.

C: Province has committed to developing new water conservation standards and will likely revise existing standards. Therefore, we should be cognizant of this and set goals that are in excess of current guidelines or standards.

R: CH2M HILL will document how the flow calculations are done by the MOE. (Diana suggested that if we can note the origin of some numbers, i.e. URC calculations, then the WWTMP can be more easily updated)

C: Would still like to make the estimates middle of the road.

C: It was suggested that water use is not increasing in parallel with population growth and money allocated for expansion should be eliminated. Paul commented that reductions from water conservation efforts become more difficult as the most easily implemented reductions are achieved.

C: There should be a line added on the graph to see if we spend on efficiency then we can decrease the dollars needed for infrastructure. Show conservation targets.

C: The follow sentence was offered for inclusion in the report – "It is expected that by the time these decisions are taken there is a move from operational objectives that are designed to avoiding effects to those of providing high quality water."

C: There should be a consideration (somewhere) that water taking may be frozen at 2008 levels. Cam indicated that if this was the case then this would extend existing capacity.

Suggestions to modify draft report:

- Update costs to be more aggressive (It was suggested that the tone of the report be more aggressive in terms of water conservation)
- Include more on conservation – a full City report is available and will be referenced.
- Prioritize recommendations and costs for Council consideration
- Explain the decisions and key milestones points for the first 10-year period of the Master Plan Implementation
- The first three years need to be carefully managed in the Report due to the changing market conditions.
- Include a note on economic conditions related to growth – what if there is a decrease in new units.
- Include a narrative to acknowledge that the projections of costs and demand are all moving targets and are contingent upon optimization, aggressive conservation, economy etc. Provide linkages with other studies and initiatives.
- Provide a cost table that can be more easily updated based on reductions from initiatives such as water conservation

City of Guelph Wastewater Treatment Master Plan

PAC Meeting #4
November 20, 2008

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Master Plan Purpose

To develop a 50-year Wastewater Treatment Plan to provide direction for wastewater infrastructure planning, investment, and implementation to the year 2054.

CH2MHILL

Mission Statement

In keeping with the City of Guelph's strategic plan, community vision, corporate responsibility, core values, and demonstrated commitment to environmental stewardship, develop a comprehensive master plan that addresses the long-term wastewater treatment servicing needs of the community over the next 50-year planning horizon.

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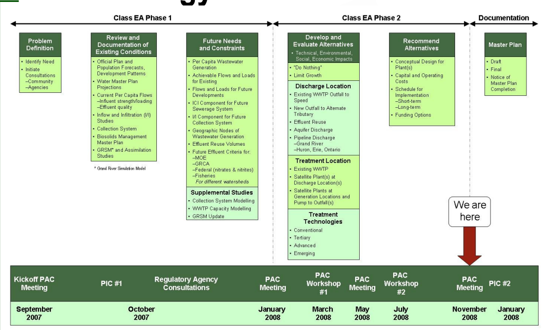
Methodology Overview



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Meeting Agenda

Workshop Topics: Master Plan Recommendations

1.	Welcome	Kiran Suresh
2.	Introduction	Don Drone
3.	Review of Recommendations	CH2M HILL
4.	Implementation Plan/Schedule	CH2M HILL
5.	Costing Estimates	CH2M HILL
6.	Additional Comments	All
7.	Next Steps	All

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Master Plan Recommendations

- Studies:
  - Urban Reuse, Facility Plan, Energy Audit, Satellite Treatment, Climate Change Adaptation, Sewer-Use By-Law Update
- Programs and Policies:
  - Water Conservation/Efficiency, I/I Control, Water Managers of the Grand
- Infrastructure:
  - Short-, Med-, and Long Term

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Recommendations: Studies

Urban Reuse

- Diversion of a portion of effluent for reuse
  - irrigation, dust control, dual water systems, industrial applications
- Need to confirm/determine:
  - Regulatory requirements
  - Market demand
  - Cost estimates
  - Impact on Speed River
  - Integration with other City services
  - $500,000 (allocation)

Facility Plan

- Planning tool for WWTP
  - looks at capital requirements over a defined period of time
- Assists with:
  - Determination of supporting upgrades
  - Confirmation of required maintenance
  - Detailed site layout for planning
  - Capital investment planning
  - $75,000 (allocation)

Energy Audit

- Supports the Community Energy Plan
  - assist with achieving energy goals
- Audit would look at:
  - Estimated annual energy use
  - Estimates of energy consumption by process
  - Estimates of renewable energy produced
  - Options for modifications/upgrades
  - Options for future specifications
  - $90,000 (allocation)

Satellite Treatment Plants

- To look at the feasibility of satellite treatment plants
  - As part of new developments
- Study would look at:
  - Regulatory requirements
  - Investigation of impacts (environmental, social etc.)
  - Cost estimates (capital and O&M)
  - $100,000 (allocation)

Climate Change Adaptation Study

- To examine potential impacts of climate change on wastewater treatment infrastructure
- Study would look at:
  - Predicted climate change scenarios
  - Potential impacts
  - Potential risks to the Guelph WWTP
  - $60,000 (allocation)

Sewer Use By-Law Update

- Update the existing by-law
  - ensure it is up to date and address gaps in content or enforcement approach
- Review would involve:
  - ensuring consistency with changes in regulations
  - reference to enforcement by-law
  - review nature of industries and develop a list of control parameters specific to City
  - $75,000 (allocation)

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Recommendations: Infrastructure

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Short-term Requirements

- 2008 – 2020
- Increased WWTP capacity to 73.3 MLD
  - through plant expansion
  - through optimization
    confirmation pending completion of demonstration tests and approvals (2009-2010)
  - through combination of both
- Previously approved under Schedule C Class EA (1998) & EA Update (2006)

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Medium-term Requirements

- 2021 – 2031
- WWTP Expansion to 85 MLD
  - recommending advanced technologies – tertiary membranes
- Schedule C Class EA required prior to expansion
- Master Plan provides rationale and background for Class EA
- $59.5M to $62.5M cost opinions

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Long-term Requirements

- 2032 – 2054
- WWTP Expansions to 144 MLD
  - through three potential expansions
  - preferred technology – tertiary membrane
- Will be re-examined through Master Plan updates (5-year intervals)
- Schedule C Class EA required prior to expansion

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Implementation Plan

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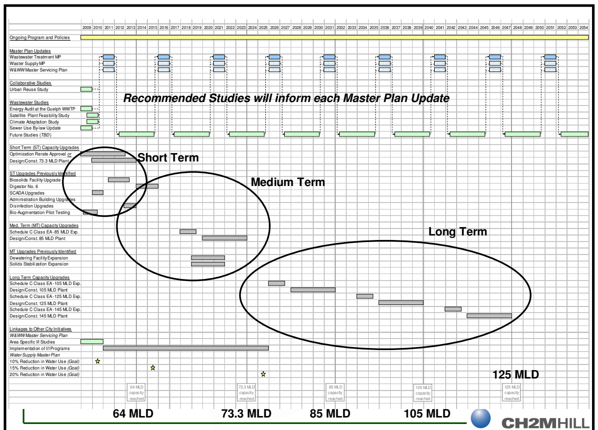

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Cost Estimates

Master Plan Recommendations	2008 – 2011	2012 – 2018	2019 - 2025	2026 – 2031	2032 - 2054
Facility Plan	$75,000				
Urban Reuse Study	$500,000				
Energy Audit at the WWTP	$90,000				
Satellite Plant Feasibility	$100,000				
Climate Adaptation Studies	$60,000				
Sewer Use By-Law Review and Update	$75,000				
Master Plan Updates	$200,000	$200,000	$200,000	$400,000	$800,000
Future Studies[1]		$500,000	$500,000	$500,000	$1,500,000
Optimization – Plant Rerating	$400,000	$100,000			
Phase 2 Expansion to 73.3 MLD	$20,000,600	$10,000,000			
Schedule C Class EA for 85 MLD Expansion		$400,000			
Design and Construction of 85 MLD Expansion			$60,000,000		
Long Term Expansions				$60,000,000	$120,000,000
From Biosolids Management Plan/Ongoing Maintenance/Upgrades					
Biosolids Facility Upgrade	$5,000,000	$37,000,000			
Digester No. 6		$6,000,000			
Dewatering Facility Expansion			$10,000,000		
Solids Stabilization Expansion			$15,000,000		
Secondary Pumping Expansion		$8,000,000			
Misc. WWTP Upgrades/Maintenance	$4,000,000	$4,000,000			
SCADA Upgrades	$550,000				
Administration Building Upgrades	$1,000,000				
Disinfection Upgrades		$8,000,000			
Bio-Augmentation Pilot Testing	$1,200,000				
Totals	**$33,250,600**	**$74,200,000**	**$85,700,000**	**$60,900,000**	**$122,300,000**

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Additional Comments?
Questions?

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Next Steps

- PIC #2 – Planned for early January 2009
- Master Plan filed for comment – end of January 2009
- Report to Council for Endorsement
- Implementation of Master Plan components starting with studies in 2009

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Thank You.

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Appendix H
Agency Consultation

Title	Name	Title 2	Company	Address1	City	Province	Postal Code	Organization Code
Ms.	Jennifer Arthur	EA and Planning Coordinator	Ministry of the Environment West Central Region Office	F12-119 King St. W.	Hamilton	Ontario	L8P 4Y7	1
Mr.	Paul Odom	Technical Support	Ministry of the Environment West Central Region Office	F12-119 King St. W.	Hamilton	Ontario	L8P 4Y7	1
Ms.	Dolly Goyette	District Manager	Ministry of the Environment Guelph District Office	1 Stone Road West, 4th Floor	Guelph	Ontario	N1G 4Y2	1
Mr.	Fred Natolochny	Senior Planner	Grand River Conservation Authority	400 Clyde Road, P.O. Box 729	Cambridge	Ontario	N1R 5W6	1
Ms.	Sandra Cooke	Senior Water Quality Supervisor	Grand River Conservation Authority	400 Clyde Road, P.O. Box 729	Cambridge	Ontario	N1R 5W6	1
Mr.	Mitch Wilson	Area Supervisor	Ministry of Natural Resources Guelph District	1 Stone Road West	Guelph	Ontario	N1G 4Y2	1
Ms	Paula Thompson	Senior Policy Advisor	Ministry of Natural Resources Water Resources Section, Lands and Waters Branch	300 Water Street P.O. Box 7000	Peterborough	Ontario	K9J 8M5	1

Ms.	Pam Wheaton	Directory, Policy and Relationships Branch	Ontario Secretary of Aboriginal Affairs	720 Bay St., 4^{th} Floor	Toronto	Ontario	M5G 2K1	1
Mr.	Surinder Singh Gill	Ontario Secretariat of Aboriginal Affairs, Attorney General	Policy and Relationships Branch	720 Bay St., 4^{th} Floor	Toronto	Ontario	M5G 2K1	1
Mr.	Rob Dobos	Head, EA Section, Ontario Region	Environment Canada	P.O. Box 5050, 867 Lakeshore Road	Burlington	Ontario	L7R 4A6	1
Mr.	Neal Ferris	Heritage Planner/Archaeologis t	Ministry of Culture	900 Highbury Ave.	London	Ontario	N6A 1L3	1
Mr.	Bruce Curtis	Manager Community Planning and Development	Ministry of Municipal Affairs and Housing	659 Exeter Road, 2^{nd} Floor	London	Ontario	N6E 1L3	1
Mr.	George Potter	Regional Manager	Ministry of Tourism and Recreation	30 Duke Street West, Suite 405	Kitchener	Ontario	N2H 3W5	1
Mr.	Kevin Bentley	Manager Southwestern Region	Ministry of Transportation	659 Exeter Road	London	Ontario	N6E 1L3	1
Ms	Carol Neumann	Rural Planner	Ministry of Agriculture and Food Agricultural Land Use Division	Wellington Place RR #1	Fergus	Ontario	N1M 2W3	1
Mr.	Wayne Orr	Director	Wellington-Dufferin-Guelph Health Unit	474 Wellington Road #18, Suite 100, RR#1	Fergus	Ontario	N1M 2W3	1

Mr.	Gary Cousins	Director of Planning	County of Wellington	74 Woolwich Street	Guelph	Ontario	N1H 3T9	2
Mr.	Thomas Schmidt	Commissioner of Transportation and Environmental Services	The Regional Municipality of Waterloo	150 Frederick Street	Kitchener	Ontario	N2G 4J3	2
Mr.	Eric Hodgins	Manager, Water Resources Protection	The Regional Municipality of Waterloo	150 Frederick Street	Kitchener	Ontario	N2G 4J3	2
Ms.	Janice Sheppard	Clerk/CAO	Township of Guelph/Eramosa	8348 Wellington Road 124 P.O. Box 3000	Rockwood	Ontario	N0B 2K0	2
Mr.	Darryl Lee	City Clerk	The City of Brantford	100 Wellington Square, P.O. Box 818	Brantford	Ontario	N3T 5R7	2
Ms	Janis Lankester	Chief Administrative Officer/City Clerk	County of Haldimand Clerk's Division Cayuga Administration Building	45 Munsee Street North P.O. Box 400	Cayuga	Ontario	N0A 1E0	2
Ms	Lindsay Burzese	Manager	Ministry of the Environment West Central Region Office	F12-119 King Street West	Hamilton	Ontario	L8P 4Y7	3
Ms	Mary Ellen Scanlon	Great Lakes Advisor/Analyst	Ministry of the Environment West Central Region Office	F12-119 King St. W.	Hamilton	Ontario	L8P 4Y7	3
Ms	Lou-Ann Cornacchio	APEP Supervisor	Ministry of the Environment Hamilton	F12-119 King St. W.	Hamilton	Ontario	L8P 4Y7	3

			Regional Office					
Ms	Jennifer Day	Public Affairs Specialist	International Joint Commission	100 Ouellette Avenue, Floor 8	Windsor	Ontario	N9A 6T3	3
Mr.	Jon MacDonagh-Dumler	Regional Coordination	Great Lakes Commission Eisenhower Corporate Park	2805 S Industrial Hwy, Suite 100	Ann Arbor	Michigan	48104-6791	3
Mr.	Mathew Doss	Environment Quality	Great Lakes Commission Eisenhower Corporate Park	2805 S Industrial Hwy, Suite 100	Ann Arbor	Michigan	48104-6791	3
Mr	John MacKenzie	General Manager, Planning Asset Review	Ontario Realty Corporation	11th Floor, Ferguson Block 77 Wellesley Street West	Toronto	Ontario	M7A 1N3	3
Mr.	Mark Wright	A/Inspection Supervisor Navigable Waters Protection	Fisheries and Oceans Canada Coast Guard Central & Artic Region	201 Front Street North, Suite 703	Sarnia	Ontario	N7T 8B1	3
Chief	David General		Six Nations of the Grand River Territory	PO Box 5000 1695 Chiefswood Road	Oshweken	Ontario		3
Grand Chief	Chris McCormick		Association of Iroquois and Allied Indians	387 Princess Avenue	London	Ontario	N6B 2A7	3
	Nadia Bartolini	A/Research Manager	Indian & Northern Affairs Canada Specific Claims	10 Wellington Street, Room 1610	Gatineau	Quebec	K1A 0H4	3

		Branch					
Louise Trepanier	Director, Claims East of Manitoba	Indian & Northern Affairs Branch Comprehensive Claims Branch	10 Wellington Street, Floor 8	Gatineau	Quebec	K1A 0H4	3

Codes for Organizations:
1 – Mandatory EA Review Agencies
2 – Other Municipalities
3 – Other Agency representatives

Notice of Commencement – Wastewater Treatment Master Plan

The City of Guelph is developing a 50-year Wastewater Treatment Master Plan to provide direction for wastewater infrastructure planning, investment and implementation to the year 2054. The Master Plan study will include a review of the City's current wastewater treatment infrastructure and an analysis of alternative treatment options to accommodate current and future wastewater treatment needs.

The Master Plan study will follow Phases 1 and 2 of the Municipal Class Environmental Assessment (June 2000) and will incorporate comments received from the public and agencies through consultations during the course of the study. Consultation with the public and government review agencies is a vital component of the study. Notices will be distributed to interested members of the public at key stages in the project, two public information sessions will be held, and information will be made available on the City's website.

As part of the Master Planning Process a Public Advisory Committee (PAC) will be established. The PAC will be responsible for providing advice and feedback to the Wastewater Treatment Master Plan project team at key milestone points over the course of the study. If you are interested on being a member of the PAC, applications are available on the City's website or by contacting the Project Manager listed below.

A mailing list of interested public and agencies will be developed. If you wish to be placed on the mailing list to receive project information, or if you have any questions regarding the study, please contact:

Kiran Suresh
Project Manager, Wastewater Services Division
Environmental Services Department
City Hall, 59 Carden Street
Guelph, Ontario N1H 3A1

Phone: (519) 837-5629
Fax: (519) 837-1226
E-mail: kiran.suresh@guelph.ca

CH2M HILL
Project Consultants
72 Victoria St. South
Suite 300
Ktichener, Ontario
N2G 4Y9

Phone: (519) 579-3500
Fax: (519) 579-8986
E-mail: GuelphWWTMP@ch2m.com

City website – www.guelph.ca

This Notice issued October 12, 2007 and 19, 2007.

Ministry of the Environment

119 King Street West
12th Floor
Hamilton, Ontario L8P 4Y7
Tel.: 905 521-7640
Fax: 905 521-7820

Ministère de l'Environnement

119 rue King ouest
12e étage
Hamilton (Ontario) L8P 4Y7
Tél. : 905 521-7640
Téléc. : 905 521-7820

Ontario

FILE No. 16.161.167

June 11, 2007

RECEIVED
City of Guelph
JUN 13 2007
Environmental
Services

KPS
cc: COW ✓
JLL ✓

Kiren Suresh
Wastewater Services Division
Environmental Services Department
City Hall, 59 Carden Street
Guelph, Ontario
N1H 3A1

**Re: City of Guelph Wastewater Master Plan
Notice of Master Plan Commencement**

Thank you for the Notice of Study Commencement dated May 31, 2007, regarding the Master Plan undertaking for the above noted project. Projects resulting from this type of study often require approval under the *Environmental Assessment Act* (EAA). To obtain the authority for the Projects to proceed, the City of Guelph must plan for the Project in accordance with the *Municipal Class Environmental Assessment* (Class EA).

In accordance with the Class EA, Master Plans are required to address a minimum of Phases 1 and 2 of the Class EA process. The work undertaken in the preparation of Master Plans should recognize the Planning and Design Process of the MEA Class EA, and should incorporate the key principles of successful environmental assessment planning identified in Section A.1.1. of the MEA Class EA document. It is also important that public and agency consultation take place during each phase of the study process, specifically at the initiation of the Master Plan and at the selection of the preferred set of alternatives stage.

It is important for the master planning process to ensure that the public is kept well-informed as to the progress that is being made, and that particular effort be made to ensure that information is readily available in as user-friendly language as possible, given the technical nature of the project. You should also be aware that is it becoming Ministry practice to require detailed documentation regarding the public consultation process that has been undertaken and the efforts made to address the public or agencies' concerns, especially where Part II Orders may be received.

With respect to agency consultation, please keep in mind the range of other approvals and/or permits that may be required in order to implement the specific projects that are identified through the master planning exercise. These agencies should be circulated so that their input is obtained and their issues are addressed. With respect to this Ministry, it is highly recommended that you begin consultation with our staff as early in the process as possible to discuss effluent criteria and assimilative capacity of the intended receiving water, as this fundamental to the consideration of wastewater treatment options to be identified in the Master Plan.

In summary, it is our expectation that the master planning exercise will:

- Address the key principles of successful environmental planning as outlined in Section A.1.1. of the MEA Class EA document;
- Address at least the first two phases of the MEA;
- Allow for an integrated process with other planning initiatives;
- Provide a strategic level assessment of various options to better address overall system needs and potential impacts and mitigation;
- Take a system-wide approach to planning which relates infrastructure either geographically or by a particular function;
- Recommend a master plan which can be executed through the implementation of separate projects; and
- Include a description of the specific projects including any other approvals that will be required.

Once the Master Plan is finalized, a final public notice is issued allowing the public an opportunity to review and provide input to the municipality. Depending on the Master Plan Approach selected, the final public notice may also become the Notice of Completion for any Schedule B or C projects identified within the study. You are reminded that when concerns are raised during the public comment period, the concerned party should be consulted in an attempt to resolve the concerns. Discussions to this end should proceed for an appropriate period of time, even if this means the 30-day review period is exceeded. The concerned party must be advised that if such discussions are unsuccessful at resolving the concerns, they can submit a Part II Order request if they have not already done so to the Minister within a further seven calendar days following the end of the discussions.

We request that the proponent forward one copy of the Notice of Completion with the complete Master Plan Document to this Office for our review, filing and potential comments as well as any information that is available in the interim.

Should you have any questions regarding the Class EA process, please feel free to contact me at (905) 521-7864 or at Barbara.Ryter@ontario.ca.

Thank you,

Barbara Ryter

Barbara Ryter
Environmental Assessment & Planning Coordinator
West Central Regional Office

cc. Ms D. Goyette (By Email only)

A.I.A.I.

Association of Iroquois and Allied Indians
Ontario Environmental Assessment Act
Fax Back Form

Date: July 13th

Kiran Suresh, Project Manager
Environmental Services Department
Wastewater Services Division
City Hall, 59 Carden Street
Guelph, Ontario, Canada
N1H 3A1
(519) 837 1226

Re:

City of Guelph Wastewater Treatment Master Plan Notice of Master Plan Commencement

We are in receipt of documentation produced under the Ontario Environmental Assessment Act for our review and comment. Please accept this letter as a response to your invitation and not an act of consultation. We cannot and do not consider this response letter to be consultation as we are not mandated to consult on behalf of our member nations. Our involvement as a representative for the First Nations occurs when invited by one of our member First Nations to do so. Consultation should always occur with the First Nation(s) specifically impacted.

As an association, we understand that your role in the environmental assessment process is primarily technical and that our concerns, which are Aboriginal rights, socio-economic and indigenous knowledge-based, are to fit within established scientific, technological and policy frameworks established by the Province of Ontario. We are of the view that this framework is invalid as it has been developed without input or consultation with First Nations.

Our organization receives no federal or provincial funding in helping to facilitate a mutual understanding of environmental concerns between proponents and our member First Nations. Based on this lack of understanding, funding and resources, we are only able to state that we do have member First Nations whose traditional hunting and gathering areas may be affected by this project.

Our organization and Member Nations are usually open to participating in sustainable planning processes. However, the current federal and provincial practices in this policy area are left to the goodwill of proponents, in terms of collaborating with First Nations, and in identifying potential First Nation issues and incorporating these into the overall planning processes.

Aboriginal people are listed as "stakeholders" in environmental assessment processes, however this is only partially correct. First Nations people have collective constitutional rights, including land rights, hunting, gathering and fishing rights. The practice and recognition of these rights in southern and central Ontario is an outstanding issue between the provincial and federal governments and our member Nations.

Therefore, in proposed land use situations, First Nations can seek legal remedies before the courts, including legal injunctions and other judicial intervention.

Our comments on documents produced under the current Environmental Assessment Act are as follows:

- It is our experience that when First Nations are approached respectfully and referenced in an appropriate way, that this overall approach tends to lead to more positive dialogue.

- We currently do not have the capacity to address the methodology developed for the site selection criteria and technological alternatives, at this particular time. The Proponent should use discretion in considering the selection of a site and technology that may interfere with the exercise of First Nations rights, including treaty and rights to access to wild game, water, plants, fish and ceremonial areas etc. Consideration should be put towards treaty boundary lines, real and potential land claims, and First Nations communities in the surrounding area.

- While the provincial EA legislation and EA practice may put the onus on the Proponent to consult First Nations, federal and provincial Crowns do have a constitutional obligation to uphold the rights of First Nations, and a duty to consult. The provincial and federal governments may not be forthcoming regarding this duty, as this duty currently exists in common law and is not reflected in Ontario EA legislation; which needs to be updated.

- As a safeguard, we suggest that First Nations be directly involved in the development and application of the Terms of Reference to accommodate for any potential First Nation intervention or interests. This approach would be ideal for addressing any First Nation issues that may arise. For example, where there may be archaeological discoveries at a site, First Nations customs vary and the Proponent should be ready to address that situation with the appropriate First Nations, in an innovative or other culturally appropriate manner.

- Based on archeological finds, it may be necessary to consult with other First Nations that have not been presently identified by the Ministry of the Environment or the Ontario Aboriginal Affairs Secretariat. First Nations that currently reside in the Province of Quebec may also have an interest in projects located in Ontario.

We thank you for taking the time to contact our organization and regret that we are not able to provide you with more assistance. If you have further questions or concerns please contact our office at (519) 434-2761.

Sincerely,

Adriana Poulette B.A., M.A.
Senior Policy Analyst and Government Relations Advisor
The Association of Iroquois and Allied Indians

Ontario

Ministry of Municipal Affairs and Housing
Ministère des Affaires municipales et du Logement

Municipal Services Office - Southwestern
659 Exeter Road, 2nd Floor
London ON N6E 1L3
Telephone: (519) 873-4020
Toll Free: 1-800-265-4736
Fax: (519) 873-4018

Bureau des services aux municipalités - région du Sud-Ouest
659 Exeter Road, 2e étage
London ON N6E 1L3
(519) 873-4020
Sans frais: 1-800-265-4736
Télécopieur: (519) 873-4018

June 12, 2007

Kiran Suresh, Project Manager
Wastewater Services Division
City of Guelph
City Hall, 59 Carden Street
Guelph, ON N1H 3A1

Dear Kiran,

Re: Notification of Master Plan Commencement
City of Guelph Wastewater Treatment Master Plan

Thank you for your recent circulation of the above-noted matter to us for our review. In this regard, we offer the following comments for your consideration.

The purpose of this Class Environmental Assessment is to develop a 50-year Wastewater Treatment Master Plan for the City of Guelph to provide direction for wastewater infrastructure planning, investment and implementation to the year 2054. It is understood the Master Plan study will include a review of the City's current wastewater treatment infrastructure and an analysis of alternative treatment options to accommodate current and future wastewater treatment needs.

This office provides access to provincial services on municipal government, finance and administration, as well as land use planning and development issues covered under the *Planning Act*. Section 2 of the *Planning Act* speaks to matters of provincial interest. When exercising any authority that affects a planning matter, this section of the *Planning Act* directs decision-making bodies (whether it is a council of a municipality, a local board, a planning board, a minister of the Crown and a ministry, board, commission or agency of the government, or the Ontario Municipal Board) to be consistent with the policy statements issued under Section 3 of the *Planning Act* and to conform with provincial plans that are in effect.

On June 16, 2006, the Growth Plan came into effect and force. The Growth Plan contains population and employment forecasts for all upper tier and single tier municipalities within the Greater Golden Horseshoe and these forecasts are to be used when planning and managing growth. The City of Guelph is located within the Greater Golden Horseshoe and is subject to the Growth Plan requirements. A copy of the Growth Plan is available on the Ministry of Public Infrastructure Renewal website at: www.pir.gov.on.ca/english/growth/ggh_plan.htm.

Policies on land use planning matters in Ontario are also contained in the "Provincial Policy Statement 2005" (PPS). The PPS speaks to issues such as the promotion of efficient, cost-effective development and land use patterns and the proper consideration of the various resources of this province, as well as matters dealing with public health and safety. A copy of the PPS is available on our website at: www.mah.gov.on.ca/Page1485.aspx.

The requirements of the *Planning Act* apply to applications for planning approvals under this legislation; these applications include official plan amendments and zoning bylaw amendments. From our review of this particular matter, it appears that no planning approvals are being sought in this case. However, this project may have implications with respect to those matters covered by the Growth Plan and the PPS as noted above, and we recommend that you consider these policies in developing the 50-year Wastewater Treatment Master Plan for the City of Guelph. The Growth Plan is to read in conjunction with the PPS and where there is a conflict between the Growth Plan and the PPS, the Growth Plan policies prevail.

Environmental Assessments such as this, that examine wastewater treatment, should include input from neighbouring lower-tier municipalities and neighbouring upper-tier County governments. You should also ensure that you incorporate the City of Guelph's Official Plan policies into the assumptions regarding the preferred solution recommended under this Wastewater Master Plan study.

Finally, our comments on this undertaking should not be considered as approval for any other related applications under the *Planning Act* or other provincial legislation that may be required, may be related to, or may result from this project.

Please keep us on your circulation list for this project. If you have any questions or comments, please telephone me at (519) 873-4695.

Sincerely,

Dwayne Evans

Dwayne Evans, MCIP, RPP
Planner, MSO-Southwestern

SIX NATIONS COUNCIL

KPS.

FILE No. 16.161.167

June 27, 2007

RECEIVED
City of Guelph
JUL 10 2007
Environmental
Services

Kiran Suresh, Project Manager
Wastewater Services Division
City Hall, 59 Carden Street
Guelph ON N1H 3A1

Dear: Ms. Suresh

Re: City of Guelph Wastewater Treatment Master Plan
Notice of Master Plan Commencement

The Six Nations of the Grand River (Six Nations) has received the Notice of Commencement for the Wastewater Treatment Master Plan study.

Six Nations' cultural, sustenance and other rights are recognized by the Province of Ontario by way of the 1701 Treaty of Fort Albany. Six Nations' rights and interests in relation to lands six miles either side of the Grand River (the Grand River Tract) was also confirmed by way of treaty, through the Haldimand Proclamation of 1784.

Six Nations is requesting a meeting to discuss the current water/wastewater management of the City of Guelph. For further information, please do not hesitate to contact Lonny Bomberry at (519) 753-0665 ext. 12. We appreciate the City of Guelph for informing us of this study.

Respectfully,

George Montour

Councillor George Montour, Chair
Six Nations Lands and Resources Committee
SIX NATIONS OF THE GRAND RIVER

CC: Mr. Lonny Bomberry, Director: Six Nations Lands and Resources
Mr. Leroy Hill, Secretary: Haudenosaunee Six Nations Confederacy Council
Minister David Ramsay, Ontario Ministry of Aboriginal Affairs and Natural Resources
Minister Jim Prentice, Indian and Northern Affairs

This letter is without prejudice to the positions that Six Nations has and may take in respect to its claims and litigation in relation to the Six Nations Tract/ Haldimand Proclamation Lands.

Affaires indiennes et du Nord Canada | Indian and Northern Affairs Canada

October 30, 2007

Mr. Kiran Suresh
Project Manager
Wastewater Services
City Hall, 59 Carden Street
GUELPH, ON N1H 3A1

RE: Notice of Public Information Centre

Dear Mr. Suresh,

I am responding to your notification sent to the Comprehensive Claims Branch, by mail, on October 12, 2007.

We can confirm that there are no comprehensive claims in the City of Guelph, Ontario. We cannot make any comments regarding potential or future claims, or claims filed under other departmental policies. This includes claims under Canada's Specific Claims Policy or legal action by the First Nation against the Crown. For more information, I suggest you contact the Director General of Specific Claims Branch at (819) 994-2323 and the Director General of Litigation Management and Resolution Branch at (819) 997-3582.

INAC- Comprehensive Claims Branch does not have any specific interest in the project and would request to be taken out of the mailing list.

Yours truly,

Kevin Clement, A/ Director
for
Lynn Bernard, Director General
Comprehensive Claims Branch

DISCLAIMER: In this Disclaimer, "Canada" means Her Majesty the Queen in right of Canada and the Minister of Indian Affairs and Northern Development and their servants and agents. Canada does not warrant or assume any legal liability or responsibility for the accuracy, completeness, or usefulness of any data or information disclosed with this correspondence or for any actions in reliance upon such data or information or on any statement contained in this correspondence. Data and information is based on information in departmental records and is disclosed for convenience of reference only. In accordance with the provisions of the *Access to Information Act* and the *Privacy Act*, confidential information has not been disclosed. Canada does not act as a representative for any Aboriginal group for the purpose of any claim. Information from other government sources and private sources (including Aboriginal groups) should be sought, to ensure that the information you have is accurate and complete.

Canada

Appendix I
Public Consultation

Cambridge jobs head west

Babcock & Wilcox plant losing 75 workers

CAMBRIDGE

The union representing workers at Babcock & Wilcox Canada Ltd. is hoping any layoffs caused by the move of some work to Saskatchewan can largely be mitigated.

Increased competition from offshore manufacturers prompted Babcock & Wilcox to announce yesterday that it will shift fossil power-related tube shop work to its plant in Melville, Sask.

The move would result in the reduction of about 75 jobs in Cambridge, according to Yvette Amor, spokesperson for the company, a manufacturer of components for the nuclear industry.

The plant in Cambridge currently employs around 900 people.

David Hilker, a staff representative with the United Steelworkers, said he hopes the impact on individual workers will largely be offset by retirements and replacement work.

He said he has learned that 39 jobs will be affected in January because of the move of the tube shop work to Saskatchewan.

The rest of the impact may not be felt until next October, he said.

There are about 25 hourly workers who are eligible for retirement now, Hilker said.

By the time the full impact of the reduction is felt, there may be other retirements and perhaps replacement work in other parts of the industry, he said.

"So at the end of the day, hopefully it will be just a small number," of individuals who are affected, Hilker explained.

The company is also trying to mitigate the impact of the reduction by offering an early retirement program to the hourly employees in Cambridge.

Amor said it is not yet known how many people will take advantage of the early retirement opportunity.

The Saskatchewan plant recently lost more than half its workforce.

Babcock & Wilcox announced it was laying off 48 people in Melville because of lower demand for products and increased competition.

But it is still cheaper to do the tube shop work in Melville, and by shifting the work to that site, the company hopes to become more competitive, Amor said.

"It is an efficient operation in Melville, so we definitely want to keep it going," she said.

The central reason for the workforce reduction is offshore competition from manufacturers in countries such as China, Mexico and eastern Europe, where some components are also being made for the nuclear industry at a cheaper price, Amor said.

The high Canadian dollar is not a direct cause of the layoffs, "but it doesn't shield us in any way," she said.

Had the Canadian dollar continued to be low, "we would have had more wiggle room to make it work."

Amor said the company will still maintain a core tube shop in Cambridge to serve as an emergency repair facility for boiler panels.

• *The Record*

ALONG FOR THE RIDE THE RECORD

Laura Arnold rides with her dog Marley inside a specially-built seat on the back of her scooter as she travels around Kitchener yesterday.

Body from Grand River is identified

BRANTFORD

A body pulled from the Grand River this week has been tentatively identified as missing Brantford resident Leo Sexsmith who disappeared during a boating trip with a friend last week.

Members of the OPP emergency response and canine team found the body floating in an isolated section of the river at about 4 p.m. Wednesday.

OPP spokesperson Mark Foster said the body was sent to the Hamilton General Hospital for a post mortem examination to determine the cause of death and confirm the man's identity.

Results of the post mortem weren't available yesterday.

Foster said Sexsmith, 58, and a 60-year-old friend had launched the boat Oct. 4 in Brantford at about noon. They were on the water for an undetermined period of time before Sexmith fell into the river and disappeared.

At about 5:30 a.m., Oct. 5, two boaters found his 60-year-old friend on the riverbank. He had the boat with him and appeared to be in distress.

When police arrived at the scene about an hour later, he told them his friend was missing in the river.

• *Hamilton Spectator*

Family reeling from Thanksgiving crash

Police blame street racing for two deaths

KITCHENER

Jennifer Waites' days now drift between sorrow and outrage.

Her 49-year-old mother lies in a Beeton cemetery, and her nine-year-old son Benjamin will grow up without his grandmother.

Thanksgiving will forever be a dark reminder for her Kitchener family, Waites said, after the horrific seven-vehicle pileup on a highway south of Bolton.

Her mother, Cynthia Louise Dougherty, and her best friend Maria Dalsass, 44, were killed instantly on Saturday when an out-of-control car smashed into theirs, triggering a massive chain reaction.

Since learning of the death, Waites has spent her hours either crying, angry or violently ill.

"I can't eat, I can't sleep, I can't do anything. . . . This has shattered my family," Waites said. "I think I've burned a hole in the floor. All I do is pace."

What angers her is this: police say the crash seems linked to street racing.

Witnesses reported two men driving in separate cars at speeds in excess of 140 kilometres an hour in a posted 80 km/h zone before the crash.

Two Mississauga brothers have been charged with criminal negligence causing death.

"She didn't deserve to die like this," Waites said. "This wasn't her time. How can you accept something that is so stupid? You can't."

For nearly 40 years of her life, Kitchener was home for Dougherty.

Born Cynthia Lobsinger, she grew up on David Street, went to Forest Heights high school, and raised two children, Waites and brother Dustin, as a single mother.

About 10 years ago, Dougherty remarried and moved to Beeton, a small town north of Toronto.

She found "happiness" and planned to retire there, Waites said.

She and husband Derrick Dougherty had recently bought a new home and spent their weekends boating on Georgian Bay.

Dougherty was very spiritual, Waites said, and even after moving two hours away, always seemed to know to call when something wasn't right with her daughter.

Now her daughter is bracing herself to follow the case against the two brothers through the courts.

There is a bail hearing today.

She said reliving the tragedy in a courtroom is not something she wants to do but has to do.

"I have to do this for her," Waites said.

"I need justice to be served. My family doesn't want me to do it, but I feel like it's my job now."

Dougherty and Dalsass' deaths were immediately seized upon by Ontario's political leaders in the dying days of the election.

Waites hopes their condemnation of the incident will translate into tougher laws to curb street racing.

A public outcry is needed, she said.

"If it had just been an accident, I wouldn't be doing this is," she said. "Something needs to be changed."

All this comes after new legislation that aimed to curb street racing — including giving police the power to impound vehicles for one week that are driven over 50 km/h above posted limits — was just implemented this month.

In between sobs, Waites asks one more request of a reporter.

"Can you put in there that we're going to miss her very much, and that we hope she rests in peace?"

• *The Record*

Welcome to the

City of Guelph
Wastewater Treatment
Master Plan
Public Information Centre

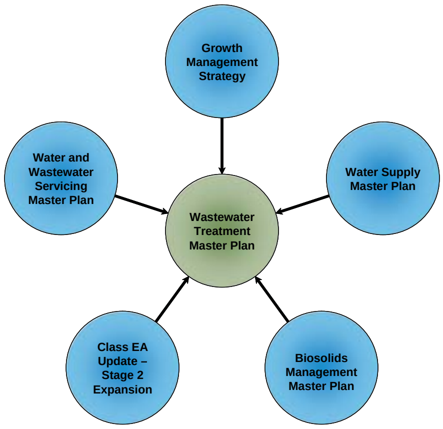
October 24, 2007

Please Sign In and take an Information Bulletin and Comment Sheet.
City of Guelph staff and their consultants from CH2M HILL are on hand to answer your questions.

City of Guelph   CH2MHILL

Master Plan Purpose and Study Area

The City of Guelph is undertaking, or has recently undertaken, a number of planning initiatives and strategies that examine the changing demographics in the City and regulatory environments and the impact these changes have on municipal services.



Master Plan Purpose

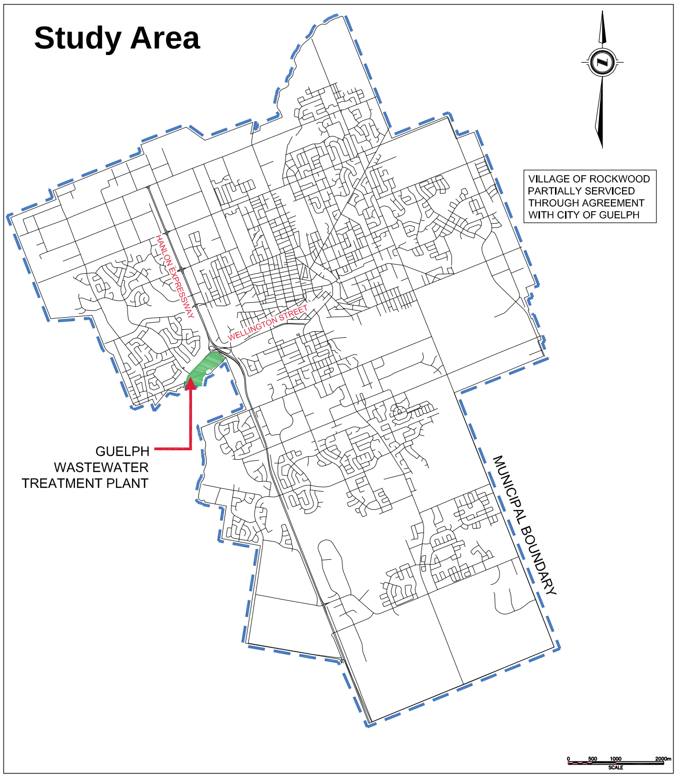
To develop a 50-year Wastewater Treatment Plan to provide direction for wastewater infrastructure planning, investment and implementation to the year 2055.

Mission Statement

In keeping with the City of Guelph's strategic plan, community vision, corporate responsibility, core values, and demonstrated commitment to environmental stewardship, develop a comprehensive master plan that addresses the long-term wastewater treatment servicing needs of the community over the next 50-year planning horizon.

Study Area

The Guelph Wastewater Treatment Plant (WWTP) collects and treats wastewater from within the urban boundaries of the City of Guelph. The WWTP also treats wastewater from the Village of Rockwood through a Memorandum of Understanding with the City of Guelph.



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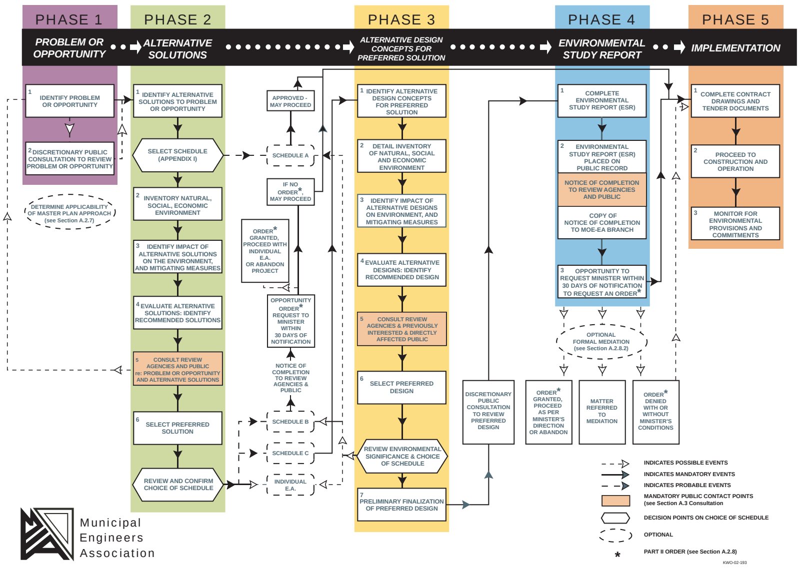
Study Methodology

Master Plans are long range plans that examine the current and future requirements of a given infrastructure system using environmental assessment planning principles. Master Plans, at a minimum, must address Phases 1 and 2 of the Municipal Class Environmental Assessment (EA) process as shown below.

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



The approach from Phases 1 and 2 of the Class EA was further refined to develop the decision-making process for the Guelph Wastewater Treatment Master Plan project as shown below.

Master Plan Approach

Class EA Phase 1

Problem Definition
- Identify Need
- Initiate Consultations
  –Community
  –Agencies

Review and Documentation of Existing Conditions
- Official Plan and Population Forecasts, Development Patterns
- Water Master Plan Projections
- Current Per Capita Flows
  –Influent strength/loading
  –Effluent quality
- Inflow and Infiltration (I/I) Studies
- Collection System
- Biosolids Management Master Plan
- GRSM* and Assimilation Studies

* Grand River Simulation Model

Future Needs and Constraints
- Per Capita Wastewater Generation
- Achievable Flows and Loads for Existing
- Flows and Loads for Future Developments
- ICI Component for Future Sewerage System
- I/I Component for Future Collection System
- Geographic Nodes of Wastewater Generation
- Effluent Reuse Volumes
- Future Effluent Criteria for:
  –MOE
  –GRCA
  –Federal (nitrates & nitrites)
  –Fisheries
  For different watersheds

Supplemental Studies
- Collection System Modelling
- WWTP Capacity Modelling
- GRSM Update

Class EA Phase 2

Develop and Evaluate Alternatives
- Technical, Environmental, Social, Economic Impacts

- "Do Nothing"
- Limit Growth

Discharge Location
- Existing WWTP Outfall to Speed
- New Outfall to Alternate Tributary
- Effluent Reuse
- Aquifer Discharge
- Pipeline Discharge
  –Grand River
  –Huron, Erie, Ontario

Treatment Location
- Existing WWTP
- Satellite Plant(s) at Discharge Location(s)
- Satellite Plants at Generation Locations and Pump to Outfall(s)

Treatment Technologies
- Conventional
- Tertiary
- Advanced
- Emerging

Recommend Alternatives
- Conceptual Design for Plant(s) and Collection System
- Capital and Operating Costs
- Schedule for Implementation
  –Short-term
  –Long-term
- Funding Options

Documentation

Master Plan
- Draft
- Final
- Notice of Master Plan Completion

Kickoff PAC Meeting	PIC #1	Regulatory Agency Consultations	PAC Meeting	Regulatory Agency Consultation	PAC Meeting	PIC #2	PAC Meeting

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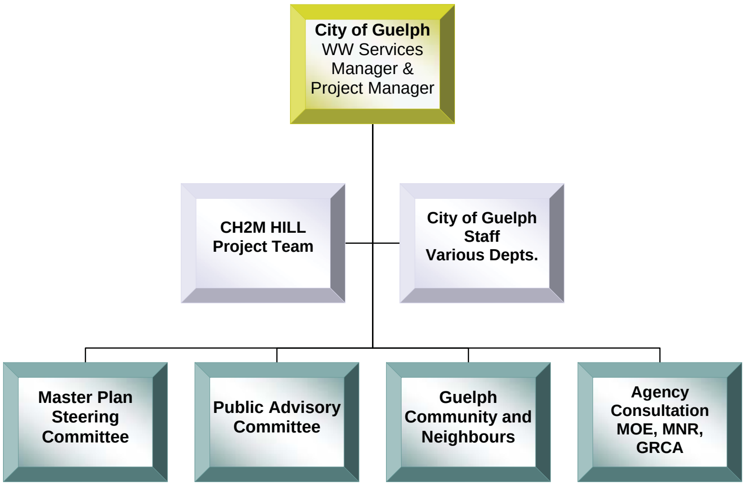
Consultation Plan

In order to facilitate effective communication with stakeholders, a consultation plan was developed for the WWTP. The plan includes the active participation of a Public Advisory Committee and two Public Information Centres.

The City of Guelph wants to provide stakeholders an opportunity to offer suggestions, comments, and ideas into the Master Planning process. The various stakeholders are shown in the figure below.

Master Plan Stakeholders



The Public Advisory Committee (PAC) is responsible for providing advice and feedback to the project. Members of the PAC and the organizations they are representing are listed below.

Community Sector	Representative
Business/Industry (2)	Doan Bellman (Sleeman Breweries) Ian Smith (Chamber of Commerce)
Development	Paul McLennan (Guelph Developers Association)
Academia	Khosrow Farahbakhsh (University of Guelph)
Agriculture	Gary Nelson (Federation of Agriculture)
Environment (2)	Dorothy Remmer, Laura Murr (Green Plan Steering Committee)
Community-at-Large (2)	James Ford, Hugh Whiteley
Council	Bob Bell
Chair	Don Drone

The Master Plan Steering Committee is responsible for advising on technical issues and activities, and is comprised of members of the project team, City staff, and the GRCA.

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Guelph Wastewater Treatment Plant (WWTP)

The Guelph WWTP has a current rated capacity of 64 MLD and a capacity of 73.3 MLD approved for the next future expansion.

Wastewater arriving at the Guelph WWTP undergoes multiple stages of treatment: preliminary, primary, secondary, tertiary and disinfection. The final treated effluent is discharged to the Speed River.

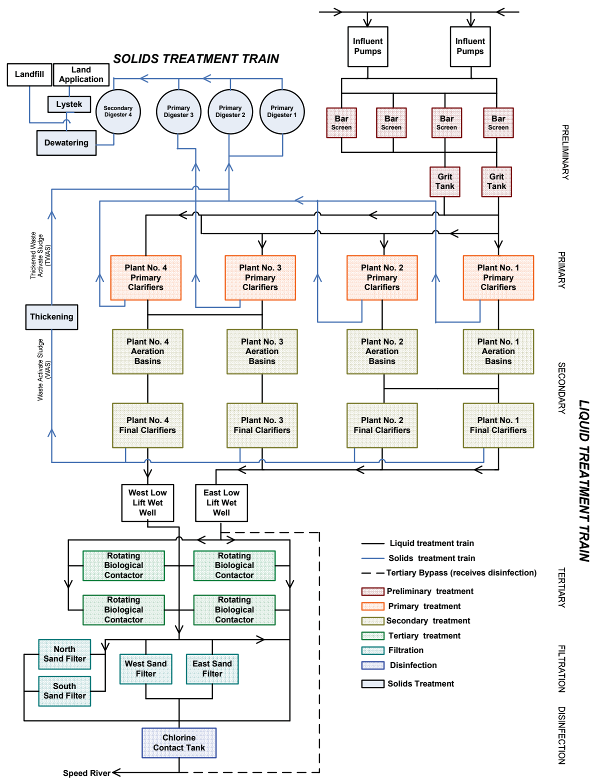
Over the years, the WWTP has undergone numerous upgrades and expansions:

Table 1 – History of Guelph WWTP

	1958	Plant No. 2
Plant No.3	1968	
	1978	Rotating biological contactors Automatic backwash filters for nitrification and filtration
Instrumentation and control upgrade	1979	
	1980	Outfall extension
Sludge Dewatering Facilities Plant Headworks	1983	
	1986	Fine bubble aeration retrofit
Plant No. 1 upgrade	1987	
	1992	Dewatering Facility upgrades
Sludge composting facilities	1995	
	1996	Digester and heating upgrade
Digester No. 3 upgrade	1997	
	1998	Wastewater Treatment Strategy Class EA
Plant No. 4 upgrade	2001	
	2007	Biosolids Management Master Plan Class EA
Class EA Update Stage 2 Expansion	2007	
	2007	Digester Capacity Expansion

The figure below shows the current treatment processes at the WWTP.

The interconnection of the various treatment processes is shown in the following schematic:



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Existing Conditions and Future Wastewater Projections

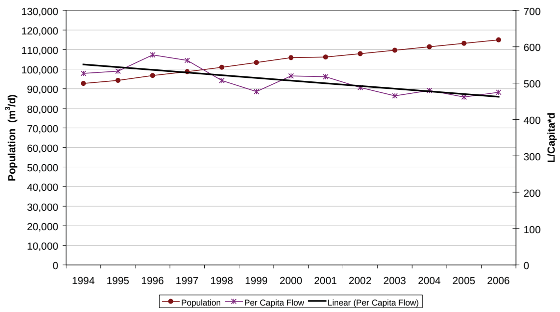
To predict future wastewater flows, it is important to determine the current wastewater generation rate. Table 2 summarizes data used to estimate the per capita wastewater generation rate.

Table 2 - Current Flow and Population Data for the Guelph WWTP

Parameter	Value
Total Average Daily Flow (2006)	55,896 m^3/d
Average Daily Flow from Rockwood (2006)	956 m^3/d
Average Daily Flow from Guelph only (2006)	54,940 m^3/d
2006 Population (from census)	114,943

The per capita wastewater generation rate for Guelph is 478 litres per capita per day (Lpcd). This rate is representative of total wastewater flows arriving at the WWTP including inflow and infiltration. The City's ongoing water conservation and inflow/infiltration initiatives have resulted in a decrease in the per capita generation rate, as can be seen in the figure below.

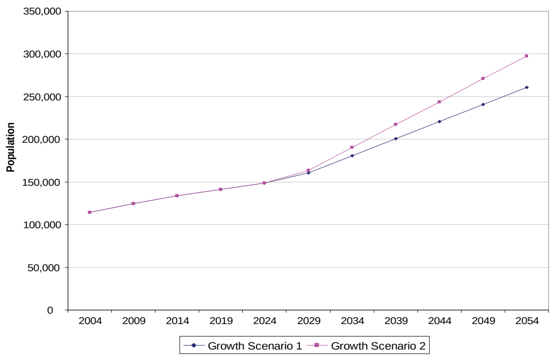
Population and Per Capita Flow



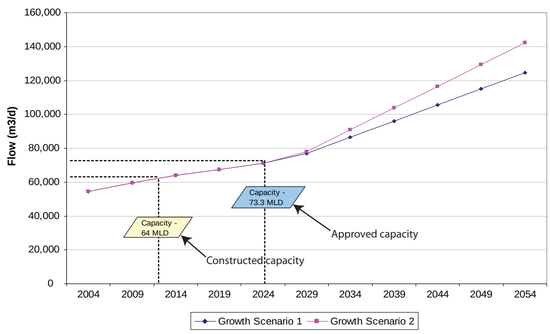
As population in the City of Guelph increases, so will the wastewater volume that requires treatment. Two growth scenarios from the Water Service Master Plan were carried forward to be used in the Wastewater Treatment Master Plan and are shown in the figure below.

The flow projections shown in the figure below are considered a conservative estimate, based on future per capita wastewater generation rates remaining consistent with current values. Programs such as water conservation and effluent reuse could impact these per capita rates.

Population Projections for the City of Guelph (2004 – 2054)



Wastewater Flow Projections for the Guelph WWTP (2004 – 2054)



Preliminary Alternative Solutions

Alternative Solution

Means feasible alternative ways of solving an identified problem (deficiency) or addressing an opportunity, from which a preferred solution is selected.

(Source: Municipal Class Environmental Assessment June 2000)

The following descriptions provide a brief overview of the alternative solutions that will be evaluated as part of the Wastewater Treatment Master Plan.

Planning Alternatives

- "Do Nothing"
  Is used as a baseline for comparison
- Limit Growth
  Growth projections are being examined as part of the Growth Management Strategy

Source Control Alternatives

- Inflow and Infiltration
  Reducing extraneous flows from entering the sewer system, e.g. through cracked pipes, maintenance hole covers, and connect roof leaders
- Sewer Use By-law
  Controlling the types and amounts of certain parameters that may enter the sewer system. Requires some industries to pretreat wastewater.
- Water Conservation
  Reducing the amount of wastewater generated

Discharge Location Alternatives

- Existing WWTP Outfall to Speed River
  Examination of the capacity of the Speed River to accept additional treated effluent flows and loads
- New Outfall to Alternate Receiver
  Examination of discharging effluent to a larger receiving water body to accept additional flows and loads
  –Grand River (River-based)
  –Huron, Erie, Ontario (Lake-based)
- Effluent Reuse
  Reusing treated effluent for seasonal irrigation on lands such as golf courses and municipal landscaping
- Aquifer Disposal
  Disposal by injecting into a non-potable aquifer

Preliminary Alternative Solutions

Treatment Location Alternatives

- Existing WWTP
  Continuing treatment at the existing location
- Satellite Plant(s) at Discharge Location(s)
  If alternate discharge location is found to be appropriate, construction of a new (satellite) plant at that location to manage a portion of the wastewater flows
- Satellite Plants at Generation Locations and Pump to Outfall(s)
  Construction of a new facility located where new wastewater generation (growth) is anticipated, discharge location would be dependant on location of anticipated growth

Treatment Technology Alternatives

- Conventional
  Preliminary, primary and secondary treatment processes, effluent disinfection
- Tertiary
  Provision of additional stage of treatment, could include sand filtration or biological contactors
- Advanced
  Application of advanced treatment technologies, such as membrane filtration, to achieve higher quality effluent than primary and tertiary
- Emerging
  Application of advanced tertiary oxidation, carbon adsorption or new technologies to further reduce organic contaminants

Ongoing Initiatives

Water Conservation

Water conservation, not only decreases the amount of water that is produced, but may decrease the amount of wastewater generated. Between 1999 and 2006 the Water Conservation & Efficiency Plan has decreased water usage by approximately 2,000 m^3/day. The water savings are in large part due to the following programs:

- Toilet Replacement Program (450 m^3/day);
- Industrial, Commercial, and Institutional (IC&I) Efficiency Program (300 m^3/day);
- Unaccounted for Water (UFW) Initiatives (1,100 m^3/day).

Sewer Use By-law

The sewer use by-law regulates the type and amount of certain parameters that may be discharged to the sanitary sewer collection system and ultimately arrive at the Treatment Plant. The City has been working with local industries to install pretreatment technologies to decrease their loadings to the sewer system.

As part of the Wastewater Treatment Master Plan, this by-law will be examined to determine if additional refinements to the by-law are required.

Energy Conservation Initiatives

The cogeneration upgrade at the WWTP will enable the re-commissioning of the two cogeneration engines and generators. The existing cogeneration units, once upgraded, will produce up to 1/3 of the total power requirement for the City's wastewater treatment infrastructure. Utilizing the digester gas to generate power will reduce our electrical consumption from the grid and will also be used as standby power.

The City is demonstrating leadership and setting an example for the community in using renewable resources for electricity generation as part of the Community Energy Plan.

Other initiatives underway include the adding of variable frequency drive (VFD) to pumps where applicable, this can offer potential energy savings in a system in which the loads vary with time. The blower operation is being reviewed in order to tap into any potential for energy savings.

Wastewater Treatment Optimization

The City of Guelph has initiated a wastewater facility comprehensive optimization program. Among the objectives of the program is to work with City staff, regulatory agencies, and external partners and stakeholders to achieve exemplary, sustainable, and economical performance from the physical and human asset, and to be a leader in North American in terms of protecting the environment and establishing Best Management Practices.

Next Steps

- Further development and evaluation of alternatives
  - Evaluation criteria will be developed through communication with the Public Advisory Committee and Steering Committee
- Recommended alternatives
  - The evaluation will result in recommendations for the City to move forward with
- Second Public Information Centre (Early 2008)
  - The next Information Centre will present the evaluation approach and recommendations for public comment
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- Ongoing communication with:
  - Public Advisory Committee
  - Steering Committee
  - Regulatory Agencies

Schedule

Alternatives Development	~ November – December 2007
Alternatives Evaluation	~ December 2007 – January 2008
Second Public Information Centre	~ Early 2008

Project website: www.guelph.ca/wastewater

City of Guelph

Wastewater Treatment Master Plan

INFORMATION BRIEF **OCTOBER 2007**

Introduction

The City of Guelph is preparing a 50-year Wastewater Treatment Master Plan. This Information Brief provides an introduction to the project and highlights key activities that are planned.

Study Purpose

The purpose of the Master Plan is to develop a strategy to provide direction for wastewater infrastructure planning, investment and implementation to the year 2054. The study includes a review of the City's current wastewater treatment infrastructure and an analysis of alternative solutions to accommodate future wastewater treatment needs.

Mission Statement

In keeping with the City of Guelph's strategic plan, community vision, corporate responsibility, core values, and demonstrated commitment to environmental stewardship, develop a comprehensive master plan that addresses the long-term wastewater treatment servicing needs of the community over the next 50-year planning horizon.

Decision-Making Process

This study is following the Municipal Class Environmental Assessment process for master plans. Major tasks include the preparation of a statement of need, development of a management strategy through an evaluation of alternatives and documentation of a Master Plan. Consultation with the community is an important component of the decision-making process.

Other City Initiatives

The City of Guelph is undertaking, or has recently undertaken, a number of planning initiatives and strategies that examine the changing demographics in the City and regulatory environments and the impact these changes have on municipal services. The ongoing initiatives which relate to the Wastewater Treatment Master Plan are shown in Figure 1.

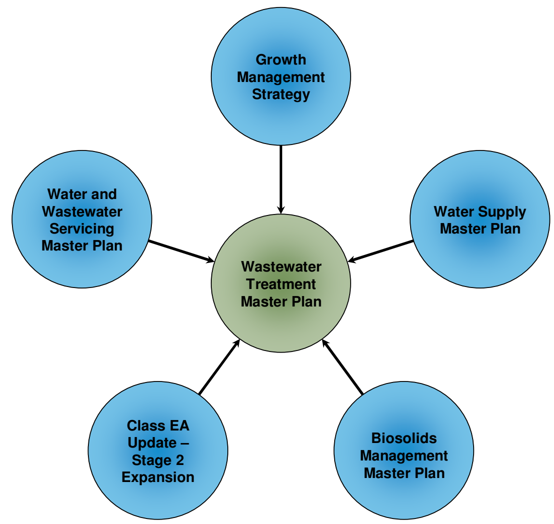

Figure 1: City Initiatives relating to the Master Plan

The Study Area

The Guelph Wastewater Treatment Plant (WWTP) collects and treats wastewater from within the urban boundaries of the City of Guelph. The WWTP also treats wastewater from the Village of Rockwood through a Memorandum of Understanding with the City of Guelph.

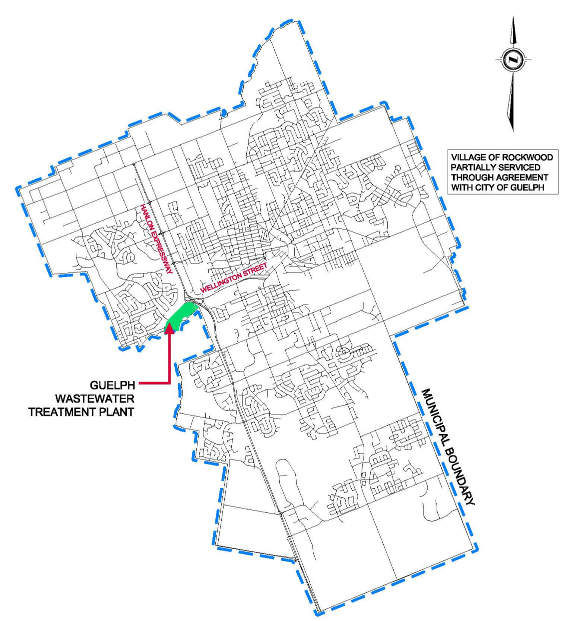

Figure 2: Study Area

The Existing Wastewater Treatment Plant (WWTP)

The Guelph WWTP has a current rated capacity of 64 MLD and a capacity of 73.3 MLD approved for the next future expansion.

The existing WWTP consists of four treatment plants. Wastewater receives primary treatment (including screening and grit removal). Partial secondary treatment is achieved in Plants 1 to 3 followed by tertiary treatment in rotating biological reactors to remove additional ammonia. Wastewater flow treated in Plant 4 receives full nitrification. The combined wastewater flows are then passed through tertiary filters, received disinfection and final treated effluent is then discharged through an outfall pipe to the Speed River.

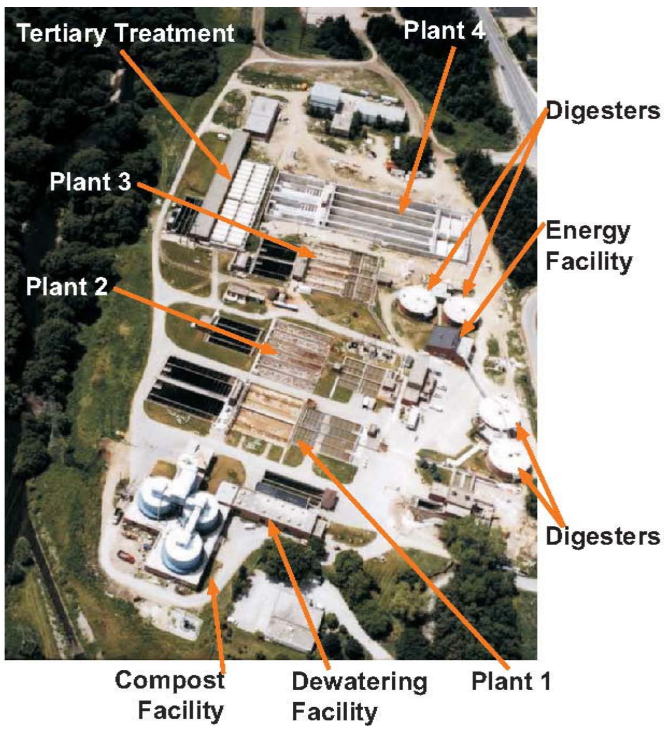

Figure 3: The Existing Guelph WWTP

Ongoing Initiatives at the Plant

Water Conservation

Water conservation, not only decreases the amount of water that is produced, but may decrease the amount of wastewater generated. Between 1999 and 2006 the Water Conservation & Efficiency Plan has decreased water usage by approximately 2,000 m^3/day. The water savings are in large part due to the following programs:

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The sewer use by-law regulates the type and amount of certain parameters that may be discharged to the sanitary sewer collection system and ultimately arrive at the Treatment Plant. As part of the Wastewater Treatment Master Plan this by-law will be examined.

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The cogeneration upgrade at the WWTP will enable the re-commissioning of the two reciprocating cogeneration engines (290 kilowatt capacity each), and generators. The existing cogeneration units, once upgraded, will produce up to 1/3 of the total power requirement for the City's wastewater treatment infrastructure, while maximizing the use of existing infrastructure. Utilizing the digester gas to generate power will reduce our electrical consumption from the grid and will also be used as standby power.

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Existing Wastewater Flows and Future Predictions

To predict future wastewater flows, it is important to determine the current wastewater generation rate. Table 1 summarizes data used to estimate the per capita wastewater generation rate.

TABLE 1 - CURRENT FLOW AND POPULATION DATA FOR THE GUELPH WWTP

Parameter	Value
Total Average Daily Flow (2006)	55,896 m^3/d
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The per capita wastewater generation rate for Guelph is 478 litres per capita per day (Lpcd). This rate is representative of total wastewater flows arriving at the WWTP including inflow and infiltration.

345572A1T1_WB102007002KWO

Population Projections…

As population in the City of Guelph increases, so will the wastewater volume that requires treatment. Two growth scenarios from the Water Service Master Plan were carried forward to be used in the Wastewater Treatment Master Plan and are shown in Figure 4.

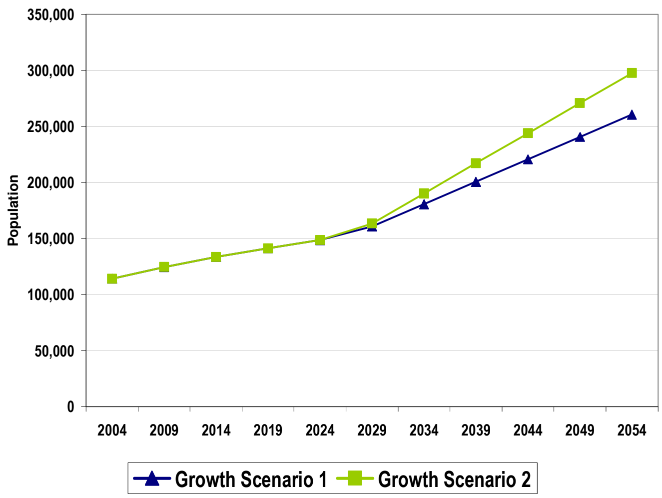

Figure 4: City of Guelph – Population Projections

Future Flow Projections…

The flow projections shown in the figure below are considered a conservative estimate, based on future per capita wastewater generation rates remaining consistent with current values. Programs such as water conservation and effluent reuse could impact these per capita rates. The estimated years when the current and future approved capacities will be reached are also shown in the Figure 5.

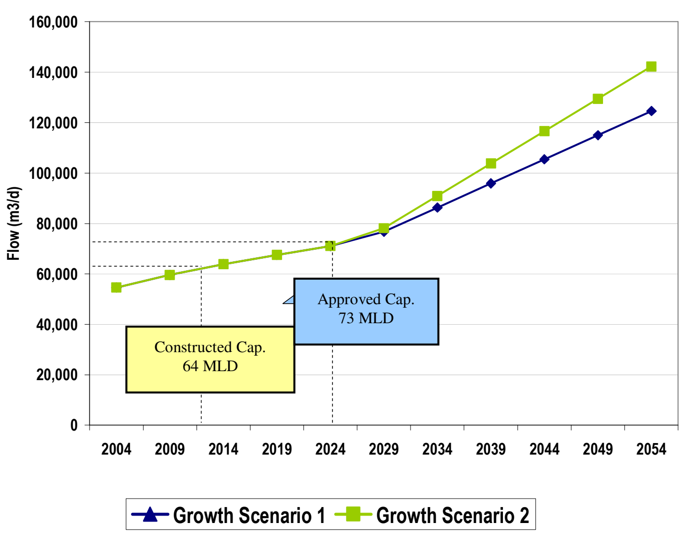

Figure 5: City of Guelph – Flow Projections

Preliminary Alternative Solutions

Alternative Solution

Means feasible alternative ways of solving an identified problem (deficiency) or addressing an opportunity, from which a preferred solution is selected.

(Source: Municipal Class Environmental Assessment June 2000)

The following descriptions provide a brief overview of the alternative solutions that will be evaluated as part of the Wastewater Treatment Master Plan.

Planning Alternatives

- "Do Nothing"
  Is used as a baseline for comparison
- Limit Growth
  Growth projections are being examined as part of the Growth Management Strategy

Source Control

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  Reducing extraneous flows from entering the sewer system, e.g. through cracked pipes, maintenance hole covers, and connect roof leaders
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  Disposal by injecting into a non-potable aquifer

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  Preliminary, primary and secondary treatment processes, effluent disinfection
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Schedule

Alternatives Development	~ November – December 2007
Alternatives Evaluation	~ December 2007 – January 2008
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For additional information, please contact:

Kiran Suresh
Project Manager
Wastewater Services
City Hall, 59 Carden Street
Guelph, ON N1H 3A1
Fax (519)837-1226
kiran.suresh@guelph.ca
www.guelph.ca\wastewater

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City of Guelph

Wastewater Treatment Master Plan

COMMENT SHEET — OCTOBER 24, 2007

Thank you for your interest in the The City of Guelph Wastewater Treatment Master Plan. The City of Guelph encourages you to provide your comments on this sheet and hand it over in to project team members .The City is soliciting your feedback before the next phase is initiated. We would appreciate your input on the following questions.

1. The study is following the requirements of the Class EA process for Master Plans. *Do you have any questions, comments, or concerns about the decision-making processes that is being followed to prepare the Wastewater Treatment Master Plan?*

   G No G Yes Please provide details: ________________________________

2. Do you have any questions or concerns about the need for this study?

   G No G Yes Please provide details: ________________________________

3. The Master Plan has examined future wastewater flow projections and estimated when current and approved plant capacities will be realized. *Do you have any questions, comments, or concerns about these projections?*

   G No G Yes Please comment: ________________________________

4. The Master Plan has outlined a long-list of potential alternative solutions to address future wastewater treatment options. The alternatives are grouped by planning alternatives, source control, discharge location, treatment locations and treatment technologies. *Do you have any questions, comments or wish to suggest other potential alternatives that have not been included?*

   G No G Yes Please comment: ________________________________

Public Consultation

1. Was the time of the Public Information Centre convenient for you?

   G Yes G No

   If no, what time would be more convenient: ______________________

2. Did the Public Information Centre help you to better understand the need for this project?

   G Yes G No G Uncertain

3. Did you have enough opportunity to ask questions, make comments or express concerns?

   G Yes G No

4. Were those questions answered to your satisfaction?

   G Yes G No G Not applicable

   If the questions were not answered to your satisfaction, please list them here:

   ____

   ____

5. How useful did you find the Public Information Centre? (please circle one)

   Very Useful Not Very Useful

   1 2 3 4 5

6. How would you describe the nature of your interest in this study?

   G Member of the General Public
   G Member of an Interest Group. Please specify: ________________________
   G Consultant
   G Agency Representative. Please specify: ____________________________
   G Other. Please specify: ____

Optional information

Name:____

Address:____

Phone/fax:____ Email:______________________________

Your completed Comment Sheet will be included in the Wastewater Treatment Master Plan report, which will be made public at the completion of this study. Please place a (✓) in the box below if you wish to have your comments included anonymously.

G Please withhold my name, address, and telephone number from publication in the Wastewater Treatment Master Plan.

Please leave this completed Comment Sheet in the box provided at the Registration Table
or fax, mail or email it, by November 2, 2007 to:

Kiran Suresh
Project Manager
Wastewater Services
City Hall, 59 Carden Street
Guelph, ON N1H 3A1
Fax (519)837-1226
kiran.suresh@guelph.ca
www.guelph.ca

CH2M HILL
Project Consultants
300 – 72 Victoria St. S.
Kitchener, ON N2G 4Y9
Fax (519)579-8986
GuelphWWTMP@ch2m.com

Thank You for Your Participation in this project!

Comments from Guelph October 2007 PIC

Questions	Comments from Public	
1. The study is following the requirements of the Class EA process for Master Plans. *Do you have any questions, comments, or concerns about the decision-making processes that is being followed to prepare the Wastewater Treatment Master Plan?*	No, looks good.	Comment noted
	No	
	No	
	Yes Upon discussion with members within the PIC, I felt this was not an opportunity for members to effectively bring their opinion. I felt I was being presented finalized ideas with no room for change.	The intent of the initial PIC was to provide background on the objective of the study and to describe the process that would be undertaken to evaluate potential alternatives and develop a recommended strategy. At this point, the evaluation has not been completed and no preferred alternatives have been chosen.
	Yes Yes, the pipeline option was removed as a <u>viable</u> option from the Water Master Plan, and should be removed immediately from this plan. Residents of Guelph have made it very clear that this option <u>should not even be considered</u>.	As part of the master planning process, all options are put on the table. As part of the evaluation, the benefits and impacts as well as the viability of each option is considered. Options which are considered non-viable will not be included in the implementation plan.
	No	
	–	
	Yes Does the company conducting this project have any connection with any company providing water treatment/Transmission facilities or parts/equipment for same?	The consultant conducting the Wastewater Treatment Master Plan provides environmental and infrastructure engineering consulting services to municipalities and industries without affiliation to any parts or equipment suppliers.
	Yes The processes do not seem to include consultations re: climate change imperatives and how to fit in with Guelph's contribution to lowering greenhouse gases.	As part of the master planning process, City initiatives to lower greenhouse gases, such as the Community Energy Plan, will be examined. Additional initiatives that can be done at the Wastewater Treatment Plant to decrease green house gases can also be reviewed.
2. Do you have any questions or concerns about the need for this study?	No, places to grow dictates the need	Comment noted
	No	
	No	
	Yes Looking at decentralized, small-scale options.	The Master Plan study will consider a range of options to address short-, medium- and long-term needs of the City of Guelph. This will require evaluating the feasibility of satellite treatment facilities and alternative effluent

Questions	Comments from Public	
		discharge locations.
	No, it is certainly needed.	Comment Noted
	No	
	No There is a need for this study with the proposed/ predicted growth of the City of Guelph and the surrounding areas.	Comment Noted.
	–	
	No	
3. The Master Plan has examined future wastewater flow projections and estimated when current and approved plant capacities will be realized. *Do you have any questions, comments, or concerns about these projections?*	Yes, Have you included U of G and its growth?	Similar to the approach taken in the Water Supply Master Plan, the University has been included within the Industrial, Commercial and Institutional (ICI) sector. It has projected that growth will be seen within this sector.
	No	
	Projections should show probably effect of effluent re-use (e.g. irrigation), additional water conservation measures and reduced I/I.	It is difficult to definitively quantify the impact of various programs and initiatives on future flows. The potential impacts if various targets are met (i.e. water conservation targets) will be examined. For planning purposes, it is recommended that forecasting future capital works be based on current per capita wastewater generation rates. The City intends to update their various master plans every 5 years and with future updates of the completed Master Plan, the per capita wastewater generation rates will also be re-examined and the future projections will be updated at that time as appropriate.
	No	
	Yes Does not take into account expected flow rates of Speed River in future; they could very well be a lot lower, does not take into account possible limits to groundwater; could limit growth.	The Grand River Conservation Authority (GRCA) regulates flows on the Speed River to maintain flows during dry periods. As part of this study, the capacity of the Speed River will be examined and impacts examined using historical low flow values which include dry periods. The City will continue to work with the GRCA through their participation with the Water Managers of the Grand to look at the future of the Grand River watershed. The effects and potential impacts of Global Warming and its potential impacts will be reviewed in the master plan. Additionally, as it is intended that the

Questions	Comments from Public	
		Master Plan be updated every 5 years, impacts and trends effecting wastewater treatment and planned projections can be reviewed and incorporated into the master plan updates.
	Yes Make sure that anything relating to population density changes via places to grow is also accounted for.	The population projections being used for this study are intended to best reflect the anticipated growth rates for the City as outlined in the Places to Grow projections. As the Growth Management Strategy is being completed in parallel to this study, findings from the Growth Strategy will be integrated into the Wastewater Treatment Master Plan in subsequent future updates
	Yes Is the City of Guelph consulting with upstream & downstream municipalities which depend on river flows to carry wastewater as well?	The City of Guelph is an active member of The Water Managers of the Grand Committee, chaired by the GRCA. Membership includes the Water Managers of the municipalities within the Grand River Watershed.
	Yes Future growth figures are taken as a given w/o challenge or offering more desirable alternatives at lower growth figures. Part of the plan should be to challenge the province to direct growth to areas of water supply and disposal.	Future growth for the City of Guelph is being examined as part of the City's Growth Management Strategy. The Growth Strategy will be looking at the various growth alternatives. This Wastewater Treatment Master Plan study examines what wastewater treatment alternatives can be implemented to support the planned growth.
	Yes These seem based on historical data re: river flow and quantity – and ignoring – ecosystem impacts facing us in the near future re: river capacities.	The Grand River Conservation Authority (GRCA) regulates flows on the Speed River to maintain flows during dry periods. As part of this study the capacity of the Speed River will be examined and impacts examined using historical low flow values which include dry periods. The City will continue to work with the GRCA as part of the Water Managers of the Grand to look at the future of the Grand River watershed. The effects and potential impacts of Global Warming and its potential impacts will be reviewed in the master plan. Additionally, as it is intended that the Master Plan be updated every 5 years, impacts and trends effecting wastewater treatment and planned projections can be reviewed and incorporated into the master plan updates.
4. The Master Plan has outlined a long-list of potential alternative solutions to address future wastewater treatment options. The alternatives are grouped by planning alternatives, source control, discharge location, treatment locations and treatment technologies. *Do you have any questions,*	No	
	No, except for Lake Huron, Erie, Ontario options, what about water out & in the same lake? Please note my input re: using less clean water and hence creating <u>less</u> wastewater. Use in-line hot water	As part of the master planning process, all options are put on the table. As part of the evaluation, the benefits and impacts as well as the viability of each option is considered. Options which are considered non-viable will

Questions	Comments from Public	
comments or wish to suggest other potential alternatives that have not been included?	heaters to avoid waiting for running hot water to get hot at the tap. We waste 25% or more compared to total use of hot water waiting for hot water to arrive.	not be included in the implementation plan. If a Great Lakes pipeline were considered as a viable option, it would be confirmed that water taking and wastewater discharge would take place within the same watershed to maintain the water balance. Water conservation initiatives are being considered as part of this master plan and your comments on the use of in-line water heaters will be provided to the City department in charge of this program.
	Yes Treatment technology options could be further expanded to be broken down into liquid treatment, solid treatment, and side stream treatment. Cogeneration capacity should be expanded. Opportunity for use of direct drive engines could be explored. VFDs should be implemented as they are very cost-effective.	Within the master plan, further detail will be provided on the various treatment technology options. Solids treatment options and management options were recently examined as part of the Biosolids Master Plan. The City is examining how to make the processes at the Wastewater Treatment Plant more efficient, this includes optimization of the cogeneration and boilers as well as the installation of variable frequency drives (VFDs) to decrease energy usage.
	Yes As mentioned before, policy for new building to include grey water system, composting human waste, Lake Erie pipeline should be rejected as a potential consideration.	Effluent reuse alternatives will be reviewed as part of this wastewater master plan. As part of the master planning process, all options are put on the table. As part of the evaluation, the benefits and impacts as well as the viability of each option is considered. Options which are considered non-viable will not be included in the implementation plan.
	Yes I believe it is due diligence to include as many viable options as possible; however, the lake pipeline option is not one of them and needs to be removed. One explicit option I would like to see is for Guelph to "live within its natural means", i.e. growth constrained by natural carrying capacity of its surroundings. This does not necessarily equate with a "no growth option", more of a managed/slow growth option.	As part of the master planning process, all options are put on the table. As part of the evaluation, the benefits and impacts as well as the viability of each option is considered. Options which are considered non-viable will not be included in the implementation plan
	Yes Consider the conclusions of the plan in conjunction with the other initiatives. So if an idea from say the energy plan could result in a decrease in water usage, that can be factored in.	The impact of other City initiatives on the Wastewater Treatment Plant and any proposed treatment facilities and processes will be considered as part of this planning process.

Questions	Comments from Public	
	Yes What will be the impact of the proposed Roszell Pit (major extraction 25 years +) in Puslinch Township bordering the Speed River? (May eventually be a quarry – proposed extraction below water table and creation of 3 large lakes with silt barriers.)	Planned developments which will effect the assimilative capacity of the Speed River are anticipated to be included in the modeling of the assimilative capacity of the Speed River. It is anticipated that impacts of this potential water taking will be examined as part of the permitting process and with input from the GRCA.
	– Not enough emphasis on construction/reduction. Before a pipeline is considered, we must consider advanced treatment and use of effluent for aquifer re-charge. If it can be treated to a drinking standard, then surely it can recharge our aquifer or at least be used to increase river flows. Other countries have achieved this level of treatment. Such a plant would be cheaper to build and operate than a pipeline and make more sense in keeping our water at home.	As part of the master planning process, all options are put on the table. As part of the evaluation, the benefits and impacts of all of the options will be considered. Evaluation criteria addressing social, economic, environmental and technical considerations will be used to determine the preferred options to carry forward as part of the implementation plan.
	Yes We are relying far too much on engineered solutions instead of ecosystem possibilities and conservation. We should be putting a moratorium on the increased population of P2G until we have the development bylaws in place that will reduce our clinistic footprint. E.g. support for geothermal and solar capabilities for all new houses and buildings, grey water use for toilets and outdoors, reduction of paved spaces by using permeable surfaces, etc. Why is the Great Lakes pipeline in the plan???	Future growth for the City of Guelph is being examined as part of the City's Growth Management Strategy. The Growth Strategy will be looking at the various growth alternatives. This wastewater master plan study examines what wastewater treatment alternatives can be implemented to support the planned growth. As part of the master planning process, all options are put on the table. As part of the evaluation, the benefits and impacts as well as the viability of each option is considered. Options which are considered non-viable will not be included in the implementation plan
Public Consultation		
1. Was the time of the Public Information Centre convenient for you? *If no, what time would be more convenient?*	Yes (all responses)	
2. Did the Public Information Centre help you to better understand the need for this project?	Yes (all responses)	
3. Did you have enough opportunity to ask questions, make comments, or express concerns?	Yes, staff were great	Comment Noted
	Yes	
	Yes	

Questions	Comments from Public	
	No	
	Yes	
	Yes	
	Yes	
	Yes	
	Yes	
4. Were those questions answered to your satisfaction? *If the questions were not answered to your satisfaction, please list them here.*	Yes, Cameron Walsh was very helpful	Comment Noted
	Yes	
	Yes	
	No How come the WWTP is not considering incentives for new building plans to include grey water infrastructure? Why is a pipeline to Lake Erie being considered after last year's public opinion against a pipeline for water supply?	Effluent reuse alternatives will be reviewed as part of this wastewater master plan. As part of the master planning process, all options are put on the table. As part of the evaluation, the benefits and impacts as well as the viability of each option is considered. Options which are considered non-viable will not be included in the implementation plan
	No I would like it to be clearly understood that an EA requires all viable/reasonable options to be considered, not every option possible; the pipeline option is not required for the EA, just like the master plan.,	As part of the master planning process, all options are put on the table. As part of the evaluation, the benefits and impacts as well as the viability of each option is considered. Options which are considered non-viable will not be included in the implementation plan
	Yes	
	–	
	Yes	
	No I get the sense that no one has read Timothy Flannery, George Monbiot, Marg deVilliers, Robert Sandford, or ever seen Inconvenient Truth or the Eleventh Hour.	Comment noted.

Questions	Comments from Public	
5. How useful did you find the Public Information Centre? *1 (Very Useful) to 5 (Not Very Useful)*	1 (one response)	
	2 (four responses)	
	3 (one response)	
	4 (two responses)	
	5 (no responses)	
6. How would you describe the nature of your interest in this study?	Member of an Interest Group: Friends of Guelph (one response)	
	Member of General Public (eight responses)	

CITY OF Guelph

CITY NEWS

Your weekly source of City information

Mark your calendar

Winterfest 2009

Celebrate the Canadian Winter at the 14th Annual Winterfest

Sunday, February 1

This city-wide celebration is an annual gathering of community and neighbourhood groups offering fun family activities.
Admission is free!

For a list of Winterfest locations and events call **519-837-5618** or visit **guelph.ca/winterfest**

in motion Physical Activity - do it for life!

CITY OF Guelph Making a Difference

Welcome, Guelph-Wellington EMS

On January 1, 2009 the City of Guelph welcomed 134 new paramedic staff to the Guelph-Wellington Emergency Medical Service (EMS) team. Paramedics provide land ambulance service to people in Guelph and Wellington County.

Direct delivery of land ambulance service allows the City of Guelph to provide efficient delivery of service and make service improvements in response to the needs of our community.

Please join us in welcoming the Paramedics of Guelph-Wellington EMS.

Regards,

Hans Loewig
Chief Administrative Officer

K. Shawn Armstrong
Director, Emergency Services

ADAPTED AQUATICS

Volunteers Needed

The City of Guelph is accepting applications for volunteers to assist with the Adapted Aquatics swimming lessons for the winter and spring sessions. Volunteers are responsible for supporting children with special needs in the water and must possess swimming skills.

For more information call **519-822-1260 x 2641.**

NOTICE

Wastewater Treatment Master Plan

Notice of Public Information Centre

The City of Guelph is nearing the completion of a 50-year Wastewater Treatment Master Plan. The purpose of the Master Plan is to develop a strategy to provide direction for wastewater infrastructure planning, investment and implementation to the year 2054. The study includes a review of the City's current wastewater treatment infrastructure and an analysis of alternative solutions to accommodate future wastewater treatment needs.

This study is following the Municipal Class Environmental Assessment process for master plans. Major tasks include the preparation of a statement of need, development of a management strategy through an evaluation of alternatives and documentation of a Master Plan. Consultation with the community is an important component of the decision-making process.

The Public Information Centre takes place:
Tuesday, February 10
5 to 8 p.m.
Holiday Inn, 601 Scottsdale Drive, Guelph (parking available)

Why attend the Public Information Centre?

The purpose of this second Open House for the Wastewater Treatment Master Plan is to provide the community with an overview of the proposed recommendations from the Master Plan and will include a description of the evaluation process, descriptions of the alternatives evaluated and information on the proposed recommendations.

A display of information on the project will be available for visitors. The City staff and the consultant team will be on hand to answer questions and to discuss the project.

If you are unable to attend the Public Information Centre and wish to comment on this project or receive information, please contact:

Kiran Suresh
Project Manager, Wastewater Services
Environmental Services
T **519-822-1260 x 2960**
E **kiran.suresh@guelph.ca**
guelph.ca/wastewater

Pam Law
Project Consultant
CH2M HILL
T **519-579-3501 x 3235**
E **pam.law@ch2m.com**

PARKING

Please be considerate when parking this winter

With snow accumulation, road widths on residential streets reduce significantly.

When parking on-street, please refrain from parking opposite another parked vehicle. This will ensure access for emergency services as well as other vehicles.

For more information contact the City's By-law Compliance and Enforcement office at **519-836-7275,** 24 hours a day, seven days a week.

WET-DRY+

Put your waste out the right way this winter

During the winter months, Wet, Dry and Waste bags and containers can be hidden by snow and snowbanks.

Bags and containers set out for collection must be in an area that is **clear of snow and ice,** and within **one foot of the curb.** Please place bags and containers in the **mouth of your driveway**, or a **spot shovelled from the snowbank** that is **adjacent to your driveway** and **level with the boulevard**, to ensure the safety of the collection crew and that your waste is not buried in the snow. **Bags and containers placed on top of snowbanks will not be collected.**

For more information contact Solid Waste Resources at **519-767-0598** or visit **guelph.ca/wetdry**

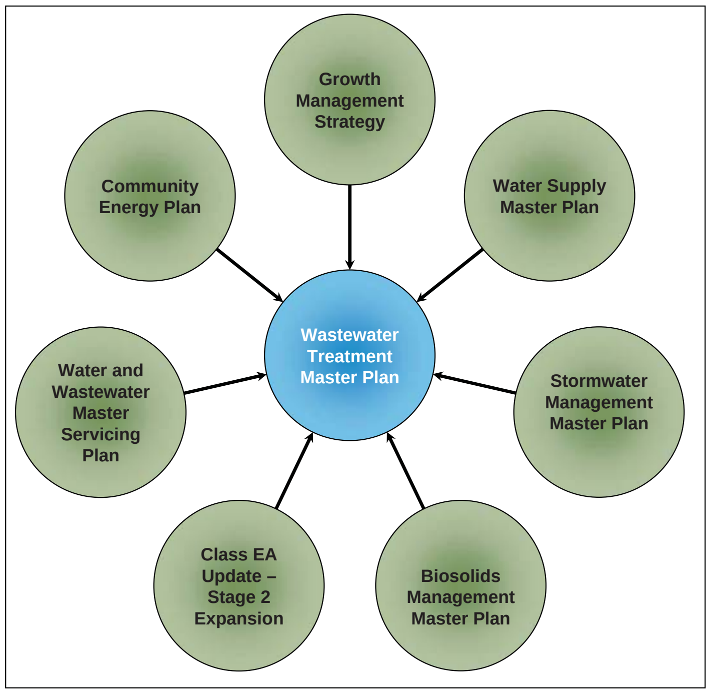
Welcome to the

City of Guelph
Wastewater Treatment
Master Plan
Public Information Centre #2

February 10, 2009

Please Sign In and take an Information Bulletin and Comment Sheet.
City of Guelph staff and their consultants from CH2M HILL are on hand to answer your questions.

Master Plan Purpose and Study Area



The City of Guelph is undertaking, or has recently undertaken, a number of planning initiatives and strategies that examine the changing demographics in the City and in the regulatory environments and the impact these changes may have on municipal services.

Master Plan Purpose

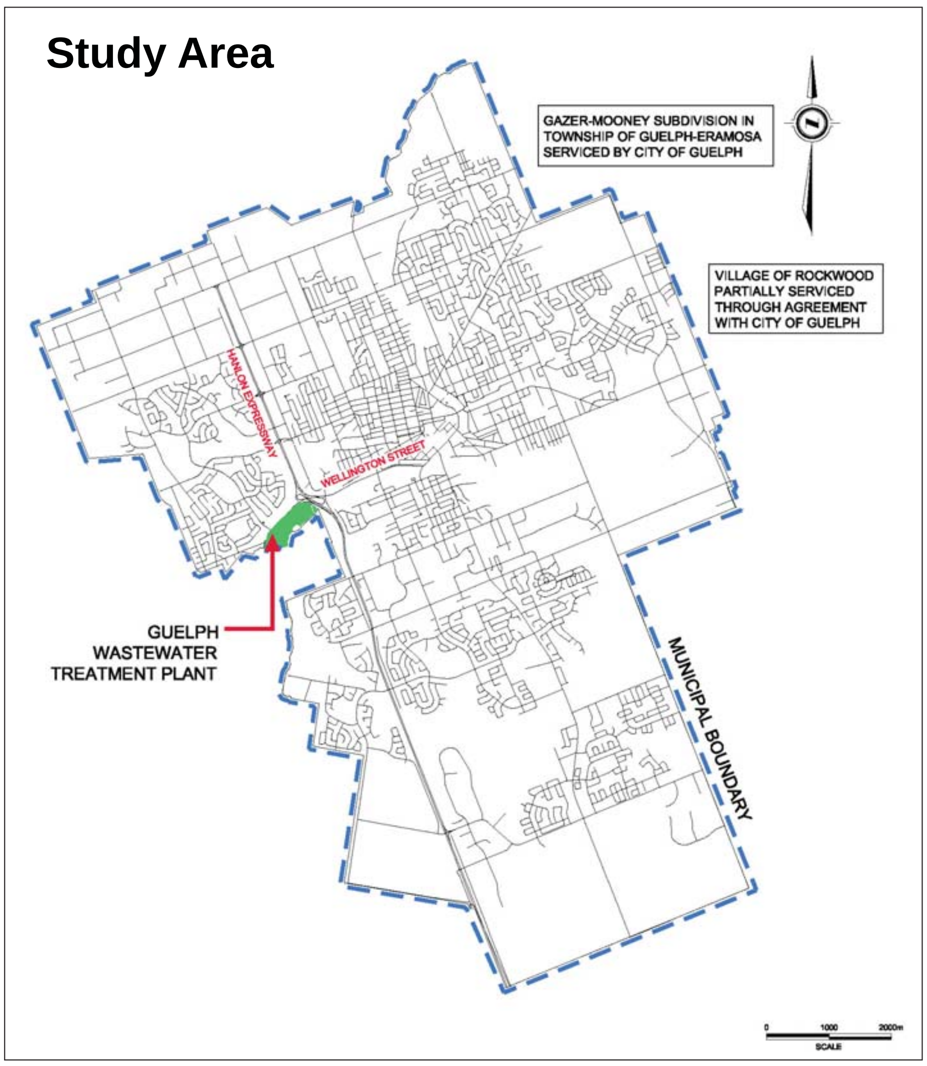
To develop a 50-year Wastewater Treatment Plan to provide direction for wastewater infrastructure planning, investment and implementation to the year 2054.

Mission Statement

In keeping with the City of Guelph's strategic plan, community vision, corporate responsibility, core values, and demonstrated commitment to environmental stewardship, develop a comprehensive master plan that addresses the long-term wastewater treatment servicing needs of the community over the next 50-year planning horizon.

Study Area

The Guelph Wastewater Treatment Plant (WWTP) collects and treats wastewater from within the urban boundaries of the City of Guelph. The WWTP also treats wastewater from the Village of Rockwood and a subdivision in the Township of Guelph-Eramosa.



CITY OF Guelph
Making a Difference

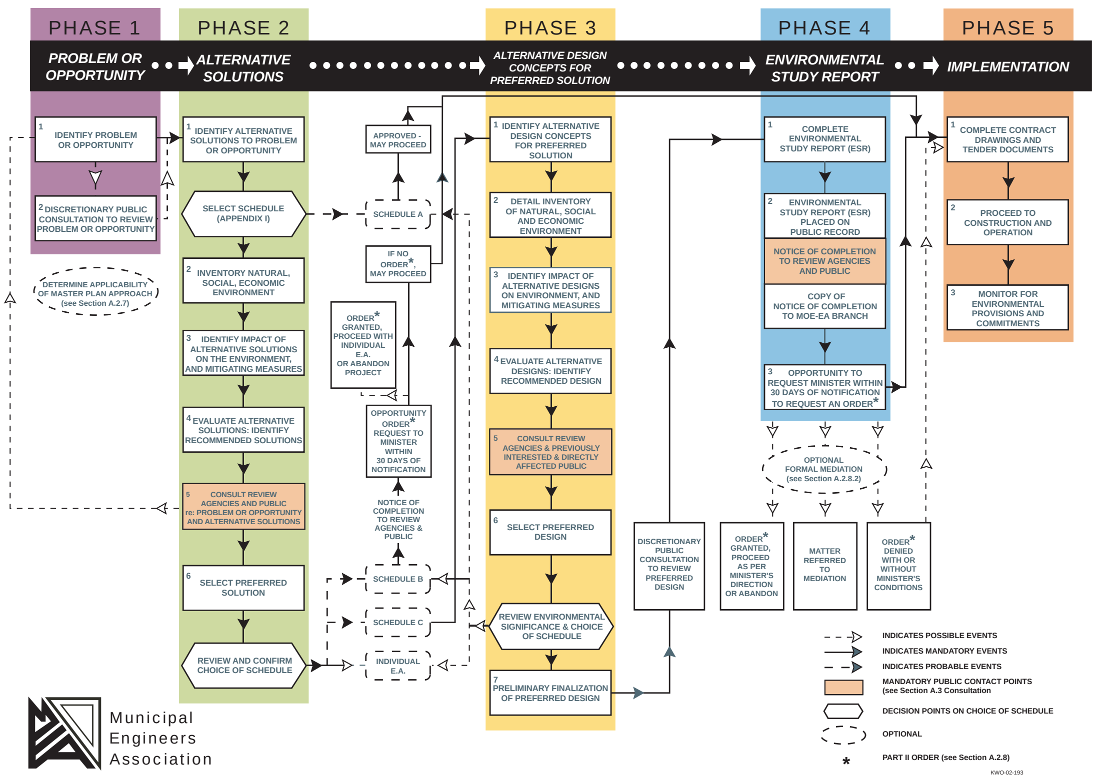
CH2MHILL

Study Methodology

Master Plans are long range plans that examine the current and future requirements of a given infrastructure system using environmental assessment planning principles. Master Plans, at a minimum, must address Phases 1 and 2 of the Municipal Class Environmental Assessment (EA) process as shown below.

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*



Municipal Engineers Association

The approach from Phases 1 and 2 of the Class EA was further refined to develop the decision-making process for the Guelph Wastewater Treatment Master Plan project as shown below.

Master Plan Approach

Class EA Phase 1

Problem Definition
- Identify Need
- Initiate Consultations
  –Community
  –Agencies

Review and Documentation of Existing Conditions
- Official Plan and Population Forecasts, Development Patterns
- Water Master Plan Projections
- Current Per Capita Flows
  –Influent strength/loading
  –Effluent quality
- Inflow and Infiltration (I/I) Studies
- Collection System
- Biosolids Management Master Plan
- GRSM* and Assimilation Studies

* Grand River Simulation Model

Future Needs and Constraints
- Per Capita Wastewater Generation
- Achievable Flows and Loads for Existing
- Flows and Loads for Future Developments
- ICI Component for Future Sewerage System
- I/I Component for Future Collection System
- Geographic Nodes of Wastewater Generation
- Effluent Reuse Volumes
- Future Effluent Criteria for:
  –MOE
  –GRCA
  –Federal (nitrates & nitrites)
  –Fisheries
  For different watersheds

Supplemental Studies
- Collection System Modelling
- WWTP Capacity Modelling
- GRSM Update

Class EA Phase 2

Develop and Evaluate Alternatives
- Technical, Environmental, Social, Economic Impacts

- "Do Nothing"
- Limit Growth

Discharge Location
- Existing WWTP Outfall to Speed
- New Outfall to Alternate Tributary
- Effluent Reuse
- Aquifer Discharge
- Pipeline Discharge
  –Grand River
  –Huron, Erie, Ontario

Treatment Location
- Existing WWTP
- Satellite Plant(s) at Discharge Location(s)
- Satellite Plants at Generation Locations and Pump to Outfall(s)

Treatment Technologies
- Conventional
- Tertiary
- Advanced
- Emerging

Recommend Alternatives
- Conceptual Design for Plant(s)
- Capital and Operating Costs
- Schedule for Implementation
  –Short-term
  –Long-term
- Funding Options

Documentation

Master Plan
- Draft
- Final
- Notice of Master Plan Completion

Kickoff PAC Meeting | **PIC #1** | **Regulatory Agency Consultations** | **PAC Meeting** | **PAC Workshop #1** | **PAC Meeting** | **PAC Workshop #2** | **PAC Meeting** | **PIC #2**

Guelph — Making a Difference

CH2MHILL

Guelph Wastewater Treatment Plant (WWTP)

The Guelph WWTP has a current rated capacity of 64 MLD and a capacity of 73.3 MLD approved for the next future expansion.

Wastewater arriving at the Guelph WWTP undergoes multiple stages of treatment: preliminary, primary, secondary, tertiary and disinfection. The final treated effluent is discharged to the Speed River.

Over the years, the WWTP has undergone numerous upgrades and expansions.

Partial History of Guelph WWTP

	1958	Built Plant No. 2
Built Plant No.3	1968	
	1978	Installed Rotating Biological Contactors Added Automatic Backwash Filters for Nitrification and Filtration
Upgraded Instrumentation and Control	1979	
	1980	Built Outfall Extension
Built Sludge Dewatering Facilities Built Plant Headworks	1983	
	1986	Retrofit to Fine Bubble Aeration
Upgrade to Plant No. 1	1987	
	1992	Upgraded Dewatering Facility
Built Sludge Composting Facility	1995	
	1996	Upgraded Digester and Heating
Upgraded Digester No. 3	1997	
	1998	Wastewater Treatment Strategy Class EA
Stage 1 Expansion – Built Plant No. 4	2001	
Class EA Update Stage 2 Expansion	2007	Biosolids Management Master Plan Class EA
	2008	Digester Capacity Expansion – Built Digester 5

The figure below shows the current treatment processes at the WWTP.

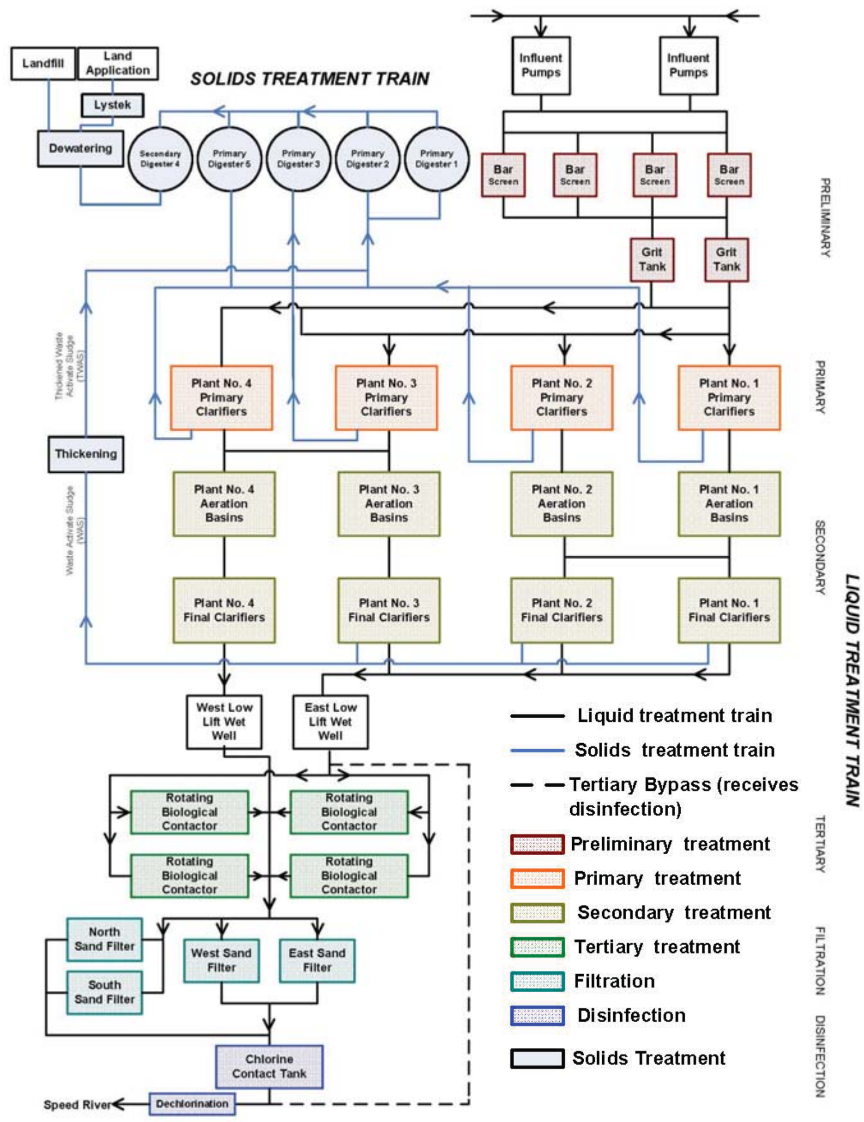
LEGEND:

BUILT STRUCTURES:

- (A) SLUDGE DEWATERING FACILITY
- (B) SLUDGE COMPOSTING FACILITY
- (C) ENERGY FACILITY
- (D) ADMINISTRATION BUILDING
- (E) DIGESTER No.2
- (F) DIGESTER No.1
- (G) PLANT No.3
- (H) DIGESTER No.4
- (I) DIGESTER No.3
- (J) PLANT No.4
- (K) PLANT No.2
- (L) PLANT No.1
- (M) HEADWORKS
- (N) CHLORINE CONTACT TANK AND DECHLORINATION FACILITY
- (O) MAINTENANCE AND STORAGE BUILDING
- (P) ROTATING BIOLOGICAL CONTACTORS
- (Q) SAND FILTERS No.1 AND 2
- (R) SAND FILTERS No.3 AND 4
- (S) HUMANE SOCIETY ANIMAL SHELTER
- (T) BELL SWITCHING STATION
- (U) OUTFALL (NOT VISIBLE)
- (V) SODIUM HYPOCHLORIDE AND ALUMINIUM SULPHATE STORAGE

PRPOPERTY LINE

The interconnection of the various treatment processes is shown in the following schematic:



Consultation Activities

Public Information Centre #1

A Public Information Centre (PIC) was held in October 2007. This PIC provided an overview of the following:

- Introduction to the project
- Description of the Class EA process for Master Plans
- Description of the Guelph WWTP
- Existing conditions and future wastewater treatment requirements
- Preliminary list of alternatives
- Next steps

Public Advisory Committee

The Public Advisory Committee (PAC) is responsible for providing advice and feedback to the project team. Members of the PAC represented various sectors of the community including business, development, academia, environment and the community at large. The following table summarizes the topics and outcome of each PAC meeting.

Meeting/Date	Purpose	Topics	Outcome
PAC Meeting #1 June 2007	To provide a Project Introduction, present the Study Process, and identify key issues	• Master Plan Process and Scope • Role of PAC • Consultation Plan • Problem Statement • Key Issues • Purpose of Public Information Centre #1	• Understanding of roles, and endorsement of study process • Identification of key issues moving forward
PAC Meeting #2 September 2007	Presentation of existing and future conditions; and discussion of alternatives, evaluation process, and impacts of consultation efforts to date	• Existing and Future Conditions • Wastewater Service Alternatives • Evaluation Methodology and Criteria • Results of Consultation Efforts	• Endorsement of Alternatives for Evaluation • Endorsement of Evaluation Methodology • Feedback on Consultation Efforts
PAC Meeting #3 May 2008	Presentation of evaluation outcomes, and discussion of recommended Master Plan components	• Evaluation Outcomes • Recommended Master Plan Components • Key Issues Status • Purpose of PIC #2	• Endorsement of Evaluation Outcomes and Master Plan Recommendations • Feedback on Messaging for PIC#2
PAC Workshop July 2008	Presentation of City initiatives related to the WWMP	• Growth Management Plan Recommendations • W&WW SMP Recommendations • Guelph's Water Efficiency Program • Wastewater Optimization Program	• Provide Broader City Context for Master Plan Recommendations and Linkages to other City Programs and Activities
PAC Meeting #4 October 2008	Discuss Draft Master Plan Report	• Master Plan Components • Implementation Plan and Cost Opinions • Results of Public and Agency Consultations	• Endorsement of Overall Master Plan and Implementation

Preliminary Alternative Solutions

Alternative Solution

Is defined as "feasible alternative ways of solving an identified problem (deficiency) or addressing an opportunity, from which a preferred solution is selected."

(Source: Municipal Class Environmental Assessment October 2000, as amended in 2007)

The following descriptions provide a brief overview of the long list of alternatives that will be prioritized and then evaluated as part of the Wastewater Treatment Master Plan.

Planning Alternatives

- ***"Do Nothing"*** – Is used as a baseline for comparison
- ***Limit Growth*** – Growth projections are being examined as part of the Growth Management Strategy

Source Control Alternatives

- ***Inflow and Infiltration*** – Reducing extraneous flows from entering the sewer system, e.g. through cracked pipes, maintenance hole covers, and connect roof leaders
- ***Sewer Use By-law*** – Controlling the types and amounts of certain parameters that may enter the sewer system. Requires some industries to pretreat wastewater.
- ***Water Conservation*** – Reducing the amount of wastewater generated

Discharge Location Alternatives

- ***Existing WWTP Outfall to Speed River*** – Examination of the capacity of the Speed River to accept additional treated effluent flows and loads
- ***New Outfall to Alternate Receiver*** – Examination of discharging effluent to a larger receiving water body to accept additional flows and loads
- ***Effluent Reuse*** – Reusing treated effluent for seasonal irrigation on lands such as golf courses and municipal landscaping
- ***Aquifer Disposal*** – Disposal by injecting into a non-potable aquifer

Treatment Location Alternatives

- ***Existing WWTP*** – Continuing treatment at the existing location
- ***Satellite Plant(s) at Discharge Location(s)*** – If alternate discharge location is found to be appropriate, construction of a new (satellite) plant at that location to manage a portion of the wastewater flows
- ***Satellite Plants at Generation Locations and Discharges to Existing Outfall*** – Construction of a new facility located where new wastewater generation (growth) is anticipated, and discharge effluent sent to existing outfall

Treatment Technology Alternatives

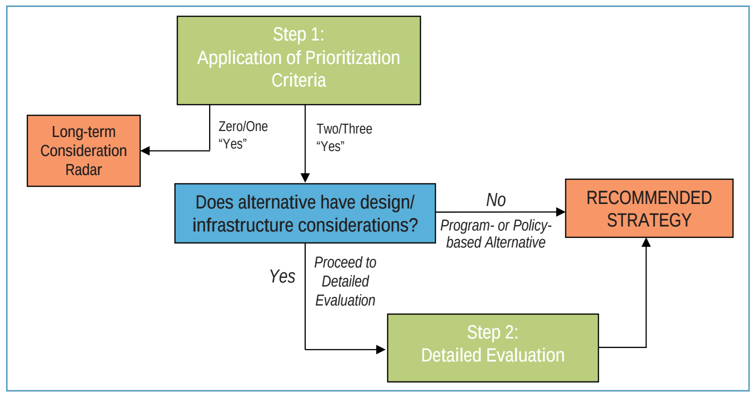
- ***Conventional*** – Preliminary, primary and secondary treatment processes, effluent disinfection
- ***Tertiary*** – Provision of additional stage of treatment, could include sand filtration or biological contactors for nitrification
- ***Advanced*** – Application of advanced treatment technologies, such as membrane filtration, to achieve higher quality effluent than conventional and tertiary
- ***Emerging*** – Application of advanced tertiary oxidation, carbon adsorption or new technologies to further reduce organic contaminants and increase effluent quality

Evaluation Methodology

For this Master Plan exercise, a two-stage decision process was developed:

- Stage 1: Prioritization
- Stage 2: Detailed Evaluation

The decision-making process is shown in the figure at right. If the alternative met two or more of the prioritization criteria, it was carried forward.



Alternatives that received a lower prioritization were placed on a radar screen for long-term consideration.

Criteria were developed for both the prioritization and the detailed evaluation. These are described below.

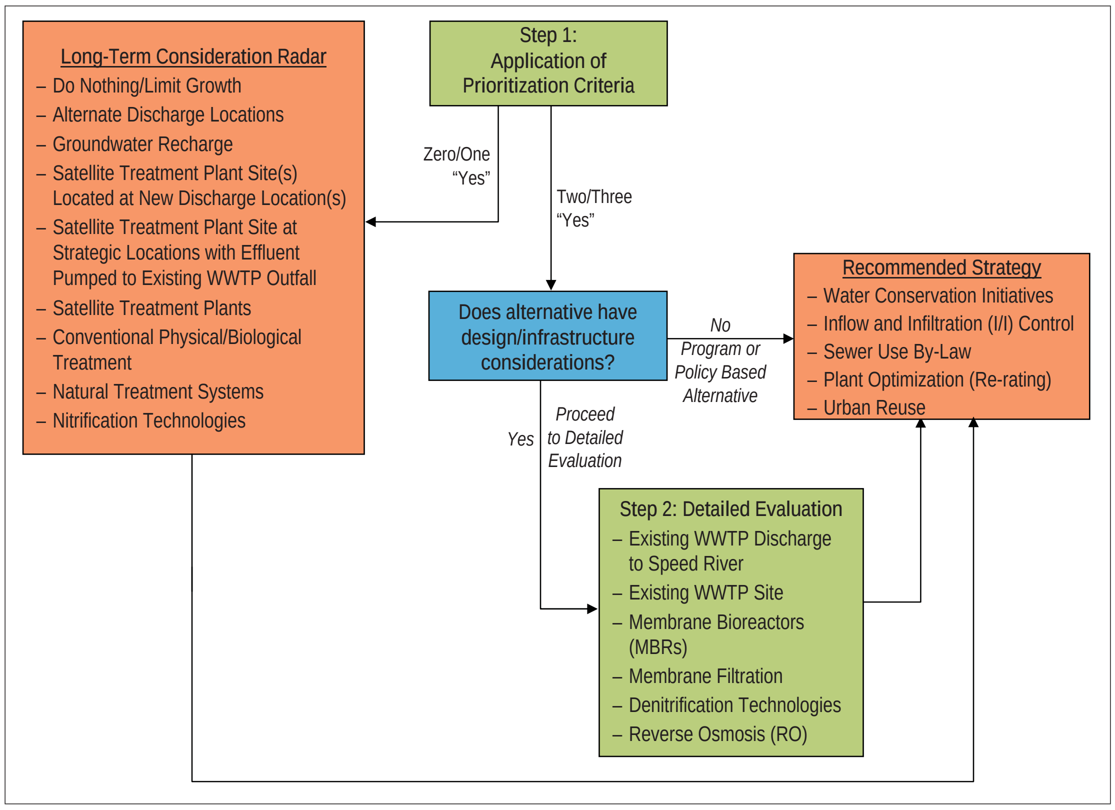
Prioritization Criteria	Consideration
Practicality – Given existing conditions in Guelph	Alternative provides the opportunity to take advantage of the City's existing infrastructure and is within the City's ability to implement (technically, financially, regulatory).
Sustainability – Consistent with the City's strategic plan	Alternative contributes to a solution that protects community and environmental health and well-being for current and future residents of the City of Guelph.
Efficiency – Consistent with responsible municipal management	Alternative achieves the intended use and has the potential to meet or exceed Ontario's regulatory requirements and standards.

Evaluation Category	Definition
Technical Criteria	
Performance Record	Ability of alternative to perform with high degree of reliability and predictability
Ability to Meet Treatment Capacity Requirements (Short-, Medium-, Long-term)	Ability of alternative to provide the wastewater treatment requirements for short-, medium-, and/or long-term needs
Ease of Implementation	Ability of alternative to minimally disrupt existing wastewater treatment operations
Regulatory Constraints	Ability of alternative to be approved with minimal, if any, conditions
Environmental Criteria	
Surface Water Quality	Potential for receiver (Speed River, Grand River, Lake Erie, etc.) to assimilate effluent to regulatory requirements
Ground Water Quality and Supply	Potential for alternative to avoid negatively impacting sensitive groundwater resources
Terrestrial Habitats and Corridors	Potential for alternative to avoid negative impacts to terrestrial habitats
Aquatic Habitats and Fisheries	Potential for the alternative to protect or enhance aquatic habitats
Air Quality	Potential for alternative to minimize any increase in greenhouse gas emissions
Flood Plain	Potential for alternative to maintain existing flood plain and flood volume capacity in the Speed River
Wetlands	Potential for alternative to protect and maintain wetlands
Environmental Criteria	
Land Use Compatibility	Potential for alternative to support City of Guelph's Growth Management Strategy
Community Growth Requirements	Potential for alternative to be implemented, for short-, medium-, and long-term community needs
Occupational Health and Safety	Potential for alternative to minimize risks to occupational health and safety
Community Health and Safety	Potential for alternative to minimize risk to community health and safety
Urban Design Requirements and Aesthetics	Potential for alternative to support City's design standards and community aesthetics
Community Energy Plan	Potential for alternative to produce energy for community use
Heritage/Cultural Resources	Potential for the alternative to avoid heritage and cultural resources
Economic Criteria	
Capital Costs	Relative costs of land, equipment, and facilities compared to other alternatives
Lifecycle Costs	Relative lifecycle costs (including Operations and Maintenance and Depreciation/ Replacement) compared to other alternatives
Funding Availability	Potential for alternative to be eligible for provincial/federal funding programs

Evaluation Results

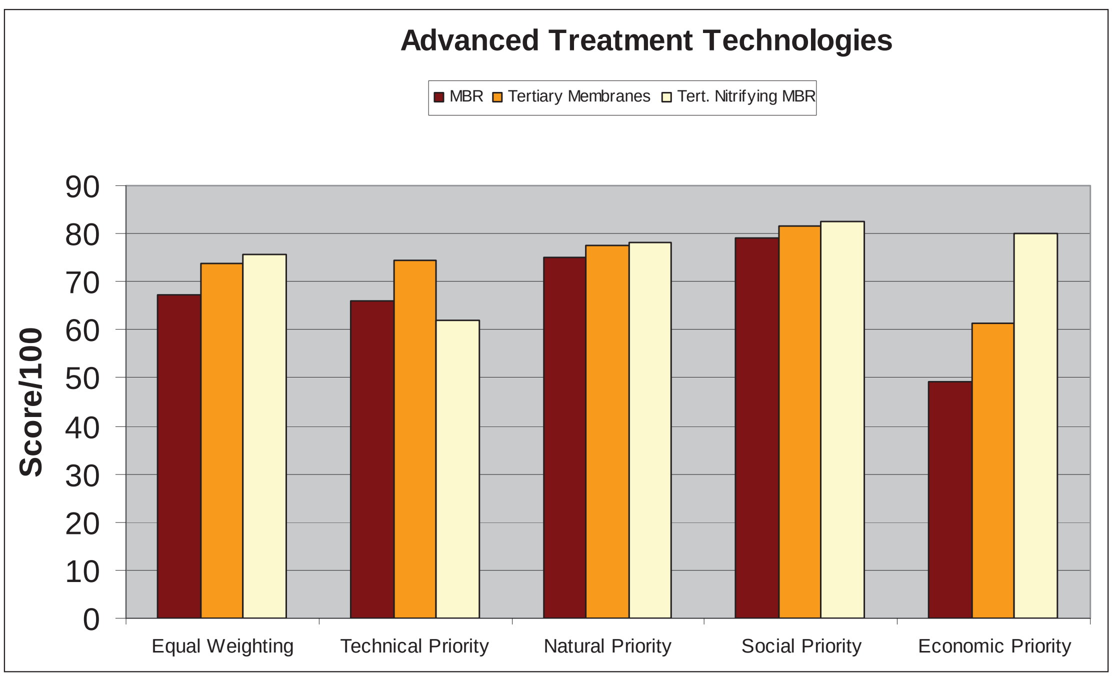
Prioritization

The prioritization process involved the review of alternatives with prioritization criteria. Based on this prioritization process, the figure below indicates which alternatives proceeded on to the recommended strategy, which required further evaluation and which were put on the City's "radar" for review in subsequent master plans.



Detailed Evaluation

A detailed evaluation of infrastructure-based treatment alternatives was completed by the Project Team and City representatives. Sensitivity scenarios developed by the Public Advisory Committee were applied to each of the evaluations, as shown below:



The results from the detailed evaluation that form part of the recommended strategy are described in further detail on the "Recommended Strategy Components" panel.

Recommended Strategy Components

The recommended strategy components for Guelph's Wastewater Treatment Master Plan can be divided into three categories: Studies, Programs/Policies and Infrastructure.

Studies

These alternatives require additional information before the City can develop a path forward:

Study	Description
Urban Reuse	Urban reuse involves diversion of a portion of treated effluent for applications such as: municipal/golf course irrigation, construction dust control, dual water systems, or industrial applications Study would look at market analysis, costs and regulatory requirements.
Facility Plan	This is a tool that the City can use for detailed capital investment and help to integrate recommendations from master plans along with maintenance requirements. Study would summarize recommendations on a cost and land allocation basis and assist the City in developing their detailed investment planning.
Energy Audit of the Guelph WWTP	This audit would contribute to the City's Community Energy Plan by looking at current and potential future energy uses at the WWTP. Study would make recommendations for future specifications of equipment and look at potential operation modifications that could be made. Renewable energy produced that the plant would also be quantified.
Climate Change Adaptation	This study would look at predicted climate change scenarios as they relate to the Guelph area. This undertaking would involve integration with other organizations, such as the Grand River Conservation Authority, who are doing work on this topic.
Sewer Use By-Law Review and Update	This by-law is an important tool the City uses to control the quality of wastewater that reaches the WWTP. This study would review the City's current by-law in detail and make recommendations for improvements.

Programs and Policies

A key component of this Master Plan is the continuation and enhancement of current programs and policies. These programs have and will continue to have beneficial impacts on the WWTP.

Program/Policy	Description
Water Conservation and Efficiency	The City's Water Efficiency program has effectively reduced the per capita water consumption over the years. The City continues to update and enhance this program which could contribute to reductions in per capita wastewater generation.
Inflow and Infiltration Control	Inflow and Infiltration (I/I) is extraneous flow that enters the wastewater collection system. Through the City's Water and Wastewater Servicing Master Plan recommendations have been made to reduce I/I from entering the system and arriving at the WWTP.
Optimization	The City will continue to look at potential opportunities for optimization of the WWTP by looking at potential bottlenecks and seeing how the WWTP can be operated differently to reduce these bottlenecks.
Water Managers of the Grand	The City will continue to be active in the Water Managers of the Grand. They will work with the GRCA to improve the monitoring along the Speed River, which will assist in identifying areas to be targeted for improvement of the overall health of the Grand River Watershed.

Recommended Strategy Components (cont'd)

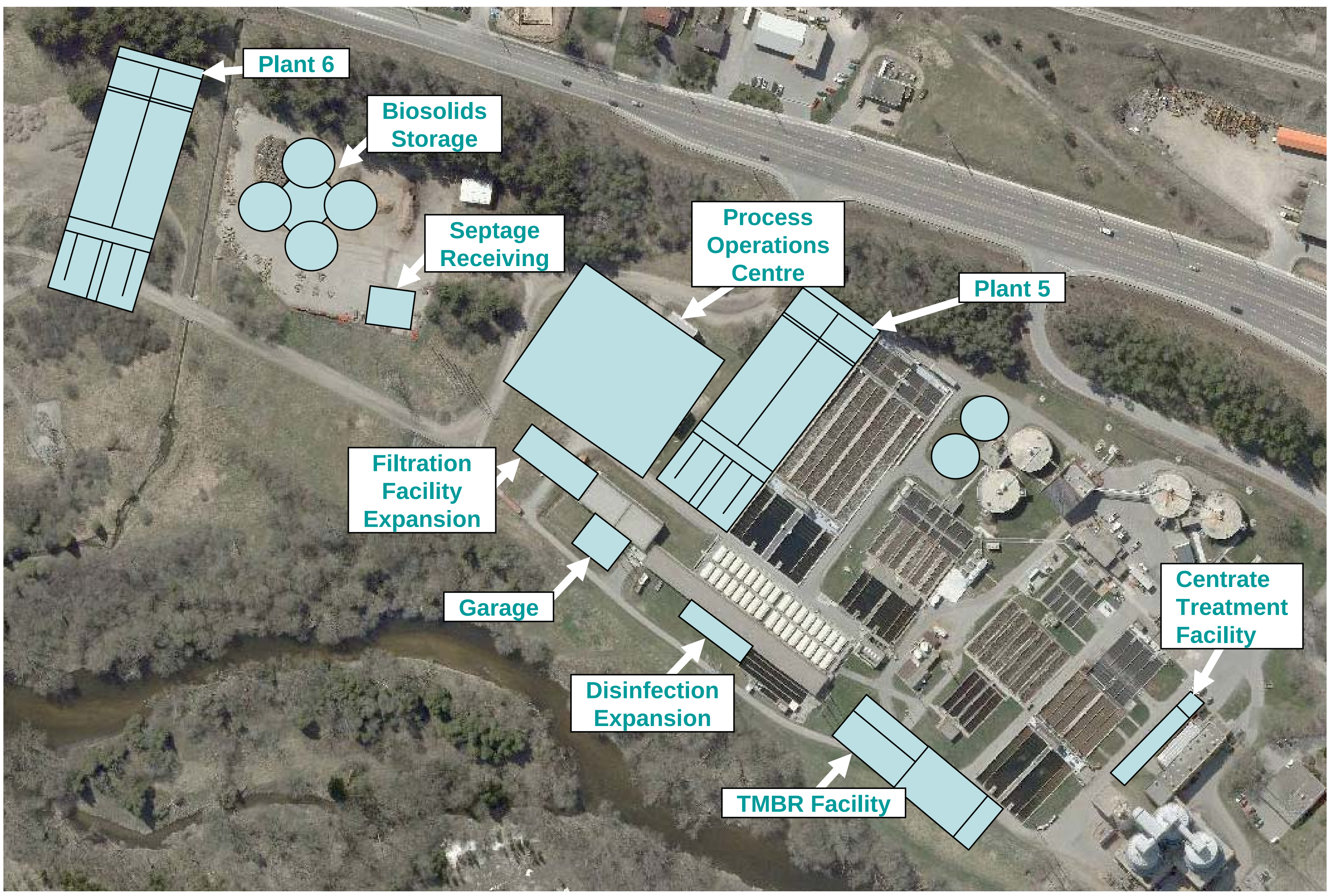
Infrastructure

The recommended infrastructure components have been divided into three timeframes: short-term (2008 – 2020), mid-term (2021 – 2031), and long-term (2032 – 2054).

The recommendations summarized within the table are based on best information available at the time of this Master Plan. Changes in available technology and/or regulatory conditions, will likely impact some of the recommendations in the future. Therefore, all recommendations and flow projections will be reviewed during each update of the Master Plan, which is to occur every 5 years.

Timeframe	Current Recommendation/Direction
Short-term (2008 – 2020)	Based on current projections, flows during this timeframe will not exceed 73.3 MLD. Recommendations to upgrade the WWTP to 73.3 MLD have already been examined and approved under a previous Class EA process and were not re-examined under this Master Plan.
Mid-term (2021 – 2031)	Based on current flow projections, the approved capacity of 73.3 MLD will be reached by approximately 2024. Prior to the commencement of the expansion design, a Schedule C Class EA will need to be completed and approved. For this expansion it is recommended that the City consider advanced treatment technologies such as membranes.
Long-term (2032 – 2054)	The review and evaluation of treatment alternatives indicated that, at this time, tertiary membrane technology is the preferred method of achieving long-term effluent quality compliance limits beyond 2031. Consideration was given to staged treatment capacity expansions from 2031 to 2054 to provide a total treatment capacity of 144 MLD at the Guelph WWTP.

A conceptual footprint of what the Guelph WWTP may look like in 2054 is shown in the figure below:



Implementation

Cost Estimates

The estimated costs associated with the recommendations in the implementation plan have been summarized in the table below. This table also includes projects previously identified by the City.

Recommendation	2008 – 2011	2012 – 2018	2019 - 2025	2026 – 2031	2032 – 2054
Facility Plan	$75,000				
Urban Reuse Study	$500,000				
Energy Audit at the WWTP	$90,000				
Satellite Plant Feasibility	$0				
Climate Adaptation Studies	$35,000				
Sewer Use By-Law Review and Update	$75,000				
Master Plan Updates	$200,000	$200,000	$200,000	$400,000	$800,000
Future Studies[1]		$500,000	$500,000	$500,000	$1,500,000
Optimization – Plant Rerating	$400,000	$100,000			
Phase 2 Expansion to 73.3 MLD	$10,000,000	$20,000,000			
Schedule C Class EA for 85 MLD Expansion		$400,000			
Design and Construction of 85 MLD Expansion			$60,000,000		
Long Term Expansions				$60,000,000	$120,000,000
From Biosolids Management Plan/Ongoing Maintenance/Upgrades					
Biosolids Facility Upgrade	$5,000,000	$37,000,000			
Digester No. 6		$6,000,000			
Dewatering Facility Expansion			$10,000,000		
Solids Stabilization Expansion			$15,000,000		
Secondary Pumping Expansion		$8,000,000			
Misc. WWTP Upgrades/Maintenance	$4,000,000	$4,000,000			
SCADA Upgrades	$550,000				
Process Options Centre Building	$1,000,000				
Disinfection Upgrades		$8,000,000			
Totals	**$21,925,000**	**$84,200,600**	**$85,700,000**	**$60,900,000**	**$122,300,000**

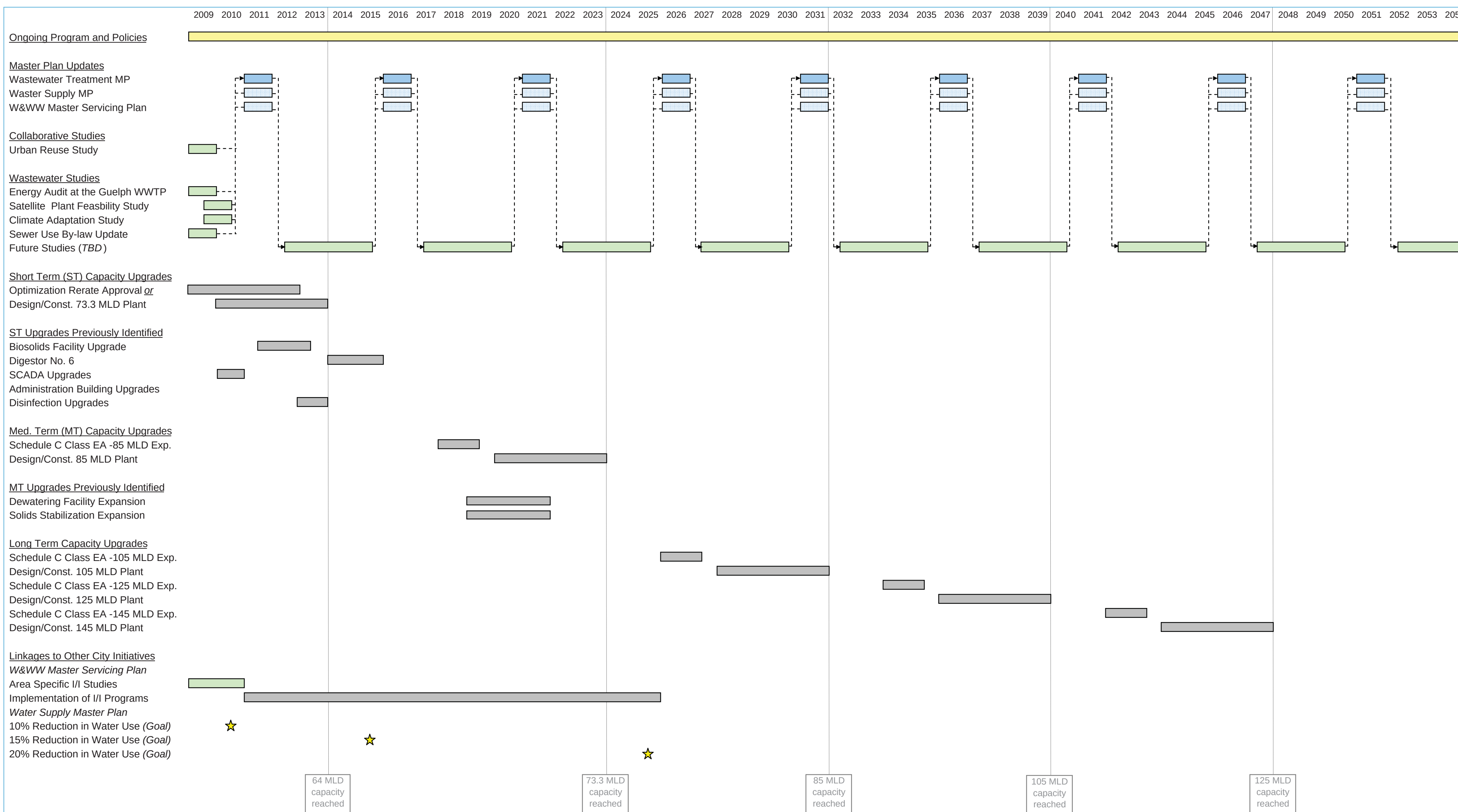
[1] A placeholder dollar value has been provided for future studies which will be recommended from Master Plan updates
Cost estimates do not include escalation

Implementation (cont'd)

Schedule

The schedule below shows a proposed outline for implementation of the recommended strategy components. Final prioritization and implementation of the projects will be completed by the City.

It is important to note that the City will be reviewing and updating this Master Plan every five years as shown on the schedule.



NOTES:

Implementation timeline is based on current projected flow rates and best available information. Recommendations may be deferred or modified based on the success of City programs, population projections and findings from subsequent Master Plan updates

Collaborative Studies require coordination between multiple City departments such as Wastewater Operations, Engineering, Planning and Water Supply

Next Steps

In the Master Planning Process

- Comments from the Public Information Centre will be received until February 18, 2009
- Comments will be reviewed and the Master Plan Recommendations will be revised where appropriate
- The Master Plan Report will be available for the public to view. Notice will be published in the local newspaper and on the City's website.

In Implementing the Master Plan Recommendations

Prioritization and Integration into the City's Capital Planning

The recommendations included will be reviewed by the City, and prioritization of projects will be confirmed with consideration of budget, regulatory requirements, public priorities, and integration with other City initiatives.

Ongoing Areas for City Tracking and Review

It has been recognized that there are a number of ongoing activities, programs and initiatives that may have an impact on the recommendations made within this Master Plan.

A number of these items may evolve and change over time and so the City has committed to tracking these items and reviewing their impact on wastewater treatment operations prior to implementing any of the recommendations and/or at each subsequent update of the Master Plan, whichever occurs sooner. These items include results of the WWTP optimization study, water conservation impacts, I/I reduction efforts, economic impacts and variations in growth projections.

Project website: www.guelph.ca/wastewater

Wastewater Treatment Master Plan

INFORMATION BRIEF **FEBRUARY 2009**

Introduction

The City of Guelph is preparing a 50-year Wastewater Treatment Master Plan. This Information Brief provides a description of the decision-making process completed and a summary of the recommended strategy components for the Master Plan. The Master Plan will be reviewed and updated by the City every five years.

Study Purpose

The purpose of the Master Plan is to develop a strategy to provide direction for wastewater infrastructure planning, investment, and implementation to the year 2054. The study includes a review of the City's current wastewater treatment infrastructure and an analysis of alternative solutions to accommodate future wastewater treatment needs.

Mission Statement

In keeping with the City of Guelph's strategic plan, community vision, corporate responsibility, core values, and demonstrated commitment to environmental stewardship, develop a comprehensive master plan that addresses the long-term wastewater treatment servicing needs of the community over the next 50-year planning horizon.

Decision-Making Process

This study is following the Municipal Class Environmental Assessment process for master plans. Major tasks include the preparation of a statement of need, development of a management strategy through an evaluation of alternatives, and documentation of a Master Plan.

Consultation Activities

First PIC was held in October 2007. A Public Advisory Committee (PAC) was formed in June 2007 and has provided guidance through four meetings and a workshop.

Other City Initiatives

The City of Guelph is undertaking, or has recently undertaken, a number of planning initiatives and strategies that examine the changing demographics in the City and regulatory environments and the impact these changes have on municipal services. The ongoing initiatives which relate to the Wastewater Treatment Master Plan are shown following in Figure 1.

Figure 1: Links to other City Initiatives

The Study Area

The Guelph Wastewater Treatment Plant (WWTP) collects and treats wastewater from within the urban boundaries of the City of Guelph. The WWTP also treats wastewater from the Village of Rockwood and a small subdivision in the Township of Guelph-Eramosa.

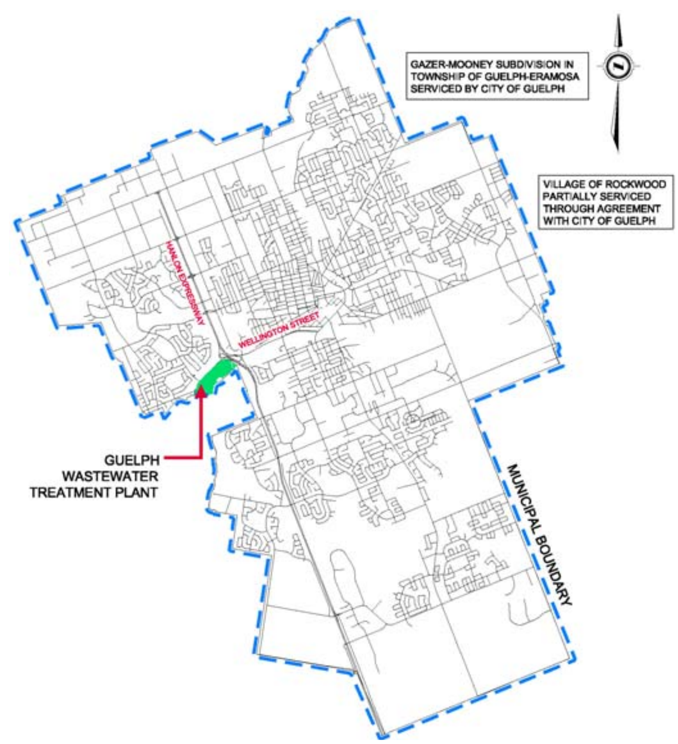


Figure 2: Study Area

The Existing Wastewater Treatment Plant (WWTP)

The Guelph WWTP has a current rated capacity of 64 MLD and a capacity of 73.3 MLD approved for the next future expansion.

Wastewater arriving at the Guelph WWTP undergoes multiple stages of treatment: preliminary, primary, secondary, tertiary, and disinfection. The final treated effluent is discharged to the Speed River.

The figure below shows the current treatment processes at the Guelph WWTP.

Figure 3: The Existing Guelph WWTP

LEGEND:

BUILT STRUCTURES:

(A) SLUDGE DEWATERING FACILITY	(L) PLANT No.1
(B) SLUDGE COMPOSTING FACILITY	(M) HEADWORKS
(C) ENERGY FACILITY	(N) CHLORINE CONTACT TANK AND DECHLORINATION FACILITY
(D) ADMINISTRATION BUILDING	(O) MAINTENANCE AND STORAGE BUILDING
(E) DIGESTER No.2	(P) ROTATING BIOLOGICAL CONTACTORS
(F) DIGESTER No.1	(Q) SAND FILTERS No.1 AND 2
(G) PLANT No.3	(R) SAND FILTERS No.3 AND 4
(H) DIGESTER No.4	(S) HUMANE SOCIETY ANIMAL SHELTER
(I) DIGESTER No.3	(T) BELL SWITCHING STATION
(J) PLANT No.4	(U) OUTFALL (NOT VISIBLE)
(K) PLANT No.2	(V) SODIUM HYPOCHLORIDE AND ALUMINIUM SULPHATE STORAGE

Long List of Alternatives

A long list of alternatives was developed. This long list went through an initial prioritization exercise before proceeding to detailed evaluation. The long list of alternatives by category is provided following.

Planning Alternatives

- ***"Do Nothing"***
  Is used as a baseline for comparison
- ***Limit Growth***
  Growth projections are being examined as part of the Growth Management Strategy

Source Control

- ***Inflow and Infiltration***
  Reducing extraneous flows from entering the sewer system, e.g. through cracked pipes, maintenance hole covers, and connect roof leaders
- ***Sewer Use By-law***
  Controlling the types and amounts of certain parameters that may enter the sewer system. Requires some industries to pretreat wastewater before discharging to the sewer.
- ***Water Conservation***
  Reducing the amount of wastewater generated

Discharge Location

- ***Existing WWTP Outfall to Speed River***
  Examination of the capacity of the Speed River to accept additional treated effluent flows and loads
- ***New Outfall to Alternate Receiver***
  Examination of discharging effluent to a larger receiving water body to accept additional flows and loads
- ***Effluent Reuse***
  Reusing treated effluent for seasonal irrigation on lands such as golf courses and municipal landscaping
- ***Aquifer Disposal***
  Disposal by injecting into a non-potable aquifer

Treatment Technologies

- ***Conventional***
  Preliminary, primary and secondary treatment processes, effluent disinfection
- ***Tertiary***
  Provision of additional stage of treatment, could include sand filtration or biological contactors
- ***Advanced***
  Application of advanced treatment technologies, such as membrane filtration, to achieve higher quality effluent than primary and tertiary
- ***Emerging***
  Application of advanced tertiary oxidation, carbon adsorption or new technologies to further reduce organic contaminants

Evaluation Methodology

A two-stage evaluation process was performed. The initial stage was a prioritization of the alternatives based on criteria of practicality, sustainability, and efficiency. If the alternative met two or more of the prioritization criteria, it was carried forward. Otherwise the alternative received a lower prioritization and was placed on the City's radar for long-term consideration.

Evaluation Results

Based on the prioritization process, Figure 4 shows which alternatives proceeded on to the recommended strategy, which required further evaluation and which were put on the City's "radar" for review in subsequent master plans.

A detailed evaluation of infrastructure-based treatment alternatives was completed by the Project Team and City representatives. Sensitivity scenarios developed by the Public Advisory Committee were applied to each of the evaluations.

Recommended Strategy Components

The recommended strategy components for Guelph's Wastewater Treatment Master Plan can be divided into three categories: Studies, Programs/Policies, and Infrastructure.

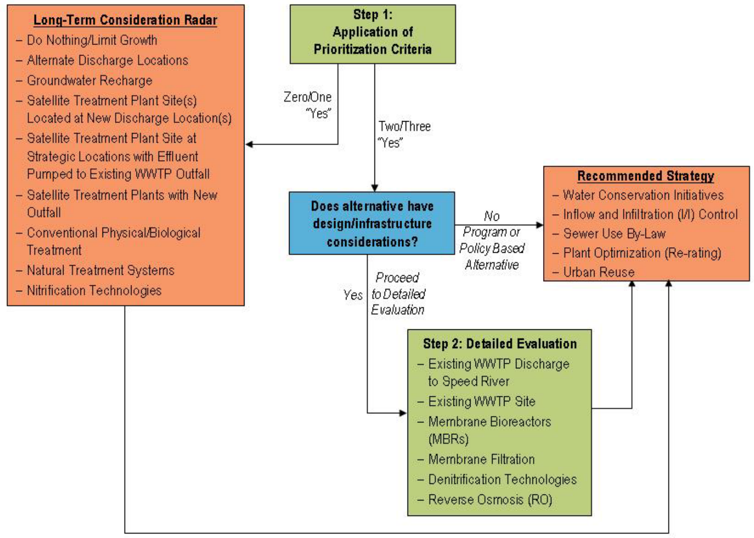


Figure 4: Prioritization Results

Studies

These alternatives require additional information before the City can develop a path forward:

Study	Description
Urban Reuse	Involves increased treatment and diversion of a portion of effluent for applications such as: municipal/golf course irrigation, dual water systems, or industrial use. Study will look at market analysis, treatment technologies, costs, and regulatory requirements.
Facility Plan	A tool that the City can use for detailed capital investment and help to integrate recommendations from master plans along with maintenance requirements. Study would summarize recommendations on a cost and land allocation basis and assist the City in developing their detailed investment planning.
Energy Audit of the Guelph WWTP	Would contribute to the City's Community Energy Plan by looking at current and potential future uses at the WWTP. Study would make recommendations for future specifications of equipment and look at potential operation modifications that could be made. Greenhouse gas emissions and renewable energy produced that the plant would also be quantified.
Climate Change Adaptation	Would look at predicted climate change scenarios as they relate to the Guelph area. This undertaking would involve integration with other organizations, such as the Grand River Conservation Authority, doing work on this topic.
Sewer Use By-Law Review and Update	This by-law is an important tool the City uses to control the quality of wastewater that reaches the WWTP. This study would review the City's current by-law in detail and make recommendations for improvements.

Programs/Policies

Program/Policy	Description
Water Conservation and Efficiency	City's Water Efficiency program has effectively reduced per capita water consumption to date. The City continues to update and enhance this program which could contribute to reductions in per capita wastewater generation.
Inflow and Infiltration Control	Inflow and Infiltration (I/I) is extraneous flow that enters the wastewater collection system. Through the City's Water and Wastewater Servicing Master Plan recommendations have been made to reduce I/I entering the system and arriving at the WWTP.
Optimization	The City will continue to look at potential opportunities for optimization of the WWTP by looking at potential bottlenecks and seeing how the WWTP can be operated differently to reduce these bottlenecks, achieving increased capacity.
Water Managers of the Grand	The City will continue to be active in the Water Managers of the Grand. They will work with the GRCA to improve the monitoring along the Speed River, which will assist in identifying areas to be targeted for improvement of the overall health of the Grand River Watershed.

Infrastructure

The recommended infrastructure components have been divided into three timeframes: short-term (2008 – 2020), mid-term (2021 – 2031), and long-term (2032 – 2054). The recommendations summarized within the table are based on the best information available at the time of this Master Plan. Changes in available technology and/or regulatory conditions will likely impact some of the recommendations in the future. Therefore, all recommendations and flow projections will be reviewed during each update of the Master Plan, which is to occur every five years.

Timeframe	Current Recommendation/Direction
Short-term (2008 – 2020)	Based on current projections, flows during this timeframe will not exceed 73.3 MLD. Recommendations to upgrade the WWTP to 73.3 MLD have already been examined and approved under a previous Class EA process and were not re-examined under this Master Plan.
Mid-term (2021 – 2031)	Based on current flow projections, the approved capacity of 73.3 MLD will be reached by approximately 2024. Prior to the commencement of the expansion design, a Schedule C Class EA will need to be completed and approved. For this expansion it is recommended that the City look at advanced treatment technologies such as membranes.
Long-term (2032 – 2054)	The review and evaluation of treatment alternatives indicated that, at this time, tertiary membrane technology is the preferred method of achieving long-term effluent quality compliance limits beyond 2031. Consideration was given to staged treatment capacity expansions from 2031 to 2054 to provide a total treatment capacity of 144 MLD at the Guelph WWTP.

Cost estimates (based on 2008 $) for the recommendations from the implementation plan and projects previously identified are summarized below:

Recommendation	2008 – 2011	2012 – 2018	2019 – 2025	2026 – 2031	2032 – 2054
Facility Plan	$75,000				
Urban Reuse Study	$500,000				
Energy Audit at the WWTP	$90,000				
Climate Adaptation Studies	$35,000				
Sewer Use By-Law Review and Update	$75,000				
Master Plan Updates	$200,000	$200,000	$200,000	$400,000	$800,000
Future Studies		$500,000	$500,000	$500,000	$1,500,000
Optimization – Plant Rerating	$400,000	$100,000			
Phase 2 Expansion to 73.3 MLD	$10,000,000	$20,000,600			
Schedule C Class EA for 85 MLD Expansion		$400,000			
Design and Construction of 85 MLD Expansion			$60,000,000		
Long Term Expansions				$60,000,000	$120,000,000
From Biosolids Management Plan/Ongoing					
Biosolids Facility Upgrade	$5,000,000	$37,000,000			
Digester No. 6		$6,000,000			
Dewatering Facility Expansion			$10,000,000		
Solids Stabilization Expansion			$15,000,000		
Secondary Pumping Expansion		$8,000,000			
Misc. WWTP Upgrades/Maintenance	$4,000,000	$4,000,000			
SCADA Upgrades	$550,000				
Administration Building Upgrades	$1,000,000				
Disinfection Upgrades		$8,000,000			
Totals	**$21,925,000**	**$84,200,600**	**$85,700,000**	**$60,900,000**	**$122,300,000**

Next Steps

- Public comments will be received until February 18, 2009
- Comments will be reviewed and the Master Plan Recommendations will be revised where appropriate
- The Master Plan Report will be available for the public to view. Notice will be published in the local newspaper and on the City's website.
- The Wastewater Treatment Master Plan will be updated every five years.

For additional information, please contact:

Kiran Suresh
Project Manager
Wastewater Services
City Hall, 59 Carden Street
Guelph, ON N1H 3A1
Fax (519)837-1226
kiran.suresh@guelph.ca
www.guelph.ca\wastewater

CH2MHILL

COMMENT SHEET FEBRUARY 10, 2009

Thank you for your interest in the City of Guelph Wastewater Treatment Master Plan. The City of Guelph encourages you to provide your comments on this sheet and hand it over to any project team member. The City is soliciting your feedback prior to completing the draft Master Plan report. We would appreciate your input on the following questions.

1. The study is following the requirements of the Class EA process for Master Plans. *Do you have any questions, comments, or concerns about the decision-making processes that is being followed to prepare the Wastewater Treatment Master Plan?*

   ☐ No ☐ Yes Please provide details: ______________________________

2. The Recommended Strategy Components for the Master Plan included a number of studies, programs, and policies. Please provide your comments on the following Master Plan components:

   a. Studies (including urban reuse, facility plan, energy audit, climate change adaptation, sewer use by-law review)

   b. Programs/Policies (including water conservation, inflow and infiltration, optimization, Water Managers of the Grand)

3. The Master Plan also recommends new infrastructure including a plant expansion in approximately 2024 (mid-term) and three subsequent expansions from 2031 – 2054 (long-term). It is recommended that the City look to advanced treatment technologies such as membranes for these expansions. Please provide your comments on the recommended infrastructure components.

Public Consultation

1. Was the time of the Public Information Centre convenient for you?

   ☐ Yes ☐ No

   If no, what time would be more convenient: ______________________

2. Did the Public Information Centre help you to better understand the Master Plan recommendations?

   ☐ Yes ☐ No ☐ Uncertain

3. Did you have enough opportunity to ask questions, make comments, or express concerns?

   ☐ Yes ☐ No

4. Were those questions answered to your satisfaction?

   ☐ Yes ☐ No ☐ Not applicable

   If the questions were not answered to your satisfaction, please list them here:

   ____

   ____

5. How useful did you find the Public Information Centre? (please circle one)

   Very Useful — Not Very Useful

   1 2 3 4 5

6. How would you describe the nature of your interest in this study?

   ☐ Member of the General Public
   ☐ Member of an Interest Group. Please specify: _________________________
   ☐ Consultant
   ☐ Agency Representative. Please specify: ______________________________
   ☐ Other. Please specify: ____

Optional information

Name:____

Address:____

Phone/fax:____ Email:____________________________

Your completed Comment Sheet will be included in the Wastewater Treatment Master Plan report, which will be made public at the completion of this study. Please place a (✓) in the box below if you wish to have your comments included anonymously.

☐ Please withhold my name, address, and telephone number from publication in the Wastewater Treatment Master Plan.

Please leave this completed Comment Sheet in the box provided at the Registration Table
or fax, mail or email it, by February 18, 2009 to:

Kiran Suresh
Project Manager
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Kitchener, ON N2G 4Y9
Fax (519)579-8986
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Thank You for Your Participation in this project!

CH2MHILL

Comments from Guelph February 10, 2009 PIC

Questions	Comments from Public	Responses
1. The study is following the requirements of the Class EA process for Master Plans. *Do you have any questions, comments, or concerns about the decision-making processes that is being followed to prepare the Wastewater Treatment Master Plan?*	Yes - Just a general concern regarding overall population growth over the next 50 years. Where are all those people going to go? Hopefully nodal growth will be in hand.	Location and type of growth has been reviewed and developed through the Local Growth Management Strategy.
	Yes - The integration of this plan with other City business, i.e. development change increases land use and water use cannot be separated.	This master plan has been developed considering the City's Growth Management Strategy and Water Supply Master Plan. It is agreed that there is integration between all of the other City departments.
	No - The process seems very <u>inclusive</u> of the public and you are to be complimented for this public involvement. More people <u>should</u> have come to this (Feb 10) meeting. I cannot remember seeing the notice in TODAY'S Mercury. Perhaps you should do this in the future.	Comment has been noted.
2. The recommended Strategy Components for the Master Plan included a number of studies, programs, and policies. Please provide your comments on the following Master Plan components:		
a) Studies (including urban reuse, facility plan, energy audit, climate change adaptation, sewer use by-law review)	Please to see climate change considerations, with the Speed River on the receiving end.	Comment has been noted.
	- Urban re-use could include rainwater harvesting - What about source water protection planning? - What about stormwater infrastructure renewal throughout the City?	Rain water harvesting and grey-water re-use is being examined by the City through the Water Conservation and Efficiency Strategy Update. The City's has a program looking specifically at source water protection. The City initiated a Storm Water Master Plan in January 2009 which will be looking at infrastructure renewal.
	The proposed studies seem to be nice(!). That being said, will there be an overall view that brings it all together? Will the studies be done in concert or as separate entities? If the outcomes and recommendations of the study are contradictory or opposed, who or how would this be resolved? There does not seem to be anything on the removal of synthetics, drugs, etc. pharmaceuticals.	The City is looking at integration of master planning activities being completed. Members from other City departments are included in the review of this master plan. Consideration has also been given to impacts of recommendations from other studies, i.e. the Water Supply Master Plan and the Water and Wastewater Servicing Master Plan. The consideration to microconstituents (pharmaceuticals etc) is included in the report. Projects are underway looking at the fate of these chemicals through wastewater treatment processes.

Questions	Comments from Public	Responses
		The Canadian government is also in the process of looking at the regulation of these compounds.
b) Programs/Policies (including water conservation, inflow and infiltration, optimization, Water Managers of the Grand)	Interested in optimization. Membrane technology is intriguing. Water conservation, of course, helps deal with volume growth at its source. Any housing development laws requiring mandatory installation of efficient shower heads, 2-stage toilets, etc.	Comment has been noted.
	What incentives exist for builders, consumers to implement or purchase water conservation technologies into new homes, i.e. tax credits.	Incentives and rebates for water conservation have been looked at through the City's Water Conservation and Efficiency Strategy Update.
3. The Master Plan also recommends new infrastructure including a plant expansion in approximately 2024 (mid-term) and three subsequent expansions from 2031 – 2054 (long-term). It is recommended that the City look to advanced treatment technologies such as membranes for these expansions. Please provide your comments on the recommended infrastructure components.	Go for the best! Our watershed deserves it!	Comment has been noted.
	What about exploring other systems, i.e. distributed, non-centralized treatment possibilities? That would be actually challenging the status quo! And then "urban sprawl" would not have to exist.	Non-centralized treatment was examined as part of the master planning process and was not found to be the preferred approach to treatment in the City.
Public Consultation		
1. Was the time of the Public Information Centre convenient for you? *If no, what time would be more convenient?*	Yes	
	Yes	
	Yes	
2. Did the Public Information Centre help you to better understand the need for this project?	Yes	
	Uncertain	
	Yes	
3. Did you have enough opportunity to ask questions, make comments, or express concerns?	Yes	
	Yes	
	Yes	
4. Were those questions answered to your satisfaction? *If the questions were not answered to your satisfaction, please list them here.*	Yes	
	How this plan is going to be linked to other plans to achieve integrated resource management?	The City is examining ways to formally integrate other master plans.
	Yes	