

1. Background and Introduction

1.1 Background

Combined sewer overflows (CSO), discharges from stormwater sewers, and stormwater runoff have contributed to the degradation of Toronto area watercourses and the waterfront. Improving water quality by eliminating CSO and better managing stormwater is a priority environmental issue for the City of Toronto and its residents. Towards this objective, the former City of Toronto completed a Master Plan to develop options for ameliorating the negative impacts of CSO and stormwater discharges. One option identified in the Master Plan for controlling CSO and stormwater was construction of an underground storage tunnel from Glendale Avenue to just west of Strachan Avenue (i.e. the Western Beaches Tunnel).

The Western Beaches Tunnel project was undertaken as a Schedule C project in accordance with the Class Environmental Assessment process for Municipal Water and Wastewater projects. As such, an Environmental Study Report (ESR) was completed and subject to a 30-day public review. During the review period, there were several requests to bump up the project from a Schedule C, Class EA to an individual EA. The Minister of the Environment at the time granted the bump up request. However, in response to City concerns, the newly elected government initiated a review of the status of the project, by seeking the advice of the Environmental Assessment Advisory Committee (EAAC) (May 1994). In its Report No. 56, EAAC recommended exemption of the Tunnel from an individual EA conditional on:

“... the City of Toronto shall set up a Non-Structural Programs Working Group ... and to direct the Non-Structural Programs Working Group to examine the feasibility of implementing non-structural solutions for stormwater management at the Ellis Avenue and Howard Road¹ stormwater outlets.”

The purpose of the above EAAC directive was to eliminate the discharges from the two subject storm sewer outfalls from entering the Western Beaches Tunnel, which is intended for combined sewer overflows only.

The purpose of this project is to identify preferred methods for managing stormwater from the areas drained by the Ellis Avenue and Colborne Lodge Drive storm sewers. The project will be undertaken in accordance with the planning and design requirements for Schedule C projects outlined in the Municipal Engineers Association *Municipal Class Environmental Assessment*. This requires a description of the problem, assessment of alternative solutions and designs, selection of a preferred alternative, and preparation of an Environmental Study Report (ESR), as well as extensive public and agency consultation. In keeping with the EAAC directive and the goals of the Toronto Stormwater Group, the City's preference is that the preferred stormwater management system be a non-structural type of system utilizing source control and natural treatment technologies.

¹ Now referred to as the Colborne Lodge Drive storm sewer outfall.

1.2 Ontario's Environmental Assessment Act

Studies of this type are subject to Ontario's Environmental Assessment (EA) Act. The Act was passed in 1975 and began being applied to municipalities in 1980. The EA Act requires the study, documentation and examination of the environmental effects that could result from major projects or activities and their alternatives.

The objective of the Act is to consider possible effects of these projects early in the planning stage when concerns may be most easily resolved, and to select a preferred alternative on the basis of these effects.

The Act defines environment very broadly as:

- a) air, land or water;
- b) plant and animal life, including humans;
- c) the social, economic and cultural conditions that influence the life of humans or a community;
- d) any building, structure, machine or other device or thing made by humans;
- e) any solid, liquid, gas, odour, heat, sound, vibration or radiation resulting directly or indirectly from human activities; or
- f) any part or combination of the foregoing and the interrelationships between any two or more of them, in or of Ontario.

In applying the requirements of the EA Act to undertakings, the EA Act identifies two types of environmental assessment planning and approval processes:

- Individual Environmental Assessments (Part II of the EA Act) – projects for which a Terms of Reference and an individual environmental assessment are carried out and submitted to the Minister of the Environment for review and approval, or
- Class Environmental Assessments (Class EAs) - projects that are approved subject to compliance with an approved class environmental assessment process with respect to a class of undertakings. Providing the appropriate Class EA approval process is followed, a proponent will comply with Section 13 (3) a, Part II.1 of the EA Act.

An approved Class EA document describes the process for a class or group of undertakings that a proponent must follow in order to meet the requirements of the EA. The approved Class Environmental Assessment document prepared by the Municipal Engineers Association in June 2000 outlines the procedures to be followed for projects of the type considered here to satisfy the EA Act requirements. The Class EA planning and design process is shown in Figure 1-1.

The Class EA document places projects into three possible schedules, depending on their characteristics (i.e. Schedule A, B or C projects). The schedule in which a project falls determines the planning and design procedures that must be followed. There are five phases of assessment in the Class EA process. 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 (i.e. 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 impacts, and select a preferred solution. They must also contact relevant agencies and affected members of the public. Provided no significant impacts are found and no requests are received to elevate the project to Schedule C or to order the project to comply with Part II of the Environmental Assessment Act (referred to as a Part II order), the project may proceed to detailed design (Phase 5). Schedule C projects require more detailed study, public consultation, and documentation as they have more significant impacts. Projects categorized as Schedule C must proceed through all five phases of assessment.

This preferred stormwater management system will likely include a natural treatment technology such as a constructed wetland. It is a Schedule C project and subject to all five phases of the Class EA process.

1.3 Study Approach

To satisfy the Class EA requirements the following steps were completed:

1.3.1 Phase 1

- Identify the problem.
- Describe environmental conditions in the study area, and identify effluent quality objectives.
- Notify public and government agencies of study commencement.

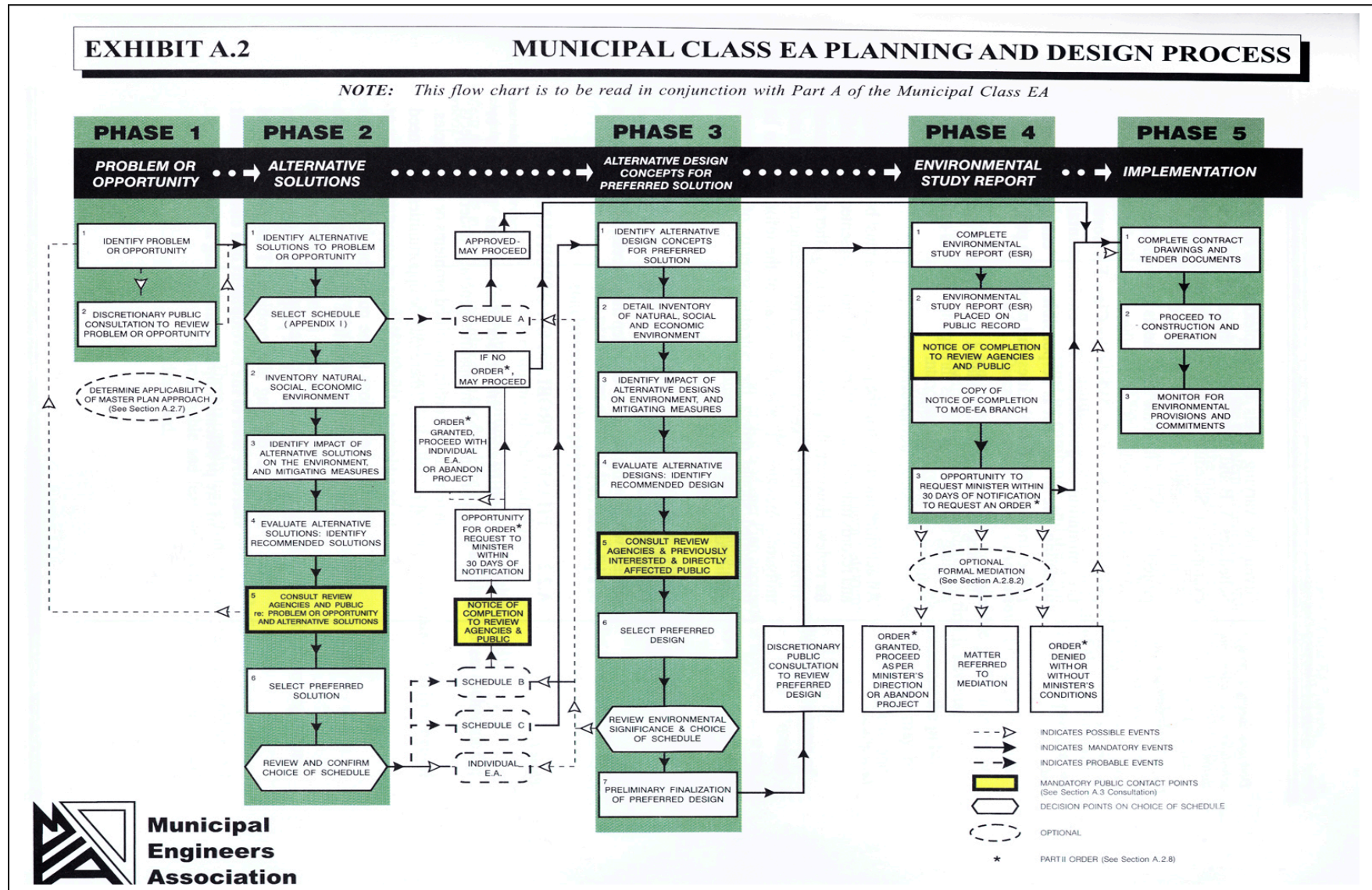
1.3.2 Phase 2

- Identify alternative solutions to the problem.
- Evaluate impacts of alternative solutions.
- Recommend a preferred solution.
- Seek public and agency input concerning the assessment and recommended solution.
- Revise and finalize the preferred solution.

1.3.3 Phase 3

- Identify alternative design concepts for the preferred solutions.
- Evaluate impacts of alternative design concepts.
- Recommend preferred design concepts and develop implementation plan.
- Seek public and agency input concerning the assessment and recommended design concepts and implementation plan.
- Revise and finalize the preferred design concepts and implementation plan.

FIGURE 1-1
MUNICIPAL CLASS EA PLANNING AND DESIGN PROCESS



1.3.4 Phase 4

- Prepare an Environmental Study Report (ESR) which documents the study process and findings.
- Notify the public and government review agencies of completion of the project.

The planning process of a Schedule C project ends at Phase 4. At this point, the ESR is placed on the public record for a period of at least 30 calendar days. This is achieved by issuing a Notice of Completion in local newspapers and to interested individuals who have been involved throughout the planning process. During the 30-day review period, the public has an opportunity to review the ESR and provide additional comments and input. If concerns cannot be addressed through discussions with the City, a person/party may request the Minister of the Environment to order the project to comply with Part II of the Environmental Assessment Act. If Part II orders are received, the proponent and the concerned parties can work together to help resolve conflicts. If conflicts cannot be resolved, the Minister of the Environment makes a decision as to whether or not the Part II order should be granted and an Individual EA completed, based on available information. If there are no Part II orders, the proponent may proceed with the project. (The Notice of Completion for this ESR and information on Part II order requests are provided at the front of this document.)

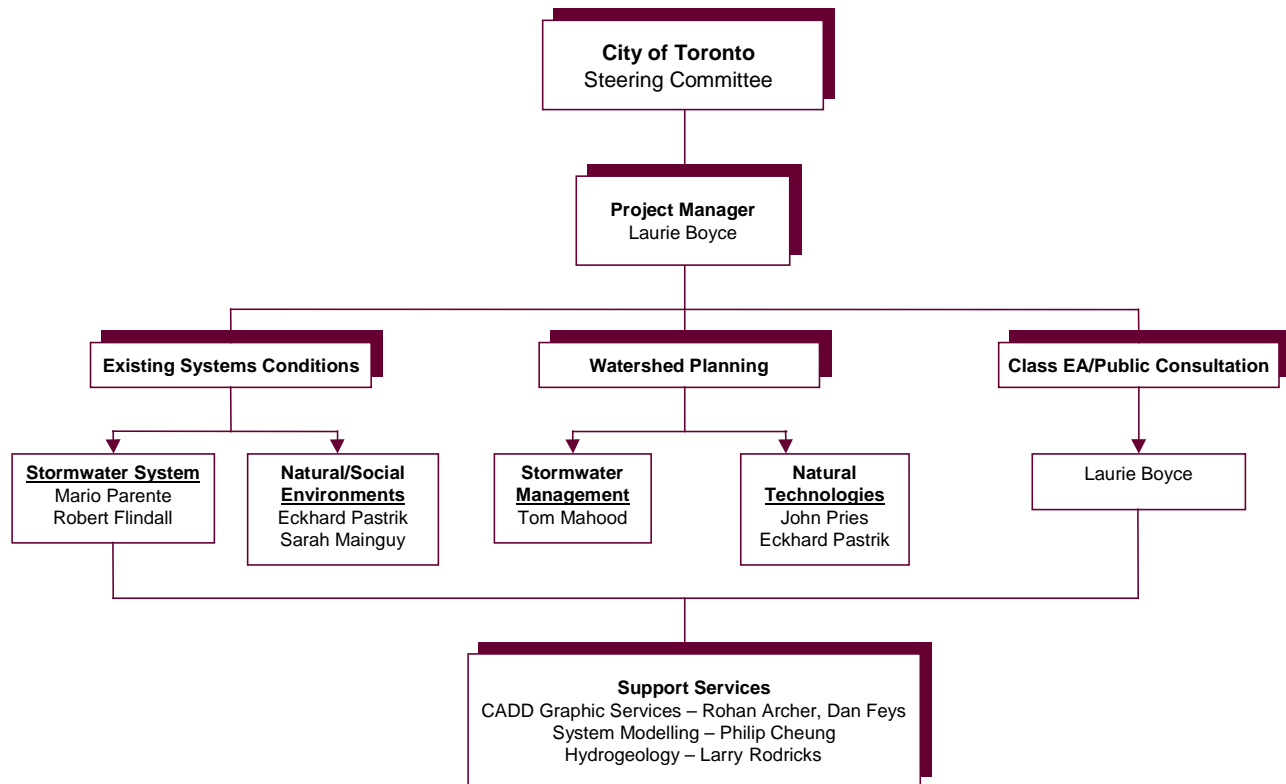
1.4 Project Organization

The study was initiated in January 2000. The proponent of the study is the City of Toronto. The study is being directed by a Steering Committee made up of members of the public, interested groups and senior City of Toronto staff. Figure 1-2 provides a chart of the study organization. Members of the Steering Committee are listed in Table 1.1.

TABLE 1.1
LIST OF STEERING COMMITTEE MEMBERS

Name	Association
Don Barnett	High Park Citizens Advisory Group
Kristina Guiguet	Stormwater Group and Area Resident
Karey Shinn	Stormwater Group, Area Resident, Safe Sewage Committee
Pat Chessie	Works and Emergency Services, Quality Control and Systems Planning
Ted Bowering	Works and Emergency Services, Soil/Water Quality Improvement
Tim Dennis	Works and Emergency Services, Design and Construction, District 1, Area 2
Carol Guy	Parks and Recreation, High Park
David O'Hara	Parks and Recreation, Planner
Mae Lee (Rigmea Lee)	Works and Emergency Services, Public Consultation and Community Outreach

FIGURE 1-2
STUDY TEAM ORGANIZATION



1.5 Report Outline

This report documents the Class EA, including the public consultation program. It consists of the following sections:

- Section 2: Problem Definition – This section describes the purpose of the study, including stormwater management objectives.
- Section 3: Existing Conditions – This section describes the physical, natural and social environments in the study area, as well as the existing conditions.
- Section 4: Identification and Assessment of Source Control and Conveyance System Alternatives - Phase 2 of the Class EA process involves identifying and assessing alternative solutions to the problem. Alternative solutions include source controls, conveyance system modifications and end-of-pipe treatment. This section provides an assessment of the effectiveness of source controls, including recommendations.
- Section 5: Identification and Assessment of Conveyance System Modification Alternatives. This section provides an assessment of effectiveness of conveyance system

modifications. Recommendations regarding conveyance system modifications are also made in this section.

- Section 6: Identification and Assessment of Treatment Alternatives – This section provides an assessment of treatment alternatives, including comparison of alternatives with the Western Beaches Tunnel Alternative. Preferred solutions are selected based on the assessment. Preferred solutions are a combination of source controls, conveyance system modifications and treatment alternatives.
- Section 7: Identification and Assessment of Alternative Design Concepts – Alternative designs for the recommended solutions are identified and assessed in this section. Preferred designs are selected based on the assessment.
- Section 8: Preferred Alternative – The preferred alternative for managing and using stormwater in the study area is described in this section, including costs, implementation plan, environmental impacts, and mitigation and monitoring techniques.
- Section 9: Public Consultation – The public consultation program, including a listing of concerns and responses is provided in Section 8. The public consultation materials (e.g. comment sheets, meeting minutes, and advertisements) are provided in the Appendix.
- Section 10: References.

10. References

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- Ministry of Natural Resources (MNR). 1994. *Fish Habitat Protection Guidelines for Developing Areas*. Ontario: Queen's Printer for Ontario.
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2. Problem Definition

2.1 Purpose of the Study

The purpose of this study as defined by the Steering Committee is:

- To identify preferred systems for control and use of stormwater from the areas drained by Ellis Avenue and Colborne Lodge Drive storm sewers, with the objectives of minimizing negative environmental effects, and enhancing the beneficial use of stormwater in both natural and built environments

2.2 Study Area

Figure 2-1, the Study Area, illustrates the Ellis Avenue and Colborne Lodge Drive drainage areas.

The Colborne Lodge Drive storm sewer collects stormwater runoff from Colborne Lodge Drive south of the Queensway, as well as from the Queensway, the Gardiner Expressway and Lakeshore Boulevard to the east and west of Colborne Lodge Drive. The drainage area to the Colborne Lodge Drive storm sewer consists of roadway drainage as identified above and open areas adjacent to these roadways and the CNR lands north of the Gardiner Expressway.

The Ellis Avenue storm sewer outlet intercepts the outflow from the Grenadier Pond. In addition to the Grenadier pond outflows, the sewer collects the stormwater drainage from Ellis Gardens, Coe Hill Drive and the Queensway east of Windermere Avenue to Ellis Avenue, and the stormwater drainage from the Gardiner Expressway from Windermere Avenue to Colborne Lodge Drive. The majority of stormwater in the Ellis Avenue storm sewer is diverted by a weir into a sewer on Lakeshore Boulevard that flows westerly and outfalls into the Humber River after collecting additional drainage from Lakeshore Boulevard, Windermere Avenue and the Gardiner Expressway. When flows exceed the capacity of the Lakeshore Boulevard sewer, the weir is overtopped and stormwater is discharged directly to Lake Ontario via the Ellis Avenue outfall. The Ellis Avenue storm sewer follows the alignment of the original Grenadier Pond outfall stream prior to diverting the pond's outfall to the Humber River. The Ellis Avenue storm sewer is an open swale from the Queensway through private Stelco owned land and is then piped through easements from the CNR areas south to Lake Ontario.

The study area also includes the drainage area north of the Queensway to Bloor Street that drains into the West Pond (also known as Catfish Pond), and the drainage area north of the Queensway that contributes to the Ellis Avenue storm sewer. These areas then discharge into Grenadier Pond and ultimately into the Ellis Avenue storm sewer. The study area does not include the area tributary to Wendigo Creek, the Valleysmede and Clendenan Avenue storm sewers and any overland flows to Grenadier Pond.

The West Pond is a relatively shallow natural pond that has never been dredged. The City of Toronto carried out a sediment quality sampling program for the West Pond and Grenadier Pond, and identified that the West Pond's sediments are contaminated. The City also determined that if the sediments were removed, they would require disposal at a controlled landfill site. Alternatively, the sediments could be capped within the pond so that the contaminants will not be re-suspended.

2.3 Stormwater Management Objectives

The following sources have been reviewed in order to develop the stormwater management objectives for the study area. The stormwater management objectives encompass both water quality and water quantity issues. Measurable indicators and targets relating to stormwater have been identified where possible.

2.3.1 MOE Stormwater Management Practices Planning and Design Manual

The current MOE guidelines (MOEE, 1994) for stormwater discharge quality are based on protection of aquatic habitat using removal of suspended sediment as an indicator. A subjective relationship has been determined based on the lethal and chronic effects of suspended solids on aquatic habitat. Level 1 Protection applies to Type 1 habitat as defined in the Ministry of Natural Resources *Fish Habitat Protection Guidelines for Developing Areas* (MNR, 1994) and requires 80% removal of total suspended solids (TSS). Level 2 Protection applies to Type 2 habitat and requires 70% removal of TSS. The receiving waters of the West Pond and Grenadier Pond require Level 2 Protection. The receiving waters of Lake Ontario and the Humber River require Level 1 Protection. As a minimum, 50% removal of TSS must be achieved for retrofit and redevelopment situations. The MOE suspended sediment removal guidelines do not supercede the Provincial Water Quality Objectives.

In addition to sediment removal, the MOE provides guidelines on the allowable change in the thermal regime of receiving waters resulting from stormwater discharges. For cold receiving waters (<20°C) the allowable change is +1°C. For warm receiving waters (>20°C) the allowable change is +2°C.

The MOE design manual also provides guidelines for reducing erosion potential from stormwater discharges. The MOE suggest that runoff from a 25mm storm be detained for 24 hours and released at the predevelopment flow rate. The potential for flood hazards must also be addressed. Reducing the peak flow to the pre-development condition generally mitigates flood hazards. Assessment of flood hazard potential should be carried out on a watershed basis to account for the timing of peak flows from different areas within the watershed.

The MOE design manual provides direction on the issue of stormwater quantity control. The manual states that no runoff from a 5-mm storm should occur for any development (excluding paved surfaces). This level of runoff quantity control can be achieved through infiltration and depression storage. This level of quantity control is intended to ensure that groundwater contribution to baseflow in streams and ponds is maintained.

The 1994 MOE design manual is used as a baseline reference document in the review of stormwater management applications for approval under section 53 of the Ontario Water Resources Act as administered by the Ontario Ministry of the Environment.

2.3.2 Provincial Water Quality Objectives

The Provincial Water Quality Objectives (PWQO) are numerical and narrative criteria, which serve as chemical and physical indicators representing a satisfactory level for surface waters. The PWQO are set at a level of water quality which is protective of all forms of aquatic life and all aspects of aquatic life cycles during indefinite exposure to water. The Objectives for protection of recreational water uses are based on public health and aesthetic considerations (*Water Management, Goals, Policies, Objectives of the Ministry of the Environment and Energy, 1994*).

The general narrative objectives of the PWQO are as follows.

All waters shall be free from contaminating levels of substances and materials attributable to human activities which in themselves or in combination with other factors can:

- Settle to form objectionable deposits;
- Float as debris, scum or oil or other matter to form nuisances;
- Produce objectionable colour, odour, taste or turbidity;
- Injure, are toxic to, or produce adverse physiological or behavioral response in humans, animals or plants; or
- Enhance the production of undesirable aquatic life or result in the dominance of nuisance species.

Appendix A contains Table 2 of the PWQO that defines the numerical and narrative criteria. The following are selected criteria that apply to stormwater discharges in the study area. Other pollutants that are listed in the PWQO may also be present in stormwater from time to time and should also be addressed.

Aesthetics	Water used for swimming, bathing and other recreational activities should be aesthetically pleasing. The water should be devoid of debris, oil, scum or any substance that would produce an objectionable deposit, colour, odour, taste or turbidity.
Bacteria	100 <i>Escherichia coli</i> per 100 mL.
Oil and Grease	Oil or petrochemicals should not be present in concentrations that: <ul style="list-style-type: none"> – can be detected as a visible film, sheen, or discoloration on the surface; – can be detected by odour; – can cause tainting of edible aquatic organisms; – can form deposits on shorelines and bottom sediments that are detectable by sight or odour or are deleterious to resident aquatic organisms.

Temperature	The natural thermal regime of any body of water shall not be altered so as to impair the quality of the natural environment.
Turbidity	Suspended matter should not be added to surface water in concentrations that will change the natural Secchi disc reading by more than 10 percent.

The goals, policies and guidelines set out in the Provincial Water Quality Objectives are used by the MOE to assist those making decisions under or related to the *Ontario Water Resources Act* and the *Ontario Environmental Protection Act*. The policies and guidelines themselves do not have any legal status, but as used as standard practices for water resources management in Ontario.

2.3.3 Canadian Federal Fisheries Act

The Fisheries Act states that no person shall deposit or permit the deposit of a deleterious substance of any type in waters frequented by fish. A deleterious substance is defined as any substance that would degrade the quality of the receiving water so that the water is rendered deleterious to fish or fish habitat.

2.3.4 City of Toronto Sewer System Master Plan

The City of Toronto Sewer System Master Plan was prepared in 1992 but has not been formally adopted by City Council. The Master Plan identified stormwater quality objectives through consultation with various agencies (MOE, MNR, TRCA, City of Toronto); interest groups (Metro Toronto Remedial Action Plan, the Royal Commission of the Future of the Toronto Waterfront, the Don River Task Force, and others); and the general public.

The following are the stormwater quality criteria recommended in the Master Plan.

<u>Concern</u>	<u>Criterion</u>
Swimming	Control Bacteria 100 fecal coliforms per 100 mL
Fishery	Control Sediments 24 hour detention of runoff from a 13 mm or 25 mm storm (13 mm for warm water fisheries, and 25 mm for cold water fisheries)
Aesthetics	Control floatables and turbidity

The Sewer System Master Plan has as one of its primary objectives the virtual elimination of combined sewer overflows (CSOs). The Ellis Avenue, Colborne Lodge Drive study area has separated sewers, therefore reduction of stormwater flows to reduce CSOs is not an issue. No basement flooding problems have been identified in the study area. In addition, although erosion of slopes surrounding Rennie Park and the West Pond occurs during extreme runoff events, it is not a major problem to land users in the study area. The Master Plan does encourage the use of infiltration techniques for redevelopment areas where soil conditions are favourable. The maintenance of groundwater base flows is identified in the Master Plan as an objective for the ponds in and around High Park and for the Humber River.

2.3.5 Great Lakes Water Quality Agreement of 1978

In 1978, Canada and the United States entered into an agreement on water quality in the Great Lakes. The International Joint Commission administers the agreement, which outlines General Objectives for the water quality in the Great Lakes, as well as Specific Objectives related to the concentration of pollutants in the waters of the Great Lakes system. The General Objectives are as follows.

The waters of the Great Lakes system should be:

- a) Free from substances that directly or indirectly enter the waters as a result of human activity and that will settle to form putrescent or otherwise objectionable sludge deposits, or that will adversely affect aquatic life or waterfowl;
- b) Free from floating materials such as debris, oil, scum, and other immiscible substances resulting from human activities in amounts that are unsightly or deleterious;
- c) Free from materials and heat directly or indirectly entering the water as a result of human activity that alone, or in combination with other materials, will produce colour, odour, taste, or other conditions in such a degree as to interfere with beneficial uses;
- d) Free from materials and heat directly or indirectly entering the water as a result of human activity that alone, or in combination with other materials, will produce conditions that are toxic or harmful to human, animal, or aquatic life; and
- e) Free from nutrients directly or indirectly entering the waters as a result of human activity in amounts that create growths of aquatic life that interfere with beneficial uses.

In addition to the General Objectives, the Agreement includes Specific Objectives related to measurable pollutant concentrations or levels within the Great Lakes system. Appendix B contains the Specific Objectives of the Great Lakes Water Quality Agreement.

The General and Specific Objectives of the Agreement have no legal status. However, Canada and the United States are obligated under the *Boundary Waters Treaty* (1909) to develop and implement cooperative programs to restore and maintain the chemical, physical and biological integrity of the Great Lakes Basin Ecosystem. As such, the parties agree that water quality standards and other regulatory requirements of the parties shall be consistent with the achievement of the General and Specific Objectives. Examples of ways in which the Agreement has been implemented include Remedial Action Plans for Areas of Concern, and Lakewide Management Plans for Critical Pollutants such as phosphorous.

2.3.6 Toronto Region Conservation Authority

The Toronto Region Conservation Authority (TRCA) has developed a number of objectives for the Humber River watershed to protect and enhance the water resources of the watershed. These objectives were defined by the Humber Watershed Task Force (MTRCA, 1997). A number of these objectives are related directly to stormwater discharges.

Objective 2: Protect the form and function of the Humber River and its tributaries

Objective 4: Protect groundwater sources

Objective 5: Manage stormwater to protect people and the health of streams and rivers

- Objective 6: Prevent groundwater contamination
- Objective 7: Reduce the amount of sediment that enters surface waters
- Objective 8: Reduce the amount of nutrients and bacteria that enter ground and surface waters
- Objective 9: Reduce the amount of pesticides, chemical fertilizers, oil, grease, metals, road salt, and other contaminants that enter ground and surface waters
- Objective 10: Protect ground and surface waters from spills and illegal discharges of hazardous materials

The TRCA is currently undertaking a monitoring program to determine the existing water quality in the Humber River. This will allow the agency to set targets and indicators for water quality assessment. Similar water quality assessments have been made for the Don River (DWRC, MTRCA, 1997). The Don River water quality targets and indicators relate to the water quality of the river itself, not to the water quality of stormwater discharges. The targets and indicators related to water quality are as follows:

- 1) Sediment measured as total suspended solids (TSS) will be less than 80 mg/L more than 75% of the time.
- 2) A diverse group of invertebrate species will be found throughout the watershed. Restore the balance of species to the 1949 community of 13% pollution intolerant, 65% moderately tolerant, and 22% pollution tolerant.
- 3) Chemical contaminants will be within the International Joint Commission's Aquatic Life Guideline.

The stormwater quantity objective for the Humber River watershed is the protection of people and the health of streams and rivers. This objective includes the maintenance or increase in groundwater base flow, erosion control and flood protection.

2.3.7 Selected Stormwater Quality and Quantity Objectives

The most clearly defined objectives for stormwater management in Ontario are the MOE guidelines for sediment removal and thermal regime modification. The MOE guidelines will be adopted as the stormwater management objectives for the Ellis Avenue and Colborne Lodge Drive drainage area for the purposes of this study. Accordingly, the stormwater management objectives for discharges to the West Pond and Grenadier pond are 70% removal of total suspended solids, and a 2°C increase in thermal regime of the receiving water. The objectives for discharges to the Humber River and Lake Ontario are 80% removal of total suspended solids, and a 1°C increase in thermal regime of the receiving water. The Humber River and Lake Ontario require a higher level of sediment removal because they contain more sensitive areas for Fish Habitat near the outfalls.

The Provincial Water Quality Objectives and the Great Lakes Water Quality Agreement provide specific water quality objectives for pollutant concentrations in stormwater discharges. Removal of suspended sediments is the primary concern in terms of lethality and chronic effects associated with stormwater discharges. Nutrients, metals, bacteria and oil/grease are generally regarded as sediment associated (MOEE, 1994, p. 168). Attainment

of the Specific Objectives of the PWQO and the Great Lakes Water Quality Agreement will primarily be achieved through removal of suspended sediments. The selection of stormwater management alternatives will be guided by the requirement to remove additional pollutants to meet the Specific Objectives identified in the PWQO.

The stormwater quantity objective for this study is the maintenance and enhancement of groundwater baseflows throughout the study area. The MOE guideline with respect to quantity control and baseflow maintenance is that no runoff from a 5-mm storm should occur, except from paved surfaces. All of the stormwater from the 5-mm storm event should be infiltrated into the groundwater system, or trapped in depression storage where it can be removed by evaporation.

3. Existing Conditions

This section provides a general description of the physical and natural environment, drainage conditions, and social conditions in the Ellis Avenue and Colborne Lodge Drive drainage areas. It also describes the existing stormwater control and use programs implemented in the study area by the City and private landowners. The information presented in this section provides the basis by which alternatives are developed and assessed.

3.1 Physical and Natural Environment

3.1.1 Topography

Three areas, with distinct topographic features, comprise the study area. The topography of the watershed has greatly influenced the land uses in the area, and controls the drainage patterns. The topography of the study area presents both opportunities and constraints for stormwater management.

The upper portion of the watershed is a gently sloping plateau bounded to the north by Bloor Street and to the south by Waller Avenue. The plateau is bounded to the east by Kennedy Ave and to the west by Windemere Avenue. The topography generally slopes from north to south with gradients of between 0.3% to 2.8%. The upper area is bisected by a valley depression extending north from Rennie Park to Deforest Road. Slopes in this valley depression range from 10% to 30%.

South of Morningside Avenue and north of the Queensway, the topography is characterized by the steeply cut valleys in Rennie Park and along the west side of Grenadier Pond. The valley slopes range from 20% to over 30% in some areas. From Morningside Avenue to Ellis Gardens, there is a vertical drop of 30 m over 850 m, or 3.5%. Valleys that existed west of Coe Hill Drive were filled in during the early part of this century.

South of the Queensway, the man-made embankments for the railway and highway corridors dominate the topography. These embankments are built with 3-to-1 side slopes and rise 4 to 5 metres above the surrounding topography. South of the transportation corridor, the ground slopes very slightly to the shoreline of Lake Ontario. The area between the transportation corridor and Lake Ontario has been built up with fill material over the past 150 years. The shoreline of Lake Ontario has been extended 90 to 120 m into the lake from its original location just south of the railway corridor.

3.1.2 Soil Conditions

The formation of the Quaternary geology of the study area is primarily the result of sedimentary deposits from two historical lake levels in the Lake Ontario Basin dating from the last glacial period 10,000 years ago. As well, in the past 150 years, considerable amounts of man-made deposits (i.e. fill) have been placed within the study area. The three major sub-surface soil formations are shown in Figure 3-1.

Glacial Lake Scarborough deposited the oldest sediments in the study area. The formation known as the Sunnybrook Drift is composed of silts and clay and likely represents a deep-water deposit. This formation lies south of Waller Avenue and west of Grenadier Pond, and extends as far south as the former shoreline of Lake Ontario below the Gardiner Expressway. The steep ravine slopes of the West Pond are evidence of this clay-till material. The silt and clay soils of this area belong to Hydrologic Soil Group BC or C, indicating a moderate to low capacity for infiltration of surface water.

The formation of Lake Iroquois, as the Ontario lobe of the Wisconsin Ice sheet retreated approximately 12,000 years ago, resulted in the second major deposit in the study area. The post-glacial Lake Iroquois formed in the Lake Ontario Basin but exceeded the depth of Lake Ontario by approximately 53 to 61 metres. Detritus, transported by rivers and streams from the retreating glacier, were deposited as soft deltaic sediments of sand, silt and gravel in the Humber Bay of Lake Iroquois. This sandy formation lies north of Waller Avenue, and east of Grenadier Pond, and extends as far south as the former shoreline of Lake Ontario below the Gardiner Expressway. This higher plateau of land is typical of the Iroquois Sand Plain. The sandy soils of this area belong to Hydrologic Soil Group A or AB, indicating a high to moderate capacity for infiltration of surface water.

The shoreline of Lake Ontario has received large amounts of man-made fill material since the middle part of the 1800's. This material has been placed for road and railway construction, earth material disposal (lakefill), construction of Sir Casimir Gzowski Park, and erosion protection. The fill material is a mixture of silty clay, sand, gravel, rubble and debris.

The steep slopes of the ravine in Rennie Park have been subjected to filling for the construction of residences, schools and playing fields along Coe Hill Drive. To the west of Coe Hill Drive, three valleys have been completely filled-in since the early part of the 1900's. It is interesting to note that the pond presently known as West Pond was known as East Pond in 1916 but has been renamed following the filling of the other ponds. In addition, fill material has also been placed in the upper portions of the study area along the steep valley slopes of Wendigo Creek and along Willard Gardens. The shorelines of Grenadier Pond and West Pond have also received infilling.

3.1.3 Surface and Subsurface Hydrology

Surficial Hydrology

The surficial hydrology is dominated by the developed urban condition of most of the study area. Runoff is primarily directed onto roads where it is captured in the gutter by catchbasins and discharged to a separated storm sewer system. The majority of buildings in the study area (67.6%) have roof downspouts directly connected to the storm sewer. A further 11.4% of downspouts discharge on to paved areas that drain directly to the street where runoff is quickly captured by the catchbasins. The storm sewers discharge into man-made channels or directly into the receiving waters. Natural streams no longer exist in the study area. Infiltration of surface runoff has been reduced due to development, the direct connection of downspouts to the storm sewer system, and increased paved surfaces.

Urban development has also altered the drainage patterns of the study area. Prior to the development of the area in the late 1800's, the West Pond was only a deep open water

section in a marshy stream rather than a pond. The “pond” was bordered on the south by an extensive marshy area and flowed via two streams into Grenadier Pond. The draining of the southern marsh and impoundment of the West Pond likely occurred in the late 1800’s when the village of Swansea constructed Ellis Avenue (Zimmerman et al., 1986). Similarly, up until 1853, Grenadier Pond was connected to Lake Ontario by a channel cut through a barrier beach, which separated the pond from the lake (Gartner Lee Ltd., 1995).

The development of the Village of Swansea and the City of Toronto further modified the drainage pattern in the area by replacing the natural overland flow system with a curb and gutter road network and storm sewers. The construction of sewers has also reduced the total drainage area contributing to the West Pond and Grenadier by diverting flows north of Bloor to other catchments (Gartner Lee Ltd., 1995).

The natural outlet from Grenadier pond has been replaced by a storm sewer outfall under the Gardiner Expressway and Lakeshore Boulevard. Subsequently, the majority of outflow from Grenadier Pond, and therefore the entire Swansea area, has been directed to a new outfall at the mouth of the Humber River. Only a tiny portion of the former creek outlet exists on the Stelco property located at the corner of the Queensway and Ellis Avenue.

The stormwater runoff east and west of Colborne Lodge Drive is collected in a sewer system that discharges through an outfall into Lake Ontario. The outfall runs through Sir Casimir Gzowski Park directly south from Colborne Lodge. Before the construction of the storm sewer there was a small creek that drained the north side of the Queensway into Lower Duck Pond where it joined the water from Spring Creek and entered Lake Ontario through a natural channel near Parkside Drive.

The pre-development topography of the study area consisted of steeply cut valleys south of Morningside Avenue. Streams, marshes, and ponds existed in the valley bottoms, similar to those found in Rennie Park and High Park along Wendigo Creek. These valleys have subsequently been filled, eliminating the streams and ponds. West Pond and Grenadier Pond have had portions of banks filled in and large areas in Rennie Park have also received fill material.

Subsurface Hydrology

The subsurface hydrology (hydrogeology) of the study area can be categorized by the three main subsurface soil conditions found there. North of Waller Avenue, the soils have a high capacity for infiltration. Groundwater generally follows the contours of the surface and can be expected to flow from north to south with a natural outlet at the upper end of Rennie Park. The groundwater level near Bloor Street is approximately 3.65 metres below the ground. In Rennie Park, the groundwater table reaches the surface level of the West Pond. South of Waller Avenue and west of Grenadier Pond, the soils have lower infiltration capacity. What groundwater there is will flow from the higher points of ground along Coe Hill Drive and Ellis Avenue and exit at the base of the steep slopes along the West Pond and Grenadier Pond. The average groundwater flow into the West Pond has been estimated at 1.64 litres/s (Gartner Lee, 1995). The average groundwater flow into Grenadier Pond, excluding groundwater flows from West Pond, has been estimated at 13.96 litres/s (Gartner Lee, 1995). The primary source of groundwater flows is seepage from the Lake Iroquois Sand Plain north and east of the pond.

South of the Gardiner Expressway, the groundwater level is located just below the ground surface and is controlled by the surface level of Lake Ontario.

3.1.4 Terrestrial Conditions

Generally, natural areas within the City of Toronto are considered high value because of their scarcity. All forests with a high preponderance of native tree species are classified as locally, regionally or provincially significant, depending on their dominant species. Mature trees, whether they occur within a forest or stand alone, are also highly valued by the Toronto public. Therefore, treed areas should be avoided as much as possible in selecting alternative treatment sites.

Aside from High Park, natural vegetation in the southwest part of Toronto is extremely limited. Most non-treed upland areas consist of mowed grass, except in High Park itself where efforts are being made to manage provincially significant successional communities such as savannah. Alternative sites for stormwater treatment, therefore, should focus mainly on open space, such as manicured lawn areas. There are several such areas in the study area. These areas are: north of West Pond, south of Grenadier Pond, southwest of the Lower Duck Pond, east of Windermere and south of the Queensway, and along the Lakefront. The terrestrial environment in each of these areas is described below.

Location 1 - North of West Pond

West Pond is located within a natural depression in the landscape, part of the original ridge and slough topography of the Toronto waterfront before it was filled and modified for development. The native soil material in these areas consists of Lake Scarborough silt and clay that forms the Sunnybrook Drift soils. A steep walled, forested ravine forms the north half of this area. The West Pond, in a shallower portion of the landscape, occupies the southern half of the area. Urban development surrounds the ravine; this is primarily residential housing, except for the playing fields that abut the northwest portion of the ravine. Mowed grass on a terrace below the southeastern end of the playing fields provides an official off-leash dog walking area within the City.

The vegetation on the north portion of the ravine slope is dominated by extremely large white oak (*Quercus alba*) and red oak (*Q. rubra*), sometimes reaching 1 m diameter at breast height (d.b.h.). Other trees include Norway maple (*Acer platanoides*), eastern cottonwood (*Populus deltoides*), white pine (*Pinus strobus*) and sugar maple (*Acer saccharum*). The forest floor is relatively disturbed in many places, consisting mainly of non-native shrubs, including Manitoba maple (*Acer negundo*), with garlic-mustard (*Alliaria petiolata*) and dame's rocket (*Hesperis matronalis*) dominating the ground layer. There are some native shrubs in the understory, i.e. choke cherry (*Prunus virginiana*). The floor of the ravine is relatively more disturbed than the slopes. In some places, residential back lots encroach along the east slope to the base of the ravine. Debris from fallen limbs and trees provides some microhabitat at the base of the ravine.

The east walls of the ravine are dominated by similar vegetation up to the north end of the pond. However, the forest along the west wall and floor of the ravine becomes predominantly non-native in composition at a point approximately level with the south end of the playing fields. The slopes consist mainly of young Manitoba maple, with a highly disturbed ground layer of garlic-mustard and dame's rocket. Small openings in the forest

sustain vegetation characteristic of fields in an intermediate stage of succession after being abandoned, with the most common species being brambles (*Rubus idaeus* and *R. allegheniensis*), asters and goldenrods (*Aster* spp and *Solidago* spp) and riverbank grape (*Vitis riparia*).

The slopes along the southwest slope of the ravine, north of the West Pond are less steep than in the northern part of the ravine. The floor of the ravine in this area is broader and wetter than at the north end, and there is less encroachment by neighbouring residents. The floor of the ravine in this area is dominated mainly by non-native wetland species such as crack and hybrid willow (*Salix fragilis* and *S. x rubens*), and dense mats of creeping bent-grass (*Agrostis stolonifera*). Common natives include pussy willow (*Salix discolor*) and bittersweet nightshade (*Solanum dulcamara*).

In summary, the main significant feature of this area, several massive oak trees in a predominantly native oak forest, is found along the north, east and northwest slopes of the ravine north of the west pond. White oak-red oak upland forest is considered locally significant in the Toronto area (Varga 1989), but forest containing oak trees of such size should be considered regionally significant. The west slopes and bottomland of the ravine north of the West Pond are highly disturbed and do not sustain rare tree species or unusually large trees, but are remaining examples of natural seepage wetlands in the Toronto area. However, seepage wetlands in the High Park area can sustain regionally rare sedge species (Varga 1989). These areas should therefore be studied in greater detail at a time when sedges are identifiable (late July or early August), if this location is chosen as an alternative for construction of stormwater facilities.

The entire area is accessible to the public, from the playing fields to the northwest and from a public access point on Ellis Avenue, from which there are steps leading into the ravine. Residences overlook the ravine from Ellis Avenue and Coe Hill Drive. A public path traverses the area, with a wooden bridge providing access over the channel at the bottom of the ravine.

Location 2 - South End of Grenadier Pond

A small area of fill at the south end of Grenadier Pond sustains a cover of mowed grass, kept short by geese. Picnic tables provide rest areas for the public. The area is accessible to the public from a paved path that runs along the south end of Grenadier Pond. The only trees consist of planted weeping hybrid willows (*Salix x pendulina*) along the water's edge. The area is low, with moist soils, and sustains no significant natural features.

Location 3 - Southwest of Lower Duck Pond

This area, a previously filled wetland adjacent to the Queensway and a short distance west of the Lower Duck Pond, is vegetated with mowed grass. The grass was waterlogged at the time of the field visit, with numerous pools of standing water.

Locally and regionally significant oak forest dominates the ridges and slopes on all sides. The grassed space itself does not sustain significant features. If the area were to be used as a location for stormwater facilities, the oak forest should be protected from impacts of construction. Most importantly, the fringe of shrubs between the grass and the oak forest should be retained. These shrubs, though non-native [mainly common buckthorn (*Rhamnus*

cathartica), a highly invasive non-native weed], function as a buffer to the forest on the slopes. Ideally, the non-native component should be replaced by native shrubs, as is being done in other areas of the Park as part of restoration projects.

The area is accessible to the public from paths through the forest on all sides, and from the paved sidewalk along the south edge of High Park. However, the public may be discouraged from using the area for much of the year because the soils are so wet.

Location 4 - East of Windermere Ave., South of The Queensway

This fenced area is bounded to the north by the Queensway, to the east by Ellis Avenue, to the south by a railway embankment and to the west by Windermere Avenue. The western half consists of a graveled parking lot. The eastern portion is sparsely vegetated with mowed grass and common herbaceous species of recently disturbed soils such as chicory (*Cichorium intybus*), wild carrot (*Daucus carota*), and Canada goldenrod (*Solidago canadensis*). A few small American elm (*Ulmus americana*) and Norway maple are located at the west edge of the vegetated portion. Large crack willows (*Salix fragilis*) are found along the remnants of a creek channel and along the bottom of the railway embankment. The slopes of the railway embankment sustain old field species and additional young trees. The base of a large electronic billboard occupies most of the vegetated space. There is a pumping station on the north side of the area adjacent to the Queensway. This area is not accessible to the public.

Location 5 - Lake Front (Sir Casimir Gzowski Park)

This linear, lakefront park is almost entirely vegetated with mowed grass. The lake front in this area is accessible to the public. There are numerous walking and bicycling paths throughout. Planted trees consist mainly of non-native flowering crab and hybrid willow. There are many monuments and plaques in various locations along the waterfront, as well as facilities such as concession stands and park benches.

The west end of the park near the Humber River has been naturalized, with considerable evidence of effort in creating small paths, planting wildflowers and young trees, and allowing natural areas to regenerate.

Any construction of new stormwater treatment facilities in the area should be coordinated with City efforts to preserve the natural characteristics of the Lakefront.

3.1.5 Aquatic Conditions

Several recent analyses of the water quality in Grenadier Pond and the West Pond have been carried out and are summarized in this section. In addition, several surveys of the fish species present in Grenadier Pond have been carried out and are summarized in this section.

West Pond and Grenadier Pond Water Quality

The following is a summary of the findings of the water quality studies undertaken for the West Pond and Grenadier Pond (Zimmerman et al., 1986; City of Toronto, 1993; Gartner Lee Ltd., 1995).

- Grenadier and West Ponds are highly eutrophic (dissolved nutrients such as phosphorous present in excessive amounts). Phosphorous exceeds the Provincial Water Quality Objectives.
- The chemistry of both ponds is heavily influenced by sodium and chloride. Sodium and chloride comprise an average of 58% and 43%, respectively, of major cation and anion equivalencies, compared to 16% in Lake Ontario and 5% in smaller inland lakes.
- The West Pond is more severely affected by elevated concentrations of sodium and chloride. The lake has become permanently chemically stratified with no mixing of water between the lower levels which are more dense due to increased density from dissolved solids. The deep-water zone (monimolimnion) of the West Pond is anaerobic (free oxygen absent) and highly reduced (at a lower oxidation state).
- The water clarity in Grenadier and West Pond is poor. In 1986 the average secchi depth was only 0.6 metres in the West Pond. In Grenadier Pond the secchi depth average was 2.0 metres in 1986. More recent secchi depth measurements (1993 and 1994) in Grenadier Pond ranged between 0.5m to 1.6m. The secchi depth provides an indication of the depth to which plants and algae can grow.
- Heavy metal concentrations are elevated in both the West Pond and Grenadier Pond. Concentrations of cadmium, copper, iron, lead, nickel and zinc exceed the Provincial Water Quality Objectives. Copper concentrations greatly exceed the PWQO. Potassium is also elevated in the West Pond, but no PWQO exists for potassium. Refer to Table 3.1 for a comparison of water quality in the ponds to the Provincial Water Quality Objectives.
- Fecal coliform densities in both ponds have been found above the PWQO of 100 cells per 100 mL.

In 1996, a stormwater sedimentation facility was constructed at the upper end of Grenadier Pond to treat stormwater that enters the pond from Wendigo Creek and the Clendenan storm sewer outfall (HP2). This pond is an extended detention wet pond with a sediment forebay. The forebay and permanent pool have a storage volume of approximately 550 m³, and the extended detention storage is approximately 2600 m³. The extended detention storage is only large enough to store runoff from rain events up to 8-mm. All flows from events greater than 8-mm are by-passed around the stormwater management facility and into Grenadier pond. The overall effect of the sedimentation facility on the water quality in Grenadier Pond is unknown at this time, but an improvement is expected due to the reduced amount of suspended sediment entering the pond.

TABLE 3.1
SUMMARY OF WEST POND AND GRENADIER POND WATER QUALITY DATA

	Units	West Pond	Grenadier Pond	Grenadier Pond	Provincial Water Quality Objectives
Reference		(1)	(1)	(2)	
<u>General Chemistry</u>		7			
Ammonia/Ammonium	mg/L	0.32	0.27		
Nitrates	mg/L	0.078	<0.06		
Nitrite	mg/L	0.124	0.12		
Total Kjeldahl Nitrogen	mg/L	1.36	0.82	0.99	
Total Phosphorous	mg/L	0.118	0.086	0.28	0.03 ¹
Total Suspended Solids	mg/L				
<u>Bacteriology</u>					
<i>E. Coli</i>	#/100 mL	676	20	12	100
<u>Heavy Metals</u>					
Cadmium	µg/L	0.2	0.3	<10	0.2
Chromium	µg/L	3	3	67	100
Copper	µg/L	11	18	17	5
Iron	µg/L	338	99	<1000	300
Mercury	µg/L	0.02	0.02		0.2
Manganese	µg/L	126	114	73	
Nickel	µg/L			26.7	25
Lead	µg/L	8	7	<20	5-25 ² , 1-5 ^{1,2}
Zinc	µg/L	12	7	30	20 ¹
Sodium	mg/L	235.7	176.5	171	
Potassium	mg/L	17.7	3.68	3.84	
Magnesium	mg/L	30.4	22.7	21.0	

¹ Interim PWQO

² varies with hardness or alkalinity

References

- (1) *The Comparative Limnology of Grenadier and Catfish (West) Ponds, High Park, Toronto, Ontario* (Zimmerman et al., 1986)
- (2) *1992 Grenadier Pond Survey of Inflows and Water Quality* (City of Toronto Department of Works and the Environment, 1993)

Fish Community

The fish community in Grenadier Pond has undergone considerable change in the past 150 years. Grenadier Pond and the West Pond once had a natural channel connection to Lake

Ontario. In addition, fluctuations in lake-levels could have submerged the historical beach and lake water could have flooded into the ponds. The fish communities in the ponds would have reflected those that could enter into the ponds and marsh to feed and return to the lake for some or all of their life cycle (e.g. salmon, sturgeon, pike, suckers, minnows). With the direct connection to the lake replaced by sewers and weir control structures, the fish are trapped in the ponds and rely on them for all of their life cycle requirements.

The most recent detailed survey fish species in Grenadier Pond was undertaken in 1976 when Wainio et al. (1976) undertook an inventory using seine and hoop nets. Table 3.2 provides a listing of the fish species recorded in Grenadier pond since that time. Recently, bass and pike have also been released into the Pond.

TABLE 3.2
LIST OF FISH SPECIES RECORDED IN GRENADIER POND

1976	1985/86	1987	1993
Bass, Large and Smallmouth	Bass, Large and Smallmouth, Rock	Bass, Large and Smallmouth, Rock	Bullhead, Brown
Bowfin	Bluegill	Bluegill	Perch, White
Bluegill	Bullhead, Brown	Bullhead, Brown	Pumpkinseed
Bullhead, Brown	Carp, Common	Carp, Common	
Carp, Common	Crappie, Black	Crappie, Black	
Crappie, Black	Goldfish	Perch, Yellow and White	
Gar, Longnose	Perch, Yellow		
Goldfish	Pumpkinseed		
Northern Pike	Shad, Gizzard		
Perch, Yellow and White	Shiner, Golden		
Pumpkinseed	Sucker, White		
Shad, Gizzard			
Shiner, Common and Golden			
Sucker, White			

Source: Gartner Lee Limited, 1995

West Pond and Grenadier Pond Sediment Quality

The sediment in the West Pond and Grenadier Pond is contaminated with heavy metals. The sediment in both ponds has been sampled and analyzed on several occasions, and the results are summarized in Table 3.3 and Table 3.4 (Zimmerman et al., 1986; Gartner Lee Ltd., 1995). The sediment analyses are compared to the *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario* (MOEE, 1993), and *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants* (US DOE, 1997).

In the Ontario sediment quality guidelines, the Lowest Effect Level indicates a level of sediment contamination that can be tolerated by the majority of sediment-dwelling and

benthic organisms. The Severe Effect Level indicates the level at which pronounced disturbance of the sediment-dwelling community can be expected. The Severe Effect Level is the concentration of a compound in the sediment that would be detrimental to the majority of sediment-dwelling and benthic species.

Review of Table 3.3 shows that sediment in the West Pond exceeds the Severe Effect Level for lead and Total Kjeldahl Nitrogen. In addition, the Lowest Effect Level is exceeded for cadmium, chromium, copper, iron, manganese, nickel, zinc, total organic carbon, and total phosphorous. A sediment management plan may be required for this sediment.

TABLE 3.3
SUMMARY OF WEST POND AND GRENADIER POND SEDIMENT QUALITY

	Units				Guidelines for the Protection and Management of Aquatic Sediment Quality (MOEE, 1993)	
		West Pond	West Pond	Grenadier Pond	Lowest Effect Level	Severe Effect Level
Reference		(1)	(2)	(3)		
<u>Metals</u>						
Arsenic	µg/g	8.91	<1.0	2.5	6	33
Cadmium	µg/g	2.6	<0.5	1.2	0.6	10
Chromium	µg/g	28	12.1	12.1	26	110
Cobalt	µg/g	6	1.1	<2		50
Copper	µg/g	62	38.1	45.3	16	110
Iron	Percent	2.2	1.0	1.2	2	4
Lead	µg/g	430	110.9	163	31	250
Manganese	µg/g	910	305	600	460	1100
Mercury	µg/g	0.19	0.06	0.183	0.2	2
Nickel	µg/g	22	6.4	<2	16	75
Silver	µg/g		<0.5	<0.3		0.5
Zinc	µg/g	570	213.3	260	120	820
<u>Nutrients</u>						
Total Organic Carbon	Percent	7	4.5	6.1	1	10
Total Kjeldahl Nitrogen	µg/g	5000	5040	5600	550	4800
Total Phosphorous	µg/g	1400	528	800	600	2000

References

- (1) *The Comparative Limnology of Grenadier and Catfish (West) Ponds, High Park, Toronto, Ontario* (Zimmerman et al., 1986)
- (2) *Analysis of 9 Samples from Duck Pond and West Pond* (Metropolitan Toronto and Region Conservation Authority, 1996) Unpublished
- (3) *Proposals for the Rehabilitation of Grenadier Pond, Wendigo Creek and Associated Wetlands* (City of Toronto Department of Works and the Environment, 1993)

The sediment in Grenadier Pond is less severely contaminated. Only Total Kjeldahl Nitrogen exceeds the Severe Effect Level. The Lowest Effect Level is exceeded for copper, lead, manganese, zinc, and Total Phosphorous. A sediment management plan may be required for this sediment. In 1996, a sedimentation facility was constructed at the north end of Grenadier Pond to treat the stormwater flows from the Clendenan storm sewer. Current

sediment loading rates to Grenadier Pond will be decreased, but the effect on sediment chemistry in the pond is unknown.

The chemical contamination of the sediment in the West Pond and Grenadier Pond may present challenges for the growth of emergent wetland vegetation. The sediment chemical concentrations are compared to the *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants* (US DOE, 1997) in Table 3.4. These benchmarks provide an indication of the chemical concentration in soils that would cause a twenty-percent reduction in the growth or yield of various plant species.

Review of Table 3.4 shows that sediment in the West Pond and Grenadier Pond exceeds the Screening Benchmark for toxicity to plants for aluminum, chromium, lead, manganese, and zinc. Plants growing in the pond sediment may experience reduced growth rates and productivity.

TABLE 3.4
SUMMARY OF WEST POND AND GRENADIER POND SEDIMENT QUALITY FOR TOXICITY TO PLANTS

Reference	Units	West Pond (1)	West Pond (2)	Grenadier Pond (3)	Screening Benchmark Concentrations for the Phytotoxicity of Chemicals in Soil and Soil Solution (US DOE, 1997)	
					Soil (µg/g)	Soil Solution (µg/ml)
<u>Metals</u>						
Aluminum	µg/g	12000	-	6100	50	0.3
Arsenic	µg/g	8.91	<1.0	2.5	10	0.001
Cadmium	µg/g	2.6	<0.5	1.2	4	0.1
Chromium	µg/g	28	12.1	12.1	1	0.05
Cobalt	µg/g	6	1.1	<2	20	0.06
Copper	µg/g	62	38.1	45.3	100	0.06
Iron	Percent	2.2	1.0	1.2		10
Lead	µg/g	430	110.9	163	50	0.02
Manganese	µg/g	910	305	600	500	4
Mercury	µg/g	0.19	0.06	0.183	0.3	0.005
Nickel	µg/g	22	6.4	<2	30	0.5
Silver	µg/g		<0.5	<0.3	2	0.1
Zinc	µg/g	570	213.3	260	50	0.4

References

- (1) *The Comparative Limnology of Grenadier and Catfish (West) Ponds, High Park, Toronto, Ontario* (Zimmerman et al., 1986)
- (2) *Analysis of 9 Samples from Duck Pond and West Pond* (Metropolitan Toronto and Region Conservation Authority, 1996) Unpublished
- (3) *Proposals for the Rehabilitation of Grenadier Pond, Wendigo Creek and Associated Wetlands* (City of Toronto Department of Works and the Environment, 1993)

3.2 Existing Drainage System

The existing storm drainage system is typical of an urban drainage system. The study area is serviced by a separated storm sewer system with curb and gutter drainage of streets. A

large percentage (79%) of building roof drainage is directly or indirectly connected to the storm sewer (See Figure 3-2). In addition to below-ground sewers, there is a system of above-ground channels and ponds that receive water from the sewers. A large portion of the study area drains directly to the West Pond by overland flow that does not enter a storm sewer.

3.2.1 Drainage Areas

Seven distinct drainage areas can be identified for the study area based on the existing sewer system. These drainage areas are shown in Figure 3-2. These drainage areas also define the areas for assessment of stormwater management alternatives. A summary of the characteristics of the drainage areas is given in Table 3.5.

Drainage Area A lies south of Bloor Street and North of Waller Avenue. This is a largely residential area characterized by small lot sizes and closely spaced dwellings. Drainage is through separated storm sewers receiving inflows from paved surfaces and directly connected roof drainage. The outlet for the sewer system is a gabion-lined channel that flows through Rennie Park into West Pond.

Drainage Area B is located along Windemere Avenue, Budgell Terrace, and Coe Hill Drive. This area is characterized by closely spaced single dwelling lots and large multi-dwelling buildings on larger properties. Drainage is through separated storm sewers receiving inflows from paved surfaces and directly connected roof drainage. The outlet for the sewer system is West Pond via direct discharge from the sewer.

Drainage Area C encompasses Rennie Park and the West Pond including a large portion of Swansea Public School and the Swansea Community Recreation Centre. All of the drainage is overland surface flow that makes its way into West Pond.

Drainage Area D includes all of the sewers connected to Ellis Avenue and discharging into Grenadier Pond. The area is characterized by single detached dwellings. Drainage is through separated storm sewers receiving inflows from paved surfaces and directly connected roof drainage. The outlet for the sewer system is an open channel that flows a short distance from Ellis Avenue into Grenadier Pond. The outflow from the West Pond enters the same channel before discharging into Grenadier Pond.

Drainage Area E is located north of the Queensway and includes Ellis Gardens and a portion of Coe Hill Drive. The area is characterized by single detached dwellings. Drainage is through separated storm sewers receiving inflows from paved surfaces and directly connected roof drainage. The outlet for the sewer system is an open channel that flows a short distance through the Stelco property before entering a culvert under the transportation corridor with eventual discharge to the Humber River and Lake Ontario.

Drainage Area F includes portions of the Stelco property, the transportation corridor and an area along Lakeshore Boulevard. The area is characterized by the paved surfaces of roads and parking lots. The railway and highway are located on embankments built up above the surrounding area. Drainage is through separated storm sewers receiving inflows from paved surfaces and directly connected roof drainage. All of the upstream flows from Drainage Area E and discharges from Grenadier Pond flow through the sewer system in Area F. Under low-flow conditions the outlet for the sewer system is the Humber River via direct sewer discharge. Under higher-flow conditions the sewer system also discharges directly to Lake Ontario through the Ellis Avenue outfall. The area south of Lakeshore Boulevard in Sir Casimir Gzowski Park drains directly to Lake Ontario by overland flow.

Drainage Area H includes Colborne Lodge Drive south of the Queensway, as well as parts of the Gardiner Expressway, the Queensway and Lakeshore Boulevard and the lakefront. A small portion of Colborne Lodge Drive north of the Queensway also enters the system. The area surrounding Colborne Lodge in High Park has indeterminate drainage due to the natural topography but is included in this drainage area for the purpose of this study. The railway and highway are located on embankments built up above the surrounding area. Drainage is through a system of roadside ditches and separated storm sewers. Discharge is directly to Lake Ontario via the Colborne Lodge Drive outfall sewer. The area south of Lakeshore Boulevard in Sir Casimir Gzowski Park drains directly to Lake Ontario by overland flow.

TABLE 3.5
DRAINAGE AREA CHARACTERISTICS

Drainage Area Identification	Land Use Description	Drainage Area (ha)	Percent Impervious (Typical)	Percent of Roofs Directly Connected	Soil Type
A	Residential, Detached and Duplex Dwellings	36.0	53%	77%	Sand-Silt
B	Residential, Detached and Multi-Unit Dwellings	8.8	54%	98%	Sand-Silt and Silt-Clay
C	Open Space Parkland, with school and park buildings	15.1	12%	N/A	Silt-Clay
D	Residential, Detached Dwellings	8.9	52%	84%	Silt-Clay
E	Residential, Detached Dwellings	3.6	43%	72%	Silt-Clay
F and G	Commercial, Transportation and Open Space Parkland	17.1	84%	N/A	Fill Material over Beach Sand and Gravel
H	Transportation and Open Space Parkland	13.8	42%	N/A	Fill Material over Beach Sand and Gravel

3.2.2 Stormwater Quantity

The City of Toronto has prepared hydrologic computer models of the study area using the Quantity-Quality Simulation (QQS) model and Hydrograph Volume Method (HVM) model licensed from Dorsh Consult. The HVM and QQS models compute runoff hydrographs at any location in a drainage area, and simulate conveyance of the hydrograph through a defined drainage system (pipes, channels, and storage facilities). The model can be run for a single rain event, and on a continuous time basis to model runoff for an entire year or longer. The QQS model can also be used to simulate pollutant loadings and accumulation in the sewer system.

The model parameters relating to stormwater runoff quantity are rainfall data, drainage area, percent of drainage area that is impervious to infiltration, initial losses and depression storage, and soil infiltration rates. CH2M HILL Canada Limited staff have reviewed these parameters and verified their accuracy.

The tributary drainage areas and the discharge locations assumed in the HVM and QQS models are shown on Figure 3-2. Table 3.6 presents the HVM and QQS model results for single rainfall events and a continuous analysis of rainfall data from an entire representative year (i.e. 1980). The model results are presented in terms of the return period, or statistical probability, of the precipitation event magnitude.

TABLE 3.6
HYDROLOGIC MODELING RESULTS

HVM Results – Single Rainfall Event Simulation

		<u>Rainfall Event</u>		
Storm Return Period		6 Months	1 Year	2 Year
Total Precipitation (mm)		17 ¹	26.7	31.8
<u>Outfall</u>	<u>Outfall Location</u>	<u>Total Runoff Volume (m³)</u>		
HP7	Rennie Park	2755	4477	5868
HP8	Coe Hill Drive	389	632	801
HP5	Ellis Ave.	636	1034	1346
H1	Humber River	3521	6252	7353
W12	Ellis Ave. Overflow	414	887	1517
W11	Colborne Lodge Drive	908	1476	1810

QQS Cumulative Volume Results – Continuous Simulation – Average Year: 1980

H1	Humber River	204,058 m ³
W12	Ellis Ave. Overflow to Lake Ontario	2635 m ³
W11	Colborne Lodge Drive	20,950 m ³

Note: 1. An analysis of the Toronto Bloor Street precipitation gauge indicates that the daily capture of storms up to 17 mm represents 87% of the annual precipitation. (MOEE, 1994, Appendix C)

3.2.3 Stormwater Quality

Stormwater Discharge Quality

A series of studies characterizing storm sewer discharges to the Toronto waterfront have been undertaken in the past ten years as part of the Toronto Wet Weather Outfall Study. Stormwater discharges in the study area were sampled and analyzed in the summer of 1992. Flows from the storm sewer outfall from Valleymede Road to Grenadier Pond, and the storm sewer outfall from Clendenan Avenue to Wendigo Creek north of Bloor Street were analyzed at that time. A summary of the findings of these studies and a comparison to the *Provincial Water Quality Objectives* is provided in Table 3.7.

A review of Table 3.7 indicates that stormwater in the study area may at times exceed the Provincial Water Quality Objectives. The parameters found to exceed the PWQO's include: total phosphorous, *E. Coli*, silver, aluminum, cadmium, copper, iron, lead, Aldrin/Dieldrin, Anthracene, Benz(a)anthracene, Benzo(k)flouranthene, Chrysene, and Phenanthrene.

TABLE 3-7
SUMMARY OF STORMWATER QUALITY DATA

	Units	Inflow to Grenadier Pond	Toronto Area Phase I Wet Weather Study	Toronto Area Phase II Wet Weather Study	Provincial Water Quality Objectives
Reference		(1)	(2)	(3)	
<u>General Chemistry</u>					
BOD	mg/L	27.3			
Alkalinity	mg/L		83.6	97.5	
Cyanide (val. unfilt. react)	mg/L			0.005	0.005
COD	mg/L		760	2250	
Ammonia/Ammonium	mg/L		0.24	0.08	
Nitrates	mg/L		3.15	1.96	
Nitrite	mg/L		0.052	0.14	
Nitrates + Nitrites	mg/L		3.202	2.1	
Total Kjeldahl Nitrogen	mg/L		2.46	4.11	
Phenolics	mg/L		16.9	13.7	1
Total Phosphorous	mg/L	0.38	0.51	0.82	0.03 ¹
Total Suspended Solids	mg/L	68.2	124	238	
<u>Bacteriology</u>					
<i>E. Coli</i>	CNT/ 100 mL	60 to 2540	378,816	409,000	100
Fecal Coliform	CNT/ 100 mL	70 to 3000	542,610	528,000	
Fecal Streptococcus	CNT/ 100 mL	120 to 5400		122,000	
<u>Heavy Metals</u>					
Arsenic	µg/L		0.96		100, 5 ¹
Silver	µg/L		2.9	2.0	0.1

	Units	Inflow to Grenadier Pond	Toronto Area Phase I Wet Weather Study	Toronto Area Phase II Wet Weather Study	Provincial Water Quality Objectives
Aluminum	µg/L		1680	1400	75
Barium	µg/L		46.7	41	
Beryllium	µg/L			0.13	11 ²
Cadmium	µg/L	< 10	2.9	0.94	0.2
Chromium	µg/L	42	14	7	100
Copper	µg/L	27.4	120	45	5
Iron	µg/L	3282	4592	2830	300
Mercury	µg/L		0.0587	40 (?)	0.2
Manganese	µg/L	155	170	160	
Nickel	µg/L	22.1	10.6	10	25
Lead	µg/L	55	50.6	57	5-25 ² , 1-5 ^{1,2}
Zinc	µg/L	112	382	150	20 ¹
Selenium	µg/L				100
Organochlorine Pesticides/ Chlorobenzenes/PCBs					
Alpha – bhc	µg/L		0.00188	0.00184	
Gamma – bhc (Lindane)	µg/L		0.00114	0.00103	0.01
Chlordane – alpha	µg/L			0.00245	0.06
Chlordane – gamma	µg/L			0.00269	0.06
Aldrin/Dieldrin	µg/L		0.0008	0.00239	0.001
Hexachlorobenzene	µg/L		0.00032	0.00021	0.0065
DMDT – Methoxychlor	µg/L			0.00178	0.04
Endosulfan – Sulphate	µg/L			0.00062	0.003
Tetrachlorobenzene 1,2,3,5-	µg/L		0.00325		0.1
Polynuclear Aromatic Hydrocarbons					
Anthracene	µg/L		0.051	0.094	0.0008 ¹
Benz(a)anthracene	µg/L		0.249	0.059	0.0004 ¹
Benz(a)pyrene	µg/L		0.320	0.048	
Benzo(k)flouranthene	µg/L		0.553	0.119	0.0002 ¹
Chrysene	µg/L		0.333	0.080	0.0001 ¹
Indeno (1,2,3-CD) Pyrene	µg/L		0.274	0.110	
Phenanthrene	µg/L		0.555	0.186	0.03 ¹

¹ Interim PWQO

² varies with hardness or alkalinity

(?) Data is questionable, possible typing mistake in report

References

- (1) 1992 Grenadier Pond Survey of Inflows and Water Quality (City of Toronto, Department of Works and the Environment, 1993)
- (2) Metropolitan Toronto Wet Weather Outfall Study, Phase I (Paul Theil Associates Limited, 1992)
- (3) Metropolitan Toronto Wet Weather Outfall Study, Phase II (Aquafor Engineering Limited, 1993)

3.3 Social Environment

3.3.1 Land Uses

The land use characteristics in each of the seven identified drainage areas shown on Figure 3-2 are described in Section 3.2.1, and reviewed below:

- Drainage Area A, which lies south of Bloor Street and north of Waller Avenue, is a largely residential area. Single family lots dominate this land use. Private residential lot sizes vary throughout the study area but are typically smaller lots, with small front and deeper rear yards.
- Drainage Area B is located along Windemere Avenue, Budgell Terrace and Coe Hill Drive. The north part of this drainage area is characterized by single detached dwellings, while large multi-dwelling apartment buildings on large properties dominate the central and southern part of the drainage area.
- Drainage Area C includes Rennie Park and the West Pond, as well as the Swansea Public School and Community Recreation Centre. The West Pond area is categorized as a Natural Area in the City's Draft Official Plan, while the area north of the Pond is classified as Open Space.
- Drainage Area D is the area west of Grenadier Pond along Ellis Avenue. Land uses in this area are similar to Drainage Area A (i.e. private small residential lots).
- Drainage Area E is located north of the Queensway and includes Ellis Gardens and a portion of Coe Hill Drive. Single detached dwellings characterize the area.
- Drainage Areas F and G include the rail and highway transportation corridors as well as Sir Casimir Gzowski Park.

3.3.2 City of Toronto Policies

The policies and goals adopted by the City relating to land use, environmental protection, and stormwater management, which relate to this project and will influence the selection and assessment of stormwater management alternatives are described below.

Draft Official Plan

The City's draft Official Plan provides the policy framework for meeting the environmental, physical, social and economic goals of the City. The key Official Plan principles influencing this study are:

- Council shall attempt to reduce water pollution by adopting and advocating appropriate stormwater management techniques (i.e. control at source is encouraged).
- Council shall endeavour to protect, preserve, and maintain and, where possible, enhance Natural Areas of the City.
- Council shall promote the planting of a variety of native trees.

- Council shall develop and encourage the development (and continuation) of a significant system of parks and open spaces throughout the City.

Environmental Task Force Proposed Environmental Plan

The Environmental Task Force (a City Council Special Task Force) recently completed the report entitled *Clean, Green and Healthy: A Plan for an Environmentally Sustainable Toronto* (January 2000). The recommendations of this plan which influence this study are:

- Increase parks and natural areas
- Plant more trees
- Eliminate the Use of Pesticides
- Encourage Green Roofs
- Restore the Health of Rivers, Streams and the Waterfront
- Improve Stormwater Management

Stormwater Management Group Principles

The Stormwater Management Group principles, which govern this study, are:

- Green infrastructure is preferred means of restoring ecological health
- Getting rain out of the drain is a priority strategy
- Rain is a resource
- Pollution prevention is the most effective means of mitigating water quality problems
- Non-structural, ecosystem based approaches are cost-effective means of restoring health to our waters
- Public participation is essential to cooperative support and planning

3.3.3 Public Issues and Concerns

As part of the public consultation program for this study, the City of Toronto distributed a survey questionnaire to 2500 residential and business landowners in the study area. The questionnaire sought input on the types of stormwater management techniques preferred.

Of the 2,500 questionnaires distributed, over 180 questionnaires were returned as of March 3, 2000. A copy of the questionnaire and responses are provided in Appendix E, while the major findings are described below:

- The residential respondents preferred to adopt the following stormwater management techniques in order of preference: downspout disconnection, rainwater gardening, planting trees/shrubs, and rainbarrels.
- The business respondents indicated a preference for the following techniques (in order of preference): downspout disconnection, porous pavement/roof top gardens, and storage tanks or cisterns.

- With respect to stormwater management techniques on public lands, respondents indicated, in order of preference, the following: wetlands with habitat restoration, settling ponds, swales, and infiltration trenches.

Many respondents also indicated that they required further information prior to deciding on preferred stormwater management techniques.

The above survey results, while general, provide important guidance for identifying and assessing alternative stormwater management techniques, and in developing subsequent public consultation activities.

3.4 Existing Stormwater Control and Use Programs

There are several stormwater control and use programs being implemented by the City of Toronto in the study area that are aimed at controlling stormwater at source. These source control measures can best be described as stormwater runoff controls applied on a lot-by-lot basis in order to reduce peak flows and runoff volumes and/or enhance runoff quality. The existing programs currently in place are described below.

3.4.1 Source Control of Pollutant Initiatives

Initiatives in place by the City aimed primarily at controlling the amount of pollutants transported by runoff and enhancing runoff quality include:

- **Catchbasin Cleaning:** Catchbasins collect some of the debris and pollutants before they enter the sewer system. Catchbasin cleaning is necessary to maintain the effectiveness of catchbasins for pollutant removal. The goals of a cleaning program are to reduce the first flush of collected solids into the sewer system and to control potential street flooding. The City cleans catchbasins at least once a year to maintain their pollutant removal effectiveness.
- **Street Sweeping:** Street runoff is a major contributor to pollutant loadings to receiving waters in urban areas. Pollutants from automobiles and de-icing practices accumulate on streets and are washed into the sewer system. The City maintains street sweeping on a regular basis.
- **Anti-litter by-laws:** The City has anti-litter by-laws in place to enhance the visual aesthetics of neighbourhoods, and to protect environmental and human health.
- **Pet Control by-laws:** The City also has pet control by-laws in place to reduce fecal coliform discharges from urban areas. Within the study area, parts of Rennie Park are posted with “stoop and scoop” signs.
- **De-Icer Control:** To reduce pollutant loading to receiving waters, the City has stopped dumping collected snow into receiving waters, and in some areas has been exploring the use of natural treatment technologies to manage collected snow (e.g. the Bloor Street Snow Dump). The City also controls the amount of de-icing materials used where possible.

- **Fertilizers/Pesticide Control:** As part of the City's public awareness program, residents are encouraged to use less pesticide, herbicide and fertilizer on their lawns. In addition, the Environmental Task Force is recommending that the City adopt a goal of elimination of pesticides, where possible. As part of the recommendation the Task Force requests all City Agencies, Boards and Commissions to develop plans to ban pesticide use except in emergency or exceptional situations on all City lands by the end of 2000, and to develop a strategy to eliminate pesticide use on private lands.

3.4.2 Source Control of Quantity Initiatives

The major source control initiative in place, aimed primarily at reducing the volume of runoff, is the City's Downspout Disconnection Program. The City encourages residents to disconnect downspouts and re-direct runoff towards grassed areas or to rain barrels. Their public outreach program is aimed at educating homeowners as to the benefits of downspout disconnection, and how to disconnect downspouts and install rain barrels. Landowners or the City staff can install rain barrels. The City of Toronto currently has an active rain barrel installation program in place, which includes free property inspection to assess site conditions and a free rain barrel.

As part of this project, CH2M HILL completed a survey of the area with respect to downspout disconnection participation. The results of the survey are summarized in Table 3.8 and shown on Figure 3-3. As illustrated, only about 21% of buildings in the study area have their downspouts disconnected and directed towards grassed areas or to rain barrels. The remaining are not disconnected or direct the runoff to impervious surfaces such as driveways.

TABLE 3.8
RESULTS OF DOWNSPOUT DISCONNECTION SURVEY

Downspouts	Number of Buildings	Percent
Disconnected to pervious surface	178	20.7%
Disconnected to rain barrel	3	0.3%
Disconnected to impervious surface (i.e. driveway)	98	11.4%
Connected or Not Determined	582	67.6%
Totals	860	100.0%

The City of Toronto has also experimented with the use of porous pavement. The City has installed porous pavers (open brick-work type) in laneways, subject to soil conditions. The pavers have not been in place for a significant period of time, therefore, the City does not have any experience with the cleaning of pavers or the degree to which infiltration may decrease over time. The City has found that "soak-away pits" are more effective and economical than porous pavers. Soak-away pits are applied, in appropriate soil conditions, at the edge of lanes or parking lots. The pits have a tendency to raise the local water table, and if buildings are adjacent to the pits, wet basements may result. This problem has resulted in the City removing several soak-way pits.

3.4.3 Wet Weather Flow Management Master Plan

In addition to the above initiatives, the City of Toronto is currently undertaking a Wet Weather Flow Management Master Plan. The purpose of the master plan is to identify preferred strategies for managing wet weather flow within the City of Toronto. The major study principles are as follows:

- Rainwater is to be treated as a resource to be utilized to enhance and nourish the City's environment
- As a priority, rainwater (including snow melt) should be managed where it falls on the lots and streets of the City, particularly before it enters a sewer
- Wet weather flow quantity and quality issues are to be managed on a watershed basis to enhance and preserve the ecosystem health through a hierarchy of source, conveyance, and end-of-pipe control and/or treatment measures
- Source controls will be considered first in this hierarchy manner that is balanced with the other two measures in terms of environmental, social, and economic impacts

4. Identification and Assessment of Source Control Alternatives

Phase 2 of the Class Environmental Assessment process involves identifying and assessing alternative solutions for managing stormwater, and selecting a preferred stormwater management system based on the assessment. Alternative solutions are alternatives that fulfil the purpose of the study in functionally different ways. CH2M HILL's approach is to examine alternatives to treatment (i.e. source control and best management practices) first as a means of stormwater management. If alternatives to treatment alone are not capable of meeting stormwater management alternatives, then treatment technologies are identified and assessed. Priority is given to natural treatment technologies that rely on the natural passive treatment processes of sedimentation and biological assimilation and reduction of pollutants.

The approach for assessing alternative solutions is as follows:

1. Identify and Review Source Control
 - a) Identify and review the pros/cons of management and operational practices (i.e. source control programs aimed primarily at removing pollutants from stormwater)
 - b) Make recommendations with respect to enhancement of management and operational practices within the study area
 - c) Identify and review pros/cons of source control alternatives aimed primarily at reducing runoff volume or rate
 - d) Select source control alternatives aimed at reducing runoff volume and rate that can be enhanced or implemented in the study area
 - e) Undertake a quantitative analysis on selected source control alternatives to estimate runoff reduction potential
 - f) Summarize recommendations regarding source control
2. Identify and Review Conveyance System Alternatives
 - a) Identify options for modifying the conveyance system
 - b) Assess opportunities for modifying the conveyance system
 - c) Develop recommendations regarding conveyance system modifications
3. Identify and Assess Stormwater Treatment Alternatives
 - a) Identify alternatives by drainage area
 - b) Short-list alternatives based on their pros and cons

- c) Establish detailed criteria for measuring the technical, cost, natural and social impacts of the short-listed alternatives
 - d) Assess short-listed alternatives based on the detailed criteria
 - e) Select recommended treatment alternatives by drainage area
4. Describe the Preferred Stormwater Management System (consisting of a variety of alternatives) for achieving the stormwater management goals for the area.

This section of the report provides an assessment of source control alternatives, while Sections 5 and 6 focus on the assessments of conveyance system and end-of-pipe alternatives, respectively.

For this study, source control initiatives have been broken into two categories:

- Source control of pollutant initiatives: These are generally maintenance and operational activities the City has in place that are aimed primarily at controlling the amount of pollutants transported by runoff and enhancing runoff quality.
- Source control of quantity initiatives: These controls are primarily aimed at reducing the volume and rate of runoff.

The City's existing source control programs, with respect to the above categories, have been described in Section 3.4, and are reviewed in more detail in this Section as to their effectiveness in meeting stormwater management objectives. In addition, opportunities for implementing new source control initiatives are also explored.

4.1 Source Control of Pollutant Initiatives

The City has several programs in place aimed primarily at controlling the amount of pollutants transported by runoff and enhancing runoff quality. A description of these programs and their effectiveness is provided below, while Table 4.1 provides a summary of the pros and cons of these programs and recommendations.

The source control programs presented in this section are management and operation practices that are implemented on a city-wide basis. They are generally non-quantifiable, and therefore are reviewed with respect to their level of current operations in Toronto and whether or not there would be benefits to enhancing these programs in the study area for this project.

TABLE 4-1
REVIEW OF EXISTING SOURCE CONTROL OF POLLUTANT INITIATIVES

Existing Control Measure	Review of Existing Measures		Recommendations and Opportunities
	Pros	Cons	
Catchbasin Cleaning	Maintains the effectiveness of catchbasins for pollutant removal. Reduces the first flush of	Will only achieve a maximum of 15% reduction of TSS on average; fails to remove finer particles.	Continue on City-wide basis.

Existing Control Measure	Review of Existing Measures		Recommendations and Opportunities
	Pros	Cons	
Street Sweeping	collected solids into the sewer system; somewhat effective in the reduction of heavy particles.		
	Controls potential street flooding.		
Anti-litter By-laws	Helps remove sediments from impervious surfaces before they enter the sewer system.	Increased street sweeping effort has limited effectiveness with existing equipment.	Invest in more updated street cleaning equipment when existing equipment reaches the end of its useful life. Improved street cleaning equipment will further help remove pollutants before they enter the sewer system and receiving waters.
		Limited effectiveness at removing finer particles.	
Pet Control By-laws	Enhances the visual aesthetics of neighbourhoods, and helps to protect environmental and human health.	Limited improvements to runoff quality.	Litter in the study area has been noted as a problem. Enhancement of enforcement efforts will help reduce litter.
		Relies on public involvement, and City enforcement.	
Sewer Use By-laws	Reduces fecal coliform discharges from urban areas to receiving waters (e.g. West Pond).	Limited improvements to runoff quality.	Pet wastes have been noted as a problem in the study area; enhancement of enforcement will help reduce problem.
		Relies on public involvement, and City enforcement.	
De-icer Control	Reduces the illegal dumping of pollutants or discharge of contaminated water into the storm sewer system.	Limited improvements to runoff quality.	Continue on City-wide basis.
		Relies on public involvement, and City enforcement.	
De-icer Control	Reduces salt contamination of runoff, which will help to restore the West Pond ecosystem and enhance the effectiveness of any natural treatment alternatives implemented in the West Pond (e.g. wetland).	Reducing use of road salt or using alternative de-icers may impact road safety.	Continue to limit the use of road salts and investigate alternatives to road salt and sand. Salt contamination is impacting West Pond ecosystem; limiting use of road salts in study area required to improve ecosystem health.
Pesticide/Herbicide and Fertilizer Reduction	Removes many chemical and metal pollutants at their source.	Relies on public acceptability and adaptability, or new by-laws and regulations.	Continue with programs to eliminate the use of pesticides, herbicides and fertilizers on public property, and continue to develop a strategy to eliminate pesticide use on private lands.
	Will provide some improvement to the water quality in the West Pond and Grenadier Pond and the function of downstream treatment	May result in more weeds and nuisance vegetation on public and private lands.	

Existing Control Measure	Review of Existing Measures		Recommendations and Opportunities
	Pros	Cons	
	facilities such as wetlands and wet ponds.		

4.1.1 Catchbasin Cleaning

Catchbasins collect some of the debris and pollutants before they enter the sewer system. Catchbasin cleaning is necessary to maintain the effectiveness of catchbasins for pollutant removal and to maintain the conveyance capacity of the sewer system. The goals of a cleaning program are to reduce the first flush of collected solids into the sewer system and to control potential street flooding. The City cleans catchbasins at least once a year to maintain their conveyance capacity.

Catchbasin cleaning is effective in the reduction of large particles, but fails to remove finer particles. The effectiveness of catchbasin cleaning for overall sediment removal is highly dependent on the frequency of cleaning and the timing of cleaning activities in relation to the occurrence of rainfall events. Therefore, it is not a reliable method of removing pollutants and will likely achieve less than 15% removal of sediments on an annual basis. On its own, it will not achieve the required stormwater management objectives.

4.1.2 Street Cleaning

Runoff from streets and roads is the major contributor to pollutant loadings to receiving waters in urban areas. Pollutants from automobiles and de-icing practices, and eroded material from pervious areas accumulate on streets and are washed into the sewer system. Common methods of street cleaning are flushing, sweeping, and vacuuming. Street flushing is effective in removing sediment from road surfaces; however, it sends the particles into the stormwater system, increasing the total suspended solids in runoff. Street sweeping helps to remove sediments from impervious surfaces but leaves behind the finer particles which often contain the more significant pollutants such as heavy metals and toxins. Street vacuuming is more effective in collecting these finer particles.

The effectiveness of street cleaning for overall sediment removal is highly dependent on the frequency of cleaning and the timing of cleaning activities in relation to the occurrence of rainfall events. Therefore, it is not a reliable method of removing pollutants.

The City provides street sweeping on a regular basis. When the existing street sweeping equipment reaches the end of its useful life, the City should consider investing in high efficiency street vacuuming equipment to further reduce the amount of finer particles entering the stormwater system. Given the removal efficiencies of street cleaning, however, this method alone will not achieve the required stormwater management objectives.

4.1.3 Anti-litter By-laws

The City has anti-litter by-laws in place to enhance the visual aesthetics of neighborhoods, and to protect environmental and human health. The City should continue to enforce anti-litter by-laws. The City can also enhance its anti-litter campaign and education programs by providing more litter bins, more frequent collection of litter, and continued education

efforts. Control of floatables (i.e. litter) is only one aspect of the stormwater management requirements for the area, therefore reducing litter will not achieve all of the stormwater management objectives.

4.1.4 Pet Control By-laws

The City has pet control by-laws in place to reduce fecal coliform discharges from urban areas by requiring pet owners to collect and remove animal feces from public property. Within the study area, parts of Rennie Park are posted with “stoop and scoop” signs. This by-law should continue to be enforced to help improve the quality of runoff to the West Pond (also known as Catfish Pond), Grenadier Pond and Lake Ontario. An important improvement would be an education program aimed at ensuring that pet owners properly dispose of pet feces. Visual evidence suggests that people are collecting their pet waste in bags, but some of these bags are being dropped into storm sewer catchbasins or otherwise end up in the storm sewer. Elimination of fecal coliform contamination is only one aspect of the stormwater management requirements for the area; therefore, reducing pet litter will not achieve all of the stormwater management objectives.

4.1.5 Sewer Use By-law

The City has an existing sewer use by-law that has recently been revised and updated. The new sewer use by-law has strict limits on the concentrations of many metals, chemicals and other pollutants that can be discharged to the City's sewer system. The City should continue to enforce the sewer use by-law, and continue to provide information to the public about the harmful effects of dumping pollutants such as waste oil into the sewer system. Most of the pollutant load in stormwater originates from non-point sources, therefore application of the sewer use by-law to eliminate stormwater contamination is not possible.

4.1.6 De-icer Control

The City currently uses salt applications to de-ice roads during winter conditions. This salt runs off the roadways and contributes to degradation of the West Pond and other receiving water bodies. Accumulation of chlorides (rock salt is composed of sodium, chloride, and less amounts of calcium and magnesium) is evident in West Pond and has led to a density stratification in the pond.

Two alternatives exist to reduce the impact of de-icers on receiving water. The first is to find an alternative substance to replace the use of chloride salts. Various hydrophobic substances have been identified and investigated (see Appendix C). In addition, toxic compound such as cyanide and chromium, used as anti-caking agents and corrosion inhibitors, should be banned. Generally, the material and application costs of alternatives exceed those of rock salt, but when considering the relative damage to the environment, the costs may be acceptable. The use of abrasives, such as sand and cinders, is also an alternative to road salt. Abrasives will also become stormwater pollutants by contributing significant amounts of suspended solids. Safety is a major concern with the use of any alternative substance. The ‘bare pavement’ philosophy is considered to be the safest by most highway authorities. The Ontario Ministry of Transportation research to date indicates that rock salt is still the most effective de-icing product in terms of cost and performance.

The second alternative is to modify salt application procedures in order to minimize the effect on receiving waters. Less salt can be used by reducing salt application on straight flat road sections, by providing better training for operators of salt-spreading equipment, inspection and calibration of spreader equipment, reducing spillage from trucks, and by keeping records of salt use. The Town of Richmond Hill has employed a computerized road salt application program that has been successful in reducing the volume of salt applied to roads in that community. Some municipalities have also been experimenting with installation of sensors in the road itself that report the air temperature, moisture content and pavement temperature. These sensors help predict when ice will form on the road and indicate when salt should be applied.

To reduce pollutant loading to receiving waters, the City has stopped dumping collected snow into receiving waters, and in some areas has been exploring the use of natural treatment technologies to manage collected snow (e.g. Bloor Street Snow Dump). The City also controls the amount of de-icing materials used, where possible. These efforts to reduce the use of road salts will improve the water quality in the West Pond and Grenadier Pond and ultimately in Lake Ontario. Reduced contamination of runoff from salt will also improve the function of downstream treatment facilities such as wetlands and wet ponds. This alternative alone, however, will not be sufficient to meet all of the stormwater management objectives of the study.

4.1.7 Fertilizers/Pesticide Control

Control of horticultural pesticides, herbicides and fertilizers is a means of removing many chemical and metal pollutants at their source. The majority of pesticides and fertilizers are reasonably innocuous to the environment if they are properly applied.

As part of the City's public awareness program, residents are encouraged to use less pesticide, herbicide and fertilizer on their lawns. In addition, the Environmental Task Force is recommending that the City adopt a goal of elimination of pesticides, where possible. As part of the recommendation, the Task Force requests all City Agencies, Boards and Commissions to develop plans to ban pesticide use except in emergency or exceptional situations on all City lands by the end of 2000, and to develop a strategy to eliminate pesticide use on private lands.

Reduction in pesticide, herbicide and fertilizer use will provide some improvement to the water quality in the West Pond and Grenadier Pond. Reduced contamination of runoff from lawn and garden chemicals will also improve the function of downstream treatment facilities such as wetlands and wet ponds. This alternative alone will not be sufficient to meet all of the stormwater management objectives of the study.

4.2 Source Control of Quantity Initiatives

The City of Toronto has a number of initiatives underway aimed at reducing the quantity of stormwater runoff. In addition, there are other source controls implemented elsewhere that may be applied within the study area. A summary of the pros and cons of source controls aimed primarily at quantity improvements, and recommendations with respect to their opportunities in the study area are presented in Table 4.2, and reviewed below. Based on the

review, options considered most effective and applicable in the study area are selected for further "quantitative" assessment with respect to their runoff reduction potential.

TABLE 4-2
REVIEW OF SOURCE CONTROL OF QUANTITY INITIATIVES

Control Measure	Review of Measures		Opportunities
	Pros	Cons	
Downspout Disconnection to Pervious Areas and Rain barrels	Helps to reduce runoff volume and increases infiltration if runoff is directed to pervious surface.	<p>May not be appropriate for all buildings (e.g. may require substantial lot re-grading).</p> <p>Relies on public acceptability and adaptability, and/or new regulations/by-laws.</p> <p>Has a minor effect on pollutant removal.</p> <p>Overall effectiveness for improving water quality is low since most of the pollutant load washes off streets, sidewalks, lawns and gardens rather than roofs.</p>	<p>Further opportunity to disconnect downspouts to pervious surfaces or rain barrels in the study area.</p> <p>Carried forward in assessment for further quantitative analysis of impacts.</p>
Roof Leader Discharge to Ponding Areas	Helps reduce runoff volume and increase infiltration.	<p>Re-grading of existing properties may be required.</p> <p>Space limitations on small lots; i.e. Ponding areas should be located at least 4 m away from any building.</p> <p>Conflicts with other land uses; i.e. parkland, useable yard space.</p> <p>Relies on public acceptability and adaptability.</p> <p>Has a minor effect on pollutant removal.</p> <p>Overall effectiveness for improving water quality is low since most of the pollutant load washes off streets, sidewalks, lawns and gardens rather than roofs.</p>	<p>Further opportunity to disconnect downspouts to ponding areas in the study area.</p> <p>Carried forward in assessment for further quantitative analysis of impacts, in conjunction with the above recommended alternative.</p>

Control Measure	Review of Measures		Opportunities
	Pros	Cons	
<p>Tanks and Cisterns</p> <p>Applicable mainly for buildings with large roof areas</p>	<p>Helps to reduce runoff volume and increase infiltration if runoff is directed to pervious surface.</p>	<p>Use for collected water must be identified and encouraged.</p> <p>Conflicts with other land uses; i.e. parkland, useable yard space.</p> <p>Relies on public acceptability and adaptability.</p> <p>Pumping may be required.</p> <p>Has a minor effect on pollutant removal.</p> <p>Overall effectiveness for improving water quality is low since most of the pollutant load washes off streets, sidewalks, lawns and gardens rather than roofs.</p>	<p>Further opportunity to disconnect downspouts to cisterns/tanks in the study area.</p> <p>Carried forward in assessment for further quantitative analysis of impacts, in conjunction with the above recommended alternatives.</p>
<p>Impervious Area Reduction: Public lands</p>	<p>Helps reduce runoff volume and increase infiltration.</p>	<p>Limited opportunities in study area; e.g. no unused buildings to replace, significant portion of public paved areas are high traffic areas.</p> <p>Retrofit of existing impervious surface often difficult and expensive to implement.</p> <p>Effectiveness is reduced overtime (e.g. surfaces become impervious again with use)</p>	<p>Minimal opportunity in study area to reduce impervious areas on public lands.</p> <p>The only low traffic areas that are currently paved, and offer opportunities for replacement with porous materials, are the schoolyard around Swansea Public School (less than 1 hectare), and the public walkways (6% of study area).</p> <p>Carried forward in assessment for further quantitative analysis of impacts, in conjunction with the above alternative.</p>

Control Measure	Review of Measures		Opportunities
	Pros	Cons	
Impervious Area Reduction: Private lands	Helps reduce runoff volume and increase infiltration.	<p>Relies on public acceptability and adaptability.</p> <p>Retrofit of existing impervious surface often difficult and expensive to implement.</p> <p>Effectiveness is reduced overtime (e.g. surfaces become impervious again with use).</p> <p>Requires development and implementation of City program to implement and maintain.</p>	<p>Opportunities exist to reduce impervious areas on private lands (e.g. replacement of driveways, walkways with porous surfaces).</p> <p>Carried forward in assessment for further quantitative analysis of impacts, in conjunction with the above recommended alternatives.</p>
Porous Pavement (technology for reducing impervious areas)	Helps to reduce runoff volume and increases infiltration.	<p>Suitable only for lightly traveled surfaces.</p> <p>Long-term reliability is unknown (e.g. Clogging).</p> <p>Retrofit of existing paved surface often difficult and expensive to implement.</p>	As a technology, could be used to replace impervious surfaces at the schoolyard around Swansea Public School (less than 1 hectare), and the public walkways in the study area.
Green Roofs	<p>Reduces runoff volume.</p> <p>Can enhance the design of new and existing buildings by providing insulation on roof and aesthetics.</p> <p>Benefits from increased vegetation in urban environment realized.</p>	<p>Suitable only on flat roofs where roof load-bearing capacity is adequate.</p> <p>Suitable only where access to roof for maintenance of planters is available.</p> <p>Relies on public acceptability and adaptability, or changes to the building codes.</p> <p>Overall effectiveness for improving water quality is low since most of the pollutant load washes off streets, sidewalks, lawns and gardens rather than roofs.</p>	<p>Limited opportunities for use on existing roofs in the study area.</p> <p>Continue City's efforts on an experimental basis throughout the City, and consider for new developments only in the study area.</p>
Landscaping and Vegetative Techniques	Helps reduce runoff volume and increase infiltration.	Re-grading of existing properties may be required.	Opportunities for increased use of these techniques, particularly

Control Measure	Review of Measures		Opportunities
	Pros	Cons	
Landscaping and Vegetative Techniques (continued)	Benefits from increased vegetation in urban environment realized.	Relies on public acceptability and adaptability.	<p>on larger properties (e.g. apartments, commercial establishments) in Drainage Area B.</p> <p>Carried forward in assessment for further quantitative analysis of impacts, in conjunction with the above recommended alternatives.</p>
Roof Top Storage and Parking Lot Storage	Helps to reduce runoff rate by increasing evaporation and slow release of stored water to the sewer system.	<p>Does not reduce pollutant loads.</p> <p>Suitable only where load-bearing capacity is adequate.</p> <p>Relies on public acceptability and adaptability; or changes to the building codes.</p> <p>Overall effectiveness for improving water quality is low since most of the pollutant load washes off streets, sidewalks, lawns and gardens rather than roofs.</p>	<p>Limited opportunity for existing roofs or parking lots in the study area.</p> <p>The City should explore opportunities on an experimental basis for roof top or parking lot storage throughout the City for new developments.</p>
Soak-Away Pits/ Infiltration Trenches:	Helps reduce runoff volume and increases infiltration.	<p>Re-grading of existing properties required.</p> <p>Space limitations on small lots; i.e. facilities must be located at least 4 m away from any building.</p> <p>Conflicts with other land uses; i.e. parkland, useable yard space.</p> <p>Relies on public acceptability and adaptability.</p> <p>Routine maintenance is required or the system will fail.</p>	<p>Limited opportunity for use on public or private lands in the study area.</p> <p>Other more practical source control and natural treatment methods are available in the study area.</p>

Control Measure	Review of Measures		Opportunities
	Pros	Cons	
Soak-Away Pits/ Infiltration Trenches: (continued)		Soils are not suitable in many of the public areas (e.g. parts of Rennie Park and the Transportation Corridors). Infiltration capacity is too low and groundwater level is too high.	

4.2.1 Downspout Disconnection

Rain Barrels and Pervious Surfaces

To reduce the volume of runoff entering the stormwater system the City has a Downspout Disconnection Program. Through the program, the City encourages residents to disconnect downspouts and re-direct runoff towards grassed areas or to rain barrels. The City's public outreach program is aimed at educating homeowners as to the benefits of downspout disconnection, and provides information on how to disconnect downspouts and install rain barrels. The City of Toronto currently has an active rain barrel installation program in place, which includes free property inspection to assess site conditions and a free rain barrel. Landowners can install the rain barrels or the City staff will arrange for a contractor to do the installation for a small fee.

In March 2000, CH2M Hill Canada Limited completed a downspout disconnection survey of the study area. The results of the survey are shown in Table 4-3. As illustrated, over 67% of the buildings in the study area have their downspouts connected to the stormwater system. In addition, over 11% of the buildings have their downspouts directed to impervious surfaces such as driveways which are directly connected to the storm sewer system on the City streets through adjacent catchbasins.

TABLE 4.3
Results of Downspout Disconnection Survey (February 2000)

Downspouts	Number of Buildings	Percent
Disconnected to pervious surface	178	20.7%
Disconnected: Rain barrel	3	0.3%
Disconnected to impervious surface (i.e. driveway)	98	11.4%
Connected or Not Determined	582	67.6%
Totals	860	100.0%

Currently, 21% of the buildings in the study area have downspouts that are disconnected from the storm sewer and are directed to pervious areas or rain barrels. Only three buildings were identified with rain barrels in the entire study area. Disconnection of downspouts alone will not significantly reduce runoff unless the downspout is directed to a large pervious area.

Roof Leader Discharge to Ponding Areas

The discharge of roof leaders to ponding areas is an enhancement of the roof leader disconnection concept. An area for ponding is created in the front or rear yard of a lot. Roof leaders are discharged to the surface and directed to the ponding area. Water is detained in the ponding area until it evaporates or is infiltrated.

Ponding areas must be located at least 4 m away from any building to avoid groundwater damage to the structure. They may therefore not be suitable for the smaller private lots in the study area. Within the study area, there are also limitations to apply these techniques on public lands and large private lots. These limitations include lack of space, competing land uses (e.g. parklands), high groundwater levels, potential soil contamination, and the existing grades of properties. The need to maintain ponded areas to ensure long-term performance of the facilities is also a concern. Roof leader discharge to ponding areas has the ability to reduce the volume of runoff from a typical residential lot in the same manner as using rain barrels, and are somewhat more effective than simply directing the roof leader to pervious areas. The use of ponding areas should be encouraged, where practical, by the City.

Tanks and Cisterns

Tanks and cisterns are similar to rain barrels except they are larger. They tend to be installed below ground level on larger sized institutional or commercial lots. Pumping is required to make use of the water if the cistern is located below ground. Owners of rain barrels and cisterns must be encouraged to use all of the collected water before the next rain event.

Tanks and cisterns require adequate space to implement, as well as routine maintenance to ensure long-term performance. They may also be more expensive to implement than other source control initiatives if pumping is required. Tanks and cisterns, however, could be considered by larger property owners, and should be encouraged, where practical, by the City.

Summary of Effectiveness and Opportunities for Disconnecting Roof Leaders to Rain Barrels, Pervious Areas, Ponding Areas or Tanks and Cisterns

The feasibility of expanded downspout disconnection is site specific and depends on lot size, grading and property owner acceptance. For example, in the City of Sarnia 50% voluntary disconnection compliance was achieved following an intensive educational program. The City of St. Catharines has attained 95% roof leader disconnection through the implementation of a roof leader disconnection by-law. However, within the City of St. Catharines, there is no requirement to direct roof runoff to pervious surfaces, and many homeowners direct runoff to their driveways or other impervious surfaces.

Roof leader disconnection to rain barrels or pervious surfaces will help reduce runoff. Overall reduction in stormwater flows from roof leader disconnection programs in municipalities such as Sarnia and St. Catharines have been estimated to be less than 10% of the pre-disconnection amount. While these amounts aren't large, they help contribute to the

beneficial use of stormwater. The washoff of pollutants from rooftops to the sewer system, while minor in comparison with pollutant loads from streets¹, will also be reduced.

Within the study area, it is feasible to disconnect more roof leaders to rain barrels or pervious surfaces. To increase the number of homeowners participating in roof leader disconnection programs requires:

- A more extensive public consultation program in the study area to encourage landowner participation (or a City-wide by-law requiring homeowners to disconnect roof leaders)
- A more extensive program in the study area to help disconnect downspouts, and install rain barrels, create ponding areas in yards, and/or regrade lots
- Follow-up programs

The cost of implementation would vary depending on the extent of property work required to disconnect roof leaders to pervious areas. Currently, the City spends approximately \$250/house to disconnect roof leaders and install rain barrels, plus the cost of public communication efforts. The cost of implementation, however, would increase if major property work were required to disconnect roof leaders to pervious surfaces (e.g. creating ponding areas/lot regrading).

Within the study area it is assumed that up to about 50% of roof leaders could be disconnected to pervious areas, rain barrels or ponding areas, without substantial lot regrading work and/or City-wide by-laws. This assumption is based on a visual survey of the property characteristics in the study area, and a review of experience in other municipalities and in other areas of Toronto. Given the potential of this alternative, it is carried forward in the Class EA process for further quantitative analysis of impacts.

4.2.2 Impervious Area Reduction

General

Reducing the impervious area in the watershed will encourage infiltration and depression storage of rainwater. Impervious area reduction involves reducing, replacing or eliminating asphalt and concrete surfaces such as driveways, walkways and patios, and removal of unused buildings. Reduction in the impervious area will enhance interception, storage, infiltration and evapotranspiration of rainwater. These techniques can be applied on public lands or private lots.

Porous Pavement

The City has experimented with a method of reducing the amount of impervious area on publicly owned lands by replacing paved surfaces with porous pavement or other porous materials. Porous pavement consists of various surface treatments including open concrete pavers and porous asphalt. As a source control its objective is to reduce the total impervious area and thereby reduce the volume of runoff. Open concrete pavers rely on openings in the paving stones and between the joints to provide the pervious area for infiltration. Porous

¹ The overall effectiveness of this alternative for improving water quality is low since most of the pollutant load washes off streets, sidewalks, lawns and gardens rather than roofs. For example roads, sidewalks and driveways account for approximately 21% of the total coverage in residential areas, and 50% of the overall impervious area.

asphalt technology involves installation of a pervious, open-graded asphalt wearing course over a base course with large void spaces. The base course functions as a detention reservoir. Rain then passes through the wearing course, collects in the void space of the base course, and ultimately drains away by natural infiltration. Porous pavement has been suggested for areas such as driveways, sidewalks, parking lots, and playgrounds for individual lots. Porous pavements are not recommended for high traffic areas, including highways and City streets.

The City has experimented with the use of porous pavement. They have installed porous pavers (open brick-work) type in laneways, subject to soil conditions. The City has found that these pavers have been difficult to clean, and that other infiltration techniques, such as “soak-away pits” are more effective and more economical than porous pavements.

Summary of Effectiveness and Opportunities to Reduce Impervious Areas

Reducing the area of impervious surfaces will provide an incremental benefit in reducing runoff volumes and contaminant loads. When water lands on a pervious surface, it will begin to infiltrate or soak into the ground. A portion of the rain may also be stored on the pervious surface in shallow depressions for subsequent infiltration or evaporation. Depression storage can vary from 5 to 14 mm on pervious surfaces, but only 1 to 2 mm for impervious surfaces. If the rainfall intensity exceeds the infiltration rate and depression storage, then runoff will result. In the Toronto area, 20 percent of all daily rainfall totals are less than 2 mm, 50 percent of all daily rainfall totals are less than 5 mm, and 70 percent of all daily rainfall totals are less than 10 mm, as shown on Figure 4-1.

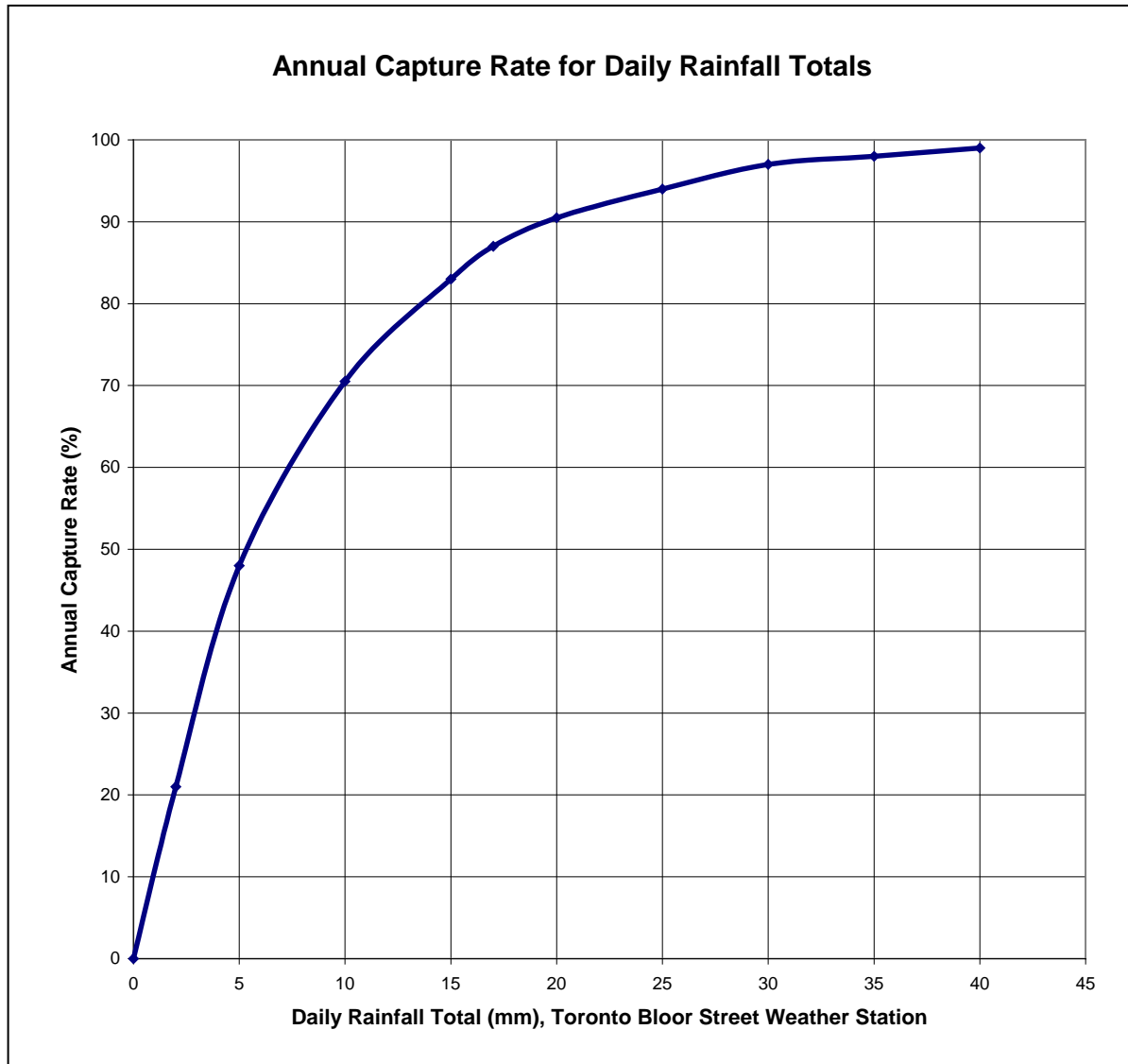
Within the study area, the impervious area ranges from 43% to over 90%. A large portion of this impervious area includes city streets, sidewalks, and driveways. For example, in the typical residential areas, A and E roofs make up 50% of the impervious area while roads, sidewalks and driveways make up the remaining 50% of the impervious area. In areas F and H, roads and sidewalks comprise 70% to 100% of the impervious area. Public walkways in the study area make up about 6% of the total impervious area.

The opportunities for reducing impervious areas on public lands are limited in the study area. A large portion of the study area is a high-traffic area, and is therefore unsuitable for the use of porous materials. In addition, there are no unused buildings that can be demolished and replaced with porous surfaces. There are also no rear-yard laneways or other low traffic roads and parking lots that can be modified to reduce impervious areas. The only low traffic areas that are currently paved, and offer opportunities for replacement with porous materials, are the schoolyard around Swansea Public School (less than 1 hectare), and the public walkways.

Opportunities for reducing impervious areas on private properties also exist. For instance, driveways and walkways on typical lots represent 8 to 12% of the total drainage area. Replacement of these surfaces with porous materials (e.g. porous pavement, parking pads, interlocking brick, stones, grass, etc.) would help reduce impervious areas. To implement these initiatives, however, requires landowner cooperation. Extensive public consultation will be necessary to encourage landowners to replace driveways and walkways with pervious materials. A pilot program along with financial assistance from the City may also be necessary to get significant cooperation. Finally, it is important to ensure extensive

maintenance to maintain pervious surfaces, as they tend to become impervious with use. With sufficient programs in place, the amount of pervious areas in the study area can be increased. This alternative is, therefore, carried forward for further quantitative analysis of impacts.

FIGURE 4-1



4.2.3 Green Roofs

Roof greening is the creation of gardens or contained vegetation on top of buildings, and is also a method of reducing the impervious area of the catchment. The greening can be accomplished through the use of free-standing containers or planters, or incorporated as another layer of the roofing system. Green roof techniques can be applied to public and private buildings. When considering roof greening, the following must be considered: the type, size and design capacities (load bearing capacity) of the roof tops, the need for an

impermeable layer between the roof structure and soils/ plants (e.g. water proof membrane), roof maintenance access, effectiveness and costs.

Green roof techniques are being applied on an experimental basis on certain buildings in the City (e.g. some buildings on the CNE grounds, the Eastview Community Centre located near Jones and Gerard Avenues, and the Jim Campstead Real Estate Facility near Nathan Philips Square). The City should continue applying these techniques on suitable buildings, and consider opportunities for greening roofs on new developments.

Within the study area there are limited opportunities for green roofs. The apartment buildings in Drainage Area B may have potential for green roofs. However, they are older buildings, which would require detailed assessments of their structural capacity, and extensive roof retrofits to be suitable for green roofs. Given that these buildings also have large grassed lots, implementation of landscaping and vegetation techniques to control runoff from the buildings is a more effective and cost efficient alternative, as described in the following section.

While green roofs are not recommended for existing roofs in the study area, they can be considered for new developments when they occur. The City should encourage the use of green roof systems for private developments. Green roofs are able to reduce the volume of runoff from a typical residential lot in the same manner as rain barrels or directing roof leaders to pervious areas. The actual volume of rain water captured and stored in the green roof is dependent on the size and design of the green roof. Since the potential for green roof retrofits is small within the study area, the overall reduction in runoff will be minimal.

4.2.4 Landscaping and Vegetative Techniques

Landscaping and vegetative techniques consist of reduced lot grading, tree-planting and stormwater fed gardens that can be applied to portions of the urban drainage system to enhance interception, storage, infiltration and evapotranspiration of rainwater. Bird and animal habitat value, and appearance of the urban development is also a benefit. These techniques can be applied on public lands or private lots. The City of Toronto currently has a tree preservation by-law and an urban forest program. These initiatives should be continued and enhanced to encourage the use of natural revegetation on public and private property.

Landscaping, grading and vegetative techniques are lot level strategies for reducing the quantity of rainwater that runs off a property. They are intended to promote recharge and reduce runoff rather than improving stormwater quality since they do not treat runoff from roads or other impervious surfaces.

Typical development standards for lot grading require minimum lot grades of 2% for adequate drainage of stormwater away from a building. If the property size is large enough the lot grading can be reduced to less than 2%. In order to ensure that foundation problems do not occur, the grading within 2 to 4-m of the building should be maintained at 2% or greater. In the study area, many yards have slopes greatly in excess of 2%, and on some lots there exists reverse grading towards the building. On the larger lots, the property owner could reduce the slope of the land by building terraces or other means. This will reduce the rate at which water flows over the ground and thereby promotes increased infiltration. The

reduced slope areas could also be planted with gardens, natural groundcover, trees and shrubs to increase the interception and infiltration of water.

Interception is a process whereby rainfall is prevented from coming in direct contact with the ground. This occurs naturally when rain falls onto vegetation. Trees intercept approximately 2 mm of rainfall over the area covered by their canopy. Maintaining existing vegetated areas, trees and bushes is the first step in maintaining a level of control by interception. The second step is to increase the vegetative cover by trees and shrubs. A review of several sites within the study area indicates that tree coverage could be increased by at least 50%. Interception by new trees could reduce the average annual runoff by 10% to 20% from lots that have increases in canopy cover.

Within the study area, several landowners have applied landscape techniques to effectively increase infiltration and decrease runoff. These techniques include lot grading, terracing, and increased vegetation cover. The City, through their public education program, should encourage private landowners to plant trees and employ other landscaping techniques to reduce runoff from their properties.

Landscaping techniques will reduce the quantity of runoff but will do little to improve the quality of stormwater because runoff will still occur from streets and other paved surfaces. This alternative alone will not be sufficient to meet all of the stormwater management objectives of the study. However, it is carried forward for quantitative analysis to estimate impacts on runoff volume.

4.2.5 Roof Top and Parking Lot Storage

Roof tops or parking lots can be designed to store water up to a certain rainfall event level. The water is then allowed to evaporate, rather than runoff into the sewer system. To implement these options requires flat roofs or large parking areas, as well as properly designed facilities, with sufficient storage capacity and overflow devices. Given that there are few buildings with flat roofs and large parking lots in the study area, opportunities for this option are limited. In addition, retrofitting the existing, few facilities, which have not been designed for stormwater storage is difficult and not recommended. However, opportunities for roof top or parking lot storage can be considered at the time of design of new facilities. As part of their Greening Roofs initiative, the City should also consider the applicability of roof top and/or parking lot storage.

4.2.6 Soak-away Pits/Infiltration Trenches

This alternative includes the use of engineered infiltration trenches, soak-away pits, and infiltration basins to reduce runoff, maintain the water table, and provide treatment of contaminated runoff. To minimize clogging and early failure of the trenches or basins, it is necessary to pre-treat any runoff that carries a high sediment load (e.g. from roads). Other requirements for successful application of infiltration measures are relatively pervious soils and a low water table.

The feasibility of soak-away pits or infiltration trenches is site specific. Given the initial survey results presented in Section 2, it is unlikely that many residents will not construct infiltration facilities on their properties due to lack of space in individual yards, concerns

with ground water mounding and long-term performance of the facilities.² Infiltration facilities must be located at least 4 m away from any building to avoid groundwater damage to the structure. Soak-away pits are able to reduce the volume of runoff from a typical residential lot in the same manner as directing roof leaders to pervious areas or rain barrels and their effectiveness is dependent on the available area to construct them.

These techniques are most applicable on public lands and large private lots that can provide the minimum recommended separation of the soak-away pit from adjacent building foundation walls. Publicly owned lands that are available in the study area are Rennie Park and the transportation corridors. The applicability of applying infiltration techniques in these areas is reviewed below.

Rennie Park

An infiltration trench for the Swansea Public School property could be located south of the playing fields in Rennie Park. The drainage area contributing to the infiltration facility is approximately 2.32 hectares (excluding the grassed playing fields) and includes the entire roof area of the school. This area has at least 85% impervious surfaces. The infiltration trench would be approximately 4.0 m wide, 44.0 m long and 1.0 m deep. The sizing of the facility and suitability of the site will be dependent on soil investigations. The preliminary facility sizing is based on a soil infiltration capacity of 60 mm/hr that would be reduced by half over the life of the facility (longevity factor) giving a final infiltration rate of 30 mm/hr. The actual lifecycle of the facility will be dependent on the sediment-loading rate from the schoolyard. The facility is sized to achieve Level 2 Protection of the watercourse for runoff from the schoolyard only. Runoff from the playing fields should bypass the infiltration facility. Given the required size of the necessary facility, the conflicting land uses in the area, and the fact that there are other more effective natural treatment options available for this area (see Section 3), this alternative is not considered further.

Transportation Corridors

The water table along the lakefront is relatively high, making infiltration trenches along the transportation corridors infeasible options.

4.3 Analysis of Source Control Methods

An analysis of source control for stormwater quantity reduction was carried out using the SWMM hydrologic model for those source control methods recommended above. These source control methods include disconnection of roof leaders to pervious areas, disconnection of roof leader to rain barrels and ponding areas, reduction of impervious area, and landscaping techniques. The model was run using hourly rainfall data at the Toronto International Airport between April and October for the year 1980. The year 1980 has been determined by the City of Toronto and the MOE to be a representative average year for precipitation. The results of the model represent typical or average annual reductions in runoff volume expected from the source control methods analyzed. The results of the

² The Wet Weather Flow Management Master Plan will help defined lot owner participation rates initiatives such as infiltration facilities and sok away pits.

analysis are summarized in Table 4.4 and illustrated in Figure 4.2. A more detailed description of the modelling techniques and assumptions is provided in Appendix C.

A description of the model set-up for each of source control methods is given below.

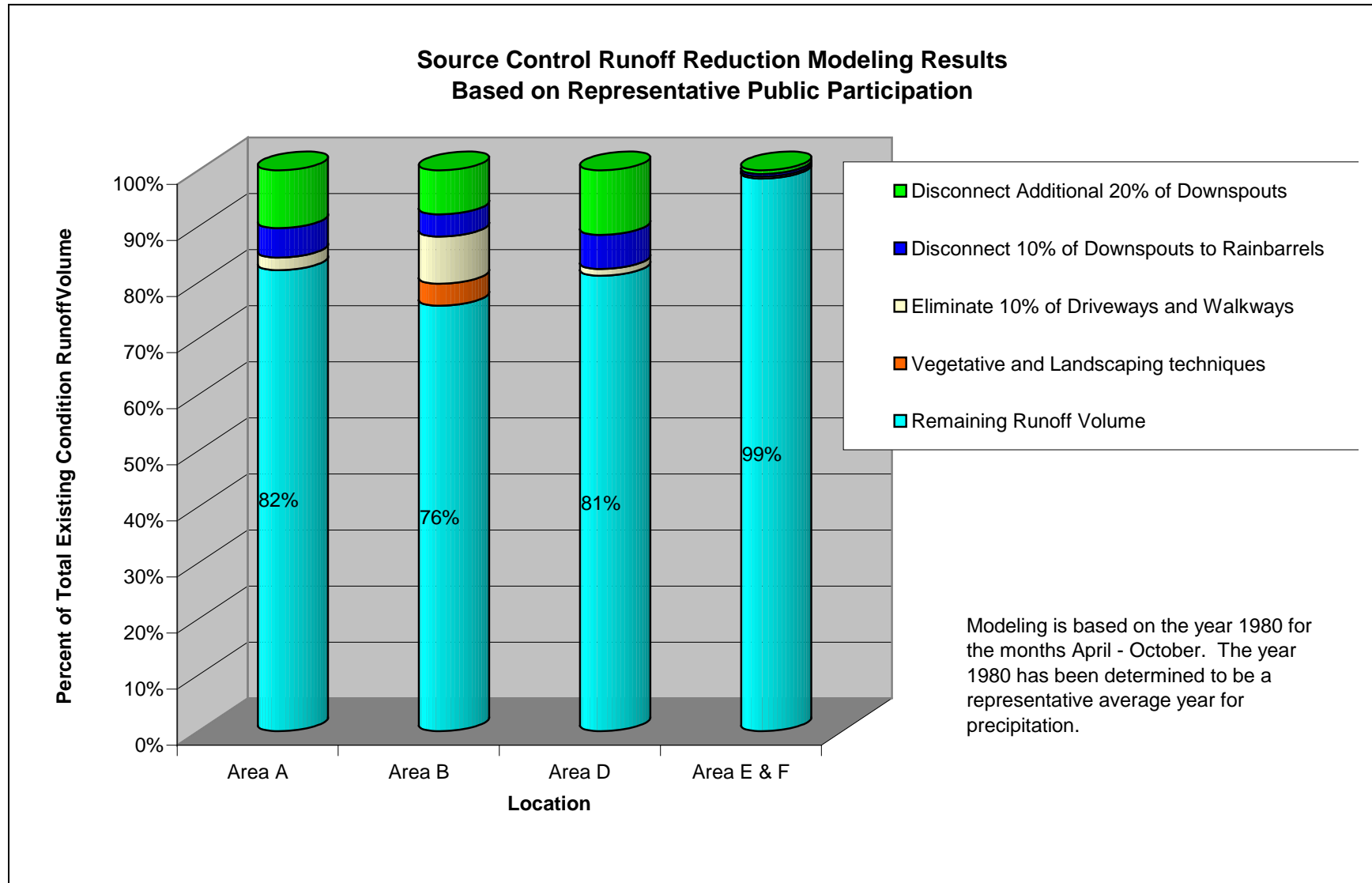
- Disconnect Roofs to Pervious Areas – the model analyses assumes 40% of roof leaders are disconnected and directed to pervious surfaces. This is an increase from 20.7% of roof leaders currently disconnected in the study area.
- Disconnect Roof to Rain barrels or Ponding Areas – the model assumes 10% of roof leaders are directed to a rain barrel or to an equivalent ponding area in the yard. This is an increase from the existing rate of only 0.3%. The model analysis was conducted for a 10% adoption of rain barrels as an expected participation rate and an additional 20% adoption as an optimistic participation rate.
- Reduce Impervious Area – the model assumes that the area of driveways and walkways is reduced by 10% across the drainage area, i.e. 1 in 10 properties have the driveways and walkways totally removed from the lot. This has the effect of reducing the overall imperviousness of the drainage area by 0.8-1.2%.
- Landscaping and Vegetative Techniques on Large Lots – the model assumes that for the large apartment building lots in drainage area B, the pervious area depression storage is increased from 6.4 mm (existing) to 15.2 mm (future). A depression storage value of 15.2 mm is typical of woodlots and open areas with dense vegetation. The infiltration rate was also increased to 254 mm/hr, which is typical for densely vegetated sandy soils.

The above percentage were assumed based on initial survey results and/or previous experience. Uptakes with respect to these and other source control initiatives may vary in the future, based on the City's public consultation programs, financial assistance programs, or new by-laws. It is noted that, at this stage, these are assumptions only that will be confirmed or revised through the Wet Weather Flow Management Master Plan. Given these assumptions, the model analysis indicates that source control initiatives can achieve 18 to 24% reduction in runoff volumes in the residential areas. In the transportation corridors, there is less opportunity for source control methods and the expected reduction in runoff is only 1.4%.

TABLE 4-4
RESULTS OF SOURCE CONTROL ASSESSMENT

Source Control Conditions	Area A – HP 7		Area B – HP 8		Area D – HP 5		Area E and F – H1		Area H – W11	
	Volume	%	Volume	%	Volume	%	Volume	%	Volume	%
Existing Condition Runoff Volume	85000		22900		21400		81000		29400	
Disconnect Additional 20% of Downspouts	8400	10%	1700	7%	2400	11%	400	0.5%	0	0%
Disconnect 10% of Downspouts to Rain barrel	4300	5%	800	3%	1200	6%	300	0.4%	0	0%
Eliminate 10% of Driveways and Walkways	1900	2%	1900	8%	300	1%	100	0.1%	0	0%
Vegetative and Landscaping techniques	0	0%	1100	4.8%	0	0%	0	0%	0	0%
Remaining Runoff Volume	70400	83%	17400	76%	17500	82%	80200	99%	29400	100%

FIGURE 4-2
SOURCE CONTROL RUNOFF QUANTITY REDUCTION



4.4 Summary and Recommendations

The City has numerous maintenance and operational programs in place aimed primarily at reducing pollutant loads. A review of these programs indicates that there are opportunities within the study area to enhance the following specific programs.

- Street cleaning: Use of more up-to-date street vacuuming equipment in the study area will help improve the quality of runoff to the West Pond and other receiving water bodies.
- Anti-litter by-law: Enhanced enforcement of the by-law will reduce litter problems noted in the study area.
- Pet-control by-law: Enhanced enforcement of the by-law will reduce problems associated with pet wastes noted in the study area.
- Road de-icer controls: Enhancement of efforts to control the amount of salt used in the study area will help improve water quality of West Pond and other receiving water bodies.

With respect to source control initiatives aimed primarily at reducing runoff volume, opportunities for the implementing the following controls in the study area were identified:

- Increased downspout disconnection to pervious areas and rain barrels.
- Downspout disconnection to ponding areas, cisterns or tanks.
- Reduction of impervious areas, both on public and private lands.
- Increased use of vegetative and landscape techniques.

A quantitative analysis of these control options was then undertaken. Results indicated that these source control initiatives could achieve 18 to 24% reduction in runoff volumes in the residential areas in the study area. In the transportation corridors, there is less opportunity for source control methods and the expected reduction in runoff is only 1.4%. To implement these controls, it was noted that the City would have to increase public consultation efforts, implement pilot programs, supply financial assistance to landowners, and carry out extensive maintenance and follow-up programs.

Through the Wet Weather Flow Management Master Plan process, the City is increasing their public awareness program regarding source control initiatives. The Master Plan will also help define reasonable landowner uptakes with respect to a variety of source controls. This study and the Wet Weather Flow Management Master Plan are part of the ongoing work to reduce stormwater problems throughout the City.

5. Conveyance System Modifications for Quality and Quantity Control

In addition to lot level source controls, there are stormwater management techniques that can be applied to the conveyance system (sewers and channels) to improve the quality and to reduce the quantity of stormwater before it is discharged from the sewer system at a downstream location. The study area already has a constructed conveyance system made up of curb and gutter drainage with collection into storm sewers. Any changes to this system would require extensive reconstruction of the City streets. The following subsection describes conveyance system alternatives for stormwater quality and quantity control.

5.1 Options for Modifying the Conveyance System

5.1.1 Perforated or Pervious Pipe Systems

These systems may be classified as an infiltration technique, which allows for exfiltration of water through storm sewer pipe walls into the surrounding soil. To minimize clogging and early failure of the perforated pipe system, it is necessary to pre-treat any runoff that carries a high sediment load (e.g. roads). In most cases, the perforated pipe system requires a storage zone around the pipe made up of crushed stone or other porous material. Other requirements for successful application of infiltration measures are soils with a high infiltration capacity and a low water table. Perforated pipe systems can be implemented at the lot level for retrofit replacement of downspout connections, or at the street level for retrofit replacement of storm sewers.

Exfiltration systems have been built and are being monitored in the former City of Etobicoke. The Etobicoke Exfiltration systems are constructed along Queen Mary's Drive and Princess Margaret Boulevard in Etobicoke. The Queen Mary's Drive site is located in an area with soils that are very similar to the soils in the area north of Rennie Park (sand to silty-sand). The storm drainage system on Queen Mary's Drive services a 13.3 hectare, low density and mature residential area. Road drainage is provided by grass swales. The groundwater is located 1.6 to 2.5 metres below the surface. The Princess Margaret Boulevard drainage area is also characterized by low density residential housing similar to the Queen Mary's Drive area. Road drainage is provided by roadside ditches. The drainage area is approximately 30.5 hectares. The soils in the Princess Margaret Boulevard area are clay till near the surface underlain by a silty-sand till.

The Etobicoke Exfiltration systems have proven effective in exfiltrating rainwater from a 15-mm 1-hour duration design storm into the areas' groundwater. Flow monitoring indicates that the systems have been able to exfiltrate all of the runoff from rainfalls up to 40.4 mm of rainfall. Some overflows from the system did occur if very intense rain storms occurred, or if the inter-event period between storms was very short (SWAMP, 1999). The effects of the exfiltration systems on the surrounding groundwater levels and quality were not determined by the most recent monitoring and assessment study.

The effectiveness of this type of system for drainage areas with higher density of development and curb and gutter drainage is not addressed by the SWAMP report. It is expected that the system could be designed to exfiltrate the larger quantities of runoff expected in the study area and to accommodate the faster runoff times.

As it is costly and disruptive to properties to retrofit existing systems, the City should only consider this alternative when new systems are necessary as a result of new developments or when existing systems have reached the end of their useful design lives.

5.1.2 Pervious Catchbasins

Pervious catchbasins are an extension of the pervious pipe system concept. They allow for exfiltration of water from the catchbasin into the surrounding soil. To minimize clogging and early failure of the perforated pipe system, it is necessary to pre-treat any runoff that carries a high sediment load (e.g. roads). In most cases, the pervious catchbasin system requires a storage zone adjacent to the catchbasin, made up of crushed stone or other porous material. Other requirements for successful application of infiltration measures are soils with a high infiltration capacity and a low water table. Pervious catchbasin systems can be implemented at the street level for retrofit replacement of existing catchbasins.

As with perforated or pervious pipe systems, it is difficult and expensive to retrofit existing sewer systems. Pervious catchbasins should only be considered in new systems or when replacements of existing catchbasins are necessary.

5.1.3 Grassed Swales

Grassed swales are an alternative to sewer pipes and lined channels. They can be used to remove some pollutants from stormwater if they are designed correctly and frequently maintained. Grassed swales can also be designed to promote infiltration of storm water and to slow down the rate at which storm water enters the sewer, especially for smaller low intensity rain storms. They are applicable where there are existing grassed boulevards or right-of-ways that can be modified to allow surface conveyance of stormwater. Grassed swales are less effective in areas with steep road grades because the flat swales grades required to remove sediments and promote infiltration cannot be maintained. Alternatively, streets with curb and gutter drainage can be modified to provide a grassed boulevard with swale and culvert drainage. This type of modification requires an adequate right-of-way width to allow construction of the grassed swale along side the paved street. In some cases, sidewalks would be eliminated on one or both sides of the street. Culverts are required across each driveway to provide a continuous flow path. In most cases, a storm sewer is still required to convey storm water for larger storm events and at locations where drainage from upstream areas is concentrated into one flow stream. The complex topography of the study area suggests that the existing sewer system could only be partially eliminated.

Review of the study area indicates that there is little applicability for grassed swales with the exception of some areas along Lakeshore Boulevard. Redevelopment of the existing street cross-sections is not cost effective for storm water improvements because it cannot resolve all of the stormwater quality issues in the study area.

5.2 Summary of Options for Modifying the Conveyance System

Table 5.1 presents a review of the opportunities for modifying the conveyance system. It is recommended that the City consider installing perforated pipe systems and pervious catchbasins when new systems or replacement systems are necessary (It is impractical to retrofit existing systems).

Grass swales may be appropriate along Lakeshore Boulevard where grassed boulevards already exist. The opportunity to revise curb and gutter street sections to swale and culvert drainage in the residential areas can be explored if major reconstruction of City streets is required for maintenance or other purposes. At that time the affected residents should be consulted to determine if the revised street section is acceptable.

TABLE 5.1
CONVEYANCE SYSTEM MODIFICATIONS

Conveyance System Modification	Review of Measures		Recommendations
	Pros	Cons	
Perforated Sewer Pipe Systems	Helps reduce stormwater sewer discharge and increase infiltration.	Requires pre-treatment of runoff to remove sediment load. Requires suitable soils and low water table level. Long-term reliability is unknown (e.g. clogging). Groundwater contamination may occur. Difficult and expensive to retrofit existing sewer systems.	Not recommended for existing systems. The City should consider this option for use when new systems are required. Applicable mainly in the residential area north of Rennie Park where sandy soils exist.
Pervious Catchbasins	Helps reduce stormwater sewer discharge and increase infiltration.	Requires suitable soils and low water table level. Groundwater contamination may occur. Difficult and expensive to retrofit existing sewer system to provide soak-away storage area.	Not recommended for existing systems. The City should consider this option for use when new systems are required. Applicable mainly in the residential area north of Rennie Park where sandy soils exist.

Conveyance System Modification	Review of Measures		Recommendations
	Pros	Cons	
Grassed Swales	<p>Helps to remove suspended sediments, and to provide some infiltration of runoff.</p> <p>Space for swales is available along Lakeshore Blvd.</p> <p>Stormwater quality from road runoff can be improved.</p>	<p>Cannot achieve stormwater management goals alone.</p> <p>Difficult and expensive to retrofit existing curb and gutter drainage system. The boulevards along Lakeshore Blvd. are currently lined with mature trees that would be removed. The trees provide other benefits besides stormwater management.</p> <p>Revision of street sections in residential areas may not be acceptable since sidewalks would likely be removed.</p>	<p>Not recommended in residential areas due to space constraints and grading. However, opportunity exists for system along Lakeshore. This opportunity for using a grass swale system to treat drainage from the transportation corridors is compared with other end-of-pipe alternatives in more detail in Section 6.</p>

6. Stormwater Treatment Alternatives

In this section, stormwater treatment alternatives are identified and assessed, and preferred treatment alternatives are recommended, based on the assessment.

6.1 Requirement for Stormwater Treatment

The opportunities for source control of stormwater runoff quantity and quality have been explored in Section 4. The conclusion of that assessment is that source control is insufficient to address all of the storm water pollutant issues of the study area. Modelling of source control methods for quantity control indicates that the expected reduction in runoff volume from these methods is in the range of 17% to 24% on a yearly basis. The majority of the volume reduction is realized for low intensity, short duration rain events. The remaining 83% to 76% of runoff will continue to wash pollutants off roads and other surfaces and carry them to the downstream watercourses.

The majority of pollutants in the runoff are generated from non-point sources related to roads and highways. Therefore, reducing the quantity of runoff by source control methods will not decrease the amount of pollutants available for transport. Similarly, the source control programs cannot eliminate all of the pollutants in runoff.

Conveyance system modifications aimed at reducing the quantity of runoff and improving the quality of runoff have been assessed in Section 5. Since the area is already largely developed with an existing curb and gutter drainage system with storm sewer servicing, it would be impractical to revise the conveyance system to provide upstream flow reduction and pollutant removal.

The conclusion reached following the assessment of source controls and conveyance system modification is that these methods can improve the quality of storm water runoff and reduce the quantity of runoff, but in this study area they are insufficient to meet the water quality objectives of the study. As a result, various stormwater treatment alternatives must be examined to determine the most appropriate way to reach the stated objectives of the study. The source control and conveyance system modifications recommended in Section 4 and 5 will work together with the treatment alternatives to meet the objectives of the study.

6.2 Identification of Alternatives

Numerous end-of-pipe treatment alternatives exist for improving the quality of stormwater, and in some instances reducing the overall quantity of stormwater discharged to a receiving watercourse. End-of-pipe treatment alternatives are described in the following subsections.

6.2.1 Wet Ponds

Wet ponds are open ponds in which stormwater is captured. The facility consists of a permanent pool of water and a storage volume above the permanent pool for extended

detention of storm flows. Sediments settle out of the storm water that is retained in the pond and are trapped in the permanent pool. These ponds are situated downstream of a stormwater collection system. They generally have a moderate to high capability of removing many urban pollutants depending on the size of the pond with respect to the amount of runoff. Wet ponds treat contaminated stormwater through the settling of sediments and associated contaminants, biological removal of contaminants, and natural die-off of microbial organisms. They also allow control of the rate at which runoff is released, and can therefore assist with erosion and flood control. Routine dredging of wet ponds is required to maintain their effectiveness.

6.2.2 Constructed Wetlands

Constructed wetlands are shallow ponded systems, which provide a high degree of stormwater contaminant removal through natural physical, chemical and biological processes. Emergent aquatic vegetation such as bulrush, reed and cattail provide a suitable environment for microbial organisms, which are effective in removing nutrients and organic matter and provide sites for the adsorption of metals and phosphorus. The wetland plants also trap and remove contaminant-laden sediment from the incoming stormwater.

Wetland treatment conforms to general policies of MOE and MNR that encourage new techniques and methods that can be integrated within a natural environment setting. When located within a natural valley or bottomland area, wetlands can be constructed at a relatively low cost. Not only do such facilities provide stormwater management, they also provide fish and wildlife habitat and potentially enhance opportunities for nature observation within an urban environment. When built in conjunction with settling and infiltration ponds, treatment wetlands provide stormwater attenuation and treatment and groundwater recharge.

To perform properly, flow rates and sediment loads must be controlled upstream. Routine maintenance of the wetland system includes sediment forebay dredging, keeping inflow and outflow structures free of debris, nuisance wildlife monitoring and control, and monitoring and maintaining the vegetation and berms.

6.2.3 Dry Ponds

A dry pond facility provides temporary storage for stormwater in excavated depressions or bermed impoundments. Sediments settle out of the storm water that is retained in the pond. Extending the detention time of stormwater within a dry pond provides an effective means of removing pollutants. These ponds referred to as dry extended detention ponds, provide both flow rate control and some water quality treatment. Pollutants are primarily removed by settling, and depending on the detention time, provide moderate to high removal of particulate contaminants. Accumulated sediments must be routinely removed from the invert of the pond, otherwise settled sediments may become re-suspended and washed downstream.

6.2.4 Sub-Surface Tanks

Subsurface tanks are underground storage tanks, which receive inflow directly from a storm sewer (s). Natural settling occurs within the tanks. The sediment is routinely removed for disposal, while the "settled" storm flow is directed to receiving waters. Settling within the tank can be assisted through the addition of precipitants such as alum. In addition, automated flushing systems can be incorporated into facility design. Tanks are relatively expensive options

for stormwater control, which are generally only considered for storage and treatment of raw sewage, or stormwater when physical constraints do not permit other options to be used.

6.2.5 High Rate Treatment Devices

High rate treatment devices are engineered devices that are generally installed at the end of storm sewer networks. These devices remove solids, oils and grease through quick settling or vortex action created within a special flow chamber. Solids removal is generally not as effective as ponds or tanks. Settling within the devices can be assisted through the addition of chemical precipitants. Solids are generally discharged directly to a sanitary sewer by gravity flow or pumping. Alternatively, solids may be pumped to an adjacent storage tank for removal later, or they may be pumped directly into a disposal vehicle.

High rate treatment devices can be designed for larger drainage areas, such as vortex separators, or for smaller drainage area, such as oil and grit separators.

Oil and grit separators are small devices that are placed along a storm sewer to trap oil and sediments (grit). The separators are generally constructed in two forms. In the first form, stormwater enters the sediment trap or sump through a drop pipe and is discharged through a submerged riser pipe. Sediment and floating oils are removed in the quiescent conditions in the sump and are trapped within the device. The second form uses the same vortex principles of high rate treatment devices to promote rapid settling of solids and phase separation of oils. Oil and grit separators are generally used for small drainage areas. They are beneficial for redevelopment projects in urban areas where space is limited, and for use in commercial parking lots and industrial sites where spills may occur. These types of devices can provide a moderate degree of pollutant removal if they are correctly designed and regularly maintained.

6.2.6 StormTreat™ Systems

StormTreat™ is a proprietary system designed to treat the first flush of water through a storm sewer. The system is a small above ground multi-chamber treatment device. Low flows including the first flush of a storm are diverted out of the storm sewer into the StormTreat™ system. Sedimentation and removal of floatables occurs in an inner chamber. Additional settling of fine particles and removal of other pollutants occurs as water passes through a small constructed wetland in the outer portion of the chamber. These devices have been shown to provide a high level of treatment if they are sized correctly and maintained.

6.2.7 StormFilter™ Systems

StormFilter™ is a proprietary system that filters stormwater through a variety of manufactured filter canisters. The canisters are housed in an underground chamber. Stormwater floods the chamber and is drawn through filter media before being discharged. The system has been demonstrated to remove oils, greases, soluble metals, sediment, total phosphorous and other pollutants. The system is usually employed to treat runoff from small drainage areas such as single retail outlets, large urban parking lots, residential streets, bridges and highway interchanges.

6.2.8 Infiltration Trenches/Infiltration Basins

Infiltration trenches and basins are described in Section 2 as a source control alternative. They may also be considered as end-of-pipe treatment techniques for larger drainage areas. Infiltration trenches and basins are basically above-ground pond systems, which are constructed in highly pervious soils. Water infiltrates the trench or basin and either recharges the groundwater system or is collected by an underground-perforated pipe network and discharged to a downstream outlet. Infiltration trenches and basins are generally applicable for small drainage areas (< 2 ha for trenches and < 5 ha for basins). To minimize clogging and early failure of the infiltration system, it is necessary to pre-treat any runoff that carries a high sediment load (e.g. roads). Other requirements for successful application of infiltration measures are soils with a high infiltration capacity and a low water table.

6.2.9 Grass Swales

Grass swales are also described in Section 5 as a conveyance system alternative. They are usually only considered for treatment of storm water from small areas and/or in combination with other treatment facilities. Grassed swales are not as effective for removal of suspended sediments as other treatment alternatives (e.g. construction wetlands). Grassed swales can also be designed to promote infiltration of storm water into permeable soils.

6.2.10 Peat-Sand Filters

A peat-sand filter consists of a large shallow basin, which is vegetated with a moisture and disease resistant variety of grass. Beneath this grass exist three separate layers:

- Peat
- Mixed peat and sand
- Sand

The peat, through microbial activity, is highly effective in removing a variety of pollutants from the runoff including fecal coliforms, BOD, phosphorous, and nitrates. Peat has an adsorption affinity for metals and hydrocarbons, which provides additional treatment. The mixed layer provides a transition between the peat and sand layers. The underlying sand layer provides a medium for draining the treated stormwater, which is then collected in a perforated underdrain. This stormwater treatment method is an emerging technology for small flows from areas less than 5 ha and has not been widely applied. Pre-treatment to remove sediment is essential to the successful long-term operation of peat-sand filters.

6.2.11 Filter Strips

Filter strips are engineered stormwater conveyance systems which treat small drainage areas (<2 ha). Generally, a filter strip consists of a flow-spreader and numerous vegetative plantings. The flow spreader ensures uniform flow over the vegetation. The vegetative plantings filter out pollutants and promote infiltration of the stormwater. Vegetated filter strips have a limited effectiveness for water quality control due to the difficulty of maintaining sheet flow through the vegetation.

6.2.12 Direct Flows to Another Drainage Area for Treatment

In some cases, stormwater flows may be directed to another drainage area within the study area for treatment.

6.2.13 Do Nothing

The do-nothing alternative, in which no specific measures are taken to control the impact of urban drainage, is included in this evaluation as a benchmark for assessing the appropriateness of other alternatives.

6.3 Development of a Short-List of Treatment Alternatives

6.3.1 Screening Criteria

As a first step in the evaluation of treatment alternatives, a screening exercise is performed based on the following overall “exclusionary” feasibility factors:

- **Effectiveness:** Does the alternative meet the study objectives and solve the problem? Is it able to meet the stormwater management objectives, either alone or in combination with other alternatives? If the alternative is not able to meet the stormwater management objectives it is not carried forward for further evaluation.
- **Practicality:** Is the alternative practical from a technical perspective? Is it a proven technology? Can it be implemented, or are there constraints to implementation, such as land availability, public acceptability? Are costs prohibitive compared to other alternatives? If the alternative is not practical, the alternative is not carried forward for further evaluation.

While not considered an exclusionary factor, preference is also given to natural treatment technologies.

6.3.2 Screening of Alternatives

Table 6-1 presents a screening of the long-list of alternatives using the exclusionary criteria described above. During the screening exercise, consideration was given to the drainage area for which the treatment alternatives would apply. These drainage areas are described and illustrated in Figure 3.2.

The results of the screening exercise indicate that Stormtreat™ systems, Stormfilter™ systems, and Peat-sand filter systems are not practical for this study area due to space constraints, the need for too many units, difficulties in installing systems, unproven reliability and/or the need to frequently clean the systems. They are not considered further in the evaluation. Likewise, infiltration basins and trenches were found to be impractical in the open space areas such as Rennie Park and the transportation corridors, as described in Section 4. Infiltration trenches in Rennie Park would conflict with existing land uses, while the water table along the lakefront is too high to make infiltration trenches effective in this location. In addition, the existence of former landfill sites in Rennie Park may pose a constraint for infiltrating stormwater at that location. All other alternatives (i.e. wet ponds, wetlands, dry ponds, sub-surface tanks, high-rate treatment devices, grassed swales, and directing flows to another drainage area for treatment) were found to be feasible in some or all of the various drainage areas as described below.

TABLE 6-1-1
DRAINAGE AREAS A AND C - SCREENING OF LONG-LIST OF TREATMENT ALTERNATIVES

Study Area and Treatment Alternatives	Screening Criteria			Recommendation
	Effectiveness	Practicality	Natural Treatment Technology	
Drainage Areas A and C: Outfall HP7 in Rennie Park				
<p><i>Wetland in Rennie Park</i></p> <p>Wetland could be located upstream of West Pond or within West Pond itself.</p>	<p>The alternative is effective; it can achieve stormwater management objectives.</p> <p>Reduction in salt and metal concentration in runoff from roads would improve wetland vegetation survival rates and treatment capabilities.</p>	<p>The alternative will change the open space park function, but is considered a technically practical alternative.</p> <p>Space is available upstream of the pond or within the pond itself. The pond is shallow enough in this location a wetland.</p>	<p>Alternative can be considered a natural treatment technology. Opportunities for enhanced wildlife habitat, public viewing and education</p>	<p>Recommended for further assessment.</p>
<p><i>Wet Pond in Rennie Park</i></p> <p>Wet Pond could be located upstream of West Pond or within West Pond itself.</p>	<p>The alternative is effective; it can achieve stormwater management objectives.</p>	<p>The alternative will change the open space park function, but is considered a technically practical alternative.</p> <p>Some loss of natural habitat with a ravine location.</p> <p>If the wet pond facility is located in West Pond sediments would have to be removed which poses a constraint.</p>	<p>Alternative can be considered a natural treatment technology. Opportunities for some wildlife habitat, public viewing and education.</p>	<p>Recommended for further assessment.</p>
<p><i>Dry Pond or Subsurface Tank</i></p> <p>Located in Rennie Park</p>	<p>The alternative is effective; it can achieve stormwater management objectives.</p> <p>However, some reliability concerns regarding re-suspension of sediments.</p>	<p>The alternative will change a portion of the park from a wooded ravine to a grassed open area. Some loss of natural habitat will occur.</p> <p>Ponds and Tanks are considered a technically practical alternative.</p>	<p>Alternative is not considered a natural treatment technology.</p>	<p>Recommended for further assessment.</p>

Study Area and Treatment Alternatives	Screening Criteria			Recommendation
	Effectiveness	Practicality	Natural Treatment Technology	
<i>High-Rate Treatment</i> (End-of-pipe Vortex Separators)	Large-scale centralized vortex separators have not been proven to achieve 70% TSS removal. Chemical addition may be needed	Some change is open space park function and some loss of natural habitat due to construction of facility at the outfall.	Alternative is not considered a natural treatment technology.	Not recommended for further assessment as a stand-alone alternative.
<i>Oil and Grit Separators on Local City Streets</i>	The alternative is somewhat effective; If numerous (10-20) oil and grit separators are installed they may be able to achieve stormwater management objectives.	Not practical alternatives for this drainage area as a whole since these devices are typically designed for small areas with simple sewer systems. Treated and untreated stormwater would mix together in the sewer network, reducing the overall effectiveness of the treatment system.	Alternative is not considered a natural treatment technology.	Not recommended for further assessment as a stand-alone alternative. However, could be used in combination with other technologies. (i.e. in lieu of sediment forebay)
<i>Peat-Sand Filters</i>	The alternative is effective; If several peat-sand filters are constructed they can achieve stormwater management objectives.	Not a practical alternative for this drainage area as a whole. Suitable only for small drainage areas (<5 ha).	Alternative can be considered a natural treatment technology.	Not recommended for further assessment.
<i>StormTreat™ System</i>	The alternative is effective. This technology only treats the first flush of stormwater; significant volumes bypass the system without treatment. Reliability is not proven for large areas or local climate.	This alternative is not considered practical. Number of units required is too large for space constraint; Difficult to install as a retrofit to existing system; Long-term maintenance of reed bed may prove problematic.	Alternative can be considered a natural treatment technology.	Not recommended for further assessment.

Study Area and Treatment Alternatives	Screening Criteria			Recommendation
	Effectiveness	Practicality	Natural Treatment Technology	
<i>StormFilter™ System</i>	The alternative is effective; it can achieve stormwater management objectives.	<p>This alternative is not considered practical. Number of units required is too large for space constraint.</p> <p>Difficult to install as a retrofit to existing system due to hydraulic gradient requirements of system.</p> <p>System requires frequent replacement of proprietary filter cartridges.</p>	Alternative is not considered a natural treatment technology.	Not recommended for further assessment.
<i>Infiltration Basin</i>	This alternative will not be effective in this location; Infiltration capacity of soil in the ravine downstream of the outfall is too low and groundwater level is too high.	<p>The water table is at or near the surface in Rennie Park ravine, therefore no potential for infiltration.</p> <p>The location of historic landfill sites within Rennie Park may limit the practicality of this alternative</p>	Alternative can be considered a natural treatment technology.	Not recommended for further assessment

 **Short Listed Alternatives**

TABLE 6-1-2
DRAINAGE AREA B - SCREENING OF LONG-LIST OF TREATMENT ALTERNATIVES

Study Area and Treatment Alternatives	Screening Criteria			Recommendation
	Effectiveness	Practicality	Natural Treatment Technology	
Drainage Area B: Outfall HP8 to West Pond				
<i>Wetland in West Pond at Outfall HP8</i>	<p>The alternative is effective; it can achieve stormwater management objectives.</p> <p>Reduction in salt and metal concentration in runoff from roads would improve wetland vegetation survival rates and treatment capabilities.</p>	<p>Some loss of open water in West Pond.</p> <p>Sediment quality in West Pond is poor for emergent vegetation growth. Sediments would have to be capped or removed prior to planting wetland vegetation.</p> <p>Construction in pond will pose constraints due to limited access and depth of pond water in this location.</p>	<p>Alternative can be considered a natural treatment technology. Opportunities for some wildlife habitat, public viewing and education</p>	<p>Recommended for further assessment.</p>
<i>Wet Pond</i> Located in West Pond at Outfall HP8	<p>The alternative is effective; it can achieve stormwater management objectives.</p>	<p>Some loss of open water in West Pond and aesthetic character of pond.</p> <p>Sediment quality in West Pond poses construction constraints. If sediment is removed it may require disposal at a controlled landfill.</p>	<p>Alternative can be considered a natural treatment technology.</p>	<p>Recommended for further assessment.</p>
<i>Oil and Grit Separators</i>	<p>The alternative is somewhat effective, but there are some reliability concerns regarding removal efficiency in retrofit situation. Maximum TSS removal likely less than 70%.</p>	<p>This alternative is technically practical and suitable for space constraints.</p>	<p>Alternative is not considered a natural treatment technology.</p>	<p>Recommended for further assessment.</p> <p>Treatment by oil and grit separator device is carried forward for detailed evaluation as a possible alternative to a wetland or wet pond in West Pond</p>

Study Area and Treatment Alternatives	Screening Criteria			Recommendation
	Effectiveness	Practicality	Natural Treatment Technology	
<i>Peat-Sand Filter(s)</i>	The alternative is effective; it can achieve stormwater management objectives.	Space constraints at outfall and upstream locations. Some loss of parkland would occur. Available grade constraints and high water table is a constraint at the outfall for this technology.	Alternative can be considered a natural treatment technology.	Not recommended for further assessment
<i>StormTreat™ System</i>	The alternative is effective; it may be able achieve stormwater management objectives. This technology only treats the first flush of stormwater; significant volumes bypass the system without treatment. Reliability is not proven for large areas or local climate.	This alternative is not considered practical for the following reasons: Number of units required is too large for space constraint; Long-term maintenance of reed bed may prove problematic.	Alternative can be considered a natural treatment technology.	Not recommended for further assessment. However, this technology could be demonstrated in this area.
<i>StormFilter™ System</i>	The alternative is effective; it can achieve stormwater management objectives.	This alternative is not considered practical for the following reasons: Number of units required is too large for space constraint; System requires frequent replacement of proprietary filter cartridges.	Alternative is not considered a natural treatment technology.	Not recommended for further assessment. However, this technology could be demonstrated in this area.
<i>Dry Pond or Subsurface Tank</i> Located adjacent to Grenadier Pond	The alternative is effective; it can achieve stormwater management objectives. However, some reliability concerns regarding re-suspension of sediments.	There is insufficient space for a dry pond or underground tank in this location.	Alternative is not considered a natural treatment technology.	Not recommended for further assessment.

Study Area and Treatment Alternatives	Screening Criteria			Recommendation
	Effectiveness	Practicality	Natural Treatment Technology	
<i>Infiltration Basin</i>	This alternative will not be effective in this location. Soils do not have enough permeability	There is insufficient space for an infiltration basin in this location	Alternative can be considered a natural treatment technology.	Not recommended for further assessment

 **Short Listed Alternatives**

TABLE 6-1-3
DRAINAGE AREA D - SCREENING OF LONG-LIST OF TREATMENT ALTERNATIVES

Study Area and Treatment Alternatives	Screening Criteria			Recommendation
	Effectiveness	Practicality	Natural Treatment Technology	
Drainage Area D: Outfall HP5 to Grenadier Pond – Ellis Avenue flow only				
<i>Wetland in Grenadier Pond at Outfall HP5</i>	The alternative is effective; It can achieve stormwater management objectives. Reduction in salt and metal concentration in runoff from roads would improve wetland vegetation survival rates and treatment capabilities.	Some loss of open water in Grenadier Pond. Sediment quality in Grenadier Pond is poor for emergent vegetation growth. Sediments would have to be capped or removed prior to planting wetland vegetation.	Alternative can be considered a natural treatment technology. Opportunities for some wildlife habitat, public viewing and education	Recommended for further assessment.
<i>Wet Pond</i> Located in Grenadier Pond at outfall	The alternative is effective; It can achieve stormwater management objectives.	Some loss of open water in Grenadier Pond and aesthetic character of pond. Sediment quality in Grenadier Pond poses construction constraints. If sediment is removed it may require disposal at a controlled landfill.	Alternative can be considered a natural treatment technology.	Recommended for further assessment.
<i>Oil and Grit Separators</i>	The alternative is somewhat effective; It may be able to achieve stormwater management objectives. Some reliability concerns regarding removal efficiency in retrofit situation. Maximum TSS removal likely less than 70%.	This alternative is technically practical and suitable for space constraints. Sewer system can be easily divided into three small sub-catchments for treatment. Small high-rate treatment device may be applicable.	Alternative is not considered a natural treatment technology.	Recommended for further assessment. Treatment by oil and grit separator device is carried forward for detailed evaluation as a possible alternative to a wetland or wet pond in Grenadier Pond.

Study Area and Treatment Alternatives	Screening Criteria			Recommendation
	Effectiveness	Practicality	Natural Treatment Technology	
Divert Drainage from Area D to the West Pond	<p>The alternative is not entirely effective. Not all flows From Area D can be directed into the wetland or wet pond</p> <p>Diversion of flows might lead to increased potential for flooding adjacent to West Pond.</p>	<p>This alternative is not technically practical since new sewers would have to be constructed down the steep valley slopes. Not all flows from Area D can be directed to the West Pond treatment locations.</p>	<p>Can be incorporated into other natural treatment systems</p>	<p>Not recommended for further assessment</p>
<i>Peat-Sand Filter(s)</i>	<p>The alternative is effective; It can achieve stormwater management objectives.</p>	<p>Space constraints at outfall and upstream locations. Some loss of parkland would occur. Available grade constraints and high water table is a constraint at the outfall for this technology.</p>	<p>Alternative can be considered a natural treatment technology.</p>	<p>Not recommended for further assessment</p>
<i>StormTreat™ System</i>	<p>The alternative is effective; it may be able achieve stormwater management objectives.</p> <p>This technology only treats the first flush of stormwater; significant volumes bypass the system without treatment.</p> <p>Reliability is not proven for large areas or local climate.</p>	<p>This alternative is not considered practical for the following reasons:</p> <p>Number of units required is too large for space constraint;</p> <p>Difficult to install as a retrofit to existing system;</p> <p>Long-term maintenance of reed bed may prove problematic.</p>	<p>Alternative can be considered a natural treatment technology.</p>	<p>Not recommended for further assessment.</p> <p>This technology could be demonstrated in this area.</p>

Study Area and Treatment Alternatives	Screening Criteria			Recommendation
	Effectiveness	Practicality	Natural Treatment Technology	
<i>StormFilter™ System</i>	The alternative is effective; it can achieve stormwater management objectives.	This alternative is not considered practical for the following reasons: Number of units required is too large for space constraint; Difficult to install as a retrofit to existing system due to hydraulic gradient requirements of system; System requires frequent replacement of proprietary filter cartridges.	Alternative is not considered a natural treatment technology.	Not recommended for further assessment. This technology could be demonstrated in this area.
<i>Dry Pond or Subsurface Tank</i> Located adjacent to Grenadier Pond	The alternative is effective; it can achieve stormwater management objectives. Re-suspension of sediment is a concern with this technology.	There is insufficient space for a dry pond or underground tank in this location.	Alternative is not considered a natural treatment technology.	Not recommended for further assessment.
<i>Infiltration Basin</i>	This alternative is not effective in this location; Infiltration capacity of soil is too low and groundwater level is too high.	The water table is at or near the surface in this location, therefore no potential for infiltration.	Alternative can be considered a natural treatment technology.	Not recommended for further assessment

 **Short Listed Alternatives**

TABLE 6-1-4
DRAINAGE AREA E - SCREENING OF LONG-LIST OF TREATMENT ALTERNATIVES

Study Area and Treatment Alternatives	Screening Criteria			Recommendation
	Effectiveness	Practicality	Natural Treatment Technology	
Drainage Area E: Coe Hill Drive/ Ellis Gardens/ Queensway drainage to Ellis Ave Outfall (No additional treatment of Grenadier Pond outflow)				
<i>Oil and Grit Separators</i>	The alternative is somewhat effective; it may be able to achieve stormwater management objectives. Some reliability concerns regarding removal efficiency in retrofit situation. Maximum TSS removal likely less than 70%.	This alternative is technically practical and suitable for space constraints. Several different separator devices are available. Small high-rate treatment device may be applicable.	Alternative is not considered a natural treatment technology.	Recommended for further assessment.
Do Nothing in this area; and treat flow in Area F	This alternative is effective if Area E stormwater is treated in Area F.	It is practical to treat these flows in Area F, and not in this area.	Natural treatment technology could be applied in Area F to treat these flows.	Recommended for further assessment
<i>Wetland</i>	The alternative is effective; it can achieve stormwater management objectives.	Only space available is on private property (Stelco).	Alternative can be considered a natural treatment technology. Opportunities for some wildlife habitat, public viewing and education	Not recommended for further assessment unless public ownership or permission from Stelco to use the property can be obtained.
<i>Wet Pond</i>	The alternative is effective; it can achieve stormwater management objectives.	Only space available is on private property (Stelco)	Alternative can be considered a natural treatment technology.	Not recommended for further assessment unless public ownership or permission from Stelco to use the property can be obtained.
<i>Dry Pond or Subsurface Tank</i>	The alternative is effective; it can achieve stormwater management objectives.	Only space available is on private property (Stelco) Some reliability concerns regarding re-suspension of sediments	Alternative is not considered a natural treatment technology.	Not recommended for further assessment unless public ownership or permission from Stelco to use the property can be obtained.

Study Area and Treatment Alternatives	Screening Criteria			Recommendation
	Effectiveness	Practicality	Natural Treatment Technology	
<i>Peat-Sand Filter(s)</i>	The alternative is effective; it can achieve stormwater management objectives.	Only space available is on private property (Stelco).	Alternative can be considered a natural treatment technology.	Not recommended for further assessment unless public ownership or permission from Stelco to use the property can be obtained.
<i>StormTreat™ System</i>	The alternative is effective; it may be able achieve stormwater management objectives. This technology only treats the first flush of stormwater; significant volumes bypass the system without treatment. Reliability is not proven for large areas or local climate.	This alternative is not considered practical for the following reasons: Number of units required is too large for space constraint; Difficult to install as a retrofit to existing system; Long-term maintenance of reed bed may prove problematic.	Alternative can be considered a natural treatment technology.	Not recommended for further assessment.
<i>StormFilter™ System</i>	The alternative is effective; it can achieve stormwater management objectives.	This alternative is not considered practical for the following reasons: Number of units required is too large for space constraint; Difficult to install as a retrofit to existing system due to hydraulic gradient requirements of system; System requires frequent replacement of proprietary filter cartridges.	Alternative is not considered a natural treatment technology.	Not recommended for further assessment.
<i>Infiltration Basin</i>	This alternative is not effective in this location; Infiltration capacity of soil in Area E is too low and groundwater level is too high.	The water table is at or near the surface in this location, therefore no potential for infiltration.	Alternative can be considered a natural treatment technology.	Not recommended for further assessment

 **Short Listed Alternatives**

TABLE 6-1-5
DRAINAGE AREA F - SCREENING OF LONG-LIST OF TREATMENT ALTERNATIVES

Study Area and Treatment Alternatives	Screening Criteria			Recommendation
	Effectiveness	Practicality	Natural Treatment Technology	
Drainage Area F: CNR/Gardiner Expressway/ Lakeshore Blvd. Drainage to Outfall H1 (No treatment of Ellis Ave Outfall W12 overflows)				
<i>Wetland at Outfall H1</i>	The alternative is effective; it can achieve stormwater management objectives.	Change in open space park function. Reduction in salt and metal loadings in runoff may be necessary to allow wetland vegetation to survive and grow productively.	Alternative can be considered a natural treatment technology. Opportunities for some wildlife habitat, public viewing and education	Recommended for further assessment.
<i>Wet Pond at Outfall H1</i>	The alternative is effective; It can achieve stormwater management objectives.	Change in open space park function.	Alternative can be considered a natural treatment technology.	Recommended for further assessment.
<i>Oil and Grit Separators</i> Installed on local sewers only. Cannot treat upstream flows.	The alternative is somewhat effective; It may not be able achieve stormwater management objectives (80% TSS removal) Some reliability concerns regarding removal efficiency in retrofit situation. Maximum TSS removal likely less than 70%.	This alternative is technically practical and suitable for space constraints. Treated and untreated stormwater would mix together in the sewer network, reducing the overall effectiveness of the treatment system.	Alternative is not considered a natural treatment technology.	Recommended for further assessment. Treatment by oil and grit separator device are carried forward for detailed evaluation as a possible alternative to a wetland or wet pond in the West Pond if they are later screened out.
<i>Screening for Floatable at Outfall W12</i>	Cannot achieve stormwater management goals alone. Will remove floatable from overflow. Considered only for additional treatment of stormwater discharged directly to Lake Ontario. Majority of flow volume treated by other means.	Change in open space park function. Structure would be added in Sir Casimir Gzowski Park.	Alternative is not considered a natural treatment technology.	Recommended as part of any treatment system for this drainage area to provide additional treatment of overflows at this location.

Study Area and Treatment Alternatives	Screening Criteria			Recommendation
	Effectiveness	Practicality	Natural Treatment Technology	
<i>Dry Pond or Subsurface Tank at Outfall H1</i>	The alternative is effective; it can achieve stormwater management objectives. Some reliability concerns regarding re-suspension of sediments.	Change in open space park function. Depth of sewers relative to Lake Ontario poses a constraint for dry ponds. Tanks may require pumping.	Alternative is not considered a natural treatment technology.	Not recommended for further assessment
<i>High Rate Treatment (Vortex separators)</i> Large device for end-of-pipe treatment for all flows.	The alternative is somewhat effective; it will not be able to achieve stormwater management objectives (80% TSS removal); chemical addition may also be necessary.	Change in open space park function. Depth of sewers relative to Lake Ontario poses a hydraulic constraint, making this an impractical alternative.	Alternative is not considered a natural treatment technology.	Not recommended for further assessment
<i>Wetland</i> Located north of Lakeshore Blvd. and east of Ellis Ave.	The alternative is partially effective; It can achieve stormwater management objectives for a portion of the local sewers only.	Cannot achieve stormwater management goals for entire Study Area F Reduction in salt and metal loadings in runoff may be necessary to allow wetland vegetation to survive and grow productively.	Alternative can be considered a natural treatment technology.	Not recommended for further assessment unless other options are unavailable.
<i>Wet Pond</i> Located north of Lakeshore Blvd. and east of Ellis Ave.	The alternative is partially effective; It can achieve stormwater management objectives for a portion of the local sewers only.	Cannot achieve stormwater management goals for entire Study Area F	Alternative can be considered a natural treatment technology.	Not recommended for further assessment unless other options are unavailable.

Study Area and Treatment Alternatives	Screening Criteria			Recommendation
	Effectiveness	Practicality	Natural Treatment Technology	
<p><i>Peat-Sand Filter</i></p> <p>Located north of Lakeshore Blvd. and east of Ellis Ave.</p>	<p>The alternative is partially effective; It can achieve stormwater management objectives for local sewers only</p>	<p>Cannot achieve stormwater management goals for entire Study Area F.</p> <p>Suitable only for small drainage areas (<5 ha). Space constraints limit the number of filters that could be constructed.</p> <p>Available grade and high water table limit applicability in this area.</p>	<p>Alternative can be considered a natural treatment technology.</p>	<p>Not recommended for further assessment unless other options are unavailable.</p>
<p><i>StormTreat™ System</i></p> <p>For local sewers only</p>	<p>The alternative is effective; it may be able achieve stormwater management objectives.</p> <p>This technology only treats the first flush of stormwater; significant volumes bypass the system without treatment.</p> <p>Reliability is not proven for large areas or local climate.</p>	<p>This alternative is not considered practical for the following reasons:</p> <p>Number of units required is too large for space constraint;</p> <p>Difficult to install as a retrofit to existing system;</p> <p>Long-term maintenance of reed bed may prove problematic.</p>	<p>Alternative can be considered a natural treatment technology.</p>	<p>Not recommended for further assessment unless other options are unavailable.</p>

Study Area and Treatment Alternatives	Screening Criteria			Recommendation
	Effectiveness	Practicality	Natural Treatment Technology	
<i>StormFilter™ System</i> For local sewers only	The alternative is effective; it can achieve stormwater management objectives.	This alternative is not considered practical for the following reasons: Number of units required is too large for space constraint; Difficult to install as a retrofit to existing system due to hydraulic gradient requirements of system; System requires frequent replacement of proprietary filter cartridges.	Alternative is not considered a natural treatment technology.	Not recommended for further assessment unless other options are unavailable.
<i>Infiltration Basin</i>	This alternative is not effective in this location; Infiltration capacity of soil in Area E is too low and groundwater level is too high.	The water table is at or near the surface in this location, therefore no potential for infiltration.	Alternative can be considered a natural treatment technology.	Not recommended for further assessment
<i>Grassed Swales for Road Drainage</i>	This alternative is not considered to be effective for areas with a high percentage of impervious area and high flow rates. Sediments will be re-suspended unless they are constantly removed by maintenance crews. Cannot achieve stormwater objectives on its own	This alternative is not considered practical to treat flows from large heavily traveled highways and arterial roadways. Modification of highways and arterial roads to swale drainage is not practical in this location. Infiltration will be minimal due to high water table in this area	Alternative can be considered a natural treatment technology.	Not recommended for further assessment unless other options are unavailable.

 **Short Listed Alternatives**

TABLE 6-1-6
DRAINAGE AREA H – SCREENING OF LONG-LIST OF TREATMENT ALTERNATIVES

Study Area and Treatment Alternatives	Screening Criteria			Recommendation
	Effectiveness	Practicality	Natural Treatment Technology	
Drainage Area H: Colborne Lodge Drive Outfall W11				
<p><i>Wetland</i> Located north of Lakeshore Blvd.</p>	The alternative is effective; It can achieve stormwater management objectives.	Change in existing land use. Reduction in salt and metal loadings in runoff may be necessary to allow wetland vegetation to survive and grow productively.	Alternative can be considered a natural treatment technology.	Recommended for further assessment.
<p><i>Wet Pond</i> Located north of Lakeshore Blvd.</p>	The alternative is effective; It can achieve stormwater management objectives.	Change in existing land use.	Alternative can be considered a natural treatment technology.	Recommended for further assessment.
<p><i>Oil and Grit Separators</i> Installed on local sewers only.</p>	The alternative is somewhat effective; it may not be able achieve stormwater management objectives (80% TSS removal). Some reliability concerns regarding removal efficiency in retrofit situation. Maximum TSS removal likely less that 70%.	This alternative is technically practical and suitable for space constraints. Several different separator devices are available. Smaller high-rate treatment devices may be applicable.	Alternative is not considered a natural treatment technology.	Recommended for further assessment. Also considered in combination with other treatment methods (i.e. in lieu of a forebay).
<p><i>High Rate Treatment</i> (Vortex separators) Large device for end-of-pipe treatment for all flows.</p>	The alternative is somewhat effective; it will not be able to achieve stormwater management objectives (80% TSS removal); chemical addition may also be necessary.	Depth of sewers relative to Lake Ontario poses a constraint, making this an impractical alternative.	Alternative is not considered a natural treatment technology.	Not recommended for further assessment.

Study Area and Treatment Alternatives	Screening Criteria			Recommendation
	Effectiveness	Practicality	Natural Treatment Technology	
<i>Dry Pond or Subsurface Tank</i> Located north of Lakeshore Blvd.	The alternative is effective; It can achieve stormwater management objectives.	Change in open space function. Some reliability concerns regarding re-suspension of sediments. Depth of sewers relative to Lake Ontario poses a constraint	Alternative is not considered a natural treatment technology.	Not recommended for further assessment.
<i>Peat-Sand Filters</i>	The alternative is effective; It can achieve stormwater management objectives.	Several Filters would be required. Depth of sewers relative to Lake Ontario poses a constraint	Alternative can be considered a natural treatment technology.	Not recommended for further assessment
<i>Infiltration Basin</i>	This alternative is not effective; Infiltration capacity is too low and groundwater level is too high	Soils are not suitable in the area for infiltration basin.	Alternative can be considered a natural treatment technology.	Not recommended for further assessment
<i>Wetland or Pond Facility located north of Queensway in High Park</i>	The alternative is effective; It can achieve stormwater management objectives.	Location is at the upstream end of the drainage area. Extreme difficulty in directing majority of flows to this location. Change in open space park function.	Alternative can be considered a natural treatment technology.	Not recommended for further assessment
<i>Grassed Swales for Road Drainage</i>	This alternative is not considered to be effective for areas with a high percentage of impervious area and high flow rates. Sediments will be re-suspended unless they are constantly removed by maintenance crews.	This alternative is not considered practical to treat flows from large heavily traveled highways and arterial roadways. Infiltration will be minimal due to high water table in this area.	Alternative can be considered a natural treatment technology.	Not recommended for further assessment unless other options are unavailable.

 **Short Listed Alternatives**

6.3.3 Short-Listed Treatment Alternatives by Drainage Area

The short-list of treatment alternatives for each drainage area are listed below:

Alternatives to Treat Stormwater from Drainage Areas A, and C (Outfall HP7 draining to the West Pond)

Drainage Areas A and C drain into the West Pond from outfall HP7. Drainage Area A is the residential area to the north of West Pond, while Drainage Area B is the residential area to the west of the Pond. Drainage Area C encompasses Rennie Park and the West Pond, including a large portion of Swansea Public School and the Swansea Community Recreation Centre. The short-list of feasible alternatives for treating stormwater flows from these drainage areas include:

- Wetland(s)
- Wet pond
- Dry pond or sub-surface tank

Alternatives to Treat Stormwater from Drainage Area B (Outfall HP8 draining to the West Pond)

Drainage Area B drains into the West Pond via outfall HP8. Drainage Area B is the residential area to the west and north of West Pond. The short-list of feasible alternatives for treating stormwater flows from this drainage include:

- Wetland
- Wet pond
- Oil and grit separators

Alternatives to Treat Stormwater from Drainage Area D (Outfall HP5 to Grenadier Pond)

Drainage Area D includes all of the sewers connected to Ellis Avenue and discharging to Grenadier Pond. The short-list of alternatives that are feasible for treating stormwater from this area are:

- Oil and grit separators on local sewers
- Wetland in portion of Grenadier Pond at outfall
- Wet pond in portion of Grenadier Pond at outfall

Alternatives to Treat Stormwater from Drainage Area E

Drainage Area E is located north of the Queensway and includes Ellis Gardens and a portion of Coe Hill Drive. There is little space available to construct treatment facilities for Drainage Area E flows. The only space available is the Stelco lands, which are unavailable for alternative uses. Consequently, the only feasible alternatives for treating stormwater drainage from this area are:

- Oil and grit separators on local sewers
- Treat drainage Area E flows with Area F drainage

Alternatives to Treat Stormwater from Drainage Areas F and G

Area F and G includes portions of the Stelco property, the transportation corridors, and the lakefront areas, which drain to the Humber River at Outfall H1 or to Lake Ontario at Outfall W12. Area G refers to the outflows from Grenadier Pond which also discharge into the Ellis Avenue storm sewer. The feasible alternatives for treating drainage from these areas that are assessed in further detail are:

- Wetland at Outfall H1 to treat flows before they enter the Humber River
- Wet Pond at Outfall H1 to treat flows before they enter the Humber River
- Oil and grit separators on local sewers only
- Screening for floatables at Outfall W12 (for overflows only) is also recommended as part of any solution to treating stormwater in this drainage area

Alternatives to Treat Stormwater from Area H (Outfall W11)

Area H includes Colborne Lodge Drive south of the Queensway, as well as parts of the Gardiner Expressway, the Queensway, Lakeshore Boulevard and the lakefront. Drainage from this area discharges at Outfall W11 into Lake Ontario. One alternative for treating stormwater from Area H is to install oil and grit separators on the local sewers. Other alternatives involve treating flows in the open area between Lakeshore Boulevard and the Gardiner Expressway using:

- Wetland(s)
- Wet pond (s), or
- Oil and grit separators on local sewers, along and in combination with wetlands (i.e. in lieu of forebay)

6.4 Detailed Assessment of Treatment Alternatives

The criteria used to evaluate in detail the short-listed alternatives described above include technical and economic considerations, as well as natural and social environmental factors. These criteria and measures of the environmental effects are presented in Table 6-2.

Tables showing the detailed evaluations of alternatives for each drainage area are presented in Table 6-3, while results of the evaluation are summarized below.

TABLE 6-2
EVALUATION CRITERIA FOR DETAILED ASSESSMENT ALTERNATIVES

Criteria	Considerations	Measure
Technical Environment		
Effectiveness	Ability of the alternative to remove total suspended solids (TSS) from the storm water (i.e. meet the MOE Guideline of 70% TSS removal for ponds; 80% TSS removal for Humber River and Lake Ontario).	<p>Good – very effective at TSS removal (i.e. meets MOE Guidelines);</p> <p>Fair – somewhat effective at removing TSS from the stormwater (i.e. some improvement over existing conditions);</p> <p>Poor - not very effective at removing TSS from the stormwater (i.e. little improvement over existing conditions)</p>
Reliability	Ability of the alternative to satisfactorily control process conditions and discharge quality on a regular and reliable basis	<p>Good – very reliable, few performance problems,</p> <p>Fair – somewhat reliable, some performance problems;</p> <p>Poor - not reliable, many performance problems</p>
Compatibility with Existing System	Ability of the alternative to be adapted to the existing infrastructure system	<p>Good - very compatible, few technical problems;</p> <p>Fair - somewhat easily implemented, some technical problems may be encountered;</p> <p>Poor - not easily implemented, many technical problems</p>
Ease of Implementation	Ability of the alternative to be easily implemented from a technical perspective (e.g. land availability, timing, approval requirements)	<p>Good - easily implemented, few problems encountered;</p> <p>Fair - somewhat easily implemented, some problems encountered;</p> <p>Poor - not easily implemented, many problems encountered</p>

Criteria	Considerations	Measure
Accessibility	Ability of to access the treatment system for construction and maintenance purposes	<p>Good - easy to access, space available for access routes</p> <p>Fair - somewhat easy to access, some regrading or removal of vegetation may be necessary to provide access</p> <p>Poor - difficult to access, significant regrading or removal of vegetation required to provide access.</p>
Economic Environment		
Operations & Maintenance Costs	Relative measure of O/M costs (staff, energy, monitoring, cleaning requirements, lifecycle costs, etc.) compared to other alternatives.	<p>High - relatively high operating and maintenance costs;</p> <p>Moderate - relatively moderate operating and maintenance costs;</p> <p>Low - relatively low operating and maintenance costs</p>
Capital Costs	Relative measure of capital costs (land acquisition, equipment, and materials required) compared to other alternatives.	<p>High - relatively high capital costs;</p> <p>Moderate - relatively moderate capital costs;</p> <p>Low - relatively low capital costs</p>
Social Environment		
Risk to Public Safety	The potential for the alternative to create a risk to public safety (e.g. steep slopes surrounding ponds).	<p>High - potential for significant risk to public safety;</p> <p>Moderate - potential for some risk to public safety;</p> <p>Low - potential for low/no risk to public safety</p>
Recreational Use	The potential for the alternative to create constraints for recreational opportunities	<p>High - potential for significant constraints for recreational opportunities;</p> <p>Moderate - potential for some constraints for recreational opportunities;</p> <p>Low - minimal or no constraints for recreational opportunities</p>

Criteria	Considerations	Measure
Impacts to Private Properties	The potential for the alternative to impact private property (access to homes, construction disturbance, etc.)	<p>High - Potential to impact many private properties;</p> <p>Moderate - potential to impact some private properties;</p> <p>Low - potential to impact few private properties</p>
Visual Character of the Area	The potential of an alternative to impact the visual character of an area.	<p>High - Potential to severely impact the visual character of an area (i.e. incompatible with land uses)</p> <p>Moderate - potential to have some impacts on the visual character of an area.</p> <p>Low - minimal impacts on the visual character of an area (i.e. compatible with existing land uses)</p>
Odour	The potential of an alternative to produce odour.	<p>High - potential to produce significant odours.</p> <p>Moderate - potential to produce some odours.</p> <p>Low - potential for no/minimal odours.</p>
Noise	The potential of an alternative to produce noise.	<p>High - potential to cause significant noise.</p> <p>Moderate - potential to cause some noise.</p> <p>Low - potential to produce no/minimal noise.</p>
Natural Environment		
Water Quality	The potential for the alternative to improve water quality.	<p>Good - potential to significantly improve water quality;</p> <p>Fair - potential to somewhat improve water quality;</p> <p>Poor - potential for minimal or no improvement to water quality</p>

Criteria	Considerations	Measure
Groundwater Quality and Flow	The potential of an alternative to impact groundwater.	<p>High - potential to severely reduce the quality of groundwater, or substantially change the groundwater flow regime.</p> <p>Moderate - potential to somewhat reduce the quality of groundwater, or substantially change the groundwater flow regime.</p> <p>Low - the alternative will not reduce the quality of groundwater, or change the groundwater flow regime.</p>
Soil quality	The potential of an alternative to reduce soil quality.	<p>High - potential to severely reduce soil quality.</p> <p>Moderate - potential to somewhat reduce soil quality.</p> <p>Low - alternative will not affect soil quality.</p>
Significant Vegetation Communities	The potential for the alternative to cause disturbance to or loss of significant vegetation communities.	<p>High - potential to intrude into large areas of significant natural vegetation communities,</p> <p>Moderate - potential to intrude into some areas of significant natural vegetation communities;</p> <p>Low - significant natural vegetation communities are avoided</p>
Tree Removal	The potential of the alternative to cause removal of trees.	<p>High - large number of native trees will be removed;</p> <p>Moderate - some native tree will be removed;</p> <p>Low - no or little (e.g. non-native species) will be removed.</p>
Fish Habitats	The potential of the alternative to cause disturbance to or loss of fisheries habitat.	<p>High - potential to cause disturbance or loss of significant area of fisheries habitat, significant compensation measures required;</p> <p>Moderate - potential to cause some disturbance or loss of fisheries habitat, some mitigation required;</p> <p>Low – minimal disturbance or no loss of fisheries habitat</p>

Criteria	Considerations	Measure
Effect on Open Space Areas	The potential for the alternative to cause disturbance to or loss of natural open space areas.	High – potential for significant loss of natural open space areas; Moderate – potential for some loss of natural open space areas; Low – minimal or no loss of natural open space areas.

TABLE 6-3-1
 DETAILED ASSESSMENT OF TREATMENT ALTERNATIVES FOR DRAINAGE AREAS A AND C

Criteria	Wetland	Wet Pond (Extended Detention)	Dry Pond or Sub-Surface Tank
Technical Environment			
Effectiveness	Very Good/Good – enhanced removal of dissolved metals, nutrients and organic pollutants	Good	Good
Reliability	Good	Good	Good/fair – some reliability concerns with re-suspension of sediments
Compatibility with Existing System	Good	Good	Good
Ease of Implementation	Good/Fair	Good/Fair - dredging and disposal of pond sediment necessary if wet pond is constructed in west pond	Good
Accessibility	Fair – ravine location poses some access constraints	Fair – ravine location poses some access constraints	Fair – ravine location poses some access constraints
Economic Environment			
Operations & Maintenance Costs	Low	Low	Moderate
Capital Costs	Moderate	Moderate	Dry pond – Low Tank – High

Criteria	Wetland	Wet Pond (Extended Detention)	Dry Pond or Sub-Surface Tank
Social Environment			
Risk to Public Safety	Low	Low	Low
Recreational Use	Low/Moderate – reduction in open water areas of west pond; trail system could be maintained	Low/Moderate – reduction in open water areas of west pond	Dry pond – High – a large area of the Rennie Park ravine would be converted to a dry pond Tank – Moderate – park area above an underground tank could be restored
Impacts to Private Properties	Low	Low	Low
Visual Character of the Area	Low - may be enhanced (e.g. wetland vegetation and wildlife)	Low	High – large amounts of vegetation would be removed from the Rennie Park ravine
Odour	Low	Low	Low
Noise	Low	Low	Low
Natural Environment			
Water Quality	Good	Good	Good
Groundwater Quality and Flow	Low	Low	Low

Criteria	Wetland	Wet Pond (Extended Detention)	Dry Pond or Sub-Surface Tank
Soil quality	Low	Low	Low
Significant Vegetation Communities	Low – if constructed entirely within West Pond Moderate – Some potential to intrude into locally significant vegetation communities if constructed with a portion in Rennie Park Ravine	Low – if constructed entirely within West Pond Moderate - Some potential to intrude into locally significant vegetation communities if constructed with a portion in Rennie Park Ravine	Moderate – some potential to intrude into locally significant vegetation communities
Tree Removal	Low – if constructed entirely within West Pond Moderate - if constructed with a portion in Rennie Park Ravine	Low – if constructed entirely within West Pond Moderate - if constructed with a portion in Rennie Park Ravine	High – large numbers of trees would be removed with this alternative
Fish Habitats	Low/Moderate – Open water fish habitat replaced with wetland fish habitat, some area of West Pond may be replaced with a sediment forebay	Moderate – some area of West Pond would be replaced with the extended detention facility	Low
Effect on Open Space Areas	Moderate – some natural open space areas would be modified with this alternative	Moderate - some natural open space areas would be modified with this alternative	High – potential for significant modification of natural open space area to accommodate this alternative

 **Recommended Alternative**

TABLE 6-3-2
 DETAILED ASSESSMENT OF TREATMENT ALTERNATIVES FOR DRAINAGE AREA B

Criteria	Wetland	Wet Pond (Extended Detention)	Oil and Grit Separators
Technical Environment			
Effectiveness	Very Good/Good - enhanced removal of dissolved metals, nutrients and organic pollutants	Good	Good/Fair – may not be able to achieve TSS removal objective of 70% removal
Reliability	Good	Good	Good
Compatibility with Existing System	Good	Good	Good
Ease of Implementation	Poor	Poor	Good
Accessibility	Poor	Poor	Good
Economic Environment			
Operations & Maintenance Costs	Low	Low	Moderate
Capital Costs	Moderate/High – capital cost will be higher in this location due to the depth of water in West Pond and the constrained access from shore	Moderate/High – capital cost will be higher in this location due to the depth of water in West Pond and the constrained access from shore	Moderate
Social Environment			
Risk to Public Safety	Low	Low	Low
Recreational Use	Low/Moderate - reduction in open water areas of pond	Low/Moderate – reduction in open water areas of west pond	Low
Impacts to Private Properties	Low	Low	Low

Criteria	Wetland	Wet Pond (Extended Detention)	Oil and Grit Separators
Visual Character of the Area	Low/Moderate – open water views across West Pond will be somewhat affected	Low/Moderate – open water views across West Pond will be somewhat affected	Low
Odour	Low	Low	Low
Noise	Low	Low	Low
Natural Environment			
Water Quality	Good	Good	Good/Fair – may not be able to meet the treatment objective of 70% TSS removal
Groundwater Quality and Flow	Low	Low	Low
Soil quality	Low	Low	Low
Significant Vegetation Communities	Low	Low	Low
Tree Removal	Low/Moderate - some trees may be removed for access	Low/Moderate - some tree may be removed for access	Low
Fish Habitats	Low/Moderate – open water fish habitat replaced with wetland fish habitat, some area of West Pond may be replaced with a sediment forebay	Moderate – some area of west pond would be replaced with the extended detention facility	Low
Effect on Open Space Areas	Moderate – some natural open space areas would be modified with this alternative	Moderate – some natural open space areas would be modified with this alternative	Low

 **Recommended Alternative**

TABLE 6-3-3
DETAILED ASSESSMENT OF TREATMENT ALTERNATIVES FOR DRAINAGE AREA D

Criteria	Wetland	Wet Pond (Extended Detention)	Oil and Grit Separators
Technical Environment			
Effectiveness	Very Good/Good - enhanced removal of dissolved metals, nutrients and organic pollutants	Good	Good/Fair – may not be able to achieve TSS removal objective of 70% TSS removal
Reliability	Good	Good	Good
Compatibility with Existing System	Good	Good	Good
Ease of Implementation	Good	Good	Good
Accessibility	Good	Good	Good
Economic Environment			
Operations & Maintenance Costs	Low	Low	Moderate
Capital Costs	Moderate	Moderate	Moderate
Social Environment			
Risk to Public Safety	Low	Low	Low
Recreational Use	Low/Moderate - reduction in open water areas of Grenadier Pond	Low/Moderate – reduction in open water areas of Grenadier Pond	Low
Impacts to Private Properties	Low	Low	Low
Visual Character of the Area	Low	Low	Low
Odour	Low	Low	Low
Noise	Low	Low	Low

Natural Environment			
Water Quality	Good	Good	Good
Groundwater Quality and Flow	Low	Low	Low
Soil quality	Low	Low	Low
Significant Vegetation Communities	Low	Low	Low
Tree Removal	Low	Low	Low
Fish Habitats	Low/Moderate – Open water fish habitat replaced with wetland fish habitat, some area of Grenadier Pond may be replaced with a sediment forebay	Moderate – some area of grenadier pond would be replaced with the extended detention facility	Low
Effect on Open Space Areas	Moderate – some natural open space areas would be modified with this alternative	Moderate – some natural open space areas would be modified with this alternative	Low

Recommended Alternative

TABLE 6-3-4
DETAILED ASSESSMENT OF TREATMENT ALTERNATIVES FOR DRAINAGE AREA E

Criteria	Oil & Grit Separators On Local Streets	Treat Drainage Area E with Drainage Area F
Technical Environment		
Effectiveness	Good/Fair – may not be able to achieve 80% TSS removal objective	Good – will only meet objectives if adequate treatment facilities are provided in area F
Reliability	Good	Good – if area F facilities are appropriately sized
Compatibility with Existing System	Good	Good
Ease of Implementation	Good	Good
Accessibility	Good	Good
Economic Environment		
Operations & Maintenance Costs	Moderate	Low
Capital Costs	Moderate	Low
Social Environment		
Risk to Public Safety	Low	Low
Recreational Use	Low	Low/Moderate – reduction in open space in area F
Impacts to Private Properties	Low	Low
Visual Character of the Area	Low	Low
Odour	Low	Low
Noise	Low	Low
Natural Environment		
Water Quality	Good	Good
Groundwater Quality and Flow	Low	Low

Criteria	Oil & Grit Separators On Local Streets	Treat Drainage Area E with Drainage Area F
Soil quality	Low	Low
Significant Vegetation Communities	Low	Low
Tree Removal	Low	Low
Fish Habitats	Low	Low
Effect on Open Space Areas	Low	Low

 Recommended Alternative

TABLE 6-3-5
 DETAILED ASSESSMENT OF TREATMENT ALTERNATIVES FOR DRAINAGE AREAS F AND G

Criteria	Wetland	Wet Pond (Extended Detention)	Oil & Grit Separators on Local Sewers
Technical Environment			
Effectiveness	Very Good/Good – enhanced removal of dissolved metals, nutrients and organic pollutants	Good	Good/Fair – may not be able to achieve 80% TSS removal objective
Reliability	Good	Good	Good
Compatibility with Existing System	Good	Good	Good
Ease of Implementation	Good	Good	Good
Accessibility	Good	Good	Good
Economic Environment			
Operations & Maintenance Costs	Low	Low	Moderate
Capital Costs	Moderate	Moderate	Moderate
Social Environment			
Risk to Public Safety	Low	Low	Low
Recreational Use	Low – wetland would be located in existing construction staging area that is not used for recreation	Low – wet pond would be located in existing construction staging area that is not used for recreation	Low
Impacts to Private Properties	Low	Low	Low
Visual Character of the Area	Low	Low	Low
Odour	Low	Low	Low
Noise	Low	Low	Low
Natural Environment			
Water Quality	Good	Good	Good

Criteria	Wetland	Wet Pond (Extended Detention)	Oil & Grit Separators on Local Sewers
Groundwater Quality and Flow	Low	Low	Low
Soil quality	Low	Low	Low
Significant Vegetation Communities	Low	Low	Low
Tree Removal	Low	Low	Low
Fish Habitats	Low	Low	Low
Effect on Open Space Areas	Low – can be incorporated into restoration of construction staging area adjacent to Humber Bridges	Low – can be incorporated into restoration of construction staging area adjacent to Humber Bridges	Low

 **Recommended Alternative**

TABLE 6-3-6
 DETAILED ASSESSMENT OF TREATMENT ALTERNATIVES FOR DRAINAGE AREA H

Criteria	Wetland	Wet Pond (Extended Detention)	Oil & Grit Separators on Local Sewers
Technical Environment			
Effectiveness	Very Good/Good - enhanced removal of dissolved metals, nutrients and organic pollutants	Good	Good/Fair – may not be able to achieve 80% TSS removal objective
Reliability	Good	Good	Good
Compatibility with Existing System	Good	Good	Good
Ease of Implementation	Fair - space constraints for forebay (oil and grit separators required for pretreatment)	Fair - some space limitations	Good
Accessibility	Good	Good	Good
Economic Environment			
Operations & Maintenance Costs	Low	Low	Moderate
Capital Costs	Moderate	Moderate	Moderate
Social Environment			
Risk to Public Safety	Low	Low	Low
Recreational Use	Low – wetland would be located between Lakeshore and the Gardiner	Low – wet pond would be located between Lakeshore and the Gardiner	Low
Impacts to Private Properties	Low	Low	Low
Visual Character of the Area	Low - may be enhanced	Low	Low
Odour	Low	Low	Low
Noise	Low	Low	Low
Water Quality	Good	Good	Good/Fair

Criteria	Wetland	Wet Pond (Extended Detention)	Oil & Grit Separators on Local Sewers
Groundwater Quality and Flow	Low	Low	Low
Soil quality	Low	Low	Low
Significant Vegetation Communities	Low - Wetland vegetation communities will be enhanced	Low	Low
Tree Removal	Low	Low	Low
Fish Habitats	Low - Wetland will provide habitat for fish	Low	Low
Effect on Open Space Areas	Moderate - impacts open areas between highways	Moderate - impacts open areas between highways	Low

Recommended Alternative

6.4.1 Assessment of Alternatives to Treat Stormwater from Drainage Areas A and C

Wetlands provide the highest level of treatment of all alternatives considered, and are reliable systems that are fairly easy to implement and compatible with the existing system. In addition, they are natural systems that may enhance the visual character of the area. Construction of wetlands within the West Pond itself reduces the loss of locally significant vegetation that would occur with other alternatives. A wetland constructed to treat flows from outfall HP7 can be oversized to provide sediment removal efficiency greater than 70%. The construction of a wetland larger than necessary at outfall HP7 may be required to meet the study objectives for the West Pond if sufficient treatment cannot be provided for Area B draining to The West Pond through outfall HP8.

Extended detention wet ponds, while also natural systems, are somewhat less effective than wetlands for overall pollutant removal. Extended detention wet ponds have the advantage that they can be smaller than wetlands while still achieving the same removal rate of suspended solids, but they are less effective for the removal of BOD, nutrients, and metals. An additional drawback of wet ponds is that they may become eutrophic over time, leading to algae blooms, odours and other problems. Wet ponds are also more difficult to implement in the West Pond than in wetlands. For instance, dredging of the West Pond and proper disposal of dredged material will be necessary with the wet pond alternative; with wetlands, the sediments can be left in place and capped.

Alternatives such as sub-surface tanks and large capacity end-of-pipe vortex separators are more costly to construct and maintain than wetlands, and are not considered “natural” treatment technologies. Centralized vortex separators have not been proven to be able to remove 70% suspended sediments over the range of design flows. The use of oil and grit separators on local sewers, peat-sand filter and infiltration basins are not practical for this drainage area due to limitations on drainage area size and available area to construct these devices.

Based on a review of the technical, economic, social and natural environmental impacts, wetland(s) treatment is recommended as the preferred alternative for treating stormwater drainage entering the West Pond from areas A and C via outfall HP7. There are numerous design considerations for a wetland system in the West Pond. Design considerations include sizing, location (e.g. entirely within the West Pond or partially within Rennie Park), and pre-treatment facilities (e.g. forebays or high rate treatment devices). Design alternatives, which take into account these various design considerations, will be identified and assessed in detail in Section 7.

6.4.2 Assessment of Alternatives to Treat Stormwater from Drainage Area B

Oil and grit separators are selected for treating storm flows from outfall HP8 because they are the only technology that can be practically constructed within the space available. A wetland or wet pond could be constructed at the outfall but construction constraints and capital cost make wetlands a less favourable option. There are several different commercially available oil and grit separators that can be applied in this location with relatively equal effectiveness. The actual product used will be specified during the detailed design.

Oil and grit separators may not be able to meet the overall study objectives for the West Pond; therefore, an oversized wetland can be constructed to treat flows from drainage Areas A and C. The combined treatment of the wetland and the oil and grit separators will meet the study objectives for West Pond.

6.4.3 Assessment of Alternatives to Treat Stormwater from Drainage Area D

For treating stormwater from drainage area D it is recommended that the wetland currently located near the outfall HP5 in Grenadier Pond be enhanced as part of the overall restoration plans for Grenadier Pond. This alternative would be more effective than a wet pond or oil and grit separators on local sewers. It would also not result in changes to the drainage system in the area, as would the alternative of diverting flows from Drainage Area D to the West Pond. Diverting flows to the West Pond would increase the risk of flooding for landowners adjacent to the pond. Diverting flows to the West Pond would also require additional or larger storm water management facilities to be constructed in the pond.

6.4.4 Assessment of Alternatives to Treat Stormwater from Drainage Area E

Although oil and grit separators can be retrofitted on existing sewers, there are some concerns regarding their ability to meet study objectives for pollutant removal efficiency. The maximum total suspended solids (TSS) removal efficiency of oil and grit separators on local sewers is likely less than 70%. In addition, oil and grit separators could be more costly than simply treating flows from Drainage Area E as part of the Drainage Areas F and G treatment system. Therefore, for Drainage Area E, the most cost-effective alternative is to treat the flows from Drainage Area E with Drainage Area F and G flows.

6.4.5 Assessment of Alternatives to Treat Stormwater from Drainage Areas F and G

Based on a review of the technical, economic, social and natural environmental impacts, wetland treatment is also recommended as the preferred alternative for treating stormwater drainage from areas F and G. The wetland would be located in the area immediately upstream of outfall HP1 in Sir Casimir Gzowski Park between Lakeshore Boulevard and the Humber River. The wetland would treat stormwater before it is discharged into the Humber River.

A portion of the flows in the Ellis Avenue storm sewer is discharged directly to Lake Ontario via the Ellis Avenue outfall. These flows occur when the capacity of the Lakeshore Boulevard storm sewer is exceeded and flows over-top the diversion weir. The majority of flows are diverted to the proposed wetland. The flows that overtop the weir are generally cleaner than the low flows that continue to the wetland. These same flows would in most cases bypass the wetland through the facilities overflow structure. To fully achieve the goals of the study floatables must be removed these overflows to protect the near shore area of the park. Therefore, along with the wetland, outfall W12 should be retrofitted with a screening device to remove floatables during overflow conditions. This screening device can also act as oil and grit separator to further protect the lakeshore.

6.4.6 Assessment of Alternatives to Treat Stormwater from Area H

A review of alternatives for this Drainage Area indicates that a wetland would be the most effective means of treating stormwater flows. The wetland system would be located between Lakeshore Boulevard and the Gardiner Expressway on both sides of Colborne Lodge Drive.

6.5 Comparison of Treatment Alternatives to the Western Beaches Storage Tunnel Treatment Alternative

The Western Beaches Storage Tunnel was originally designed to collect combined sewer overflows and storm water along the waterfront from Ellis Avenue to Strachan Avenue. The tunnel design was revised as a condition of approval such that it only intercepts combined sewer overflows and stormwater from Parkside Drive to Strachan Avenue. The stormwater flows from the Ellis Avenue and Colborne Lodge Drive storm sewers were removed from the flows allowed to enter the tunnel. A comparison of the recommended treatment alternatives to the original storage tunnel plan is provided in this section.

The storage tunnel was originally designed to collect 90% of the overflow volume from the combined sewers and storm sewers it intercepts with no overflows at beach locations. The storm water and combined sewer flows would be retained in the tunnel for an average of 32 hours, which includes 8 hours of quiescent settling and 24 hours to pump the contents of the storage tunnel to Lake Ontario. The water pumped out of the tunnel is disinfected and discharged to an outfall location near Strachan Avenue located in deep water some distance offshore. During very large storm events, or if rainfall occurs while the tunnel is completely filled, the tunnel will overflow. These overflows account for the remaining 10% of the annual combined storm and sewer flows. The overflows would occur at Strachan Avenue and Parkside Drive.

Given an average settling time of 32 hours, the storage tunnel would achieve approximately 75% removal of suspended solids. This is comparable to MOE guidelines for sediment removal from a tank (or dry pond) with batch mode operation. All of the flows, except for the 10% of overflows would be discharged to the outfall located well away from the beach area within the Western Beach.

The capital cost of connecting the Ellis Avenue and Colborne Lodge Drive Storm sewers to the storage tunnel would be approximately 1.5 to 2.0 million dollars.

The stormwater management alternative being recommended in this EA is intended to provide approximately 80% removal of suspended solids from the stormwater runoff discharge directly to Lake Ontario and the Humber River from the Ellis Avenue and Colborne Lodge Drive sewers. This is a slightly better efficiency than the storage tunnel. However, the recommended treatment system discharges all of the storm water directly into the near-shore area of the Western Beach. This can be seen as a drawback to the recommended system compared to the tunnel, which discharges 90% of the flows away from the beach area. The total cost of the recommended alternative is approximately 2.2 million dollars.

In summary, the recommended treatment approach and the Western Beaches Storage Tunnel will have similar overall benefits for Lake Ontario. The capital costs of both proposals are also similar. The storage tunnel would have provided greater benefits to the nearshore area of the Western Beach compared to the recommended treatment system because it would have eliminated discharges of stormwater along the beach from the Humber River to Colborne Lodge Drive. However, it is not a natural treatment technology, and does not provide the added benefits of improving water quality in the West Pond.

6.6 Conclusions and Recommendations Regarding Treatment Alternatives

Along with the source control and conveyance system modifications recommended in Section 4 and 5, the following treatment alternatives are recommended to achieve the water quality improvement objectives of the study:

1. To treat flows entering the West Pond from drainage Areas A and C, a treatment wetland is proposed. The wetland will be somewhat oversized to compensate for the lower treatment efficiency expected for flows from Area B.
2. Oil and grit separators are recommended to treat flows entering the pond from outfall HP8. The overall treatment efficiency provided by the oversized wetland at outfall HP7 and the oil and grit separators at outfall HP8 will achieve the desired level of treatment for West Pond.
3. To treat flows to Grenadier Pond from Drainage Area D, it is recommended that the wetland at the southwest corner of Grenadier Pond be expanded and redesigned as a treatment wetland. This should be considered as part of the restoration plans for Grenadier Pond.
4. The majority of stormwater in the Ellis Avenue storm sewer (from Grenadier Pond and Drainage Areas E, and F) is diverted by a weir into a sewer along Lakeshore Boulevard that flows westerly and outfalls into the Humber River (at outfall HP1). To treat these flows, it is recommended that a treatment wetland be constructed near outfall HP1 to treat stormwater before it enters the Humber River.
5. When flows exceed the capacity of the Lakeshore Boulevard sewer the weir is overtopped and stormwater is discharged directly to Lake Ontario via outfall W12. It is recommended that the City retrofit outfall W12 with a screening device to remove floatables during these overflow conditions.
6. To treat flows from Drainage Area H discharging at the Colborne Lodge Drive stormwater outfall (W11), it is recommended that a wetland system be constructed in the open space areas between Lakeshore Boulevard and the Gardiner Expressway on the west side of Colborne Lodge Drive.

7. Alternative Design Concepts

Phase 3 of the Class Environmental Assessment process involves developing preliminary design concepts for projects recommended as part of the preferred solution. Section 6 of this report recommends various end-of-pipe alternatives for aiding in management of stormwater runoff for the various drainage areas (See Figure 3.2 for drainage areas). These alternatives are listed below and illustrated on Figure 7.1.

- Drainage Areas A and C (Outfall HP7): Wetland
- Drainage Area B (Outfall HP8): Oil & grit separators
- Drainage Area D (Outfall HP5): Expand and redesign the existing wetland in Grenadier
- Drainage Area E
- Drainage Areas F and G:
 - Outfall HP1: Wetland
 - Outfall W12: Screening Device
- Drainage Area H (Outfall W11): Wetland system

This section provides a discussion of design concepts for the recommended end-of-pipe solutions listed above. Alternative design concepts are presented where appropriated, and assessed based on natural, social, technical and cost impacts. Recommended design concepts are selected based on the assessment.

7.1 Drainage Areas A and C (Outfall HP7)

Drainage Area A lies south of Bloor Street and north of Waller Avenue (Figure 3.2). Drainage is through separated storm sewers, which receive runoff from the largely residential area. The outlet for the sewer system is a gabion-lined channel that flows through Rennie Park into the West Pond. Drainage Area C encompasses Rennie Park and the West Pond including a large portion of Swansea Public School and the Swansea Community Recreation Centre. Drainage from this area is overland surface flow that makes its way to the West Pond.

Sections 4 and 5 of this report describe source control initiatives and conveyance systems improvements that will help improve the quality and reduce quantities of flows from these areas to the West Pond. End-of-pipe treatment is also required. The preferred end-of-pipe solution for managing drainage from Areas A and B is a constructed wetland system located in or near the north part of the West Pond.

7.1.1 Identification of Alternative Design Concepts

To perform properly, flow rates and sediment loads must be controlled upstream of wetlands by means of pre-treatment methods. Forebays (i.e. basically small settling ponds), or high rate treatment devices such as oil and grit separators, are examples of pre-treatment methods.

Based on review of the existing conditions in the area and input from the Steering Committee and the public, the following alternative designs for a treatment wetland system were identified:

1. Forebay and wetland confined to the West Pond: This alternative involves constructing a forebay and wetland within the pond itself. A conceptual plan for this alternative is shown in Figure 7.2.
2. Forebay to the north of the West Pond and the wetland within the Pond: This alternative involves constructing a forebay in the area north of the existing West Pond boundary, and constructing the wetland within the pond itself. A conceptual plan for this alternative is shown in Figure 7.3.
3. Forebay at Outfall HP7 and the wetland within the Pond: For this alternative, the forebay would be located at Outfall HP7, while the wetland would be constructed in the north part of the West Pond. A conceptual plan for this alternative is shown in Figure 7.4.
4. Oil and Grit Separator at Outfall HP7 and the wetland within the Pond: This alternative involves using an oil and grit separator for pre-treatment. The oil and grit separator would be located at the outfall, while the wetland would be constructed in the Pond. A conceptual plan for this alternative is shown in Figure 7.5.

7.1.2 Assessment of Alternative Design Concepts

The four alternative design concepts were assessed based on their impacts on the natural and social environments, as well as on technical and cost considerations. Table 7.1 presents a summary of the assessment, including a summary of the costs. (Details on the costs of alternatives are provided in Appendix D).

All alternatives will benefit the area by improving water quality, providing increased wildlife diversity and population, and creating opportunities for improving trail systems, education, viewing. Channel restoration is also a benefit associated with all alternatives. Sediment testing and groundwater quality monitoring must also be undertaken for all alternatives prior to construction in or near the West Pond, and if contaminated sediments are found appropriate disposal techniques must be implemented.

With Alternatives A and B, the pretreatment facility (i.e. forebay) is located directly adjacent to the wetland facility. In these cases, a longer access road is required than for those alternatives with pre-treatment facilities located directly at outfall HP7 (i.e. Alternatives C and D). The longer access road leads to greater disturbance to the open areas, as well as increased costs. Alternative B has the further disadvantage of the forebay being located in an area currently opened and vegetated with trees and grasses.

Alternatives C and D both have pre-treatment devices at outfall HP7, meaning that a relatively short access route to the pre-treatment facilities is possible (Figures 7.4 and 7.5). Additional sediment quality testing in the vicinity of outfall HP7 must, however, be tested prior to construction for both these alternatives. With Alternative C the pre-treatment facilities is a forebay, while Alternative D proposes the use of the oil and grit separator. The size of the oil and grit separator is much less than the forebay. However, it is not considered as natural a treatment method as the forebay. In addition, the capital costs of constructing a forebay (i.e. Alternative C) are much less the capital costs of oil and grit separators (i.e. Alternative D).

Based on the assessment, Alternative C is recommended as the preferred design. It offers the advantage of a shorter access road, less environmental disruption, and the lowest capital costs. Details on this alternative are presented in Section 8.

TABLE 7.1
WETLAND CONCEPTUAL DESIGN ALTERNATIVES FOR TREATMENT OF FLOWS FROM OUTFALL HP7

Alternative	Environmental Impacts			
	Natural	Social	Technical	Cost
A. Forebay and Wetland Confined to the Pond	<p>Improves water quality in the West Pond</p> <p>Access road will be necessary – some vegetation removal likely necessary</p> <p>Increased wildlife diversity and population</p>	<p>Maintains area and vegetation to the north of the pond</p> <p>Improves pond aesthetics</p> <p>Boardwalks and viewing areas can be incorporated into the design</p> <p>Maintains open areas of the pond for recreational activities</p> <p>Education opportunities with respect to wetland are increased</p>	<p>Some difficulties accessing area for construction and cleaning forebay</p> <p>Access road necessary for construction and maintenance purposes</p> <p>Wetland and forebay construction within pond must consider contaminated sediment removal or capping</p>	<p>Additional construction costs associated with longer access road and larger area of construction within pond, and sediment removal/ capping related costs</p> <p>Operating costs are comparable among alternatives</p> <p>Total Estimated Capital Costs \$685,000</p>
B. Forebay to the north of the existing Pond, Wetland within Pond	<p>Improves water quality in the West Pond</p> <p>Tree and vegetation removal necessary for forebay and access road; however some opportunity to replace non-native (e.g. Manitoba Maple) with native vegetation</p> <p>Increased wildlife diversity and population</p>	<p>Results in reduction of open areas north of the pond</p> <p>Improves pond aesthetics</p> <p>Boardwalks and viewing areas can be incorporated into the design</p> <p>Maintains open areas of the pond for recreational activities</p> <p>Education opportunities with respect to wetland are increased</p>	<p>Some difficulties accessing area for construction and cleaning forebay</p> <p>Access road necessary for construction and maintenance purposes</p> <p>Wetland construction within pond must consider contaminated sediment removal or capping</p>	<p>Lower construction costs than Alternative A-1 due to shorter access road and less construction within the pond and sediment management.</p> <p>Operating costs are comparable among alternatives</p> <p>Total Estimated Capital Costs \$550,000</p>

Alternative	Environmental Impacts			
	Natural	Social	Technical	Cost
C. Forebay at HP7 Outfall, Wetland within Pond	<p>Improves water quality in the West Pond</p> <p>Tree and vegetation removal necessary for forebay and access road; however some opportunity to replace non-native (e.g. Manitoba Maple) with native vegetation</p> <p>Increased wildlife diversity and population</p>	<p>Results in reduction of open areas north of the pond</p> <p>Improves pond aesthetics</p> <p>Boardwalks and viewing areas can be incorporated into the design</p> <p>Maintains open areas of the pond for recreational activities</p> <p>Education opportunities with respect to wetland are increased</p>	<p>Less difficulties than other alternatives at accessing area for construction and cleaning forebay</p> <p>Access road to forebay shorter and easier to implement</p> <p>Wetland construction within pond must consider contaminated sediment removal or capping</p> <p>Extent and nature of fill material at HP7 outfall unknown</p>	<p>Construction costs may be lower than Alternative A-1 and A-2 due to shorter access road and less construction within the pond and sediment management.</p> <p>Operating costs are comparable among alternatives</p> <p>Total Estimated Capital Costs \$495,000</p>
D. Oil and Grit Separator at Outlet and Wetland within Pond	<p>Improves water quality in the West Pond</p> <p>Some tree and vegetation removal necessary; however some opportunity to replace non-native (e.g. Manitoba Maple) with native vegetation</p> <p>Increased wildlife diversity and population</p>	<p>Results in reduction of open areas north of the pond</p> <p>Improves pond aesthetics</p> <p>Boardwalks and viewing areas can be incorporated into the design</p> <p>Maintains open areas of the pond for recreational activities</p> <p>Education opportunities with respect to wetland are increased</p>	<p>Fewer difficulties than other alternatives at accessing area for construction and maintaining oil and grit separators</p> <p>Access road to oil and grit separator shorter and easier to implement</p> <p>Wetland construction within pond must consider contaminated sediment removal or capping</p> <p>Extent and nature of fill material at HP7 outfall unknown</p>	<p>Construction costs may be lower than Alternative A-1 and A-2 due to shorter access road and less construction within the pond and sediment management.</p> <p>Operating costs are comparable among alternatives</p> <p>Total Estimated Capital Costs \$895,000</p>

7.2 Drainage Area B (Outfall HP8)

Drainage Area B is the residential area west of Rennie Park and the West Pond. Drainage from the area is collected in the storm sewer system, which discharges directly to the West Pond via outfall HP8 (Figure 3.2). The preferred solution recommended during Phase 2 of the Class EA (Section 6) was an "oil and grit separator" at the end of the outfall. The Steering Committee and the public at the first Public Open House requested that this alternative be further compared to the treatment wetland in Phase 3. For example, requests were made to develop and assess conceptual designs for a wetland at this location, and for converting the whole West Pond to a wetland.

7.2.1 Identification of Alternative Design Concepts

Along with the oil and grit separator alternative (Alternative A - Figure 7.6), two wetland conceptual design alternatives for treatment of flows from outfall HP8 were developed:

1. Forebay and wetland confined to the West Pond: In this case a forebay would be used for pretreatment. This forebay would be constructed at the end of outfall HP8 in the west pond. The wetland system would be located south of the forebay. This conceptual alternative is illustrated on Figure 7.7.
2. Oil and grit separator and wetland in the West Pond: Instead of a forebay for pretreatment, an oil and grit separator would be installed at the end of outfall HP8. A wetland would be located in the West Pond for final treatment of flows. This conceptual design alternative is illustrated on Figure 7.8.

7.2.2 Assessment of Alternative Design Concepts

A review of the natural, social, technical and cost impacts of these alternatives are presented in Table 7.2. Basically, the review confirmed Phase 2 findings, i.e., that an oil and grit separator is the preferred method of treating flows from Drainage Area B. Although wetlands would be more effective at treatment of flows, they are not a practical alternative in this instance. The steep slopes make a wetland difficult to construct. Furthermore, the water in the pond at this location is relatively deep (i.e. approximately 1.75 metres). To construct a wetland would require substantial fill and large containment barriers. This would be both expensive and detract from the natural features of the wetland.

TABLE 7.2
CONCEPTUAL DESIGN ALTERNATIVES FOR TREATMENT OF FLOWS FROM OUTFALL HP8

Alternative	Environmental Impacts			
	Natural	Social	Technical	Cost
A. Oil and Grit Separator Only	Improves water quality in the West Pond; however, alone will not likely meet 70% removal objectives (55 to 70% removal expected depending on design and operating conditions)	Maintains open areas of the pond for recreational activities (Wetland Treatment could be added to pond outlet or to Grenadier Pond wetland design)	Easy to implement oil and grit separators	Low capital costs relative to other alternatives Operating and maintenance costs relatively low
B. Forebay and Wetland Confined to the Pond	Improves water quality in the West Pond; will meet 70% removal objectives Increased wildlife diversity and population	Improve pond aesthetics Maintains open areas of the pond for recreational activities Education opportunities with respect to wetland are increased	Somewhat difficult to implement forebay (i.e. steep slopes, little area for forebay) Also difficult to implement wetland – fairly deep water (approximately 1.75 metres); needs lots of fill and containment barriers (which will distract from natural characteristics of wetland) Wetland and forebay construction within pond must consider contaminated sediment removal or capping	High capital costs relative to other alternatives (e.g. lots of fill necessary) Operating and maintenance costs relatively low

Alternative	Environmental Impacts			
	Natural	Social	Technical	Cost
C. Oil and Grit Separator; Wetland	<p>Improves water quality in the West Pond; will meet 70% removal objectives</p> <p>Increased wildlife diversity and population</p>	<p>Improve pond aesthetics</p> <p>Maintains open areas of the pond for recreational activities</p> <p>Education opportunities with respect to wetland are increased</p>	<p>Easy to implement oil and grit separators</p> <p>Difficult to implement wetland – fairly deep water (approximately 1.75 metres); needs lots of fill and containment barriers (which will distract from natural characteristics of wetland)</p> <p>Wetland construction within pond must consider contaminated sediment removal or capping</p>	<p>High capital costs relative to other alternatives (e.g. lots of fill necessary)</p> <p>Operating and maintenance costs relatively low</p>

Figure 7-9 illustrates a possible design for converting the entire West Pond to a wetland. Although this would provide improved water quality and create new habitats for wildlife, it was not found acceptable from a technical, cost and social perspective. Substantial fill would be required to construct the wetland, meaning relatively high costs. In addition, the entire pond ecosystem would change, which was a concern to many members of the public. Local landowners were also very concerned with the loss of much of the open pond areas for recreational activities (e.g. boating and skating). Consequently, this alternative is not recommended.

7.3 Drainage Area D (Outfall HP 5)

Drainage Area D includes all of the sewers connected to Ellis Avenue and discharging to Grenadier Pond. The outlet for the sewer system is an open channel that flows a short distance from Ellis Avenue into Grenadier Pond. The outflow from the West Pond enters the same channel before discharging into Grenadier Pond.

Currently, there is a small wetland in the southwest corner of Grenadier Pond. It is recommended that this wetland be expanded to treat flows from Drainage Area D. The recommended conceptual design for this alternative is illustrated and described in Section 8 of this report. Detailed designs that are developed in the future must take into consideration the restoration plans for Grenadier Pond.

7.4 Drainage Area E

Drainage Area E is located north of the Queensway and includes Ellis Gardens and a portion of Coe Hill Drive (Figure 3.2). The outlet for the sewer system is an open channel that flows a short distance through the Stelco property before entering a culvert under the transportation corridor with eventual discharge to the Humber River and Lake Ontario.

Correspondence with Stelco and the City has indicated that they are supportive of implementing on-site source controls as part of any future developments. Additional flows from Drainage Area E will be treated along with flows from Drainage Areas F and G, as indicated in Section 6.

7.5 Drainage Areas F and G

The storm sewers in Areas F and G receive flows from Drainage Area B and from Grenadier Pond, as well as local drainage from the transportation corridors and the area along Lakeshore Boulevard (Figure 3.2). The outlet for the majority of this area's drainage is outfall H1, which discharges directly to the Humber River. Under high flow conditions the sewer system overflows and excess flows are directed to Lake Ontario via outfall W12.

The recommended solution for treating flows at outfall H1 is a wetland. The wetland would be located in the area immediately upstream of outfall HP1 in Sir Casimir Gzowski Park between Lakeshore Boulevard and the Humber River. Given the site characteristics and constraints, alternative design concepts for this site are limited. Any wetland designed for this site will have similar characteristics (e.g. forebay, shallow vegetation, deep zone, overflow structure, etc). The recommended conceptual design for the wetland showing these characteristics is illustrated and described in Section 8 of this report. Detailed designs that are developed in the future must take into account the City of Toronto's Parks and Recreation Department's plans for this area of the waterfront.

The recommended solution for treatment of overflows to Lake Ontario via outfall W12 is to retrofit the outfall with a screening device to remove any floatables that may be in the overflows before they enter Lake Ontario. Preliminary design details of this screening device are described in Section 8.

7.6 Drainage Area H (Outfall W11)

Drainage Area H includes Colborne Lodge Drive south of the Queensway, as well as parts of the Gardiner Expressway, the Queensway and Lakeshore Boulevard and the lakefront. The recommended alternative for treating these flows is a wetland. The wetland system would be located between Lakeshore Boulevard and the Gardiner Expressway on both sides of Colborne Lodge Drive.

Given the site characteristics and constraints, alternative design concepts for this site are limited. For instance, a number of oil and grit separators on local sewers are necessary rather than constructing a larger forebay (due to space constraints). The recommended conceptual design for this wetland system is illustrated and described in Section 8 of this report.

8. Preferred Alternative

This section describes the preferred alternative for stormwater treatment. The estimated cost, schedule for implementation, and environmental impacts and methods of mitigation are described.

8.1 Description of the Preferred Alternative

The preferred alternative for treatment of stormwater consists of three complementary approaches for achieving the water quality objectives of the EA study. The components of the preferred alternative are:

- Source control to reduce the quantity of runoff and to improve runoff quality.
- Replacement of traditional storm sewers with an exfiltration system in the future.
- Treatment of storm sewer discharges with treatment wetlands and oil and grit separators.

8.1.1 Source Control – Runoff Quality Improvement

The source control program is described in detail in Section 4. It is recommended that the City continues or enhances all of the existing programs that improve the quality of storm water runoff at the source. These programs are catchbasin cleaning, street cleaning, anti-litter and pet waste control bylaws, the sewer use bylaw, reduction and replacement of road de-icers, and reduction in the use of pesticides/herbicides and fertilizers. Within the study area, problems relating to litter and pet wastes have been noted during site visits. In addition, the sediments and salts that run off from the road network contribute to the degradation of the West Pond and other receiving water bodies. Enhancement of the following programs will help reduce these problems, and opportunities for their enhancement in the study area should be pursued:

- Increased enforcement of anti-litter and pet waste control by laws.
- Replacement of street sweeping equipment with more up-to-date street vacuuming equipment.
- Reductions in the use of road salts as de-icers.

Studies have indicated that source control programs can reduce transported sediment volumes by up to 15%, and improve runoff quality by reducing floatables, fecal coliform contamination, chlorides (salt), nutrients, pesticides and herbicides.

8.1.2 Source Control – Runoff Quantity Reduction

The City also has a number of programs in place aimed at reducing the quantity of runoff, which should be continued. These programs include roof leader disconnection to pervious areas or rain barrels, forestry bylaws and programs aimed at maintaining tree cover,

naturalization of public open spaces with native vegetation, experimentation with porous pavement, and green roof initiatives. Within the study area, there are particular opportunities to enhance these programs as well as implement new source control initiatives. These opportunities include:

- increased property owner participation in roof leader disconnection to pervious areas, rain barrels, ponding areas and/or cisterns/tanks.
- reduction of impervious surface area on both private and public lots.
- increased use of landscaping and vegetative techniques aimed at promoting infiltration of rainwater.

A quantitative analysis of the above opportunities estimated that, together, they could achieve up to a 17% to 24% reduction of runoff volumes in some portions of the study area.

8.1.3 Conveyance System Improvements

The opportunities for conveyance system modifications are outlined in Section 5. Within the study area, there is potential to reduce the quantity of runoff by replacing existing storm sewers with an exfiltration system using perforated pipe storm sewers. The area north of Rennie Park has sandy soils that are well suited for infiltrating large volumes of stormwater runoff. Retrofitting storm sewers is an expensive and complicated construction task. It is recommended that the City proceed with the modifications only when other major road reconstruction or sewer rehabilitation work is required (i.e. in the next 10 to 15 years).

The long-term reliability of exfiltration systems needs to be assessed in terms of sediment build-up and the ability of the surrounding soils to continually infiltrate large volumes of water. Similarly, the long-term effect on the local water table needs to be determined. The long-term effect on ground water quality from infiltrating large volumes of potentially contaminated runoff must also be determined before moving ahead with this technology on a large scale. The City is currently experimenting with exfiltration sewer systems, with positive results. It is expected that in 10 to 15 years, when sewer rehabilitation and reconstruction work is required in the study area, that exfiltration systems can be applied in areas with suitable site and soils conditions.

8.1.4 Treatment of Storm Sewer Discharges

Storm sewer discharges will continue to have adverse effects on downstream water bodies since the source control efforts will not eliminate the non-point source contribution of contaminants from roads and other surfaces. Similarly, source control measures cannot eliminate stormwater runoff volumes in the study area.

Therefore, treatment of stormwater discharge that will remain following the implementation of the recommended source controls is required in the study area to meet the study objectives. The preferred alternative for treatment of stormwater runoff is a combination of treatment wetlands and oil and grit separators. These treatment systems will be combined to achieve 70% reduction in suspended solids for stormwater entering West Pond and Grenadier Pond, and 80% reduction in suspended solids for storm water discharging to the Humber River and Lake Ontario.

Sizing of the treatment wetlands and oil and grit separators is based on the current MOE guidelines for stormwater facilities. The sizing parameters utilized in the preliminary design of the facilities assumes the existing conditions within the watershed without the improvements expected from enhanced source control measures. If the proposed source control measures are applied and are found to be effective, the net effect will be an improvement in the overall efficiency of the stormwater treatment system.

A description of each treatment facility is given below according to the drainage area it serves. The preferred alternative design concepts are shown schematically in Figures 8-1, 8-2, 8-3, and 8-4, while Figures 8.5 and 8.6 show a typical treatment wetland plan and profile, and different types of wetlands, respectively. Brief descriptions of the proposed treatment systems are described below.

8.1.5 Drainage Areas A and C, Outfall HP7

The preferred treatment alternative is a treatment wetland located within the north end of end West Pond (Figure 8-1). The flows entering the wetland are pre-treated in a sediment forebay located near outfall HP7 in Rennie Park. The treatment wetland incorporates deep zones that promote flow dispersion in the wetland for improved treatment. The wetland is oversized to compensate for reduced TSS removal efficiency expected by the preferred alternative at outfall HP8.

Other features of the preferred alternative in this location are channel improvements to restore the natural creek channel, walkways, and other park amenities.

Sizing Design Parameters

Drainage Area A - 36 hectares
Percent Imperviousness - 53%

Drainage Area C - 15.1 hectares
Percent Imperviousness - 12%

Combined Average Imperviousness - 40%

70 % TSS Removal Sizing Guidelines

Permanent Pool volume requirement - 1277 m³ (25 m³/ha)
Extended Detention volume requirement - 2044 m³ (40 m³/ha)

80 % TSS Removal Sizing Guidelines (Oversizing)

Permanent Pool volume requirement - 2555 m³ (50 m³/ha)
Extended Detention volume requirement - 2044m³ (40 m³/ha)

Preliminary Design Volumes:

Sediment Forebay Permanent Pool Volume: 1850 m³
Wetland Permanent Pool Volume: 1050 m³
Total Permanent Pool: 2580 m³
Extended Detention Volume: 2900 m³

8.1.6 Drainage Area B, Outfall HP8

The preferred treatment alternative for Drainage Area B is the provision of oil and grit separator(s) located at outfall HP8 (Figure 8-1). The separators should be sized to treat all flow rates up to a 26 mm 4-hour design storm and to achieve 70% removal of suspended solids. Since the oil and grit separator will be located at the end of the sewer system of a relatively large drainage area, it is unknown if 70% TSS removal can be achieved on a consistent basis. The treatment wetland for Area A and C, therefore, is oversized to compensate for reduced TSS removal efficiency expected by the preferred alternative at outfall HP8.

Sizing Design Parameters

Drainage Area – 8.8 hectares

Percent Imperviousness – 54%

26 mm 4-Hour Design Storm Peak Flow Rate – 248 litres/sec

8.1.7 Drainage Area D, Outfall HP5

The preferred treatment alternative is a treatment wetland located within at the southwest corner of Grenadier Pond (Figure 8-2). The flows entering the wetland are pre-treated in a sediment forebay located at outfall HP5. The treatment wetland incorporates deep zones that promote flow dispersion in the wetland for improved treatment.

Other features of the preferred alternative in this location are flow separation to divert West Pond flows away from the treatment wetland, walkways, and other park amenities.

Sizing Design Parameters

Drainage Area – 8.9 hectares

Percent Imperviousness – 52%

70 % TSS Removal Sizing Guidelines

Permanent Pool volume requirement – 249 m³ (28 m³/ha)

Extended Detention volume requirement – 356 m³ (40 m³/ha)

Preliminary Design Volumes:

Sediment Forebay Permanent Pool Volume: 675 m³

Wetland Permanent Pool Volume: 260 m³

Total Permanent Pool: 935 m³

Extended Detention Volume: 375 m³

8.1.8 Drainage Areas E, F and G, Outfall H1

The preferred treatment alternative is a treatment wetland located adjacent to the Humber River south of Lakeshore Boulevard (Figure 8-3). The flows entering the wetland are pre-treated in a sediment forebay. The treatment wetland incorporates deep zones that promote flow dispersion in the wetland for improved treatment.

Other features of the preferred alternative in this location are walkways, and other park amenities.

Sizing Design Parameters

Drainage Area E – 3.6 hectares

Percent Imperviousness – 43%

Drainage Area F and G – 17.1 hectares

Percent Imperviousness – 84%

Combined Average Imperviousness – 77%

80 % TSS Removal Sizing Guidelines

Permanent Pool volume requirement – 1863 m³ (90 m³/ha)

Extended Detention volume requirement – 828 m³ (40 m³/ha)

Preliminary Design Volumes:

Sediment Forebay Permanent Pool Volume: 900 m³

Wetland Permanent Pool Volume: 1700 m³

Total Permanent Pool: 2600 m³

Extended Detention Volume: 900 m³

8.1.9 Drainage Areas E, F and G, Outfall W12

The preferred treatment alternative for overflows from the Ellis Avenue sewer that discharge at Outfall W12 is a screening device to remove floatables (Figure 8-3). The screening device would be located near Lakeshore Boulevard, immediately downstream of the diversion weir.

8.1.10 Drainage Areas H, Outfall W11

The preferred treatment alternative is a treatment wetland, both located north of Lakeshore Boulevard and situated on west side of Colborne Lodge Drive (Figure 8-4). The flows entering the wetland will be pre-treated with oil and grit separators. The treatment wetland incorporates deep zones that promote flow dispersion in the wetland for improved treatment.

Sizing Design Parameters

Drainage Area H – 13.8 hectares

Percent Imperviousness – 42%

80 % TSS Removal Sizing Guidelines

Permanent Pool volume requirement – 690 m³ (50 m³/ha)

Extended Detention volume requirement – 552 m³ (40 m³/ha)

Preliminary Design Volumes:

Wetland Permanent Pool Volume: 750 m³

Extended Detention Volume: 625 m³

8.2 Estimated Costs

8.2.1 Cost of Source Control Initiatives

The cost to implement source controls is difficult to establish because the methods of achieving the source control initiative will vary from property to property. The cost of the City's ongoing education and outreach program cannot be broken out for the study area alone. The following are cost estimates for the source control programs that can be quantified within the study area.

Source Controls for Runoff Quality Improvement

These are primarily education and outreach programs that will be implemented and enhanced across the City. No cost estimate is provided for ongoing projects.

Source Controls for Runoff Quantity Reduction

- Disconnection of roof leaders to pervious areas:¹ To reach the study's objectives, 40% of lots will have roof leaders disconnected to pervious surfaces. This requires an additional 172 properties undertake disconnection.

Cost: 172 lots at \$300/lot = \$51,600.

- Disconnect roof leaders to rain barrels or ponding areas:² To reach the study's objectives, 30% of lots will have roof leaders disconnected to pervious surfaces. This requires an additional 255 properties undertake disconnection to rain barrels.

Cost: 255 lots at \$1500/lot = \$382,500.

- Reduce impervious area: To reach the study's objectives, 10% of lots have driveways and private walkways replaced with pervious materials. This requires an additional 86 properties undertake the voluntary removal.

Cost: 86 lots at \$3000/lot = \$258,000.

¹ Assumes no lot re-grading is necessary

² Assumes landscaping or lot re-grading may be necessary

- Landscaping and vegetative techniques on large properties. To reach the study's objectives, all of the large properties in study area B would require re-landscaping. This requires 10 lots to be totally re-landscaped.

Cost: 10 lots at \$20,000/lot = \$200,000.

The total estimated cost (based on the assumptions above) to achieve 17% to 24% reduction in runoff volume is approximately \$892,000, excluding the costs of public consultation programs, or any follow-up programs.

8.2.2 Cost of Conveyance System Modification – Exfiltration System

The exfiltration sewer system recommended in this study may be implemented under suitable soil conditions when sewer replacement work is necessary. The sewer retrofits will be tied to other major road construction works. The cost of installing the exfiltration system will be depended on the site conditions. The approximate unit rate cost for installing an exfiltration pipe sewer system is \$1,100/metre. This is roughly twice the unit cost for traditional storm sewers. There are approximately 3,100 meters of roadway located in the areas with sandy soils north of Rennie Park. The cost to install the exfiltration system on all of the streets, excluding associated roadwork cost and other utility replacement costs, would be \$3,410,000.

8.2.3 Cost of Treatment Systems

Detailed cost estimates of all of the design alternatives for treatment systems (wetlands and oil and grit separators) are provided in Appendix D. The following is a summary of the estimated cost of each of the preferred alternatives.

Drainage Areas A and C, Outfall HP7

Alternative 3 – Treatment wetland located in West Pond with a sediment forebay located near outfall HP7 and channel improvements: \$495,000.

Drainage Area B, Outfall HP8

Alternative 3 – Oil and grit separator at outfall HP8: \$302,000.

Drainage Area D, Outfall HP5

Alternative 1 – Treatment wetland located in Grenadier Pond with a sediment forebay: \$380,000.

Drainage Areas E and F & G, Outfall H1

Alternative 1 – Treatment wetland located near the Humber River with a sediment forebay: \$480,000.

Drainage Area E and F & G, Outfall W12

Alternative 1 – Screening device to remove floatables: \$85,000.

Drainage Area H, Outfall W11

Alternative 3 – Treatment wetlands located at Colborne Lodge Drive with oil and grit separators for pre-treatment of flows: \$432,000.

Total cost of preferred treatment alternatives: \$2,174,000.

8.3 Implementation Schedule

8.3.1 Source Control Initiatives

Source control initiatives recommended in this study are part of ongoing programs that the City has in place. The enhancement to the existing programs and new source control programs can proceed at any time without further approval under the Environmental Assessment Act.

8.3.2 Conveyance System Modifications

This study has recommended that the City begin installing exfiltration sewer systems in the study area on an experimental basis. This retrofit work should proceed when major road or sewer reconstruction work is required for maintenance purposes. It is not expected that any major road works will be required in the study area in the next 10 to 15 years. Conveyance system modifications can proceed at any time without further approval under the Environmental Assessment Act.

8.3.3 Treatment System Construction

Improving the water quality of the Western Beaches is high priority project of the City. The City's construction should therefore be prioritized as follows:

- Areas E, F & G, outfall H1, Treatment wetland
- Areas E, F & G, outfall W12, Screening device for overflows to the Ellis Ave Outfall
- Area H, outfall W11, treatment wetlands
- Areas A and C, outfall HP7, West Pond treatment wetland and channel improvements
- Area B, outfall HP8, Oil and Grit separator system
- Area D, outfall HP5, treatment wetland

Subject to the necessary approvals, the City plans to commence detailed design later in 2002, followed by construction.

8.4 Potential Environmental Impacts and Mitigation

8.4.1 Source Control Impacts and Mitigation

The majority of source control initiatives will be implemented at the lot level and will have minimal negative impacts to homeowners if installed properly and is in suitable locations (e.g. no flooding of properties, tree removed, stagnant water, etc.). Care must be taken to properly evaluate the effects of roof leader disconnections with respect to local flooding. Roof leaders should not be disconnected such that water is discharged onto adjacent properties where it might cause damage by entering low-lying basement windows or

doorways. Sufficient lot grading is necessary to ensure that runoff that is newly introduced to the surface flows away from buildings.

Design of source controls should be based on manufacturer specifications. Each application will require consideration of environmental and other factors including slope of property, grading, cold weather conditions, adjacent property impacts, long-term use, etc.

8.4.2 Conveyance System Modifications

Any conveyance system modifications should be undertaken during planned road reconstruction. Short-term impacts associated with construction will include noise, dust, and potential inconveniences to homeowners (e.g. detours). Residences along the proposed construction routes should be notified prior to commencement of construction near their homes and asked for input regarding any potential inconveniences (e.g. specific dates, driveway crossings). The contractor should ensure there is temporary access to their properties if severance of their usual access route is necessary. Construction work and equipment operation should not extend beyond daylight hours. Problems of dust can be alleviated by periodically lightly wetting down the immediate work area. In addition, the contractor should maintain the work area in a neat and orderly fashion and ensure that all persons engaged in the work are informed of the safety regulations and special conditions in the construction area. After completion of construction, properties should be returned to pre-construction conditions (e.g. re-establishing lawns, sidewalks, etc).

Long term monitoring of exfiltration systems is required to determine if ground water contamination is occurring. Long-term monitoring is also required to determine if groundwater levels are being modified in a way that negatively impacts adjacent buildings (basement flooding) and adjacent vegetation (change in hydrologic conditions). This must be undertaken to fully assess the future continuance of the retrofit program. If negative effects are realized from the program, the City should modify the exfiltration pipes to eliminate further discharge of water into the subsurface soils.

8.4.3 Treatment Systems Construction

Potential Environmental Impacts and Proposed Mitigation Measures

Potential environmental impacts associated with the construction and operation of the proposed treatment facilities are described as follows:

Truck Traffic

Truck traffic to and from the sites will be limited to the extent possible, and appropriate access routes will be selected to limit the negative impacts of truck traffic. Working hours will conform to the City's by-law Regulations.

Noise

To limit the noise associated with construction, it is recommended that all vehicles and equipment be equipped with effective muffling devices and are operated in manner which minimizes noise levels (particularly in the residential and recreational areas). The City's existing noise by-law must also be enforced.

Mud and Dust Controls

Construction traffic could create dust and mud problems. Dust can be controlled through regulator applications of water at the construction site. In addition, public roadways will be kept clean through street sweeping and/or by tire washing of vehicles exiting the site.

Erosion and Sedimentation

The required earthworks will make the sites vulnerable to erosion and sedimentation. The proposed mitigation measure is to prepare and implement an erosion and sedimentation control plan throughout the construction period. This plan will impose strict control measures by keeping areas of excavation and disturbance to a minimum and by the use of sedimentation ponds, silt fences and/or hay bale check-dams.

Site Access

Site access routes must be chosen for construction and maintenance purposes, which minimize impacts on the natural and social environments. For instance, access routes through park areas, or areas with significant natural vegetation will be avoided where possible.

Disturbance of Existing Vegetation

Vegetation that is removed or disturbed during construction will be replaced with an equivalent mass or area of natural vegetation. Mature native trees will be avoided wherever possible. Where individual trees must be removed, the proposed mitigation measure is to plant new trees as part of the landscaping plan.

To mitigate potential impacts on existing vegetation outside the limit of the construction zone, the construction sites will be clearly delineated and fenced if appropriate.

Construction equipment will also be stockpiled away from tree root systems, in order to avoid damaging trees by compacting soil around the roots.

Fuel Spills

In refueling construction equipment, spills could occur with the potential of contaminating surface and groundwater. Only designated areas away from sensitive areas (e.g. ponds or watercourses) will be allowed for refueling construction equipment. A contingency plan for cleaning up fuel spills should also be prepared for contractors.

Contaminated Sediments

Construction of wetlands within West Pond and Grenadier pond may disturb contaminated sediments. Prior to construction, pond sediments will be fully analyzed. A sediment management plan will be prepared that will address the requirement to remove sediments or to cap sediments in situ. As part of the wetland design, it is recommended the capping of the sediments in situ by use of some type of geofabric. The geofabric will contain and separate contaminated sediments at the bottom of the pond from imported soils in which the vegetation will be planted. This should provide adequate protection of downstream water bodies. In addition, siltation control screens

will be utilized for all construction undertaken in the water to reduce the downstream movement of disturbed sediments.

Contaminated Sites

Historical information on the area and conversations with City staff suggest that there are numerous areas within and surrounding the study area that were used to receive fill materials from other parts of the City in the early 1900's (possibly up to about 1940). The composition of these fill materials is unknown, but could potentially include garbage, excavation materials and/or coal ashes, from other areas of Toronto. The City of Toronto, Technical Services Department, in consultation with Solid Waste Management Services is currently conducting a preliminary investigation on City property to determine the nature and extent of past landfilling activities in the Swansea area. The program will include an investigation of groundwater quality near the proposed wetland in West Pond. If warranted, the City will undertake a complete site characterization and risk assessment to determine any remediation measures required. If it is discovered that leachate from past landfilling practices is entering the West Pond, the design of the wetland can be modified to treat the leachate³.

Excavated material at any of the construction sites will be analyzed under MOE material reuse guidelines to determine the appropriate disposal location or method.

Public Safety

To ensure public safety, construction areas may also be fenced and signed where appropriate.

Archaeological Resources

There is potential for archaeological resources in some regions of the study area. In particular, the Ministry of Citizenship, Culture and Recreation (MCCR) has recommended that an archaeological survey of the site around the West Pond be undertaken prior to construction to ensure that there is no disturbance of previously unidentified archaeological and historical sites. As the area has been previously disturbed through infilling activities, it is unlikely that archaeological and historical sites will be discovered. However, prior to construction the City plans to have a registered archaeologist conduct a Stage 1 Archaeological Assessment of the site to identify any potential for resources. If there is potential, further archaeological assessments will be conducted. If any archeological resources are discovered, impacts will be controlled through avoidance or mitigation (e.g. re-designing the shape of the wetland).

Mosquito Control

Once the wetland cells are flooded, mosquito-consuming fish (minnows or sticlebacks) can be placed in the deep zones of the wetland cells. The fish can be collected from local

³ Wetlands have been used to treat leachate from landfill sites in Canada, the U.S., and Europe (see "Constructed Wetlands for the Treatment of Landfill Leachates" edited by Mulamootil et. al.). These wetlands are successful at removing a wide range of contaminants from landfills including metals, nutrients, suspended solids, BOD, and organics. A wetland treatment system in the West Pond, therefore, may serve to improve the quality of any potential leachate or runoff from the suspected fill areas.

shallow water bodies. They will help to control the production of mosquito larvae in the wetland. Bat roosting boxes and purple martin and swallow nesting boxes can be erected around the site to help control mosquitoes that emerge from the system.

Nuisance Wildlife Control

There are several types of wildlife that can and will have a negative impact on the wetland if they are not controlled. Carp will grub amongst the roots of the plants and uproot and destroy them. They will also add to the turbidity of the water by stirring up and re-suspending bottom sediments. This would impact the removal efficiencies since many of the contaminants that the wetland was designed to control are found in the sediment. Muskrat can create problems for the wetland if they are found in large numbers. They will build huts from the wetland vegetation thus removing the vegetation that is vital to the treatment efficiency and their huts will channel flow reducing the hydraulic retention time. Waterfowl and mammals can impact the wetland effluent water quality since their feces are indiscriminately deposited in and around the wetland perimeter and can add to the discharge fecal coliform count. Waterfowl will also feed on young plants as they are emerging in the wetland and can completely defoliate the shallow zones if allowed to. For this latter concern, waterfowl control wiring can be erected to discourage waterfowl from landing in the wetland and shrubs can be planted along the wetland edge that, once fully developed, provides a barrier to prevent large numbers of waterfowl from walking into the wetland.

Site Specific Considerations

Along with the general mitigation measures described above, each treatment systems will have its own set of challenges that will need to be overcome during the detailed design stage in order for the project to be successful. The design considerations identified by the team for this project are presented in the following section. Note that detailed surveys should be carried out for all locations where construction activities will occur since the data presented in this report represents both recent and historic measurements.

Oil and Grit Separators/Screening Device

Outfall HP8

The placement of this oil and grit separator along Coe Hill Drive will require the following:

- Geological investigation to determine subsurface conditions
- Determination of the integrity of the existing piping and suitability for connecting to an oil and grit separator
- The steep side slope east of the proposed location and its proximity to Coe Hill Drive may provide an excavation challenge due to limited space for maneuvering heavy equipment and may create traffic tie-ups or re-routing during the construction period, which must be mitigated using techniques described above.

Outfall W11

The two oil and grit separators, one immediately north of westbound Lakeshore Road and one at the bottom of the slope south of the Gardiner Expressway, require the following:

- Hydrogeological investigation to determine subsurface conditions
- Determination of the integrity of the existing piping and suitability for connecting to an oil and grit separator
- Construction access will be from the grassed area slated for construction of the wetland hence the oil and grit separators should be installed before constructing the wetland
- Required setbacks must be determined by contacting Urban Development Services and road allowance limits must be confirmed with Works and Emergency Services (WES)

Outfall W12

The screening device that has been recommended for this outfall is located adjacent to a playground south of eastbound Lakeshore Boulevard and require the following:

- Hydrogeological investigation to determine subsurface conditions
- Determination of the integrity of the existing piping and suitability for connecting a screening device.
- Mitigation measures discussed above must be implemented to limited to the extent possible negative impacts on the playground and adjacent Park area
- Required permits must be determined by contacting Toronto Parks and Recreation and WES

Treatment Wetlands

The construction of the treatment wetlands hold a unique set of challenges that, once completed, will provide wildlife benefits as well as enjoyment for Park patrons.

Outfall HP7

This outfall is located in a treed and sloped area of Rennie Park. The following should be considered:

- Hydrogeological investigation to determine subsurface conditions
- Determination of the most suitable access to each of the construction locations (forebay, channel restoration, and wetland) and may include a combination of existing trails and vehicle access paths
- Seeps emanating from the valley slope must be accommodated when constructing the forebay and vehicle access
- Prior to cutting of trees, a detailed inventory and marking of trees suitable for removal must be made

- Forebay may require pedestrian access control since the water depth will be 2 m at the deepest point
- A temporary bypass of the flows must be constructed during construction of this system to prevent washout of partially constructed components and construction should occur during normally dry periods of the year
- Due to the accumulation of sediment in the West Pond, the construction of the wetland may require a geofabric/geomembrane to provide a stable base for plantings and to provide a stable base for the construction of the berm
- Required permits must be determined by contacting Toronto Parks and Recreation and WES

Outfall HP5

This wetland should be constructed within the existing wetland at this outflow in Grenadier Pond and the construction may be able to proceed without significantly disturbing this habitat.

- Hydrogeological investigation to determine subsurface conditions
- Determination of the most suitable configuration to minimize the impact on the existing wetland
- Forebay may require pedestrian access control since the water depth may be a concern
- A temporary bypass of the flows must be constructed during construction of this system to prevent washout of partially constructed components and construction should occur during normally dry periods of the year
- Due to the accumulation of sediment in Grenadier Pond, the construction of the wetland may require a geofabric/geomembrane to provide a stable base for plantings and to provide a stable base for the construction of the berm
- Required permits must be determined by contacting Toronto Parks and Recreation and WES

Outfall W11

The location of this wetland is along a busy traffic corridor. Considerations for this location should include:

- Hydrogeological investigation to determine subsurface conditions
- Determination of the integrity of the existing piping and suitability for integrating into new manholes
- Ability to maintain current stormwater flow must be incorporated into the final design of this system to prevent washout of partially constructed components and construction should occur during normally dry periods of the year

- Required permits and setbacks from the road allowance must be determined by contacting Toronto Parks and Recreation, Urban Development Services Department, and WES
- WES Right-of-Way Management Division must be contacted to discuss temporary access issues related to the construction
- Sight lines must be maintained between motorists on Colborne Lodge Drive and Lakeshore Boulevard

Outfall H1

This wetland is located adjacent to the Humber River and requires several considerations including:

- Hydrogeological investigation to determine subsurface conditions
- Determination of the integrity of the existing piping and suitability for integrating into new headwalls
- Ability to maintain current stormwater flow must be incorporated into the final design of this system to prevent washout of partially constructed components and construction should occur during normally dry periods of the year
- Sealing of pipe outflows to the Humber River
- Excavation of the forebay and suspension of piping prior to cutting out the pipe section
- Constructing the wetland component first may provide storage and/or storm flow attenuation during the construction of the forebay
- Wetland outfall construction should be carried out during low Humber River flow conditions
- Fencing around the wetland should be required since there will be up to a 4 m difference in elevation between the bottom of the wetland and the surrounding surface
- Since the system is being constructed on a floodplain the Toronto Region Conservation Authority should be consulted. Additional permitting requirements should be determined by contacting Toronto Parks and Recreation and WES

8.5 Maintenance and Monitoring Considerations

8.5.1 Oil and Grit Separators

The operations and maintenance requirements of the oil and grit separators will follow the manufacturers recommendations. Frequency of cleaning will need to be determined based on experience. Cleaning frequency will be the most significant factor in the unit's contaminant load reduction efficiency since solids accumulation will reduce the hydraulic retention time in the oil and grit separator allowing solids to be carried through the unit.

Regular monitoring of accumulated sediment depth and cleanout will help ensure optimum efficiency.

8.5.2 Treatment Wetland

Anticipated maintenance requirements include maintaining any vegetative cover, access routes, and mechanical systems. Debris and sediments must also be removed from embankments, flow splitters, culverts and headwalls, as well as forebays on a regular basis.

In general monitoring involves observing and recording the performance and efficiency of the treatment control system. Monitoring should be directed at parameters that can be used to quantify the success of the system, such as runoff quantities (flows and volumes), influent and effluent qualities (e.g. suspended solids, e-coli), and vegetation health. Preparation of an operations and maintenance manual will provide specific details on the treatment wetland processes, start-up procedures, system operation, monitoring requirements, routine maintenance recommendations, and emergency plans and procedures.

8.6 Approval Requirements

The procedures for preparing a submission for each of the stormwater treatment facilities must be followed as set out by the MOE Certificate of Approval (CofA) submission guidelines. These projects will fall under Sections 52 and 53 of the Water Resources Act (amended 1997). Considerations for each facility may include:

- Updating the current CofA if any of the stormwater management facilities already have one.
- A pre-application consultation may be required with the MOE.
- Submission of payment of application costs for each facility.
- Filing of the applications at least 6-8 weeks prior to commencement of construction.
- Preparation of a sampling and monitoring program for tracking system performance.
- Keeping the MOE informed of the City's intentions during the planning stages.

8.7 Summary of Net Environmental Impacts

The construction of conveyance system modifications, oil and grit separators, and wetlands will cause some nuisance impacts (e.g., truck traffic, noise, and closure of the beach area during construction). However, impacts will be temporary and minor compared with the benefits of the project. The project will improve the water quality, create habitats for wildlife, and offer opportunities to improve natural and recreational systems. The combination of solutions - source control, conveyance system modifications, oil and grit separators, and treatment wetlands - will meet the stormwater management objectives specified in this study (Section 2). It also satisfies the purpose of this study as defined by the Steering Committee, which is "to identify preferred systems for the control and use of

stormwater from the areas drained by Ellis Avenue and Colborne Lodge Drive storm sewers, with the objectives of minimizing negative environmental effects, and enhancing the beneficial use of stormwater in both natural and built environments.”

9. Public Consultation

As required under regulations for the Environmental Assessment Act, the study for the proposed Ellis Avenue and Colborne Lodge Drive Storm Water Management treatment alternatives is being carried out as a Schedule C Class Environmental Assessment (EA). Public Consultation is a requirement of the Class EA process.

The Public Consultation and Community Outreach Unit of the Works and Emergency Services is co-ordinating the public consultation and community outreach activities of this project, and has prepared this section of the Environmental Study Report, as well as the related materials presented in a separate appendix. The following sections describe the public consultation activities carried out as part of the study, as well as comments received and responses. The separate appendix provides the information relating to the public consultation and community outreach events, including dates, time, attendance figures and promotional activities. Events were also documented in photographs and they are provided in appendix. The digital photos of the September 6, 2000 Open House produced courtesy of the Swansea Historical Society. These public events ranged from open houses to Earth Day information and education activities in High Park. CH2M HILL has also reviewed and provided input into the responses provided in this section.

9.1 Steering Committee

Following the guidelines of the Storm Water Group (SWG) meeting # 7 on September 27, 1999, there were two volunteers for the steering committee. The steering committee of this project consists of representatives from the Storm Water Group and High Park Citizens Advisory Group. The Swansea Area Ratepayers Association (SARA) was invited to join the steering committee and preferred to receive copies of draft reports throughout this study instead. The following is the membership of the steering committee:

9.1.1 Public

- Karey Shinn – Storm Water Group volunteer, area resident
- Kristina Guiguet – Storm Water Group volunteer, area resident
- Don Barnett – Co-Chair of the High Park Citizens Advisory Committee, area resident

9.1.2 City Staff

- Patrick Chessie – Project Manager, Works and Emergency Services (WES), Infrastructure Asset Management
- Ted Bowering – WES, Soil and Water Quality Improvement
- Tim Dennis – WES, Design and Construction, District 1 & 2
- David O'Hara – Parks and Recreation Division, Planning

- Carol Guy – Parks and Recreation Division, High Parks Supervisor
- David Chapman – Parks and Recreation Division, Rennie Park Supervisor
- Mae Lee (Rigma) – WES, Public Consultation and Community Outreach

9.1.3 Consultant

- Laurie Boyce – Project Manager, CH2M HILL Canada Limited
- John Pries – CH2M Hill Canada Limited
- Rob Flindall – CH2M Hill Canada Limited

9.2 Promotional and Notification Activities

The promotional and notification activities are described below, while a listing of these activities and dates of implementation are provided in Table 9.1.

9.2.1 Community advertisement

- Notice of Commencement of this study on the “Bloor West Villager” and “Bloor West Guardian” in April and May 2000.
- Notice of Completion of this study on the “Bloor West Villager” and “Bloor West Guardian” in December 2000.
- Notice flyers of Open House events posted in Swansea Town Hall Community Centre, Swansea Community Centre, Swansea Public School, High Park Grenadier Restaurant, High Park Library, Parkdale Library, and Runnymede Library.
- Newsletters of this study provide explanation of an EA process and the objectives of this study as well as invitations to public events.

9.2.2 Surveys/Feedback

Three survey questionnaires were used to raise storm water awareness and invite feedback from the community regarding proposed storm water treatment alternatives:

- Initial survey of “storm water awareness” level to 2,500 households in the study area in January 2000, close to 200 households responded
- Comment sheet from May 31, 2000 open house, 10 participants responded
- Comment sheet from September 6, 2000 open house, 9 participants responded

9.2.3 News Bulletins

Two newsletters were sent out to 2,500 households in the study area during Phase 2 and 3 of the process in April and August of 2000.

- The purpose of the newsletters was to explain the EA process, update the status of the study, and invite the community to public events.

- Provide invitation to April 30, May 31 and September 6 Open Houses.
- Special mail-out to all apartment units at the Swansea Village Co-op on Coe Hill Drive in May and September to solicit comments.

9.2.4 Website

- Set-up in March and updated in August of 2000.
- Roncesvalles-Macdonnell Residents Association member, Chander Chaddah, helped to promote this study on his website.

9.2.5 24-hour Comment/Response Line

- Immediate response to questions regarding this study through the public consultation unit – Mae Lee at 416 392-8210.
- Email at rlee5@city.toronto.on.ca or works_consultation@city.toronto.on.ca
- Fax at 416 392-2974 and TTY at 416 397-0831
- Access to this study through the 24-hour comment line at 416 397-7777
- Event registration at 416 392-9365

9.2.6 Community Outreach Activities

- Earth/Environment Day Public Open House # 1 at High Park on April 30, 2000
- School presentation on May 18, 2000 with Grade 7 & 8 students at Swansea Public School
- Open House # 2 at Swansea Town Hall on May 31, 2000
- Walking tour of study area on June 3, 2000
- Environment Days promotion of “Downspout Disconnection Program” and storm water awareness campaign during water month of June 2000
- Open House # 3 at Swansea Town Hall on September 6, 2000
- Bloor West Village side-walk sale social marketing of “Downspout Disconnection Program” on September 7-9, 2000

9.2.7 Agency Consultation

Government review agencies, such as the MOE and TRCA, were also notified of the study. Only one agency, the Ministry of Culture and Recreation (MCR) responded with written comments. The MCR recommended that the City retain a licensed archeologist to undertake a survey of the site prior to construction to assess the potential for any unknown archeological resources.

9.2.8 City Councillors' Briefing

Due to the enthusiastic response of the initial survey questionnaire in January 2000 from the study area residents, staff met with City Councillors David Miller and Chris Korwin-Kuczynski in March to brief them about this study. City staff presented an overview and purpose of this study, the process of an EA study and steering committee membership.

9.2.9 Storm Water Group (SWG)

- Received suggestions from steering committee member, Kristina Guiguet, to arrange specific community education activities to socially market "source control" measures – activities listed and response summary attached
- Received requests in February and July 2000 for the Storm Water Group to meet, requests copied to Storm Water Group Chair, Councillor B. Saundercook and informed Councillor J. Layton
- Copies of the draft Phase 1 & 2 reports were sent to all member of SWG for information
- The draft Environmental Study Report (ESR) sent to SWG for comments before finalizing for the public's review

9.2.10 Open House/Information Session/Tour

Three Open Houses/Information Sessions were held for the public throughout the planning and development of the EA study. To help the community to better understand the study area and the storm water treatment alternatives proposed, a walking tour was also arranged. All the public events were advertised in the "Bloor West Villager" as well as the "Bloor West Guardian" community papers and this project's own news bulletins.

The first information session was held on April 30, 2000, Earth/Environment Day in High Park. The purpose was to inform the community regarding the initial plans to improve storm water quality and decrease storm water quantity in the study area. Consultant presented an overview of the project and wetland treatment alternatives in other parts of Ontario. City staff took the opportunity to introduce the "Free Downspout Disconnection Program" to area residents and invite them to the subsequent Open House and walking tour of the study area in the following month.

A second Open House was held on May 31, 2000 in the Swansea Town Hall, to allow the public and local City Councillors an opportunity view each of the proposed alternatives, ask questions and provide input into the selection of the preferred alternatives. Project team was on hand to answer questions and provide further information or clarification. Fact sheets on wetlands', "Frequently Asked Questions" (FAQ), and displays boards are part of the hand-outs at open houses for this project. Display boards outlined the following:

- Steps of the Environmental Assessment (EA) process
- Purpose, objectives and approach of this study
- Study area map
- Existing source control initiatives

- Opportunities for additional source control initiatives
- Conveyance system control options
- End-of-pipe treatment alternatives
- Conclusion and next steps

On June 3, 2000, a walking tour was arranged for area residents to physically explore the study area and the proposed treatment alternatives' locations.

After the summer holidays, a third Open House was held on September 6, 2000 in Swansea Town Hall to present to the community the alternative designs of the recommended storm water control options.

There were handouts of the display materials and survey questionnaires at all open house events to receive feedback from the participants.

TABLE 9.1
PUBLIC CONSULTATION AND COMMUNITY OUTREACH ACTIVITIES – JANUARY TO OCTOBER 2000

EA Phase	Date/Time	Activity	Number of Participants
	Dec 1, 1999	Steering Committee met for the first time	
	Dec 15, 1999	Steering Committee selection of consultant – CH2M Gore & Storrie	
	Jan 10, 2000	CG&S meeting with Project Manager & public members of Steering Committee to discuss Public Consultation Plan - Steering Committee meeting # 1 with consultant	
	Jan 12, 2000	Steering Committee meeting # 2 with CG&S	
Phase 1	Mid January 2000	Survey Questionnaire to 2,500 households in the study area (Bloor West, Indian Drive, Windermere Ave, Queensway)	2,500 households in the study area
	Feb 23, 2000	Steering Committee Meeting # 3 Draft outline of Phase I working paper Major findings of existing conditions Preliminary list of alternatives and screening criteria	
	Early March 2000	Thank you letter to over 200 “interested parties” who responded to the survey, informing them upcoming events and update newsletters	thank you letter mailed to 250 respondents of the initial survey questionnaire
	March 2000	Website online: www.city.toronto.on.ca/involved provides the background of this EA study invitation to April, May, June open houses & tour	

EA Phase	Date/Time	Activity	Number of Participants
	Mid April 2000	Flyers of High Park Earth/Environment Day to 2,500 households Invitation to April 30 High Park Open House # 1	invitation letters mailed to 250 "interested parties" who responded to initial survey questionnaire and called
	Late April 2000	"Notice of Commencement" sent to 200 "interested parties" who responded to survey	
	Apr 26, 2000	Steering Committee Meeting # 4 Identification and review of alternative solutions Review of detailed evaluation criteria	
	Apr 28, 2000	Community newspaper "Notice of Commencement" ad on Bloor West Guardian	
	Apr 30, 2000 10:00 am – 2:00 pm	Earth/Environment Day Open House # 1 at High Park First official contact with the local community Explain the purpose of this study Advertise the Downspout Disconnection Program	over 100
	May 5, 2000	Community newspaper "Notice of Commencement" ad on Bloor West Villager	
	Mid May 2000	Bulletin # 1 to over 200 "interested parties" who responded survey	newsletter mailed to 250 households on database and distributed to 2,500 households in the study area
	May 18, 2000 1:00 – 2:30 pm	School Presentation of Downspout Disconnection program and this study to Swansea Public School – Grade 7 and 8	over 20 science class students
	May	Spring 2000 issue of the City's "Water Watch" newsletter provided coverage of this study and advertised its May 31, 2000 Open House. This newsletter is distributed to 450,000 single-family homes (houses, excluding apartments) in the City.	450,000 households in the City
Phase 2	May 31, 2000 7:00 – 9:00 pm	Open House # 2 at Swansea Town Hall Identification and assessment of alternatives	23
	Early June	110 packages of May 31 Open House information materials to all units at Swansea Village Co-op (75 – 85 Coe Hill Dr) for comments	over 100 households
	June 3, 2000 10:00 am – 12:00 noon	Walking Tour of the study area site	18
	June 28, 2000	Steering Committee Meeting # 5 Review of Apr 30 and May 31 Open Houses Commencement of Phase 3 alternative designs	

EA Phase	Date/Time	Activity	Number of Participants
Phase 3	Aug 23, 2000	Steering Committee # 6 Review and Presentation of response to s.c. comments on Phase 2 report Presentation of Phase 3 designs	
	August	Bulletin # 2 to over 200 “interested parties” on database plus 2,500 door-to-door delivery Review of Phase 2 process Invitation to Phase 3 Open House Package also included “Free Downspout Disconnection” brochure and storm water management tips	newsletter mailed to 250 households on database and distributed to 2,500 households in the study area
	August	Website update: www.city.toronto.on.ca/involved invitation to September open house	
	August	Distribution of draft Phase 1 & 2 Reports plus comments/response from the Steering Committee to all members of the Storm Water Group	
	August	110 packages of Bulletin # 2 and invitation to Sept 6 Open House information materials to all units at Swansea Village Co-op (75 – 85 Coe Hill Dr)	
	Sept 6, 2000	Open House # 3 at Swansea Town Hall	17
	6:00 – 8:00 pm	Presentation of Phase 3 design alternatives to the community Recorded visually by Swansea Historical Society	
	Sept 7 - 9, 2000	Partner with Bloor West Village BIA and Swansea Town Hall to advertise Downspout Disconnection Program through the Bloor West Village sidewalk sale	over 1,000
	10:00 am – 4:00 pm		
	Sept 7, 2000	Packages of Sept 6 Open House presentation materials and comment sheet sent to Swansea Village Co-op (75 – 85 Coe Hill Dr) for comments	over 100 households

9.3 Issues and Responses

During the course of the study, the issues raised by the Steering Committee and general public were documented and responded to by the City and CH2M HILL. A summary of the issues raised at public events and responses to the issues are provided in Table 9.2.

The Steering Committee was provided with draft copies of the Phase 1 and 2 study findings. This assessment of alternatives and this Draft ESR were revised to reflect comments received as a result of steering committee input. In addition, input received through the other consultation activities (e.g. Open Houses, Tour) was incorporated into the assessment process where appropriate.

TABLE 9.2
ISSUES AND RESPONSE

Issues/Questions	Response
<p>The Study Area is just a part of a larger city. The other parts also cause impairment of water quality at the waterfront. How is this Study impacted by that “bigger picture”?</p>	<p>The City is undertaking a Wet Weather Flow Master Management Plan for the entire area of Toronto. That Master Plan will address those areas. The findings and outcomes of this Study will be incorporated as part of that Master Plan.</p> <p>“Clean beaches” are not the sole intended or desired outcome of managing stormwater and improving water quality. Habitat for aquatic species and areas for forms of recreation other than swimming are also desirable.</p> <p>The Stormwater Group urged the City to undertake three pilot projects. One of these projects was aimed at addressing stormwater discharges coming into Grenadier Pond from the residential area north of it.</p>
<p>How much of the ground surface in the Study Area is “impervious”?</p>	<p>Approximately 43% overall – which is typical for a residential area – and up to 84% in some sections of the Study Area. Detailed information is available in Section 3 of this ESR.</p>
<p>What is the most significant amount of rainfall from a storm in this area over the past 35 years?</p>	<p>The largest recent rainfall event was May 11-12, 2000a ‘25-year storm’ – and, before that the largest would be Hurricane Hazel in 1956, a “100-year” or “200-year” storm that dropped over 80 mm in 24 hours.</p>
<p>You should more strongly recommend, and work with developers and building owners in the Area to explore, “green roofs” as a Source Control measure. (e.g.: Swansea Mews and along Coe Hill)</p>	<p>“Green roofs” were considered and deemed a measure to explore for future developments. Retrofitting buildings involves analyses to ensure that their structural integrity can be maintained and, in particular, that they can support the additional weight. “Green roofs” are definitely worth considering in new construction.</p> <p>In the developments cited as examples, there is a lot of open space and it was felt that vegetation, landscaping and downspout disconnection would be more effective, economical and advisable.</p>
<p>The “Yellow Fish Road” project in 1994 helps to remind area residents that any materials entering storm sewers in the area goes untreated, into Grenadier Pond and Lake Ontario.</p>	
<p>What is intended for the south shore of Grenadier Pond? Will the proposed wetlands in Renee Park [near the West Pond] accomplish the MOE-recommended 70% removal of suspended solids? Should there be a wetland along the south shore (of Grenadier Pond) to further ‘polish’ the water?</p>	<p>The wetlands in the West Pond can achieve 80%+ removal, better than the MOE guidelines if they are correctly designed and include sediment forebays or other pre-treatment methods.</p> <p>We are recommending restoration of wetlands in the southwest corner of Grenadier Pond to increase ‘polishing’ of flows from the West Pond, and treat water from the residential area east of that Pond in order to meet or better the 70% solids removal Objective.</p>

Issues/Questions	Response
<p>Will collected sediments in the Ponds be dredged and removed? If so, from where and how often?</p>	<p>The wetland “forebays,” which remove the larger suspended solids, will have to be dredged regularly, perhaps annually, depending upon the quantity of materials in the stormwater flowing from a given, particular sub-drainage area. The “forebays” are designed to permit this dredging.</p> <p>Dredging will <u>not</u>, typically, be performed in the “polishing” section of the wetlands – where any remaining, finer particle solids settle – since that would disturb the vegetation in those sections.</p>
<p>Where will the sediments dredged from the ponds be disposed? Can it be re-used?</p>	<p>The sediments dredged from the ponds would be analyzed to determine what materials it contains, and then disposed of based on the findings of those analyses. If the sediment dredged is not classified as toxic or hazardous, it might be sent to a controlled landfill.</p> <p>Potential re-use of the sediments dredged depends on materials (contaminants) found in the analyses. There have been programs elsewhere for recycling these sediments that could be considered in this area.</p>
<p>What would happen if there were no “forebays” in the wetlands?</p>	<p>The suspended solids would deposit as sediment in the treatment wetlands. This would be detrimental to the wetlands in that they would require more frequent dredging and re-establishment of the wetland vegetation and growing medium.</p>
<p>The information sheet regarding the proposed wetlands indicates that there may be more mosquitoes in this area and that fish can be used to control them. What control measures are being contemplated?</p>	<p>Stocking the Ponds with specific species of fish has been used here and elsewhere in the past. Building nesting boxes to attract bats, swallows and Purple Martins has also been successful. Organic larvicides may be used, with caution. The treatment wetland may not cause and actual increase in the number of mosquitoes since ponded water already exists in the West Pond and Grenadier pond.</p>
<p>The approach of adherence to the MOE Guidelines needs to be reconsidered. For example, in a project in the Waterloo area, stormwater has been diverted away from ponds/lakes in sub-divisions, contrary to the MOE Guidelines approach. The ponds/lakes thrived. In contrast, in and around the High Park water bodies and the stream feeding them, over 50% of native species are extirpated or threatened – efforts at restoring historic species have failed. “A lot more water [is] in the ground in an ‘un-natural’ way.” For example, higher soil moisture due to the downspout disconnection programme negatively impacts the Black Oak Savannah formerly found in this area.</p>	<p>A consideration of natural systems would examine the entire span of the City.</p> <p>Historically, this area drained into the ponds. Flow rates have increased due to urbanization. The source control measures and conveyance system modifications recommended for the study area will reduce the volume of runoff. However it must be noted modification to the hydrologic conditions of the area are an unavoidable effect of urbanization.</p>
<p>Why has this other approach – albeit different from the MOE guidelines – not been considered for the ponds in High Park area?</p>	<p>Natural systems change over time. Species historically present may no longer be suitable for, or find suitable habitat conditions in, a given location, even without the impact of urban developments.</p>

Issues/Questions	Response
<p>Not all community residents are in attendance at this meeting. Those folks who could, and did, turn out should, and must, share the information they learn here tonight with their neighbours and friends who were unable to attend, and urge them to attend the walking-tour on Saturday.</p>	<p>2,500 information bulletin was distributed to households in the study area and 250 direct mailing sent to households that responded to January survey questionnaire.</p> <p>Open House hand-out package was sent to all apartment units at the Swansea Village Coop to ensure that they provide comments to the proposed alternatives.</p>
<p>What “structural” solutions have been considered?</p>	<p>Sub-surface tanks, tunnels and small treatment facilities.</p> <p>Constructed wetlands, which are also structural in that they are man-made structures and systems, were also considered.</p>
<p>Has total circumvention – i.e. an approach other than “treatment in the ponds” been considered?</p>	<p>No. We’re dealing with a system of storm sewers that largely mimics the pre-existing water drainage system. If stormwater were entirely diverted, the Ponds would not exist as they are now due to the decreased water flows. In addition: if that ‘solution’ were adopted the diverted runoff may cause new or additional problems in adjacent watersheds.</p>
<p>It is a “noble gesture” to use public lands to address water contamination issues, but isn’t this an abuse of Natural Systems?</p>	<p>Source Controls relating to both quantity and quality issues must be considered and implemented in the areas here and upstream that drain into the Ponds. Otherwise, treatment alternatives, including “natural systems” approaches, cannot solve the Problem. – both Source Control and Treatment (“end-of-pipe”) solutions are required.</p> <p>Different “solutions” are more applicable (or not applicable) in various areas of the City, depending on the built-environment features and stormwater conditions present in each.</p>
<p>Despite substantial expenditure of time and money, “restored” “natural systems” do not survive. (e.g. High Park)</p>	<p>The entire “system” – the “big picture” – needs to be investigated: water flows, and the material carried in them, from areas north of Lake Ontario and north of the City must be investigated and addressed.</p> <p>Natural systems must use plants and designs that can survive urban drainage conditions. The treatment systems, whether natural or not, must be continually monitored and maintained. The pre-development condition can not be replicated.</p>
<p>What is the “vision” for the wetland complex proposed for drainage sub-areas F & G?</p>	<p>A series of shallow and deep zones roughly akin to the Duffins Works Yard is likely. Average water depths would be “shallow” – 0.3 m – 0.4 metres with deep zone.</p>
<p>What measures are proposed to reduce, or avoid, the deposit of sediments in the Ponds?</p>	<p>Reduced use of de-icer material in areas near the Ponds would be beneficial; however, those materials are not the sole source or type of suspended solids that become sediments.</p>

Issues/Questions	Response
<p>Will recommendations regarding types of vegetation and landscaping, lot-level measures and conveyance system modifications be modified in Phase III, and will modelling be performed to evaluate the effectiveness of the proposed recommendation?</p>	<p>General conclusions have been derived regarding where particular measures may, or may not, be applicable. Source control measures have been modelled to determine the expected decrease in runoff volume. (See Section 4).</p> <p>The City considers “exfiltration” conveyance systems to be “experimental.” In addition, there are concerns with exfiltration systems, such as the potential for soil contamination from gasoline spills on a street.</p> <p>Retrofitting existing systems is very expensive, so other approaches are more desirable in the study area. The exfiltration sewer technology has good potential for success in the study area and is recommended for implementation on an experimental basis using a phased incremental approach and should be coordinated with future road or sewer repair work.</p>
<p>Beware that changes in soil moisture content from increased infiltration may damage older trees by affecting their root systems.</p>	<p>This concern has been identified. If exfiltration systems are implemented they should be monitored to determine the effects on the local water table. Replacement of existing sewers will be in a phased approach, which should provide enough time to assess this concern before additional sewers are retrofitted.</p>
<p>There are a number of old landfills in the Study Area. Are their locations known?</p>	<p>The locations of all sites are not precisely known. However, in sections of the Study Area where they are known to be located, infiltration measures for Source Control (to reduce the quantity of storm water reaching the outfalls) are not recommended so that problems with leachate entering the groundwater are avoided.</p>
<p>Catfish (West) Pond was larger before landfill and infill activities in the past. Will this project involve excavations and restoration of the pond to that historical size?</p>	<p>No.</p>
<p>Will there be studies and analyses of the pond sediments to determine the type and levels of contamination?</p>	<p>Some studies have already been conducted and they indicate that a contaminated sediment management plan may be required. Before any work is undertaken in the ponds, a sediment analysis and management plan will be required.</p>
<p>How long have wetlands been used as water quality measures?</p>	<p>Their use for stormwater treatment is relatively recent. The first use of wetlands for treatment of wastewater was in the Yukon in 1965.</p>
<p>Has consideration been given to a series of “stepped” ponds rather than a channel running southward from the HP7 outfall?</p>	<p>Yes. This would require removal of greater amounts of vegetation. In addition a stepped pond approach is less desirable for treatment efficiency and for maintenance of the treatment wetlands.</p>
<p>Botanical systems change over time through “succession”. What is the projected lifetime of the proposed wetlands in terms of the form built and the species initially planted?</p>	<p>The species planted will be a mixture of many native wetland species including cattails (<i>Typha sp.</i>), bulrushes (<i>Scirpus sp.</i>) and rushes (<i>Juncus sp.</i>). These species will continue to dominate the wetlands. The lifespan of the wetland will be many years to decades depending on the sediment accumulation rate. Periodic maintenance and restoration of the wetland vegetation will be required.</p>

Issues/Questions	Response
What are the storm water volumes in the Study Area during wet weather events?	Details of expected annual runoff volumes are given in Sections 3 and 4 of this ESR. Actual volume of runoff varies from storm to storm.
Make sure you account for water flows from the playing field area (in Rennie Park), and divert them to the facilities proposed for the HP7 outfall.	This volume has been accounted for in the preliminary designs presented in this ESR.
Grenadier Pond was a TRCA test site for evaluating beetles as a means of controlling the spread of Purple Loosestrife (<i>Lythrum salicaria</i>).	
Why are wetlands and the other suggested measures being proposed instead of just sending the storm water to the Western Beaches Tunnel?	The proposed measures provide upstream benefits (e.g., improvements to the quality of the wetlands and pond) that the tunnel does not provide. In addition, treatment wetlands are considered "natural treatment" technologies, while the tunnel is not. The plants in treatment wetlands also provide greater contaminant removal than the tunnel alternative. (A comparison of the recommended alternative – source controls and wetlands – with the tunnel alternative is provided in section 6.
HP7 - What is the proximity of the forebay to the Rennie Park skating rink?	90 metres (295 ft).
What kind of work is involved with the HP7 "channel restoration"?	Meandering brook with river-stone bottom, and woodland species planted along the edges. Some deep pools may be incorporated. In short, natural channel design for energy dissipation and erosion control.
Where is the proposed maintenance access to the sediment forebay, the existing pathway?	The maintenance route would be across the open dog walk area then down the slope probably south of the existing pathway. Details will be confirmed at the detailed design stage.
HP8 - Where will be the access to maintain the "oil & grit separator" from Coe Hill Drive?	The separator will be immediately adjacent to the road.
How often do you maintain the "oil and grit separator"?	Propose twice a year, subject to operating conditions.
At what level will the maintenance of the "oil and grit separator" be, i.e. ground level or under water/underground?	Maintenance will be by vacuum truck from above ground.
Is budget set aside for the construction in 2001 Capital Budget?	The amount for construction of wetlands is requested for the 2001 capital budget.

Along with receiving copies of the Phase 1 and 2 draft reports, the Steering Committee received copies of the Draft Environmental Study Report (ESR) in February 2001. Comments were received on the report in June 2001, and have been incorporated and addressed in this final report. The comments received on the draft ESR are also listed in Table 9.3, along with the City and consultant's responses to comments.

9.4 Future Consultation Activities

The City of Toronto will present the findings from this ESR to City Council for final approval. The ESR will then be filed by the City for a least a 30-day public review period as

required as part of the Class EA process. If concerns are raised during the 30-day review period that can not be resolved, the person/party with the concern may request the Minister of the Environment to order the project to comply with Part II of Ontario's Environmental Assessment Act. Part II of the EA Act deals with Individual Environmental Assessments.

A copy of the Notice of Completion for this ESR is provided at the front of the document, along with information on requesting and granting Part II Orders (i.e. requests to complete Individual Environmental Assessments).

TABLE 9.3
COMMENTS FROM STEERING COMMITTEE ON DRAFT ESR AND RESPONSES

Issue	Response
General	
<p>In Section 1, 2 and 3, the consultants have done a thorough and excellent job of introduction, problem definition and description of existing conditions.</p>	
<p>There are several times when Colborne was written with a "u". Mainly in meetings, headings and sometimes in text. Needs an extra check for those errors that I have not marked.</p>	<p>This has been corrected throughout the ESR.</p>
<p>This report needs a 1 or 2 page commissioner's summary; it also needs a few paragraphs to support this summary, showing the page in this report.</p>	<p>An Executive Summary is provided as part of the ESR.</p>
<p>I (Karey Shinn) do not agree with the comparisons made to the 'Tunnel' alternative, nor was this ever discussed at any of our Steering Committee meetings. It is not acceptable that this option suddenly appears as an 'alternative'. When neither the old Sewer System Master Plan, or The Western Beaches Storage Tunnel ever separated out any component data for these separate drainage areas, (it was only ever mixed in with total statistics for the whole west end, and only water quality at the end of the outfalls was considered). The Western Beaches Storage Tunnel does nothing to improve water quality in the West ponds, Grenadier Pond, or Outfall H1 that discharges to the mouth of the Humber.</p>	<p>The tunnel is a feasible alternative for controlling stormwater in the study area, and therefore must be considered as part of the Class EA process. In addition, the Request for Proposal (RFP) for this assignment called for an assessment of the tunnel alternative.</p>
<p>What is the status of the Environmental Task Force request (page 4-6) that all City Agencies, Boards and Commissions have plans to ban pesticides by the year 2000?</p>	<p>The City's EP (Environmental Plan) Section 5.1 (7) eliminates the use of pesticides.</p>
<p>Although both areas A and E could have a 50% (or more) downspout disconnection component, it was not stated:</p> <ul style="list-style-type: none"> • How many households • What size of lot • No unit cost was given, per downspout disconnect • If in fact the run-off from most rainfall events would be retained on the properties and not flow into the street storm drains. • If any change in the groundwater levels would result from downspout disconnection, would any of these properties threaten oak trees that form a remnant of the original oak 	<p>CH2M HILL Canada Limited developed a model to assist in the assessment of the quantitative impacts of source control in the study area. In the modelling exercise, assumptions were made regarding number of households, lot sizes and unit costs of various lot level controls, as well as infiltration rates, percent impervious, soil conditions, etc. Details on the model are provided in Section 4.3, and in Appendix C.</p> <p>It is not expected that groundwater level changes</p>

Issue	Response
<p>General</p> <p>Savannah? If so they should be identified. (This would respond to this concern from a member of the public and the on-going work in High Park to restore indigenous trees.)</p> <ul style="list-style-type: none"> If these large properties do retain most flows on their properties then there should be some corresponding reduction in the flows entering the West Pond, erosion effects etc. I did not see this benefit anywhere. <p>It was not clear how the 18-24% reduction in volume was arrived at. It would seem that a larger reduction would result, given the large number of residential units in favourable soil conditions, and should be more in areas A and E than others. This was not broken out. If these numbers were broken out perhaps it would result in even greater effectiveness at the top and middle of the West Pond. Area A for example is 36 ha! (NOTE: If the above information were available it would be possible to promote this area as a target area, in the ongoing City downspout disconnect program. This document needs to focus on what results we can achieve in the most practical way.)</p>	<p>as a result of source controls will threaten the oak Savannah (i.e. the Savannah was there before development).</p> <p>Increasing infiltration will decrease runoff into street storm drains and through outfalls to receiving waters.</p> <p>The impacts of source control in this study area have been estimated through this Class EA. The City is currently undertaken the Wet Weather Flow Management Master Plan, which is estimating the impacts of source on a City-wide basis, and will help determine priority areas for source control efforts in the City.</p>
<p>Because salt and salt borne chemicals were very high in the area, it was not clear how much of the pollution problem changes from winter to summer sources. Is there some way to forecast what percent reduction in salt use would bring the Ponds below 'effect level' for fish?</p>	<p>Most of the salt and salt borne chemicals would enter receiving waters during spring melt periods. The purpose of this Class EA was to identify preferred stormwater management options for reducing flows and contaminants entering the pond, and not specifically to forecast how percent reduction in salt use would affect the pond ecosystem. However, It may be possible to develop a model, which simulates the environment of the pond system and the impacts of salt loadings on the system. The model would require information on the existing salt loads in the pond and sediments, the rate of dilution and settling, and the amount of salt entering the pond over time. The University of Toronto has completed studies on the contaminants in the Pond, and could possibly develop such a model.</p>
<p>On page 9-1 my name is spelled wrong. My name is Karey, not Karen.</p>	<p>Corrected in the ESR.</p>
<p>Costs: Comparisons to the Western Beaches Tunnel are not documented in a way that comparisons are possible. For example: in the Western Beaches Storage Tunnel ESR, 1993, it was assumed that because the City was undertaking a downspout disconnection program, that the size and therefore cost of the tunnel would be less.</p> <p>In this current ESR the assumption is that the downspout disconnections would be a substantial part of the cost of the preferred alternative. If this is the case, the Western Beaches Tunnel would need to show more capital cost.</p>	<p>The cost comparison in Section 6.5 only takes into account capital costs of treatment alternatives. Costs of source controls are not included in the totals.</p> <p>The capital costs of the tunnel and the capital costs of the preferred alternatives (i.e. wetlands) documented in this ESR are comparable; approximately \$2 million.</p>

Issue	Response
General	
<p>Given that there is no sanitary flow in this portion of the western area, there is no bacterial advantage to sending these flows anywhere. Only fecal coliform is use to determine beach closing and neither proposal addresses goose nor any other animal bacteria south of the Lakeshore.</p>	<p>Stormwater also has a bacterial load that contributes to beach closures. Sources of the load are from geese and other animals. The bacteria loads that runoff directly into the lake south of Lakeshore Boulevard from these sources can be controlled somewhat by continuing to enforce pet by-laws (as mentioned in the ESR), and also make the area less attractive to geese. Signs should be posted that discourage people from feeding the geese. Landscaping the park with more shrubs, trees and long grass could also help.</p>
<p>This current Ellis and Colborne Lodge Drive study includes treatment for Outfall H1, that is not captured in the Western Beaches ESR, maps show the study area ends at the bottom of Coe Hill Drive and does not go east of that point either. This means that the preferred alternative with this current ESR is not only better at meeting the study objective, but also treats more of the shoreline and near shore water.</p>	<p>The Western Beaches ESR did not consider treatment of overflows from Outfall H1, while this ESR does. However, the Western Beaches ESR was only one component of the larger “Sewer System Master Plan” study undertaken by the old City of Toronto. Overflows from outfall H1 were considered in this Master Plan study, as well as methods of controlling CSO and stormwater throughout the old City of Toronto.</p>
<p>This ESR also provides a Preferred Alternative that is more in keeping with the principle of ‘sustainability’ that the City has adopted, in that it provides ongoing benefits for more water and waterfront uses while at the same time incorporating other City initiatives such as salt reduction, habitat restoration, restoration of indigenous species, and managing water as a resource through rain barrels, and improving water quality in fishing areas in Grenadier Pond. (Some people do eat the fish)</p>	<p>Agreed.</p>
<p>There was no recommendation that the City should develop a manual to assist residents and lot owners to develop pervious areas and storm water gardens to retain rainwater and improve their properties. This also helps the City to reduce CO2 emissions when trees and plants are living longer with adequate infiltration. Durham Region has a comprehensive Storm Water Gardening Manual. A more concise manual for urban use is ‘How Does Your Garden grow?’. A Reference Guide to enhancing your rain Garden put out by Prince George County Maryland, USA.</p>	<p>The City has discussed the development of a manual to assist residents and lot owners to develop pervious areas and stormwater gardens to retain rainwater and improve their properties. It was agreed that this would be a useful reference guide for property owners.</p>
<p>(Section 3) This section makes it very clear that sediments in both the West Pond and Grenadier are in serious need for sediment management plans for excessive amounts of toxic pollutants. IN 1994, Dillon Consulting did an Environmental Study Report, Grenadier Pond Sedimentation Control Facility, for the former City of Toronto Works and the Environment Department. This study included an even greater number of toxic pollutants in Grenadier Pond. For example: Cyanide Cobalt and Silver were at or many times above the ‘effects’ level for fish, as was ‘oil and grit’.</p>	<p>Agreed.</p>

Issue	Response
General	
<p>Given that this current study identifies that fish live their entire lives in these ponds, (no dilution from Lake Ontario), the only hope of restoring these habitat areas is by carrying out the preferred alternatives, PLUS, emphasizing the need to address the existing build-up of contaminated sediments. In the case of Grenadier Pond, some work has already been done on a Sediment Management Plan, but the job is not likely to get anywhere so long as road salt and road pollution are continually entering West Pond, and then also overflowing into Grenadier Pond. This project should be noted to assist in the efforts the City is undertaking to clean up Grenadier Pond and enhance this well used park area.</p>	
<p>Was the budget for this project included in the 2001 Works Budget as reported in the ESR?</p> <p>Recommendation: the City proceeds with this project if in fact the budget has been allocated. This would capitalize on the momentum that this project has already developed recently and complete the soon operational Western Beaches Project.</p>	<p>Budget has been allocated for this project.</p>
<p>The description of the preferred alternatives for source control is not very detailed. For example, if we had a dollar for every time it has been recommended to "increase enforcement of stoop and scoop bylaws" we might actually be able to hire another by-law officer to follow dog walkers around. Seriously though, who will be recommending a practical way to implement the source control measures? The consultant has provided targets and costs, but hasn't come to grips with how we will get property owners to agree to do this work.</p>	<p>The ESR recommends the City consider enhancement of public consultation programs in the study area to encourage homeowners to disconnect roofs, increase pervious area, and consider alternative landscaping techniques. The ESR also recommends that the City enhance their enforcement efforts relating to stoop and scoop bylaws, and reduce salt use. The Wet Weather Flow Management Plan will help to identify priority areas for source control on a City-wide basis.</p>
<p>The Authority's policies related to infrastructure and Servicing in relation to Valley and Stream Corridors are outlined in Section 4.3 of the Authority's Valley an Stream Corridor Management Program (VSCMP), which has been enclosed for your information. Generally, infrastructure and servicing should be located and designed to:</p> <ul style="list-style-type: none"> • Prevent impacts associated with flooding, erosion or slope stability; • Protect and rehabilitate existing landforms, features and functions; <p>Provide for aquatic, terrestrial and human access.</p>	<p>The design of the wetlands will ensure that impacts on valley and stream corridors are mitigated. The designs will meet Conservation Authority requirements.</p>
<p>Please note that any work in the watercourses or works which may have a reasonable potential to impact on fisheries habitat would be reviewed pursuant to our Level 3 fish habitat agreement with the Federal Department of Fisheries and Oceans (DFO). Authority staff would coordinate with DFO any requirement for authorization or compensation.</p>	<p>The City will work with TRCA, MNR and DFO during the design stage to identify if any authorization or compensation under the Fisheries Act is required. (Based on experience, It is expected that the works will improve fish habitats).</p>

Issue	Response
General	
<p>In accordance with the Authority's Fill, Construction and Alteration to Waterways Regulation (Ontario Regulation, 158) a permit would be required prior to any of the following works taking place:</p> <ul style="list-style-type: none"> • Construction of any building or structure within a floodplain or swamp; • Placement of fill including site grading within a regulated area; <p>Alteration in any way of the channel of a watercourse.</p>	Noted.
<p>While the aquatic conditions in both Grenadier Pond and West Pond are highly degraded, and fish species are isolated, they nonetheless provide habitat. As such, the proposed works will result in a Harmful Alteration Destruction or Disruption (HADD) of Fish habitat and require DFO authorization under the Federal Fisheries Act.</p>	<p>Based on experience, the preferred alternatives will likely improve fish habitats. However, the City will consult with TRCA, MNR and DFO during design and construction to ensure impacts on fish are mitigated, and appropriate permits are received.</p>
<p>The proposed in-water works should conform to warm water construction timing guidelines (i.e. limited to the period between July 1 to march 31).</p>	<p>The in-water construction period will be identified through consultations with TRCA, and selected to avoid possible fish spawning and nursing periods.</p>
<p>We support the analysis of the pond sediment prior to construction and look forward to reviewing the sediment management plan. The plan should be designed so as to protect not only in-situ but also to avoid any impacts to downstream aquatic fauna and flora.</p>	<p>City has agreed to this.</p>

Issue	Response
Specific Comments	
<p>Section 4 has listed all of the source control alternatives discussed at our meetings. In section 4.2.4 I suggest that specific mention of establishment and expansion of wetlands in the drainage area which would reinforce the section 3.3.2 City of Toronto policies.</p>	<p>Noted in Section 4.2.4.</p>
<p>Section 6.2.2 addresses the subject of constructed wetlands raised in the pervious paragraph covering section 4. Again section 6 covers all of the drainage areas' treatment alternatives covered in our meeting</p>	<p>Noted.</p>
<p>Section 6.3.3 alternatives to treat storm water from drainage areas F and G should address the potential use of outfall W12 on the Stelco Lands in view of the proposed condominium development in this property. Secondly, our previous recommendation for wetland development on the south shore of Grenadier Pond should be kept in mind. This development would mesh with city initiatives for shoreline restoration.</p>	<p>Noted.</p>

Issue	Response
<p>Specific Comments</p> <p>The comparison of treatment alternatives to the Western Beaches Storage Tunnel in section 6.5 was appropriate and opens up the obvious question. Is natural treatment technology worth up to \$700,000 over connecting with the storm tunnel?</p>	<p>Although the preferred alternative in this ESR may be slightly more than connecting to the Western Beaches Storage Tunnel, it does not meet the evaluation criteria of being a “natural treatment technology or non-structural solution”. In addition, the preferred alternative in this ESR includes treatment of overflows to the Humber River at outfall H1 and treatment of upstream flows in the West Pond, which the Western Beaches Storage Tunnel ESR did not.</p>
<p>This book has page 11(two) of its contents missing. Please check how the numbering fits the final report.</p>	<p>Corrected in ESR.</p>
<p>Page 3-8.</p> <p>a) The Grenadier and West Ponds have been influenced by the high content of Na ions and Cl ions compared to Lake Ontario and other nearby smaller lakes.</p> <p>b) This heavier solution does not mix with the lighter solution (water), this bottom layer is anaerobic (no oxygen) and will not support fish life.</p> <p>c) The secchi depth, indicating the settled mud level has risen, as the ponds have not been dredged for some years (give the geological definition for “secchi level”).</p>	<p>a) If a wetland is constructed in the West Pond, it too will be influenced by salt laden runoff from local streets. Alternate de-icers will reduce the impact. The wetland contaminant reduction capability of salts is minimal, and will not affect these levels in the Pond.</p> <p>b) The anoxic layer in the West Pond will remain until salt use is reduced and or the West Pond is dredged and flushed. Note that the wetland construction is to provide water quality improvement for parameters other than salts. Addressing the fish habitat component in the West Pond is a much larger issue.</p> <p>c) A secchi disc provides a visual measurement of the depth of the water clarity. The disc is 300 mm in diameter and divided into quadrants with alternating quadrants painted black and white. The process is to lower the disc into the water until it is no longer visible. This provides a measure of turbidity in the water (water clarity), but does not necessarily correspond to the sludge level in the Pond.</p>
<p>Page 9-8 Hurricane Hazel was significant in 1956 (did it damage this area of High Park?) Local rainfall was (mm) A hundred year storm is defined as (mm Rain) This 11-12 May 2000 storm was (mm) in this area; it was a 25 year storm. It is known to affect the municipal water supply at Walkerton.</p>	<p>We do not know the extent of damage to High Park during Hurricane Hazel. Hurricane Hazel was an extreme event, and therefore is not considered when estimating return periods for storm events. There has been no return period assigned to Hurricane Hazel. However, it is known to be larger than the 100-year storm event in some areas of Toronto.</p> <p>Environment Canada statistics for the : May 11 – 13, 2000 for the comparison – 50% of 1953 storm (May 11, 2:00 am to May 13, 8:00 am) - 70.6 mm measured at University of Toronto - 75.2 mm measured at Toronto, North York</p>

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It should be noted on page 4-22 Section 4.4, that the City is planning to increase public consultation and awareness etc. in the Wet Weather Flow Management Master Plan, and this is not any additional cost to this study area, but in fact will be a part of on-going work to reduce storm water problems throughout the City.	Page 4-22 reworded to convey this fact.
P3-4- Para 6: Is the ground water flow into West Pond based on Gartner Lee work. Source of this information should be referenced.	Yes, referenced in the ESR.
P3-8-3 rd Bullet: In second sentence should read "The Pond"?	Corrected in ESR.
P3-16 Para 3: The representative year should be identified i.e., 1980?	Agreed. The representative year is 1980.
Table 4 –1: Street Sweeping Recommendations - Does "Improve water quality of West Pond and other receiving water bodies" belong here - should it not be under "Pros". Pesticide/Herbicides - Under "Pros" - do downstream treatment facilities exist?	Agreed. Table changed to reflect comments.
P4-5- Sec 4.1.5 - 3rd line - "pollutants that are allowed in water" - we should not be stating that pollutants are allowed in water. 4th line - should read "sewer use by-law" not " <u>storm</u> sewer use by-law"	Agreed. ESR changed to reflect comments.
P4-6: States that "the function of downstream treatment facilities and wetland will improve". At this stage in the EA process - Accessing source controls, there are no downstream treatment facilities.	Agreed. ESR changed to reflect comments.
Table 4-2: Porous Pavement, Roof Top Storage and Green Roofs Opportunities - "experimental basis" is recommended. Is there not enough information on these measure to be able to implement them where there is an opportunity without the need to be experimental.	Agreed. ESR changed to reflect comments.
P4-17-Section 4.2.5- Although retrofitting existing facilities may be difficult are there any opportunities in the study area?	Opportunities for retrofitting existing rooftops are limited because there are few flat roofs and buildings tend to be older. We concluded in the ESR that landscaping techniques on large apartment building lots would be more effective than retrofitting the roofs of the buildings that were not designed for stormwater storage. To store water in parking lots requires large parking lot areas with excess space. The large parking areas in the study area are at the apartments, school and arena, none of which are suitable for a

Issue	Response
<i>Specific Comments</i>	retrofit.
P 4-17 - Section 4.2.6 - 2nd para - "It is unlikely that many residents would construct infiltration facilities". How do we know? We should not speculate!	<p>Only through a detailed survey will we know how many residents in Toronto will construct infiltration facilities. City funding will be an important factor in whether or not individuals will implement infiltration facilities. The public consultation program being undertaken as part of the Wet Weather Flow Management Plan process will help identify uptakes with respect to source controls.</p> <p>This is clarified in the ESR.</p>
P4-18 - 2 nd para - What watercourse in Rennie Park is being protected to Level 2?	The watercourse from HP7 to the West Pond.
P4-19 - "The model assumes" in first bullet. What is the basis for assuming 10%?	<p>As identified in the ESR, this was an assumption based on the results of previous studies and expert judgement. It was presented to the Steering Committee and the public, and no comments were received with respect to the assumption.</p>
<p>P4-22 - Sections 4.4 - Street Cleaning - Are you recommending purchasing more up-to-date equipment. Is this cost effective?</p> <p>-Cisterns or tanks and reduction of impervious areas on public lands not discussed in section 4.3.</p>	<p>At the end of the useful life the existing street cleaning equipment, we are recommending that the City purchase more up-to-date equipment. Storage opportunity section has been incorporated in ESR.</p>
P.5-2 - Last sentence - "cannot resolve all of the storm water quality issues..." it doesn't have to, only contribute to.	Agreed. ESR changed to reflect comment.
P6-2-Section 6.2.2 - Constructed wetlands are not being implemented to provide fish and wildlife habitats - they are storm water treatment facilities.	Agreed. However, wildlife habitat is an ancillary benefit in the same way that increased public enjoyment potential is.
<p>P6-2-Section 6.2.6 - last line - just because there are no installations in Canada doesn't mean their performance is unknown. The performance is described in the above sections. Same for Section 6.2.7.</p>	<p>There have been some installations in Canada. They are similar to oil and grit separators, but can be designed to achieve higher levels of treatment. However, they tend to be more costly and require more maintenance.</p> <p>The ESR has been changed to reflect the above.</p>
P6-4-Section 6.2.9 – "Grassed swales are not as effective for removal of suspended sediments as other treatment alternative" - What or where is the basis for this statement described.	The effectiveness of all treatment methods, depend on the quantity and quality of stormwater being treated, the design of the treatment facility and how well the facility is maintained (e.g. cleaned). Grass swales must be cleaned regularly to maintain their effectiveness. As a result they are generally not as effective at removal of suspended solids as treatment methods, such as wetlands.
P6-45 -Section 6.4.5 - 2nd Para- States that floatable control should be provided for outfall W12 as these flows bypass the wetland. Is floatable control being implemented at the	W12 is the only location where there is no other form of treatment. All other locations will contain treatment where floatables control is already

Issue	Response
Specific Comments	
other outfalls where wetlands are proposed? The other wetlands facilities will also have by-pass flow.	incorporated. For instance the wetland treatment systems will incorporate floatable control into the design. Bar screens combined with subsurface discharge is one option.
P8-2-Section 8.1.4, 1st Para - At end of 2nd sentence add "Therefore treatment of storm water discharge that will remain following the implementation of the recommended source controls is required in the Study Area to meet the study objectives.	Agreed. ESR changed to reflect the comment.
P8-3 -1 st line - Should "with the improvement expected " be "without the improvement expected"?	Yes. ESR changed to reflect the comment.
P.8-3-Section 8.1.5, - 1st paragraph - The wetlands are being constructed as treatment facilities, not habitat facilities - any reference should be removed in the document. Same for Sections 8.1.7, 8.1.8, 8.1.10	Agreed – paragraph should exclude the sentences “A variety of organisms...nutrients back into the ecosystem.” Wildlife habitat creation is an ancillary benefit but not the design focus.
P8-4-Sect 8.1.6 - How can you recommend an oil and grit separator if you do not know what performance will be achieved. What size is required?	<p>The facility will be underground, approximately 10 to 15 feet in diameter. The performance of the oil and grit separators varies with the size of the storms. The oil and grit separators are most effective for smaller storm events.</p> <p>Facility will be design for with a storm peak flow rate of 248 l/s. An oil and grit separator is recommended at outfall HP8 because it is not cost effective to construct a treatment wetland in that location due to space constraints. Therefore, an oil and grit separator alone was recommended. It is recognized that it may not achieve 70% removal. However, the wetland at outfall HP7 can be made larger to achieve 80%; thereby ensuring that at least 70% is achieved for the entire West Pond. This was described in the EA, incorporated into the preliminary conceptual design of the wetland at outfall HP7, and also presented to the Steering Committee.</p> <p>Appendix D: HP8 shows wetland depth/size while it should be oil/grit separator.</p>
P8-5-Sect 8.1.8 - Permanent pool volume required should be 50 m ³ /ha, not 90 m ³ /ha.	<p>This wetland discharges to the Humber River and thus requires Level 1 protection (80%), as indicated in the ESR. The other wetlands require Level 2 protection.</p> <p>Based on Level 1 protection (80%) and 77% imperviousness, the value should be 90 m³/ha as stated.</p>
P8-5-Sect 8.1.10 - Preferred alternatives states there are two wetlands. Figure 8-4 shows only one wetland. Are there two or one?	One. Corrected in ESR.

Issue	Response
Specific Comments	
P8-11 - Sect 8.2.2, 8.3.2 - Why are exfiltration sewer systems being recommended on an experimental basis? Do existing facilities in the city not provide sufficient performance information?	Should be recommended when sewers need replacing. Corrected in ESR.
P8-8- Sect 8.4.1. -1st sentence- "The majority of source control initiatives have no adverse environmental impact." This needs to be quantified. There are usually no adverse impacts because they are not implemented where adverse environmental impacts would occur, i.e., flooding of property, removal of trees to install infiltrative basin, etc.	The potential for environmental impacts of source controls are outlined in the final ESR.

Issue	Response
Design	
HP7 and HP8: While we support the initiatives at the HP7 and HP8 outfalls, we are concerned that the preferred alternatives are not being considered in the context of a larger rehabilitation strategy for the pond system. We have completed similar work, and have a similar strategy in-place for Grenadier Pond (Proposals for the Rehabilitation of Grenadier Pond, Wendigo Creek and Associated Wetlands, Gartner Lee Ltd, June 1995). As the preferred design alternatives are refined, we would like to request that your consultants identify any future work or studies necessary for the formulation of an overall West Pond rehabilitation strategy.	We agree that this is the preferred approach. However, currently, our mandate is for stormwater quality improvement and to incorporate a rehabilitation strategy is outside the scope of this project. We could, however, add this to a list of recommended components that could be included in the design scope so that other options for dealing with the existing sediment, besides covering it with a geotextile and adding 300 mm of soil/sand for the plantings, are reviewed. The approach we have recommended was done so since we have had success with this method at the Lower Duck Pond project.
HP5: Our Department has put a great deal of effort into the rehabilitation of Grenadier Pond in recent years. If there are any options that might allow us to bypass Grenadier Pond entirely at HP5, they should be explored. I understand that the division of HP5 into West Pond was considered as an option, and then screened-out due to issues of flooding. If there is an option that connects the outfall from Area D directly to the system in Area E, bypassing the pond entirely, it should be explored or screened-out if it hasn't been already.	The HP5 option includes grit control in the sediment forebay. Diversion of the Area D flow to Area E will add to the hydraulic load of the proposed wetland for Areas E, F, and G. The footprint of this facility is already taking up most of the space available for a wetland. Diverting flow to this wetland from Area D will increase the bypass volume to W12.
As with the other preferred alternatives, the detailed design work at HP5 must ensure any treatment wetland is well integrated with the existing pond shoreline) grading, planting, channel restoration etc). In general, the use of pre-treatment facilities, such as oil and grit separators, are preferable so that we can ensure the treatment wetlands and ponds themselves are of the best possible quality.	Under the proposed treatment strategy, flow from Area D will be treated to a higher quality than what currently enters Grenadier Pond and will provide water quality improvement rather than degradation.
HP1: In the HP1 area, our staff are presently working with WES staffs to identify potential pedestrian/bicycle trail connections and prepare landscape restoration plans for the area. While we support the establishment of a treatment facility at this location, we would like to ensure that all	Agreed.

Issue	Response
<p>Design</p> <p>initiatives are looked at collectively as you move into the detailed design stage of your process. The preferred alternative for this site should be integrated in a manner which adds to the quality of the parkland.</p>	
<p>General: Our staff (Parks and Recreation Planning) should be involved as you move into the detailed phase of your process, for all areas. This includes input into, among other things the following:</p> <p>The layout and detailed of proposals (forebay & channel work, grading, planting).</p> <p>The development of a maintenance plan for the proposed facilities, to include timing, monitoring, staff responsibilities etc.</p> <p>Any planting and the re-establishment of plant communities within and adjacent to the areas impacted by the proposals.</p> <p>The establishment of service access points and routes.</p> <p>The establishment of appropriate access and trail connections for pedestrians.</p>	<p>Agreed.</p>
<p>Provide design/implementation guidelines and criteria, although the sizes of the wetlands are provided in terms of a volume and conceptual plans, other guidelines and criteria such as depths, grades, berm heights and evaluations, water levels, typical cross-sections, etc..., are required. When you consider all the requirements for design criteria, Parks, TRCA, Roads, Utilities, etc., will the wet lands fit the sites identified? i.e., HP1, W11 and W12. Have flood levels in the Humber River been accounted for? setbacks?</p> <p>In Section 8 for the proposed wetlands, it states that features of the preferred alternative include channel improvements, walkways, and other park amenities. This section should be expanded to provide more detail.</p>	<p>In developing preliminary design concepts sewer use maps, utility maps, and flood plain locations were considered. All agencies as required through the Class EA process have also been made aware of the study (e.g. MOE, TRCA). The Public Communication Section of Works and Emergency Services Division of the City of Toronto has also ensured that appropriate departments/divisions within the City have been kept informed (e.g. Planning, Parks, Roads). For instance, City Parks is part of the Steering Committee.</p> <p>Based on the detailed review of maps and land uses, and input from agencies the wetlands will fit in the sites identified. Specific sizing and design criteria for the preliminary design concepts will be developed at the design stage of this study.</p>
<p>A landscaping and planting strategy, i.e., guidelines and criteria is required.</p>	<p>Further details on the preferred alternative preliminary design concepts are provided in the ESR.</p>
<p>All site constraints must be identified such as utilities, structures, roads and highways, natural features and parks and mitigative measures addressed. For example:</p>	<p>Potential site constraints for the different projects identified as part of the preferred alternative are described in the ESR. Future plans for such initiatives as the plans for the waterfront and restoration plans for the Grenadier pond are in the process of being developed, and are not finalized.</p>
<p>Section 7.3 (outfall HP5) states "detailed designs that are developed in the future must take into consideration the restoration plans for Grenadier Pond." What do these plans entail and how will they be impacted by the proposed wetland?</p>	<p>At the detailed design stage the City must continue to work to ensure that the wetland designs are in keeping with the other ongoing initiatives in the study area.</p>

Issue	Response
Design	
<p>Section 7.5 (outfall H1) states "detail designs that are developed in the future must take into account City Parks....plans for this area of the waterfront." Again, what do these plans entail and how will they impact the proposed wetland?</p> <p>For outfall W12 are there any constraints or site requirement regarding implementation of the screening facility?</p> <p>For outfall W11 what are the constraints due to Colborne Lodge Drive, the Gardiner Expressway, the Queensway, and Lakeshore Boulevard as well as the Lakefront must be considered in the design, construction and maintenance of the proposed wetlands? These must be identified.</p>	
<p>Annual operating and maintenance costs must be provided in addition to the capital costs.</p>	<p>O&M costs depend on a range of factors including frequency of cleaning forebays, debris accumulation in inflow and outflow structures, controls required for burrowing mammals, etc. Current data is insufficient to provide any level of detail. However, typical costs from Kadlec and Knight text "Treatment Wetlands" has figures that range from \$5000 to \$50,000/year for larger systems (p.635).</p>
<p>As the Environmental Study Report contains a Preliminary Design the document will have to be signed by a Professional Engineer.</p>	<p>Since preliminary designs generally change somewhat at the design stage (and do not cover all specific details), the Professional Engineers of Ontario (PEO) requires only final designs to be stamped.</p>
<p>A Monitoring Program to monitor the effectiveness of the preferred system which outlines monitoring objectives, a monitoring approach and monitoring requirements (data, locations, equipment, frequency, etc.) is required.</p>	<p>Agreed that this will be required at the design stage. Considerations for developing such a program are outlined in this ESR.</p>
<p>A maintenance report is also required that addresses the requirements and maintenance schedules, access for maintenance and sediments disposal.</p>	<p>This will be covered in the O&M manual that will be produced during the subsequent phases of this project.</p>
<p>Identify activities required before or during the detailed design phase, eg., data needs, agency/private contacts, easement/property acquisition, approvals required, etc.</p>	<p>Activities that are required during the detailed design stage are summarized in the ESR.</p>
<p>Wetland Pond at the Humber River –</p> <p>The Transportation Services and Technical Services Divisions of WES, and Parks & Recreation Planning Division of EDCT</p>	<p>Agreed.</p>

Issue	Response
Design	
<p>will soon be jointly undertaking design activities for site restoration including cycling and pedestrian facilities in the vicinity of the new Gardiner Expressway and Lake Shore Boulevard bridges across the Humber River. Included in this work will be a review of cycling/pedestrian paths on both sides of the river south of Lake Shore Boulevard to provide connectivity between the waterfront and Humber River trail networks. The attached plan of Outfall H1 shows the creation of a new wetland pond in part of this area, on the east side of the Humber River south of Lake Shore Boulevard. Any work addressing new wetland pond concepts in this area should be coordinated with this upcoming Humber Bridges site restoration work. The design for site restoration is expected to commence in November 2000 and be completed in early 2001. It will be managed by the Structures & Expressways Design & Construction group of the Technical Services Division (Dave Mitchelson, Senior Engineer).</p>	
<p>Wetland Pond between Lake Shore Boulevard and the Gardiner Expressway at Colborne Lodge Drive:</p>	<p>The wetland is not intended to affect traffic lanes. The wetland is to be constructed within the existing grassed footprint.</p>
<p>The attached plan of Outfall W11 shows a new guard rail separating westbound Lake Shore Boulevard traffic and the wetland pond. It is not clear whether the guard rail is proposed to be located within the existing westbound curb lane, or to the north of it. Lake Shore Boulevard at this location operates as a 3-lane roadway in each direction. If it is intended that the existing traffic lanes will be affected, District 1 Traffic Operations unit (Jacqueline White, Manager) must be consulted.</p>	
<p>Drainage Areas A and C: Outfall HP7:</p>	<p>An inventory of the vegetation in the area was undertaken in the Class EA, and results and mitigation measures described in this ESR.</p>
<p>The preferred alternative is a wetland located within the north and of the West Pond. The report refers to the removal of vegetation. We would be looking for a precise inventory of the quantity and quality of vegetation proposed for removal, particularly since Section 3.1.4 states that 'several massive oak trees' are found in this general area and that 'oak trees of such size should be considered regionally is significant'. This may not be an issue since the report also states that the 'forest floor is relatively disturbed', however details are required.</p>	
<p>The report further states that the west slopes and bottom land of the ravine north of the west pond 'are remaining examples of natural seepage wetlands in the Toronto area...(and that) these areas should therefore be studied in greater at a time when sedges are identifiable'.</p>	
<p>We support the reference in Figure 7-2 to 'channel restoration' since the existing channel is gabion-lined. However, additional information is required to evaluate fully the implications of this proposal.</p>	
<p>Drainage Area B: Outfall HP8:</p>	<p>The oil and grit separator can be located as to not impact vegetation (i.e. in the road allowance if space is available)/</p>
<p>The preferred alternative: Oil and Grit Separation is</p>	

Issue	Response
<p>Design</p> <p>acceptable, although we would be looking for assurance that this will not result in the loss of any significant vegetation.</p> <p>Drainage Area D: Outfall HP5:</p> <p>The preferred alternative is a treatment wetland located at the southwest corner of Grenadier Pond. There is an existing wetland in this area and the 'Storm water Management Practices Planning and Design Manual' (1994) does not support the use of natural wetlands for storm water management purposes. At the very least, details are required regarding existing conditions and vegetation at this location to evaluate fully the implication of this proposal.</p> <p>Drainage Areas E, F and G:</p> <p>The preferred alternative is a treatment wetland located adjacent to the Humber River, south of Lakeshore Boulevard. As noted in the report, this proposal should be coordinated with City efforts to preserve the natural characteristics of lakefront.</p> <p>The proposed wetland lies in very close proximity to the Humber where VSCMP does not typically support storm water management ponds (SWMP) within the meander belt.</p> <p>The facility proposed at outfall H1 appears to be immediately adjacent to the banks of the Humber River. At the detail design stage a sufficient setback will be required.</p>	<p>The ESR concludes that a wetland to treat flows from HP5 in Grenadier Pond is a feasible alternative. Site reconnaissance indicates that there is currently a cattail wetland at the location, which could be re-engineered to handle flows from HP5. This is supported by members of the Steering Committee involved in the rehabilitation plans of Grenadier Pond.</p> <p>In developing and finalizing rehabilitation plans for the Grenadier Pond ecosystem the TRCA and MNR must be continue to be involved and ultimate approval received.</p> <p>The high water level of the Humber River was considered in locating the wetland adjacent to the Humber River. Flood protection is also recommended as part of the design of the wetland. In addition, City Parks has been involved in the study, and is currently finalizing their plans for the area. They have indicated that a wetland would be acceptable if their future plans were incorporated during the design stage.</p> <p>Agreed. This is in line with the above concern.</p>