



CITY OF WINDSOR

# Background Document Literature Review

Sewer and Coastal Flood Protection Master Plan

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## 1.0 Introduction

The City of Windsor has retained Dillon Consulting Limited (Dillon) to complete Phase 2 of the Sewer and Coastal Flood Protection Master Plan. The Sewer and Coastal Flood Protection Master Plan will follow Approach No. 2 of the Municipal Class Environmental Assessment (EA) Master Plan process.

Dillon is serving as the lead consultant for this project, partnering with AMG Environmental Limited, who has completed the flow monitoring program, and Aquafor Beech Limited (Aquafor Beech), for who we have collaborated with to expand the City-Wide baseline sewer system model, evaluate the sewer and overland drainage network, and developing alternative basement, surface and coastal flood protection solutions. Sanitary sewers, storm sewers, combined sewers, overland drainage systems and coastal flood protection features are all considered in the Master Plan.

### 1.1 Document Propose and Usage

This report was drafted in support of the Sewer and Coastal Flood Protection Master Plan, to document summaries of past studies and reports related to sewer and drainage systems within the City of Windsor. Reports included in this summary have been completed (or in draft) by December 2018, more recent reports that have been referenced in the development of solutions or findings of this study are referenced in the Technical Volume 1-3 reports (Appendix D, E and F) completed by or on behalf of the City of Windsor in relation to sanitary sewers, storm sewer, drainage and coastal systems. The documentation review process included both developing a text based summary and a geographic information systems (GIS) database.

The information documented in this literature review will help identify existing system characteristics of the City's sewer system. Additionally, this information will assist in identifying alternative solutions to reduce the risks of basement, surface and coastal flooding within the City.

#### 1.1.1 Text Summaries

The text based summaries are organized by the City's major storm and sanitary service areas and then further organized by date. The text summaries include a brief scope of work and the recommendations. The major service areas used to organize the text review are as follows:

- Turkey Creek Drainage Area
- Little River Drainage Area
- Detroit River Drainage Area
- City-Wide Study Area
- Lou Romano Water Reclamation Plant Service Area
- Little River Pollution Control Plant Service Area

## 1.1.2 GIS Database

A GIS database was developed to quantify the spatial extents of the study areas and recommended infrastructure improvements as identified in the documents. This database was developed to support the text based review. The GIS information can be used to identify locations of proposed solutions and to identify relevant reports within certain regions. A schematic of this information is provided in Figure 1 in Appendix A-1, which identifies studied infrastructure that was constructed, infrastructure which wasn't constructed per the study's recommendations, and the areas in which the studies covered. The schematic has a significant overlay of information and is provided for the reader to understand that the information was compiled spatial, to use the information a designer, engineer, planner, etc. would need to use GIS or a similar program.

## 2.0 Turkey Creek Drainage Area

### 2.1 Huron Church Line, Functional Report (Dillon, 1968)

Scope:

The study was conducted by M.M. Dillon Limited in May 1968, and includes a review of Huron Church Line from the City limit to the south, to and including its intersection with Wyandotte Street to the north. As the Ambassador Bridge is connected with this road, attention was given to all areas surrounding the Bridge Plaza so that recommendations could be developed for future access and egress treatment between these two facilities.

### 2.2 Reconstruction of Grand Marais Drain – Huron Church Line Bridge (Dillon, March 1969)

Scope:

The City of Windsor appointed M.M. Dillon Limited, to prepare a preliminary engineering study of the reconstruction of the Grand Marais – Huron Line Bridge. Maximum flow in the Grand Marais was estimated at about 2,500 cfs at the location of the site.

Recommendations:

- Subsurface drains behind the abutments are proposed with outlet into the channel on the downstream side.
- Double catchbasin with 18 inch outlet into the channel.

### 2.3 Design Report for the Grand Marais Drain (Dillon, August 1969)

Scope:

The City of Windsor appointed M.M. Dillon Limited, to prepare a storm engineering study for the reconstruction of the Grand Marais - Huron Line Bridge in 1969. This report is intended to provide guidelines and basic design criteria to permit improvements of the Grand Marais Drain in stages.

Recommendations:

- Work under this project consisted of demolishing the existing structure, reconstruction of approaches and detour construction of new bridge, utilities relocation, channel excavation and channel lining.
- The drain between the Detroit River and Todd Lane must eventually be widened and straightened, along with dykes to contain the storm flows.
- The drain between Todd Lane and Huron Church Line must be realigned and eventually widened.
- Between Huron Church Line and Randolph Avenue, three alternatives for channel relocation are given:

- Existing alignment, with a pedestrian overpass at California Avenue and bridge at Randolph Avenue.
- Relocated with closed conduit on Balmoral Street from St. Clair Avenue to Askin Avenue.
- Relocated to Balmoral Street with a pedestrian overpass at California Avenue and a bridge at Randolph Avenue.
- From Randolph Avenue to Dougall Avenue, the drain can be constructed by relocating West Grand Boulevard southerly.
- From east of the Penn Central Railroad to east of Howard Avenue, the drain will be as part of the E.C. Row Expressway.
- Concrete channel improvements from Huron Church Line to Dougall Avenue.
- Bridge substitution from Huron Church Line to Dougall Avenue.
- Box culvert under the Penn Central Railroad and South Cameron Boulevard and under Howard Avenue and the E.C. Row Expressway.

#### 2.4 Functional Study - Penn Central Culvert (Dillon, September 1969)

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##### Scope:

In August 1968, M.M. Dillon Limited was authorized by the City of Windsor to provide engineering services for the improvement and/or diversions of the Grand Marais Drain. This report assumes the acceptance of the August 1969 Design Report for the Grand Marais Drain, completed by M.M. Dillon Limited (i.e. open channel improvements to the Grand Marais Drain).

##### Recommendations:

- The construction of a new three cell culvert under the Penn Central Railway and South Cameron Boulevard. By means of this common reinforced concrete box culvert, the realigned Grand Marais Drain should cross under the Penn Central Railways and South Cameron Boulevard culvert.

#### 2.5 Storm Drainage Report (Part 1) - Wards 7 & 8 (Dillon, January 1970)

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##### Scope:

In May 1969, Windsor City Council authorized M.M. Dillon Limited "to carry out an engineering study of the existing storm sewer system in the City of Windsor in parts of Wards 1, 7 and 8, to determine a suitable network of future storm relief sewers". In Ward 1, the entire ward was investigated except for the Ford Motor Company of Canada property. The Ford Motor Company land was serviced by a private storm sewer system discharging directly to the Detroit River. In Wards 7 and 8, the areas investigated were bounded by Huron Church Line on the west and the Little River on the east. The "built-up" areas within these limits were investigated in detail. In general, all existing storm sewer systems investigated were deficient to some degree.

Recommendations:

- In several areas, new storm relief systems and new sanitary sewer systems are required.
- Relief of several areas to the Industrial Estates drain.
- Relief of several areas to the Grand Marais Drain.

2.6 Storm Drainage Report (Part 3) – Wards 7 & 8 (Dillon, July 1970)

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Scope:

This third and final report prepared by M.M. Dillon Limited covering Wards 1, 7 and 8 within the City of Windsor. The report outlines the storm drainage study including calculations, recommendations, estimated costs and preliminary plans for major storm relief works in the developed areas.

Recommendations:

- In the north-west quadrant of the Rose Street area, the combined sewer should be utilized as a storm sewer, whereas, in the rest of the area, the combined sewer would become a sanitary sewer and new local storm sewers would be installed to discharge to the proposed Rose Street trunk storm sewer.
- New sanitary sewer on Rose Avenue.
- Within the Alexis Road drainage area, the existing sewers should be converted into sanitary sewers and new local storm sewers should be installed.
- Relief of the Parent Avenue drainage area to the Grand Marais Drain.
- New relief sewer running northerly on Remington Avenue to Eugenie Street, and westerly on Eugenie Street to Ouellette Avenue.
- Howard Avenue sewer proposed on basis of ultimate development of the area.
- Increased protection of existing sewer under the Penn Central Railroad.
- Major trunk sewer on Turner Road with proposed interceptor sewers on Seymour Boulevard and Third Concession Road.
- Existing sewer in several locations on Walker Road would be suitable for conversion to sanitary with installation of new local storm sewers.
- Proposed relief sewer on Woodland Street, and a major relief sewer proposed along Beals Street and Liberty Street outletting to future trunk sewer along Northway Street.
- Roseland Drive East area requires a complete new storm system, and the Roseland Drive West area eventually will too.

2.7 Drainage Report - Improvements to Grand Marais Drain West Limits to California Avenue (Dillon, September 1970)

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Scope:

M.M. Dillon Limited provided this report for the City of Windsor regarding the Grand Marais Drain channel between the westerly City limits and the alley west of California Avenue. The report serves the purpose

to approve the proposed Grand Marais Drain improvements in accordance with the Design Report prepared by M.M. Dillon Limited, dated 5 August 1969. This report was adopted by City Council on 18 November 1969. The Windsor City Council adopted a ten year Capital Works Program with a substantial portion of the recommended work completed in this timeframe.

Recommendations:

- A section of the Grand Marais Drain, between the alley west of California Avenue and the westerly City limits shall be immediately improved by deepening, widening, realigning and also lining with concrete in accordance to the plans and specifications attached in the report.

## 2.8 Channel Improvements to the Grand Marais Drain from Randolph Avenue to Dominion Boulevard (Dillon, January 1971)

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Scope:

The City of Windsor appointed M.M. Dillon Limited to provide engineering services for the proposed improvements to the Grand Marais Drain. This report presents a summary of Dillon's design considerations for the section of drain between Randolph Avenue and Dominion Boulevard, specifically for bridge structures and floodwalls.

Recommendations:

- Reinforced concrete floodwalls were proposed for the drain from Dominion Boulevard to Curry Avenue.
- Pedestrian bridge at Glenwood Avenue and Curry Avenue.
- Road bridge at Dominion Boulevard.

## 2.9 Determination of Storm Sewer Outlets into the Grand Marais Drain from Redevelopment Area "B" (Dillon, May 1971)

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Scope:

This report was completed by M.M. Dillon Limited in accordance with instructions from the City of Windsor. It was necessary that stubs for all future outlets from the "Re-development Area B" be installed during the construction. The Windsor Department of Planning and Redevelopment had completed a street layout for "Redevelopment Area B" where the storm drainage requirements for the area were determined. This study identified the number, size and location of storm sewer outlets into the Grand Marais Drain from the "Redevelopment Area B" as shown on the study's plans.

Recommendations:

- Local storm sewers on Daytona Avenue, Betts Avenue and St. Clair Avenue should discharge directly into the Grand Marais Drain.

- The proposed storm trunk sewer for the drainage area should be located on Northway Avenue. The outlet for this sewer should be sized to accommodate the E.C. Row Expressway drainage from Huron Church Road to Dominion Boulevard. The outlet diameter will be 66 inches.

2.10 Functional Study Langlois Avenue Storm Sewer – Grand Marais Drain to E.C. Row Expressway (Dillon, June 1971)

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Scope:

M.M. Dillon Limited was retained by the City of Windsor to provide a functional design to determine the drainage boundaries, runoff coefficients, flow rates, sewer sizes and grades, and alignment locations for the proposed storm sewer.

Recommendations:

- Construction of a storm trunk sewer under Langlois Avenue outletting at Grand Marais Drain to E.C. Row Expressway.

2.11 Functional Study of the Grand Marais Drain - Dougall Avenue to Turner Road (Dillon, 1972)

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Scope:

M.M. Dillon Limited was authorized by the City of Windsor, to prepare a functional study for improvements on the Grand Marais Drain between Dougall Avenue and Turner Road.

Recommendations:

- Concrete channel improvements including new utility corridor along the Grand Marais Drain from Dougall Avenue to Turner Road.

2.12 Design Report for the Lennon Drain (LaFontaine, 1973)

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Scope:

LaFontaine, Cowie, Buratto & Associates Limited was authorized by resolution of City Council to prepare the report to improve the Lennon Drain within the City of Windsor and partially in the Township of Sandwich West. The Lennon Drain, at the present time of the report, drains approximately 1,540 acres of land in the City of Windsor and 135 acres of land in the Township of Sandwich West, with an outlet in the Cahill Drain. A summary of recommended work, construction staging and implementation of improvements to the Lennon Drain and its outlet are contained in this report.

Recommendations:

- Lennon Drain should be reconstructed from the outlet of the present covered drain just west of Howard Avenue to the west boundary of the City of Windsor.
- Lennon Drain should be reconstructed in the Township of Sandwich West from the boundary of the City of Windsor to Cahill Drain.

- Cahill Drain must be reconstructed from the junction with the Lennon Drain to its outlet in Turkey Creek.
- All culverts and other structures should be constructed at Malden Road, Huron Church Line, King's Highway 3, and St. Clair College.

### 2.13 Parent Avenue/McDougall Street – Storm Relief Sewers (Dillon, 1974)

#### Scope:

On June 15, 1973, M.M. Dillon Limited was authorized by the City of Windsor, to prepare a report on a storm relief system for Areas D, E, and F. The scope of this report involved a review of all available information with the Department of Public Works, establishment of the capacity of the storm sewer system, calculations for the theoretical requirements to establish efficiency ratios, and establishing of alternative methods for relieving existing deficiencies including preliminary designs.

#### Recommendations:

- Parent Avenue trunk storm sewer from Giles Boulevard to Tecumseh Road.
- McDougall Street trunk storm sewer from Shepherd Street to outlet in the Detroit River.
- Woodlawn Avenue trunk storm sewer from Memorial Drive to Lens Avenue.
- Hannah Street West trunk storm sewer from McDougall Street to Moy Avenue.

### 2.14 Northway Avenue Storm Drainage Study – Revised Preliminary Report (Dillon, December 1975)

#### Scope:

M.M. Dillon Limited was retained by the City of Windsor to complete a preliminary report on their recommendations for the Northway Avenue storm drainage area including the storm drainage requirements for Phase 1C of the E.C. Row Expressway, the South Cameron Planning District, Redevelopment Area 'B' and the Huron Church Line corridor.

#### Recommendations:

- Conventional gravity outlet to the proposed park northwest of Holy Names Catholic High School along Northway Avenue for the total drainage area.

### 2.15 Report on the Northway Avenue Trunk Sewer (Dillon, 1976)

#### Scope:

M.M. Dillon Limited completed this study for the City of Windsor as a result of the planned construction of the EC. Row Expressway, the Huron Church Road improvements, the development of the Bellewood planning area and remaining South Cameron planning area.



## Recommendations:

- A retention basin pond located in the South Cameron Planning District with a 7' x 7' trunk storm sewer outlet on Northway Avenue from E.C. Row Expressway to the Grand Marais Drain.
- A conventional gravity trunk sewer system serving the entire drainage area on Northway Avenue from E.C. Row Expressway to the Grand Marais Drain.

## 2.16 Grand Marais Drain Improvements – Bruce Avenue to South Cameron Boulevard (Dillon, 1977)

## Scope:

The City of Windsor authorized M.M. Dillon Limited to prepare a design report for the improvements to the Grand Marais Drain from Bruce Avenue to South Cameron Boulevard. This report also reviews and updates recommendations made in the “Preliminary Functional Planning Report for the Intersection of Dougall Avenue and West Grand Boulevard”.

## Recommendations:

- A 3 cell box culvert should be constructed across Dougall Avenue.
- Open concrete-lined channel be constructed in the Grand Marais Drain from Bruce Avenue to South Cameron Boulevard.

## 2.17 Drouillard Area Storm Relief Sewer – Functional Design Report (Dillon, 1979)

## Scope:

M.M. Dillon Limited was authorized by the City of Windsor to examine a storm relief trunk sewer as part of a Neighbourhood Improvement Program for the Drouillard Road area. Three routes were investigated for the storm trunk sewer including the Wyandotte Street route, Edna Street route, and St. Luke Road route.

## Recommendations:

- All three systems relieve approximately the same area; however, the St. Luke Road trunk relief sewer from Wyandotte Street to Whelpton Street is recommended as the optimal choice as well as the trunk sewer on Whelpton Street from St. Luke Road to Maisonville Avenue.

## 2.18 Report on the Basin Drain Improvements (Kleinfeldt, 1979)

## Scope:

As a result of the City's planned expansion of the Ambassador Industrial Park and construction of the E.C. Row Expressway, the Kleinfeldt Group prepared a report on the required improvements for the Basin Drain in June 1979. This report reaffirms the drainage area boundaries in two previous studies and recognizes the division of the Basin Drain drainage area in recommending improvements to the part of the total area west of Huron Church Road.

## Recommendations:

- Divert storm flows from the existing Talsma and Janisse Drains into the Northway Avenue trunk sewer.
- Enclose the Basin Drain from Industrial Drive to the E.C. Row Expressway.
- Maintain the Basin Drain downstream of E.C. Row Expressway on a regular basis.

## 2.19 Turkey Creek Hydrology Review (Dillon, 1980)

## Scope:

A hydrologic study and report was prepared by M.M. Dillon Limited as requested by the Essex Region Conservation Authority and the Ministry of Natural Resources. This report involved the study of catchment areas and determination of proposed channel/catchment routing.

## Recommendations:

- The response from the urban catchments should be properly accounted for in the routing scheme.
- The ultimate condition runoff should be routed through the existing conveyance system.

## 2.20 Turkey Creek Flood Line Mapping (Dillon, 1982)

## Scope:

Completed by M.M. Dillon Limited for the Essex Region Conservation Authority, the report identified detailed flood line mapping for Turkey Creek.

## 2.21 Roseland Planning District – Report on Storm &amp; Sanitary Sewers (City of Windsor, 1983)

## Scope:

City of Windsor completed this report for the Roseland Planning District. The extension of the Lennon trunk sanitary sewer into the planning district has prompted this report which reviews previous engineering studies within the Roseland Planning District and makes recommendations on storm and sanitary servicing for the district.

## Recommendations:

- Proposed storm sewer and sanitary relief sewers between Sixth Concession Road, Cabana Road, Casgrain Street, and the railroad.

## 2.22 Functional Design Report – Grand Marais Road East – Howard Avenue to Walker Road (City of Windsor, 1984)

## Scope:

The City of Windsor completed this report identifying requirements for future road improvements on Grand Marais Road East between Howard Avenue and Walker Road. The study was undertaken primarily

as a result of the roadway's existing condition, its classification as a major collector, the expected need for right-of-way widening, and planned development. During the time of this study, there were no storm sewers existing along Grand Marais Road.

Recommendations:

- Local storm sewers for the entire length of Grand Marais Road East from Howard Avenue to Walker Road will be required to be connected to future storm relief sewers crossing Grand Marais Road at several locations.
- Area from Langlois Court to Garvey Crescent requires local sanitary sewers.

## 2.23 Report on Site Servicing for Roundhouse Property (Dillon, 1984)

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Scope:

M.M. Dillon Limited has reviewed with the City of Windsor and the Windsor Utilities Commission, the commercial development and its required site servicing. The details for the proposed site servicing are enclosed in this report.

Recommendations:

- At low depths of the Grand Marais Road trunk sanitary sewer, the proposed sanitary sewers will be designed for minimum flow velocities and for gravity flow.
- At extremely deep trunk sewer connections, the proposed sewer must be designed for connection at the existing manhole.
- Storm drainage zero-increase runoff concept must be adopted for this site.
- Storm drainage facilities must be designed using detention schemes to limit runoff.

## 2.24 Roseland Planning District – Lennon Drain Storm Relief System (Dillon, 1984)

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Scope:

This addendum to the design report prepared by M.M. Dillon Limited follows up on the Essex Region Conservation Authority's review of the Lennon Drain Storm Relief System Design Report. The Authority's criteria for the proposed sewer system were found to be difficult to meet.

Recommendations:

- Incorporate the zero-increase runoff concept to the drainage area and sewer alignment for the Lennon Drain storm relief system.
- The City of Windsor should consider constructing the storm relief sewer sized to serve the entire drainage area.
- Concrete pipe be tendered as an alternative to corrugated steel pipe material to afford the opportunity to evaluate the cost increase relative to its increased design life.

## 2.25 South Windsor Sewer Relief Study – Rankin Avenue/Charlevoix Avenue (Becker, 1987)

## Scope:

N.K. Becker and Associates Ltd. completed this report for the City of Windsor due to the basement flooding in the Rankin Avenue/Charlevoix Avenue area, north of Cabana Road West. The study area is approximately 70 hectares of residential and open space land use. This report focused on cost effective short and long term relief alternatives for the Rankin Avenue/Charlevoix Avenue drainage area. The Study Documentation Report and the Implementation Report together describe the study methods, recommendations and suggested construction implementation. All recommendations were made based on the results of a computer-simulation of the drainage system.

## Recommendations:

- Sanitary detention sewers and sanitary sewer replacements (with roof leader disconnection); or
- Sanitary detention sewers and sanitary sewer replacements (with private drain connection replacement); or
- Sanitary detention sewers and sanitary sewer replacements (without roof leader disconnection and without private drain connection replacement); and
- Storm detention sewers and storm sewer replacements (with roadway storage); or
- Storm detention sewers and storm sewer replacements (without roadway storage).

## 2.26 Stormwater Management Alternatives for the Turkey Creek Watershed within the City of Windsor (MacLaren, 1989)

## Scope:

This report was prepared by MacLaren Engineers Inc. for the Essex Region Conservation Authority in June 1989, to review possible methods of stormwater management for new developments in order to make downstream improvements to Turkey Creek and to control flooding. It provided detailed hydrologic analysis update for the watershed using modern computer modelling procedures. The study determined flow for existing and future development conditions and identified measures for controlling runoff from future development.

## Recommendations

- The construction of an in-line detention facility along the Grand Marais Drain upstream of Howard Avenue.
- A central stormwater detention system be provided for the proposed developments tributary to the Cahill Drain and Lennon Drain.
- An in-line stormwater detention facility be constructed near the outlet of the Basin Drain and channel improvements be provided along the drain upstream of the detention facility.
- A stormwater detention facility be constructed near the inlet of the Northway Avenue trunk sewer to control future runoff to pre-development levels.

- Discharging of roof leaders to ground at new developments be required if proper lot grading is provided.
- On-site stormwater detention be provided at industrial and commercial developments.
- A secondary master drainage plan should be developed in the future.
- Flood levels along the major watercourses should be recalculated.
- Review of channelization and flood control for Turkey Creek watershed shall be required.
- Study on the feasibility of diversion of the Cahill Drain and Lennon Drain.

## 2.27 Master Drainage Plan for the Lennon and Cahill Drains in the City of Windsor (MacLaren, 1990)

### Scope:

MacLaren Engineers Inc. were retained by the City of Windsor to complete a Master Drainage Plan for the Lennon Drain and the Cahill Drain catchment areas within the City of Windsor. The primary objective of the Plan was to control future runoff rates in the major watercourses to existing levels since the downstream receiving channels were classified as having insufficient hydraulic capacity. A hydrologic computer model of the watersheds was developed to simulate existing runoff conditions and to predict the effect of future development on flows in the Lennon and Cahill Drains.

### Recommendations:

- Cahill Drain:
  - The proposed drainage systems for the Villa Paradiso Crescent, South Cousineau Road and Southwood Lakes Boulevard residential subdivisions be adopted as part of the Master Drainage Plan. The lakes at the Southwood Lakes Subdivision would act as wet detention ponds and provide runoff control for the area east of Howard Avenue.
  - The minor system for the area north of Highway 401 should be diverted to the Lennon Drain where runoff control will be provided at a proposed detention pond near St. Clair College.
  - Existing residential areas, the Holy Redeemer College campus and the proposed development south of the Southwood Lakes Subdivision should be permitted to drain uncontrolled to their respective receiving watercourses.
- Lennon Drain:
  - The storm sewer system should be extended to the entire area east of Howard Avenue.
  - A detention pond with a storage capacity of 13,500 m<sup>3</sup> should be provided along the Lennon Drain near St. Clair College to control flows in the drain to existing levels.
  - Existing restriction at the outlet of the 2100 mm diameter CSP through the golf course should be eliminated and the pipe used as a trunk sewer to service the area east of Dougall Avenue.
- Recommendations applicable to the entire study area are as follows:
  - Roof leaders at new developments should discharge to ground via splash pads to reduce runoff rates to the drains.

- Rear lots and streets at new developments should be graded to detain overland flows within the road allowances during severe rainfall events. This would reduce the required storage for runoff control at downstream detention facilities.

2.28 Southwood Lakes Development - Hydraulic Design Report (Hanna, Ghobrial, & Spencer, 1990)

Scope:

The City of Windsor retained Hanna, Ghobrial, & Spencer to complete a Master Drainage Plan for the Lennon Drain and the Cahill Drain catchment areas. The primary objective of the plan is to control future runoff rates in the major watercourses to existing levels since the downstream receiving channels have been shown to have insufficient hydraulic capacity. A hydraulic computer model of the watersheds was developed to simulate existing runoff conditions and to predict the effect of future development on flows in the Lennon Drain and the Cahill Drain. Significant flow increases were predicted if no stormwater management is carried out.

Recommendations:

- All weirs (in the ponds/lakes) are proposed to be 4 inches wide with a bar screen for cleaning purposes.
- A standard 2'x2' catchbasin with a 12 inch outlet pipe from lake to lake is recommended.
- Deeper sumps for sedimentation control and orifice plate installation will be required features of the roadway catchbasins.

2.29 Flood Damage Reduction Alternatives for the Turkey Creek Watershed (MacLaren, 1991)

Scope:

Prior to this report, a hydrologic study was completed by the Essex Region Conservation Authority which re-evaluated flood flows and investigated alternative stormwater management strategies for the Turkey Creek watershed. The Authority commissioned this study to re-evaluate flood levels, flood damages and alternative measures for reducing existing flooding, based on the revised flood flows.

Recommendations:

- Channelization should be carried out sufficiently to reduce existing flood damages, with channels sized to accommodate flood flows from existing development.
- Stormwater retention should continue to be imposed on new developments.
- Alignment of improved channels, approximately those proposed in the 1982 Preliminary Engineering Report, following approximately the existing alignment.

### 2.30 Grand Marais Drain - Howard Avenue to Walker Road - Functional Design Report (MacLaren, 1991)

#### Scope:

MacLaren Engineers Inc. completed a Functional Design Study in December 1991, for the City of Windsor. The study identified the location for the underground transmission lines, bicycle path, linear park concept and a proposed channel design. It also identified environmental concerns that were to be examined in the Environmental Study Report (ESR).

#### Recommendations:

- The Grand Marais Drain channel alignment between Howard Avenue and Walker Road must be contained within the proposed minimum right-of-way lands owned, or soon to be purchased by the City of Windsor. The proposed alignment virtually parallels the north limit to the right-of-way.

### 2.31 Floodway Analysis – Stormwater Management Guidelines (MacLaren, 1991)

#### Scope:

MacLaren Engineers Inc. was retained by Essex Region Conservation Authority to complete a hydraulic floodway analysis for the Turkey Creek, the Grand Marais Drain upstream of Howard Avenue and the lower Cahill/Lennon Drain. This report presents floodway limits within which infilling should not be permitted unless the required channel improvements identified in the report "Flood Damage Reduction Alternatives for the Turkey Creek Watershed" are completed.

#### Recommendations:

- Stormwater detention should be required at all new developments located upstream of Malden Road to Howard Avenue.
- Addendum No. 2 identifies alternatives for the Grand Marais Drain upstream of Howard Avenue.

### 2.32 Turkey Creek Channel Improvements – Functional Design Report (MacLaren, February 1992)

#### Scope:

In May 1991, MacLaren Engineers Inc. was commissioned by the Essex Region Conservation Authority, to carry out functional design for the proposed construction of the Turkey Creek channel improvements and identified an appropriate size channel, which would adequately accommodate existing 1:100 year flood flows and alleviate existing flooding problems.

#### Recommendations:

- Upstream limits of the proposed improvements on Turkey Creek to reach the municipal boundary between Windsor and LaSalle.

- Downstream limit of the proposed improvements on Turkey Creek is approximately 150 m west of the Essex Terminal Railway (ETR).
- Upstream limit of proposed improvements on the Cahill Drain is approximately 650-850 m upstream of Malden Road.
- Channelization noted as most effective means of relieving existing flood problems in the Turkey Creek watershed. Locations proposed for channelization include:
  - Turkey Creek downstream of the ETR Bridge to presently improved channel;
  - Cahill-Lennon Drain from its outlet approximately 1100 m upstream of Malden Road Bridge; and
  - Unimproved section of Grand Marais Drain.
- Stormwater detention would be required for all new developments to control runoff to current levels.

### 2.33 Grand Marais Drain - Howard Avenue to Walker Road – ESR (MacLaren, March 1992)

#### Scope:

Based on the findings of several recently completed engineering studies, the City of Windsor decided to initiate channel improvements along a portion of the Grand Marais Drain, particularly the reach extending from Howard Avenue to Walker Road. Channel improvements are required to alleviate existing flooding and drainage problems in the area. Studies had identified considerable properties and buildings within the area which would be prone to flooding from the 1:100 year storm event. The City of Windsor retained MacLaren Engineers Inc. to undertake a two part study, comprising functional design and preparation of this ESR.

#### Recommendations:

- Improvements to the drain from Howard Avenue to Walker Road are required to provide an adequate outlet for badly needed storm relief sewer works, which would alleviate the problem of basement flooding.

### 2.34 Cahill/Lennon Drainage System Stormwater Management Plan (Knowles, 1992)

#### Scope:

Knowles Engineering Inc. was retained by the Essex Region Conservation Authority to provide a stormwater management plan for the Cahill and Lennon drainage systems. This is the final report which incorporated the comments and suggestions of the Essex Region Conservation Authority. Based on prior studies and analyses, recommendations as to stormwater management needs are as follows.

#### Recommendations:

- Downspouts from dwellings should discharge to grassed areas.
- Stormwater detention facilities be provided to mitigate increasing flows in the Lennon Drain.



- The stormwater detention ponds should provide 350 m<sup>3</sup>/ha of total storage volume.
- Stormwater detention facilities in areas tributary to this reach of the Cahill Drain are not required to reduce flows in the Cahill Drain provided that the proposed drainage improvements in the Turkey Creek watershed currently planned by Essex Region Conservation Authority are carried out.

### 2.35 Upper Grand Marais Drain Study - Walker Road to Tourangeau Road (MacLaren, 1993)

#### Scope:

MacLaren Engineers Inc. was retained by the Essex Region Conservation Authority to carry out this study and addendum report in April 1993, which addressed the upper portion of the Grand Marais Drain from Walker Road to Pillette Road. The scope of the study was to determine existing flood damages; identify measures for reducing flood potential and to make recommendations in this regard which were consistent with the previous studies. Turkey Creek improvements downstream were based on controlling 1:100 year flood flows to the downstream area, to the existing 1:100 year flow which was based on the 1989 extent of development.

#### Recommendations:

- Lands to the south of the CP Railway east of Walker Road require SWM facilities to reduce flows to the capacity of the existing culverts under the E.C. Row Expressway and under the CP Railway.
- Lands lying between Howard Avenue and Central Avenue north of the E.C. Row Expressway/CP Railway do not require stormwater detention facilities.
- Lands north of the CP Railway and east of Central Avenue will require stormwater detention.
- The channel between Walker Road and the downstream end of the culvert through Cassens Transport and the channel upstream of Central Avenue to Tourangeau Road should be widened, deepened and graded.
- A culvert at Plymouth Avenue requires replacement.

### 2.36 Southwood Lakes Subdivision - Environmental Design Report for Lake #5 (AquaSphere, 1996)

#### Scope:

In February 1996, AquaSphere Technologies Inc. completed an environmental design report for Lake #5 to support stormwater management lakes of the Southwood Lakes Subdivision, in Windsor. The total surface area of the lake was 4.7 acres (ac.) at the High Water Level (HWL). The lake was designed for a stormwater impoundment capacity of 52,190 m<sup>3</sup> at HWL. In general, and unless otherwise indicated in these specifications, the design features of Lake #5 corresponded to those of Lake Como and/or Lake Grande.

## 2.37 Preliminary SWM Plan for North Talbot Road Subdivision (Dillon, 1996)

## Scope:

M.M. Dillon Limited prepared a Stormwater Management (SWM) report for R.V. Investments in 1996, who proposed to construct a residential subdivision on the parcel of land located between Highway 401 to the north and east, North Talbot Road to the south and Sixth Concession Road to the west. This land was zoned as Residential Holding Area and had been used for agriculture (cash crops).

## Recommendations:

The proposed North Talbot Road Subdivision consisted of a part of the Southwood Lakes Stormwater Management Area. However, due to staged development of the complete plan, the subdivision shall, if required, implement an interim plan, utilizing a temporary, shallow, dry stormwater pond and pump to empty sewers following rainfall:

- Roof leaders discharging to the surface (grassed side yard);
- Shallow depression and catchbasin at rear yard of each lot;
- Road subdrain installed along the pavement edges and backfilled with pervious granular material, allowing to intercept some flow from boulevards prior to its reaching of impermeable conveyance route (gutter); and
- Deep sumps (600 mm) in the catchbasin and stormwater manholes.

## 2.38 Grand Marais Drain/Walker Road to Central Avenue Environmental Study Report (BTS, 1998)

## Scope:

BTS Consulting Engineers was commissioned by the Essex Region Conservation Authority and the City of Windsor to undertake a Class Environmental Assessment of the Grand Marais Drain. The study area consisted of the Grand Marais Drain proper extending from Walker Road to Central Avenue (including the enclosed sections under Central Avenue and the Cassens Transport yard) and the immediately abutting properties. The exercise aimed at developing and locating the scope of improvements for the channel.

## Recommendations:

Based upon the above evaluation, the recommended solution for the study reach from Walker Road to Central Avenue is to improve the hydraulic capacity of the existing Grand Marais Drain along its present route to provide a capacity to meet the existing 1:100 year flood requirements at a water surface elevation of 183.40 metres downstream and 184.21 metres upstream.

## Improvements for the drain consist of:

- A grass-lined trapezoidal channel generally following the existing horizontal alignment of the drain.
- Deepening of the drain by as much as 0.5 m to improve the outlet available for tributary sewers.
- Flattened side slopes and a layer of rock lining the low-flow channel to prevent erosion.

- A soil management plan complete with measures to properly dispose of sediments containing non-hazardous levels of heavy metals on-site.

### 2.39 Irvine Avenue/Marentette Avenue Storm Relief Sewer (City of Windsor, 2000)

#### Scope:

An assessment by the City of Windsor was completed to review the existing sewer system as well as existing reports and studies, to design a storm relief system that will reduce the basement flooding occurrences, and provide an outlet for future construction of local storm sewers. The study area is approximately 14 hectares and is bounded by Tecumseh Road to the north, Parent Avenue to the east, Essex Terminal Railway to the south and Howard Avenue to the west.

#### Recommendations:

- A video inspection and evaluation of the existing sewer system within the drainage area.
- The initiation of an eaves trough “Downspout Disconnection Programme”.
- Creation of a priority list for the construction of local storm sewers within the drainage area based on flooding events, pavement conditions, and the condition of the existing local combined sewers:
  - A trunk storm sewer on Marentette Avenue from Tecumseh Road to Irvine Avenue and on Irvine Avenue from Marentette Avenue to Howard Avenue.
  - Storm sewers on Fraser Avenue and Lillian Street from Irvine Avenue to the Essex Terminal Railway.
  - Storm sewers on Louis Avenue and Marentette Avenue from Irvine Avenue to the Essex Terminal Railway.
- Implementation of the storm drainage scheme outlined in this report.

### 2.40 Walker Road/Canadian Pacific Railway Grade Separation - SWM Report (Dillon, June 2007)

#### Scope:

Dillon Consulting Limited was retained by the Ministry of Transportation Ontario and the City of Windsor to conduct a stormwater management report for the lands in the vicinity of the intersection of Walker Road/CP Railway track. The Walker Road/Canadian Pacific Railway (CPR) Grade Separation (WRGS) project entails the construction of a road-rail grade separation of Walker Road at the Canadian Pacific Railway crossing just south of Grand Marais Road East. It aims to provide commentary on measures designed to manage water quality and water quantity concerns during construction, and identifies ways to manage the natural functions of the Grand Marais Road drainage system without compromising public safety and the overall hydraulic functionality of the municipal drain.

#### Recommendations:

- Grand Marais Drain channel improvements from Turner Road to the CPR.

- The recommendations form the framework for completing the drainage and stormwater management design components for the WRGS project.

#### 2.41 Stormwater Management Report - Windsor Raceway Centre (Dillon, December 2007)

##### Scope:

Dillon Consulting Limited was retained by Ambassador Golf Course and Residential Development to produce a stormwater management study plan. The stormwater management plan identified the strategy to manage surface runoff and stormwater quality from a 19.0 ha site made up of a proposed big box commercial development on 17.3 ha of land and 1.7 ha of wood lot buffer area. The area is located in the City of Windsor and is bounded by Matchette Road to the east, Sprucewood Avenue to the south, Windsor Raceway to the west and Ojibway Woods to the north.

##### Recommendations:

- 1.7 ha wood lot buffer area at the north end of property.
- An internal sewer system from the commercial development to the pumping station.
- Pump station at edge of parking lot with storm sewer leading through the 4 golf course ponds.
- A stormceptor for quality treatment of runoff prior to discharging from the site.
- Temporary on-site storage and emergency discharge strategies.

#### 2.42 City of Windsor Grand Marais Drain Improvements – Environmental Study Report Addendum (Dillon, 2008)

##### Scope:

This report is an Addendum to the Grand Marais Drain, Walker Road to Central Avenue Environmental Study Report (ESR) (April 1998). Dillon Consulting Limited was retained by the City of Windsor and the Essex Region Conservation Authority, in partnership with local industry, to complete the detailed design and Class Environmental Assessment (EA) of hydraulic improvements and removals of potentially impacted materials in the Grand Marais Drain, from just east of the Canadian Pacific Railway (CPR) Arch Culvert to Central Avenue.

##### Recommendations:

- Open channel improvements for the Grand Marais Drain from the beginning of the Chrysler Centre property to Meldrum Road.

#### 2.43 Grand Marais Drain Hydraulic & Concrete Channel Assessment (Dillon, July 2010)

##### Scope:

Dillon Consulting Limited and Landmark Engineers Inc. were retained by the Essex Region Conservation Authority to undertake a study of the Grand Marais Drain. The purpose of this study was to complete a hydraulic assessment of the Grand Marais Drain and complete a condition assessment of the concrete-

lined channel. The assessment also included the creation of a HEC-RAS model of the Grand Marais Drain extending from the City of Windsor/Town of LaSalle boundary upstream to the Central Avenue Flood Control Pond. Computations were made of the water surface profile for the 100 year flood flow and other events of interest, and a comparison of calculated water levels to existing ground elevations to identify the extent of remaining flood susceptible lands was included.

Recommendations:

- For the Grand Marais Drain:
  - Considerations can and should be given to modifying the channel cross-section of the existing concrete-lined flood control channel lying downstream of Dougall Avenue to achieve a number of benefits.
  - De-brushing and channel improvements from Dougall Avenue Weir/Drop Structure upstream to E.C. Row Expressway eastbound off-ramp.
  - De-brushing and channel improvements from North Service Road upstream to east limit of Woodall Construction.
  - Removal of temporary culvert extension at CP Railway tracks upstream of Walker Road.

2.44 Grand Marais Drain Concrete Channel Study – Phase 2 Channel Design Alternatives (Dillon, September 2010)

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Scope:

Dillon Consulting and Landmark Engineering Inc. were retained by the Essex Region Conservation Authority and the City of Windsor to undertake the first two parts of a 5-part initiative, aimed at examining and improving the concrete-lined segment of the Grand Marais Drain between Dougall Avenue and the municipal boundary with the Town of LaSalle. This report represents the culmination of Phase 2 of the project, and documents the findings of Part 3 of the original five-part program. The remaining parts entail the final design and construction of concrete repairs and any desired channel transformations.

Recommendations:

- Based on study findings, three options for this drain section had been identified:
  - Maintain the concrete-lined channel in its current form.
  - Transform the existing channel throughout the entire study area.
  - Transform limited segments of the drain based on available funding.

2.45 Grand Marais Drain Channel Improvements: Class Environmental Assessment (Landmark, 2012)

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Scope:

In accordance with the approved procedures contained in the Municipal Engineers Association's Municipal Class Environmental Assessment, the Essex Region Conservation Authority and the City of

Windsor retained Landmark Engineers Inc. to carry out an environmental assessment of the existing concrete-lined segment of the Grand Marais Drain. This Class EA was aimed at exploring the potential for establishing improved connections between the communities on either side of the drain.

Recommendations:

- Various improvement alternatives were reviewed; however, under the 1:100 year event, the hydraulic gradeline elevation could not be raised to more than two-thirds at full sewer elevation.

2.46 Cabana Road/Division Road Corridor Improvements Stormwater Management Study & Functional Design (AECOM, 2012)

Scope:

AECOM was retained by the City of Windsor to review the existing stormwater system for Cabana Road/Division Road from Huron Church Road to Walker Road and prepare a recommended functional stormwater design based on the planned roadway improvements. The results of this study are expected to form the basis for the detailed stormwater design associated with the Cabana Road/Division Road roadway improvements.

Recommendations:

- Removal of the 375 mm PVC pipe through MH 8R9036 at the intersection of Whittier Avenue and Roseland Drive.
- Removal of the 900 mm steel pipe through MH 8R1419 at the intersection of Whittier Avenue and Casgrain Drive.
- Installation of a cross-connection at the rear of #3920 and #3950 Dougall Avenue.
- Lennon Drain widening from Avon Drive to Mount Carmel Drive.
- Trunk storm sewer along Cabana Road from Daytona Avenue to Howard Avenue.
- Storm sewer on Mount Carmel Drive from Cabana Road to the Lennon Drain.
- Complete the stormwater facility recommended in the 1993 Lennon Drain Report.
- Widen/clean the Lennon Drain from Casgrain Drive westerly to the stormwater facility.
- Clean the Lennon Drain through the Roseland Golf Course and east to Dougall Avenue.

2.47 Lennon Drain Stormwater Management Report: Windsor Essex Parkway (Hatch Mott MacDonald, 2015)

Scope:

This SWM Report has been prepared in support of the detailed design of the proposed realignment of the Lennon Drain, including the proposed Highway 401 and Highway 3 crossing, and to demonstrate that the proposed drainage design has met the requirements of Schedule 15-2, Part 2, and Article 7 of the Windsor-Essex Parkway Executed Project Agreement.

## Recommendations:

- Lennon Drain realignment 50 m upstream of Highway 3 for 270 m to the proposed submerged culvert crossing.
- Lennon Drain realignment downstream of the proposed submerged culvert for 180 m to the existing downstream reach of the drain.
- Proposed pond at the corner of Todd Lane and the Rt. Hon. Herb Gray Parkway.

## 2.48 Drainage Report for the Lower Portion of the Cahill Drain (Dillon, 2016)

## Scope:

Dillon Consulting Limited and N.J. Peralta Engineering were retained by the City of Windsor and the Town of LaSalle to prepare all necessary drainage reports for all drains serving the Rt. Hon. Herb Gray Parkway. The City of Windsor requested that the Cahill Drain be extended upstream to include the portion of the drain which crosses the Rt. Hon. Herb Gray Parkway and continues along the north limit of the new highway corridor within the City limits.

## Recommendations:

- Modifications to the Cahill Drain including brushing, cleaning, excavating and widening portions of the north bank.
- Supply and installation of stone erosion protection (SEP) at existing 525 mm diameter storm sewer outlet (Sandlewood Court) on the north bank.
- Replacement of Forest Trail Estates Roll No. 1900-01 Farm Bridge, with a new larger 2200 mm diameter corrugated steel pipe culvert 17 m long with sloping stone end walls.
- Construct sediment trap with rock check dam downstream of the start of the drain cleanout.

## 2.49 Lennon Drain Report (Rood Engineering, 2017)

## Scope:

Following Council Resolution, Rood Engineering Inc. was retained by the City of Windsor to develop a report summarizing repairs and improvements for the downstream part of the Lennon Drain. The portions of the Lennon Drain to be improved, comprised of the open and covered drain sections that extend from the west side of Dougall Avenue and flow westerly through the South Windsor neighborhoods.

## Recommendations:

- Portions of the open drain with significant silt and debris accumulation be cleaned out.
- The drain be widened and improved including flow control structures and conveyance channel on the Roseland Golf Course.
- Repair or replacement of bridge culverts on Geraedts Drive, Avon Drive, Mount Carmel Drive, Mount Royal Drive, Longfellow Avenue, Roseland Golf Course, and Kennedy Drive East.

- New buffer strips with a minimum width of 1.5 m be constructed or restored in all areas where no current grass buffer exists or is damaged.

## 2.50 Lennon Drain Rehabilitation (AECOM, 2017)

### Scope:

AECOM was contracted by Essex Region Conservation Authority to prepare a functional design report for the required stormwater utilities associated with the roadway improvements (Cabana SWM Report). That report included an examination of the Lennon Drain which serves as the main outlet for the improved Cabana Road from DRTP Railway east of Provincial Road to Huron Church Road. The examination of the Lennon Drain was deemed necessary as it was unknown whether the drain in its current configuration had sufficient capacity for runoff from the improved, or even the existing Cabana Road.

### Recommendations:

- Immediately east of Geraedt's Drive, a second stormwater management facility is to be created through the incorporation of the existing St. Clair College detention facilities on both the north and south sides of the Lennon Drain.
- Improvements to the drain from St. Clair College easterly to Longfellow Avenue.
- From Longfellow Avenue to Casgrain Drive, the drain channel's south wall will be changed to a concrete gabion wall.
- The Lennon Drain sewer through Roseland Golf Course is to be improved.
- 5 new stormwater facilities located immediately upstream of the outlet structure and onwards with control structures in between.
- The Kennedy Drive East culvert is to be cleaned and the drain channel to Dougall Avenue is to be reshaped and cleaned.



## 3.0 Little River Drainage Area

### 3.1 Preliminary Storm Drainage Report – Little River Drainage Area (Dillon, 1966)

#### Scope:

M.M. Dillon Limited was retained by the City of Windsor to prepare the first watershed study of the Little River Drainage Area. The studies for this report were carried out to determine the minimum requirements necessary to improve the Little River stream itself and to determine the trunk network requirements of the vacant areas where no storm sewers exist at the time. The study of the Little River Watershed involved an examination of the existing land use and a determination of the past flooding that has taken place together with a further examination of the proposed future land use to determine future flooding conditions that might be expected.

#### Recommendations:

- Gaps that have occurred at the existing dykes from the mouth of the Little River to CN Railway must be brought up to the design height.
- Contain the Standard Project Flood by means of channelization, with 2:1 side slopes and a 55-foot bottom width.

### 3.2 Report for Hawkins Drain (Dillon, 1968)

#### Scope:

M.M. Dillon Limited was retained to review the existing conditions and future requirements for the Hawkins Drain. For this report, existing capacity of the Hawkins Drain was calculated at 500 foot intervals. This investigation identified two “bottlenecks” in the drain. The 48 inch diameter culvert at Lauzon Road was considerably undersized. The two 24 inch diameter culverts at the CN Railway siding to the East Side Stamping Co. Ltd., are also severely undersized.

#### Recommendations:

- If the two 24 inch diameter culverts are not corrected, regular flooding would be expected.
- Replace Lauzon Road culvert with 12 ft. x 5 ft. box culvert.
- Replace CN Railway – East Side Stamping Co. Ltd. siding culverts.
- Case 1 Recommended Improvements:
  - Construct ditch to 4.6 ft. depth (approximate) with 5 ft. wide bottom, 2 to 1 side slopes (depth of flow = 3.6 ft.).
- Case 2 Recommended Improvements:
  - Construct ditch to 6 ft. depth (approximate) with 5 ft. wide bottom, 2 to 1 side slopes (depth of flow = 5 ft.).

### 3.3 Storm Drainage Study Ward 6 and Part Ward 7 (Dillon, January 1969)

#### Scope:

In a functional report dated January 1969, M.M. Dillon Limited was retained by the City of Windsor to report on the investigation of the existing drainage system in Ward 6. The study area included the former separated Town of Riverside and a small portion of the former Township of Sandwich East, now Ward 7, located immediately south of and draining through Ward 6 to the Detroit River. The project area included the lands within the St. Paul Avenue Pump Station, St. Rose Avenue Pump Station, Jerome Street Pump Station (at Little River Treatment Plant), East Marsh Drain Pump Station, and Jefferson Boulevard (Hawkins Drain) Pump Station drainage areas.

#### Recommendations:

- Eliminate storm runoff from the interconnections and combined sewers in Ward 6.
- Install storm relief sewers and local storm sewers as recommended:
  - Construct the remaining storm relief and local sewers at the earliest date possible.
- Establish defined drainage area boundaries.
- Construct adequate trunk storm sewers concurrent with development.

### 3.4 The City of Windsor Preliminary Engineering Report - Construction of Industrial Park Storm Drainage (Dillon, March 1969)

#### Scope:

The City of Windsor retained M.M. Dillon Limited to carry out engineering studies to provide storm drainage for the proposed Greater Windsor Industrial Estates Subdivision. Studies were conducted and reviewed in this report to determine limits of the drainage area, establish capacity requirements for drainage, investigate suitable sewer and culvert cross-sections, outline construction details, and provide cost estimates.

#### Recommendations:

- Storm drainage for the Casgrain Drain can best be provided by concrete box culverts flowing, easterly and discharging to Little River.
- Local sewers, including the Rose Avenue interceptor sewer, be eventually rebuilt and diverted to the new Industrial Estates Drain.
- The residential area would be divided at Rose Avenue flowing both to the Casgrain Drain and the Industrial Estates Drain, thus the Casgrain Drain would be enlarged or twinned.
- The Industrial Park Drain would be sized only for the industrial area east of Jefferson Avenue. The Casgrain Drain would become enlarged or twinned.

### 3.5 Little River Drainage Works (Kleinfeldt, 1969)

#### Scope:

By instruction of the City of Windsor, G. V. Kleinfeldt & Associates Ltd., commenced a survey of the Little River from its outlet in the Detroit River, southerly, to the Second Concession Drain, where the work under Contract I is to terminate.

#### Recommendations:

- The Little River in the City of Windsor be improved by deepening, widening and realigning in accordance to the plans and specifications attached, including but not limited to:
  - Realignment of channel in new locations from the Canadian National Railroad to the Second Concession Drain.
  - Construct a concrete low-flow channel from Lauzon Road southwesterly to the Second Concession Drain.
  - Storm sewers be equipped with flood gates.
  - Concrete fabrifform lining at sewer outlets.

### 3.6 Extension of Industrial Park Storm Drain – Kew Drive to Jefferson Boulevard (Dillon, 1970)

#### Scope:

In this preliminary engineering report, M.M. Dillon Limited was retained by the City of Windsor to investigate the feasibility and economics of the storm drainage plans provided for storm relief in a developed area west of Jefferson Boulevard by means of a storm drain discharging to Little River through the Industrial Estates Subdivision.

#### Recommendations:

- Within the housing project (west of Jefferson Boulevard), the drain should be constructed within a 20 foot easement adjacent to Rose Avenue and a 40 foot joint easement (with the sanitary sewer) along the easterly boundary of the park-school site.

### 3.7 St. Paul Drainage Area Storm Relief Sewers Preliminary Design Report (Dillon, 1973)

#### Scope:

M.M. Dillon Limited was retained by the City of Windsor to complete this Preliminary Design Report for the proposed storm relief sewers in the St. Paul Drainage Area. This report outlines the proposed relief sewers and details of a detention basin to be constructed in a multi-phase program. The St. Paul drainage scheme requires pumping of stormwater due to the low elevation of the area relative to the Detroit River. The detention basin proposed as part of this relief system, is a unique approach to a stormwater drainage scheme in Ontario. This report outlines the design criteria and details of the proposed basin. The requirement for stormwater pumping allows for the feasibility of a detention basin.

#### Recommendations:

- Separate existing combined systems where possible. Three key areas highlighted include Riverside Drive from Isabelle Place to approximately Lauzon Road, Lauzon Road from Wyandotte Street to Edgar Avenue, and St. Rose Avenue from Matthew Brady Boulevard to Lauzon Road.
- A 6.4 acre basin is proposed with a depth of about 25 feet with 3:1 side slopes for easier maintenance and more favorable park conditions. The bottom of the basin would have two elevations with the lower portion adjacent to the pumping station (to provide storage for low flow/higher frequency storms).
- The relief system would consist mainly of east-west collector sewers that intercept north-south sewers. Existing sewers with additional capacity, such as those on Isabelle Place, St. Paul Avenue and Cedarview Street, would be utilized in the overall storm system.
- A major storm sewer along Cedarview Street discharged to Jerome Street system. The proposed St. Paul Drainage Area system would intercept this sewer at Dieppe Street. A flap gate would be installed on this line to allow the Jerome Street system to discharge to the St. Paul Drainage Area system in the event of surcharging.
- Special chambers to be used to avoid conflicts with existing sanitary sewers.

### 3.8 Preliminary Study – Little River Stormwater Pumping Station (Pontiac Pump Station) and Network (City of Windsor, 1974)

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#### Scope:

This study completed by the City of Windsor was primarily initiated to ensure all considerations, that would have a bearing on the ultimate drainage area, were fully evaluated. The study of the Riverside Drainage District involved the examination of present land use and investigation of past flooding conditions, as well as proposed developments, in order to ascertain future storm runoffs and the necessary facilities to service the drainage district. The study area is basically defined as the built-up area presently serviced with a conventional storm drainage system lying west of Little River, and a larger undeveloped tract of land bounded by the Canadian National Railway properties on the south and Lake St. Clair on the north, between the Little River channel and the easterly City limits. Within the latter undeveloped area, ultimate schemes were analyzed to determine the optimum system that would be necessary.

#### Recommendations:

- Of the four schemes identified within the report, Scheme 4 was selected as the most economical and viable option of storm drainage. This included the following design:
  - Conventional storm drainage system.
  - New Little River storm pumping station (Pontiac Pump Station, north of LRPCP) with “screw-type” pumps.

- The existing Jerome Street Pumping Station had a remaining life expectancy of 30 months at the time of the study and a new facility would not be able to be completed and operational within three years.
- Scheme 4 proposed a new Little River (Pontiac) Pumping Station to replace the existing Jerome Street Pumping Station to service the built-up area. This scheme also included an ultimate storm trunk system to accommodate the present storm drainage flows from the western built-up area and extended to relieve the Elinor Street Subdivision and East Marsh Pumping Station Facility. This work was necessary to accommodate the future development of the rural lands to the east of the station.
- Final report recommendations included that engineering for a new pumping facility be completed by the end of 1974.

### 3.9 St. Paul Drainage Area Storm Relief Sewers – Stage 2 (Dillon, 1975)

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#### Scope:

In September 1973, M.M. Dillon Limited, Consulting Engineers, completed a preliminary report. This report presents the design considerations and functional plans for the Wyandotte Street trunk storm sewers and road reconstruction. The installation of a trunk storm sewer on Riverside Drive from St. Rose Avenue to Lauzon Road was also rescheduled for this phase.

#### Recommendations:

- Install new trunk storm sewers on the section of Wyandotte Street according to the specifications of the Preliminary Design Report for the St. Paul Drainage Area storm relief sewers.
- Proposed 48 inch diameter storm sewer on Wyandotte Street from St. Paul Avenue to Lauzon Road, which has been oversized to relieve the 48 inch diameter trunk storm on St. Paul Avenue, north of Wyandotte Street.
- Oversizing in the section of storm sewer from Frank Avenue to Lauzon Road to provide drainage for future development.

### 3.10 Technical Discussion - Proposed Little River Stormwater Pumping Station (MacLaren, 1976)

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#### Scope:

Enclosed in this report are the Technical Discussion and the accompanying Functional Drawings for the proposed Little River Stormwater Pumping Station. This report was written by MacLaren Engineers Inc. for the City of Windsor as a supplement to the Pre-Design Report. Through these documents, all the necessary preliminary investigations and explorations and other activities necessary to arrive at the point at which detailed design can commence, have been completed.

#### Recommendations:

- An Archimedes Screw Pump arrangement will be used for the new station.

- The pumping station would outlet to Little River via an artificial channel with a lip elevation of 579.5 feet so that the pump would continue to discharge to the river up to a top river level of approximately 581 feet. Above this operating level, stop gates in the proposed discharge bay would need to be closed and the station shut down.
- In order for the station shut-down to cause extensive surface ponding and basement flooding in the service area, a storm of greater intensity than the 1:100-year event would have to occur simultaneously over the 500 acre area.
- A sewer connection would be built to intercept flows from the Jerome Street Pump Station as the storm relief sewers are not expected to be built for some time.

### 3.11 Flood Line Mapping Study – Little River Watershed (Dillon, January 1977)

#### Scope:

This study by M.M. Dillon Limited was commissioned by the Essex Region Conservation Authority and completed a flood plain investigation on the Little River extending from the Detroit River to the southern boundary of the City of Windsor. The purpose of the flood plain study was to determine the effect of specified storms (Hurricane Hazel and 100 year flood) within the Little River watershed and assist in adopting a suitable watershed management program for the Little River.

#### Recommendations:

- Channel improvements including widening, deepening, realignment, diking and the enlargement of existing structures are the most feasible corrective flood prevention methods recommended. Areas of particular interest included the CN Railway crossing and the reaches between Lauzon Road and the CP Railway.
- Annual inspection and cleaning of debris should be performed along the river particularly at crossings such as the CN Railway crossing.
- The Municipal, Railway and Highway Officials should be advised on the backwater effects of existing structures. Before replacement, the Authority should be given the opportunity to make comments on the size and arrangement of new structures.
- Runoff from new development outside of the flood plain should be limited through the use of new techniques for controlling stormwater runoff such as porous concrete, on-site storage, etc.
- Flood-proofing of new and existing developments should be considered in some areas provided that the stage-storage characteristics of the channel are not adversely affected.
- In areas where the extent of flooding was minimal, the two zone development concept and flood-proofing should be considered.

### 3.12 Design Report for the Little River Storm Sewer Network (Dillon, April 1977)

#### Scope:

On 30 October 1974, M.M. Dillon Limited was authorized by the City of Windsor to prepare a report for the Little River Storm Sewer Network. The scope of the report includes the review of all available

information with the Department of Public Works including recently completed inventories and other reports that have been prepared. The report also carried out a preliminary calculation of the stormwater runoff to be assigned to the Little River Stormwater Pumping Station, permit design of the pumping station to proceed by others in parallel with this assignment. Determine the preferred conventional drainage scheme and prepare preliminary design and cost estimates.

Recommendations:

- The major storm relief sewer recommended for this area would be located along Riverdale Avenue, Menard Street, and Jerome Street in the residential area west of Little River.

### 3.13 Preliminary Engineering Study Little River (Dillon, August 1977)

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Scope:

The report was prepared by M.M. Dillon Limited for the Essex Region Conservation Authority to first, review the flood plain along the Little River including its shoreline in light of the new two zone criteria adopted by the Essex Region Conservation Authority in 1977, and second to assist the Conservation Authority and the Municipality in their long range program of development along the river valley.

Recommendations:

- Dikes should be constructed along the shoreline from Lake St. Clair to the CN Railway for flood prevention. Protection of existing and future flood plain developments should be accomplished through flood-proofing.
- The Essex Region Conservation Authority should encourage the use of flood plain land as green belt areas (e.g. golf course, park) between Lauzon Road and E.C. Row Avenue.
- Upstream of Lauzon Road, should be left open and undeveloped.
- A flood plain study for the remainder of Little River watershed should be carried out.

### 3.14 St. Paul Drainage Area: Report on Stormwater Management Study (Dillon, 1980)

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Scope:

M.M. Dillon Limited was retained by the City of Windsor to conduct this study which included the analysis of the St. Paul Drainage Area storm sewer system to determine existing deficiencies or if any cost saving modifications could be achieved. The study also acted as a trial run for the City of Windsor to determine if models such as SWMM and WRE-SWMM could be applied in Windsor and what impacts such models might have on the City's urban drainage systems.

Recommendations:

- A few design approaches to be improved including calibration, basement weepers and roof leader connections.

- The City should implement the relief sewers program in the St. Paul Drainage Area, generally as proposed in the 1973 report:
  - A new 27" diameter interceptor sewer should be installed from the existing Isabelle Place 42" trunk at Clairview Avenue moving east to the intersection of Clairview Avenue and Belleperche Place, and north on Belleperche Place to the existing 54" Riverside Drive trunk. Alternatively, the lateral sewers on Virginia Avenue, Edward Avenue and Isabelle Place, south of St. Rose Avenue could be intercepted via the proposed St. Rose Avenue trunk and drained east to the detention basin rather than north via the Isabelle Place 42" trunk.
  - The proposed 36" trunk on Cedarview Street east of Lauzon Road should be drained west from Watson Avenue to the proposed Lauzon Road trunk rather than east to the proposed Dieppe Street trunk.
- The detention basin as proposed in 1973, was recommended as an essential component of the relief sewer program.
- The St. Paul Pump Station was satisfactory. Consideration should be given to automating the existing manual pump to provide automatic start of the fully installed capacity of 440 cfs.

### 3.15 Report on Pillette Road/Seminole Street Storm Relief Sewer System (City of Windsor, 1982)

#### Scope:

This report was prepared by the Department of Public Works of the City of Windsor to develop a comprehensive plan showing the existing storm sewer network, review the existing storm sewer system including structural analysis and hydraulic capacity assessment. The proposed Pillette Road/Seminole Street Drainage Area is approximately 450 acres and is serviced by two types of separated sewers: those completely separated, and those separated but with combined manholes. The study area includes the lands north of Tecumseh Road, west of Westminster Boulevard, east of Walker Road and south of Detroit River. Flooding in the study area was found to be caused by surcharging in the sanitary sewer.

#### Recommendations:

- A detailed study should be initiated to determine the most effective means of repairing the existing sanitary sewer system.
- Storm relief system is recommended to be constructed in the Pillette Road/Seminole Street Drainage Area.
- Proposed system to drain all of the existing Pillette Road Drainage Area and portions of the existing Pillette Road Drainage Area and portions of the existing Franklin Street and George Avenue Drainage Areas.
- Temporary relief should be considered for flood prone areas with no available immediate relief including the installation of stormwater inlet control devices.



## 3.16 Engineering Study – Little River Dike Repairs (LaFontaine, 1983)

## Scope:

LaFontaine, Cowie, Buratto & Associates Limited was retained by the Essex Region Conservation Authority to conduct a study on the Little River dikes. The purpose of the study is to assess the present condition of the Little River dike system and to make recommendations for the most economically viable methods of rehabilitation to ensure that the system will perform its intended function.

## Recommendations:

- Construct protected earth dike system using 300 mm thickness of selected graded crushed rock, 75 mm to 150 mm size, placed on approved geotextile filter membrane between Riverside Drive and CN Railway.

## 3.17 Ford/Raymond &amp; Riverside/Reedmere Storm Relief Sewer System Including Supplementary Report (LaFontaine, 1986)

## Scope:

This addendum report was prepared by LaFontaine in October 1986, primarily to review the entire storm relief sewer system. Specifically, first, connecting the Ford Boulevard/Raymond Avenue, Riverside Drive/Reedmere Avenue systems into the St. Paul Drainage System by tapping into an existing 36" diameter sewer constructed on Riverside Drive as far west as St. Rose Avenue. The purpose of this cross-connection between systems would be to providing a means of "draining" the Ford Boulevard/Raymond Avenue sewers dry following a storm runoff event. Second, to consider the matter of rising lake levels and whether alterations to the outlet scheme can be made to adjust to the potentially higher lake levels.

## 3.18 Design Report Lauzon Corridor Servicing Program (N.K. Becker &amp; Associates Ltd., 1987)

## Scope:

N.K. Becker & Associates Ltd. was retained by the City of Windsor to make recommendations for the final design, coordination and scheduling of the six major Public Works projects including the Lauzon Parkway extension, the reconstruction and widening of Lauzon Road, the McHugh Street extension, the completion of the St. Paul storm relief system, the Lauzon Road/Jerome Street trunk sanitary sewer and local sanitary sewers.

## Recommendations:

- Construction of a new trunk storm sewer on Edgar Street from Lauzon Road to Parkview Avenue.
- Construction of a new trunk storm sewer on Lauzon Parkway from Wyandotte Street to the National Railway.
- Construction of the St. Paul detention basin (stormwater management pond) with outlet sewers to St. Rose Avenue and Lauzon Road.

- The Lauzon Road corridor servicing program be implemented in stages from Wyandotte Street southerly.
- Construction of the Lauzon Road/Jerome Street trunk sanitary sewer.
- Construction of local sanitary sewers south of Tranby Avenue outletting to the Lauzon Road/Jerome Street trunk.

### 3.19 Little River Comprehensive Stream Study (CH2M, April 1991)

#### Scope:

CH2M Hill Engineering Ltd. was retained by the City of Windsor to complete a preliminary assessment of effluent volumes and pollutant loadings discharging into the Little River. The purpose of the study was two-fold. Firstly, to describe with currently available data, effluent volumes and loadings. Secondly, to identify any data deficiencies that should be addressed during monitoring in the Spring of 1991.

### 3.20 Little River Comprehensive Stream Study (LaFontaine, 1992)

#### Scope:

The Little River Comprehensive Stream Study was initiated by LaFontaine, Cowie, Buratto & Associates Limited in June 1992, in response to the concerns expressed by the City of Windsor and the Ontario Ministry of the Environment in regard to the impairment of the environmental quality of the Little River. The concerns of the City of Windsor and the Ministry of the Environment were focused on the nature and extent of impairment evident in the Little River and the possible causes which could be directly related to the deterioration in aquatic habitats. The study was designed first to provide a comprehensive database through which an assessment of stream environmental quality could be made. Secondly, an inventory of all contaminant inputs and physical basin characteristics provided information in regard to the potential causes of environmental impairment.

#### Recommendations:

- Improvements to the sanitary system included:
  - Implementation of the recommendations set forth in the Riverside Infrastructure Needs Study. These included separation of the combined sewers in the area bordered by Grand Avenue (south), Pillette Road (west), South National Street (north), Jefferson Boulevard (east), as well as the area bordered by Thompson Boulevard and Esdras Place between Wyandotte Street and Riverside Drive.
  - Carrying out further Combined Sewer Overflow (CSO) and Little River Pollution Control Plant by-pass control after completion of the remedial works recommended in the Riverside Infrastructure Needs Study.
  - Providing sanitary services to areas not previously serviced.
  - Connection of all new and existing industrial facilities to municipal sanitary sewer.
- Proposed storm sewer relief projects:
  - Rose Avenue/Adstoll Avenue/Joinville Avenue storm relief system.

- Little River storm relief system.
- St. Paul Avenue storm relief system.
- Ford Boulevard/Raymond Avenue storm relief system.

### 3.21 Lakeview Planning Area SWM Hydraulic Study (Hanna, Ghobrial, & Spencer, 1994)

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#### Scope:

Hanna, Ghobrial, & Spencer was retained to complete hydraulic and hydrologic investigations for the stormwater management of the proposed development of the Lakeview Planning Area. The report compiles information obtained from previous reports and studies, maps, aerial photographs, plans and from a visual site assessment and establishes the basis for a functional design of the storm sewer system servicing the Lakeview Planning Area and the Parent Outlet Drain Drainage Area. The results of the hydraulic and hydrologic investigations, along with a review of the existing conditions and previous drainage proposals, in order to identify an appropriate stormwater management plan for the study area.

#### Recommendations:

- Construct the storage pond between Jarvis Street and Parent Outlet Drain.
- The storage pond will direct outflow to the Detroit River via pump station.

### 3.22 Turkey Creek and Little River Subwatershed Study (Dillon, 1997)

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#### Scope:

M.M. Dillon Limited was retained by the Essex Region Conservation Authority to produce a recommended subwatershed plan and implementation measures. The purpose of this subwatershed planning study is to develop an integrated subwatershed plan covering three municipalities, and two subwatersheds. The completed subwatershed planning study will provide guidance to local and regional authorities in planning future land use development while ensuring protection, restoration and enhancement of the natural features in the subwatersheds.

#### Recommendations:

- Maintain spill area to Canard River.
- Southwood Lakes provides over-control for Cahill Drain catchment within Windsor, but Sandwich South (Little River) would still require storm management control.
- Basin Drain within the City of Windsor requires a regional flow control facility.
- Upper Grand Marais Drain south of E.C. Row Expressway, an existing culvert under the E.C. Row Expressway, restricts flow. On-site control required.

## 3.23 St. Paul Area Master Storm Drainage Plan (CH2M &amp; HGS, 1998)

## Scope:

CH2M Gore & Storrie Limited and Hanna, Ghobrial & Spencer Ltd. were retained by the City of Windsor to create a master storm drainage plan for the St. Paul Avenue area. The St. Paul Drainage Area has experienced street and basement flooding during high intensity rainfall events. The identified main reason for the flooding is the lack of natural drainage due to the flat topography in the area. This plan provides methodology carried out for the flooding analysis within the St. Paul Drainage Area, the development and assessment of alternatives for the mitigation of flooding within the area and the preferred alternative to be implemented.

## Recommendations:

- Provide a storm sewer connection from the uncompleted sections of Tranby Avenue and Edgar Street trunk storm sewers to the existing large diameter trunk storm sewers on Lauzon Road south of Wyandotte Street, and Little River Road at Village Drive.
- The existing storm sewer from Edgar Street to St. Rose Avenue on St. Paul Avenue would be removed.
- Allow under-capacity storm sewers along Lauzon Road and Little River Road to be replaced by large diameter relief sewer proposed for these street segments.
- Low intensity storms should be directly routed to the St. Paul Pump Station via Lauzon Road trunk sewer, while runoff from higher intensity storms should be split between the St. Paul and Primord Stations to make use of available pumping capacity at both pumping stations.
- All inadequate local sewers identified in the findings should be considered for remedial sewer design and construction when future road construction or development takes place.

## 3.24 Pontiac Pumping Station Storm Water Flooding Assessment (CH2M Hill, 2001)

## Scope:

CH2M Hill was retained by the City of Windsor to submit a report pertaining to the Pontiac Pumping Station Stormwater Flooding Assessment due to the storm event of August 2, 2000. The scope of this study included identifying the cause of basement flooding within the study area, and an assessment of possible control alternatives to minimize surface and basement flooding. Hydraulic models were developed for the Pontiac Pump Station and Little River Pollution Control Plant drainage areas to perform the analysis.

## Recommendations:

- All pump failures and main pump breaker trips at the Pontiac Pump Station should be monitored and displayed at the Little River Pollution Control Plant.

- The Pontiac Pump Station wet well water elevation should be readily displayed at the Little River Pollution Control Plant in conjunction with the wet well water elevation in the pollution control plant.
- An alarm should be installed to indicate when the water elevation in the Pontiac Pump Station is higher than the water elevation in the Little River Pollution Control Plant wet well.
- It was recommended that the existing protocol in opening the relief valve to direct flows from the sanitary system to the storm system be reviewed and modified to account for all operation scenarios. The revised protocol was to ensure that the Pontiac Pump Station is in full operation and that the water level in the Pontiac Pump Station is at an acceptable level prior to opening the relief valve.
- The existing Little River Pollution Control Plant overflow structure to the Pontiac Pump Station should be reviewed for the installation of a check valve to ensure that flow from the Pontiac Pump Station to the Little River Pollution Control Plant wet well is prevented. This will however, remove the system flexibility of a possible overflow from the storm system to the sanitary system if the need arises.

### 3.25 North Neighbourhood Pond Final Design Report (Dillon, April 2002)

#### Scope:

Dillon Consulting Limited was retained to develop modifications to the conceptual design for the East Riverside Planning Area Stormwater Management and Flood Protection Plan (August 1999). The proposed stormwater management system consisted of a single pond to service the North Neighbourhood Development and City owned lands, and outlets to the existing Pontiac Pumping Station. The normal design water level in the pond was 172.50 m and the design high water level was 174.50 m. The flood-proofing elevation for the entire North Neighbourhood Development was 176.30 m, as per the Essex Region Conservation Authority requirements.

#### Recommendations:

- This report addresses a proposed stormwater management system consisting of a single pond to service the North Neighborhood Development and City owned lands and will outlet to the Pontiac Pumping Station.
- An outlet sewer from this pond to will run just south of Wyandotte Street to existing storm sewer leading to the Pontiac Pumping Station.

### 3.26 Environmental Study Report, Little River Stream Crossing, East Riverside Area Access (Dillon, May 2002)

#### Scope:

Dillon Consulting Limited was retained by the City of Windsor to conduct an environmental study of the Little River Stream Crossing and East Riverside Area Access. The Little River Stream Crossing/East Riverside Access Class Environmental Assessment was initiated in response to the planned development for the

East Riverside Planning Area and existing development in the Sandpoint and Lakeview Planning Areas. The Little River Stream, to the west of the East Riverside community, represents a physical barrier to all forms of transportation in the east-west direction. The study recognized that there currently is an expanding demand for travel between East Riverside and the existing Riverside community.

Recommendations:

- Mitigation plan for the new roadway crossings.
- Stormwater pond concept in East Riverside park area.
- Wyandotte Street/McHugh Street/Little River crossing bridge.

### 3.27 Provincial Road Square – Stormwater Management Report (Dillon, July 2007)

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Scope:

Dillon Consulting Limited was retained by the City of Windsor to provide a report on the proposed stormwater management plan for Provincial Road Square. Provincial Road Square is a 4.7 ha site fronting on Provincial Road that is proposed to be developed for commercial users. The purpose of this stormwater management report is to develop a stormwater management system for the Provincial Road Square site and for the Sixth Concession Drain to the west of Walker Road, and to improve the operational and maintenance issues of the current Legacy Pond.

Recommendations:

- Clean the Sixth Concession Drain to make use of the excess capacity in the Sixth Concession Drain.
- Install a new pump station to increase the discharge rate from Legacy Park, Walker Road Square and Provincial Road Square.
- Make use of the stormwater storage capacity in the parking lots for the 1:100 year storm.
- Provide underground storage for the 5 year event from Legacy Park and underground storage and an overflow pipe from Walker Road Square.
- Provincial Road Square site to discharge 5 year storm to Sixth Concession Drain with no storage.
- Outlet sewer from Sixth Concession Drain.

### 3.28 Upper Little River Watershed Master Drainage and SWM Plan, EA, ESR (Stantec, Ongoing)

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Scope:

The City of Windsor, the Town of Tecumseh, and the Essex Region Conservation Authority commenced a study in 2004 to document existing conditions and to recommend stormwater management measures to protect existing resources as development continues in the upper reaches of Little River. Stantec Consulting Ltd. was then retained to complete a Class Environmental Assessment Study to determine a preferred approach to providing stormwater management control measures for the developing lands upstream of the E.C. Row Expressway and contributing to upper Little River and to ensure that urbanization of the watershed can occur in a fashion that will not lead to negative impacts on the receiving

systems including increased flood risk, the impairment of natural watercourse features, and would allow for future enhancement of the watercourse, stream margins and wetlands.

Recommendations:

- The preliminary preferred alternative (Alternative 6) provides all stormwater management controls before outletting to the downstream watercourses.
- Group stormwater management facilities into stormwater management corridors to promote natural linkages, recreational trails, and greenways.

This study has not been finalized as of the completion of this Master Plan. Recommendations listed above are based on the latest draft version.

## 4.0 Detroit River Drainage Area

### 4.1 Prince Road Sewerage Study (City of Windsor, 1970)

#### Scope:

The City of Windsor carried out this study to investigate the sewerage system tributary to the Prince Road/Hill Street sewers and Algonquin Street/Felix Avenue/Brock Street sewers. The work included a complete field investigation of the existing system and a hydraulic analysis.

#### Recommendations:

- The existing combined sewer on Hill Street and Prince Road from Sandwich Street to the Essex Terminal Railway be converted into a sanitary sewer, supplemented by a new storm sewer discharging to the Detroit River.
- Trunk storm sewer outletting to the Detroit River to replace the combined sewer on Prince Road from Essex Terminal Railway to Huron Church Road.
- Sanitary trunk sewer be constructed in the Totten Street area following the existing Algonquin Street trunk storm sewer.
- A sanitary system be constructed to service the area west of Russell Street when required by development.

### 4.2 George Avenue Storm Relief Sewer (Dillon, 1971)

#### Scope:

M.M. Dillon Limited was retained by the City of Windsor to investigate the condition and capacity of the existing storm sewer system and determine concepts/outline functional schemes for relief of the existing system. This design report provides a preliminary design of the Area A storm relief system. The first stage of this system is an outlet sewer from Seminole Street to the Detroit River with an interceptor sewer along Seminole Street. This design report establishes the route, provides miscellaneous details where unusual situations occur and includes cost and subsidy estimates.

#### Recommendations:

- Lower the 84 inch diameter storm sewer to pass under the 21 inch sewer which exists along Riverside Drive at such a depth that it interferes.
- Proposed trunk storm sewer from Seminole Street outletting to the Detroit River on George Avenue.



#### 4.3 Design Report – Wyandotte Street East Reconstruction Ph. 1 (LaFontaine, 1974)

##### Scope:

LaFontaine, Cowie, Buratto & Associates Limited was retained by the City of Windsor to complete a design report for the proposed reconstruction of Wyandotte Street East from Patrice Avenue to St. Rose Avenue. This report includes recommendations with respect to the construction of storm sewers in this area and two alternate outlets to the Detroit River.

##### Recommendations:

- Storm sewer on Wyandotte Street from Victor Drive to St. Rose Avenue.
- Storm sewer on part of St. Rose Avenue south of Wyandotte Street to eliminate stormwater flows from combined sewers.

#### 4.4 Chilver Road/Kildare Road Storm Sewer Outfall (Dillon, 1975)

##### Scope:

Hiram Walker and Sons Limited propose to construct a Distiller's Dried Grains Storage and Shipping Building over the City of Windsor storm sewer outfall. This report was prepared by M.M. Dillon Limited requested by the City of Windsor to determine the structural adequacy of the outfall under the proposed building loading conditions and to determine if the outfall has sufficient hydraulic capacity to meet future requirements. Outfall sewers were determined to have a sufficient capacity to convey all future flows based on a 5 year design storm.

#### 4.5 Prince Road Trunk Storm Sewer (MacLaren, February 1978)

##### Scope:

James F. MacLaren Limited was retained by the City of Windsor to propose a Prince Road trunk storm sewer. The study includes a review of various alternatives to accommodate the storm flows, generated in the Prince Road Drainage Area, and how to convey this runoff to the Detroit River. The study analysed the problem using the Stormwater Management Model (SWMM) computer technique.

##### Recommendations:

- Storm flows from the Sun Valley Drive Subdivision should be discharged to the new Prince Road trunk sewer and the existing cross-connection to the Felix Avenue system should be eliminated when the new trunk is fully constructed.
- Existing lateral sewers, in areas currently served by combined sewers, will have to be converted to a sanitary sewer function, and new storm sewers installed, if the desired level of protection against flooding is to be achieved in the Prince Road Storm Drainage Area.

## 4.6 Servicing Requirements for Yawkey (Kleinfeldt, 1981)

## Scope:

Authorization was given by Council Resolution 937/79 for Kleinfeldt Consultants Limited to prepare reports, plans and specifications for the extension of services into the Yawkey Industrial Estate. This report includes the analysis of the required improvements to the existing Healy Drain storm outlet, and the construction of the trunk sanitary sewer through the Yawkey Industrial Estate to service the ultimately developed Ojibway sanitary sewerage area, in accordance with Council Resolution 661/80.

## Recommendations:

- Healy Drain outlet be deepened and widened from the Detroit River to Sandwich Street to accommodate the expected additional stormwater flows.
- The sanitary sewer outlet for the Yawkey Industrial Estates be oversized.
- The trunk sanitary sewer outlet be extended along Chappus Street to Dupont Street.
- New storm sewers in the area bound by Sandwich Street/Broadway Street/Scotten Avenue/Chappus Street.

## 4.7 Crawford Avenue Storm Relief System Functional/Design Report (Dillon, 1982)

## Scope:

M.M. Dillon Limited was authorized by the City of Windsor to undertake a design report of the Crawford Avenue Storm Relief System. An analysis of the hydraulic capacity of the existing combined sewer system indicated that the majority of the sewers south of Elliot Street West and the Wellington Avenue trunk sewer have inadequate capacities to act as combined sewers. The majority of basement flooding reports have been received in this area.

## Recommendations:

- To reduce the basement flooding, it was recommended that the Wellington Avenue trunk sewer from Tecumseh Road to University Avenue be constructed; this sewer would then outlet to the Detroit River from the storm sewer on Elm Avenue.

## 4.8 Woodlawn/Ypres Drainage Area – Flood Relief Study (Becker, 1983)

## Scope:

Frequent basement and roadway floods in the Woodlawn/Ypres Area, prompted the City of Windsor to initiate a flood relief study. N.K. Becker & Associates Ltd. was retained to carry out an engineering analysis of the Woodlawn/Ypres sewer system using a modern stormwater management approach, including computer modelling to estimate catchment runoff, effect of backwater, and branch hydraulic networks. The study area comprises approximately 115 hectares of mostly residential and open space land use. This study includes recommendations for cost effective methods to reduce the frequency and severity of basement flooding.

## Recommendations:

- A new relief sewer on Parent Avenue from Hanna Street to Lens Avenue.
- A new sewer on Vimy Avenue from Elsmere Avenue to Lillian Avenue.
- A new sewer on Hall Avenue from Lens Avenue northerly approximately 90 m.
- Eliminate interconnections between the sewer systems in the downstream lands and adjacent sewer systems.
- Construct a 1200 mm interconnection between the trunk sewer along Parent Avenue and Langlois Avenue in the vicinity of Wyandotte Street.
- Installation of catchbasin flow restrictor devices (ICDs) and storm detention sewers.
- Establish a public information program to inform all City residents about the reasons for basement flooding.

## 4.9 Windsor Riverfront Pollution Control Planning Study Phase I (LaFontaine, 1994)

## Scope:

LaFontaine, Cowie, Buratto & Associated Limited was retained by the City of Windsor, with funding assistance from the Province of Ontario, to produce a report on the Phase I of the Windsor Riverfront Pollution Control Planning Study. Phase I involves identification of all points of wastewater discharge into the Detroit River and impact estimation of pollutant loads on the river.

## Recommendations:

- The severe hydraulic overload condition in the eastern utilities sewer be solved.
- Comprehensive inspection program be undertaken of all the connection points between the combined and storm relief sewer systems.
- Continue investigations in Phase II of the study.

## 4.10 Windsor City Centre Infrastructure Master Plan (Dillon, 1996)

## Scope:

To ensure that the necessary infrastructure required to support the new Windsor City Centre development would be available, City Council authorized M.M. Dillon Limited to complete the Windsor City Centre Infrastructure Master Plan Study to identify the nature of the infrastructure requirements.

## Recommendations:

- Construction of the following storm sewers:
  - 300 mm storm sewer on Glengarry Avenue from Chatham Street to Pitt Street.
  - 750 mm storm sewer on Glengarry Avenue from Chatham Street to University Avenue.
  - 900 mm storm sewer on University Avenue from Glengarry Avenue to McDougall Street.
  - 375 mm and 450 mm storm sewer on City Hall Square Drive from Park Street to McDougall Street.

- Construct 2100 mm diameter trunk storm relief sewer on McDougall Street from Detroit River to Tuscarora Street.
- 250 mm and 300 mm diameter sanitary sewers at numerous locations.
- Construction of 1600 mm diameter sanitary sewers at McDougall Street from Chatham Street to University Avenue and on University Avenue from Mercer Street to McDougall Street.

#### 4.11 Riverside Drive East – Flood Relief Study (BTS, 1998)

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##### Scope:

BTS Consulting Engineers was retained by the City of Windsor to investigate the flooding that occurred along the 10000 block of Riverside Drive East on 9 April 1998. The principal objectives of the study included the evaluation of the existing shore protection and drainage facilities on Riverside Drive East from Greenpark Boulevard to Sandpoint Park, and BTS to provide recommendations to eliminate and substantially reduce the potential for flooding on Riverside Drive East, based on their evaluations.

##### Recommendations:

- The construction of improved secondary berms, a secondary retaining wall and a raised sheet pipe wall, a submerged breakwater or a pair of jetties.
- The installation of four ditch inlet catchbasins.
- Minor improvements to the Ganatchio Trail barrier landform.
- The construction of a cast-in-place retaining wall.

#### 4.12 East Riverside Planning Area Stormwater Management and Flood Protection Plan (Dillon, 1999)

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##### Scope:

Dillon Consulting Limited, Essex Region Conservation Authority, Hanna, Ghobrial & Spencer Ltd., and Knowles Engineering Inc., worked together to complete this stormwater management plan for the East Riverside Area between 1989 and 1999, providing a plan allowing for the future development of the area and assuring protection from flooding from the outside by Lake St. Clair or Little River and excessive flooding of low lying portions of the study area by runoff originating within the area.

##### Recommendations:

- To protect existing developments from flooding by new development's surface runoff and/or flooding by lake induced water level, the proposed drainage system for the area will be self-contained and separated from the existing Riverside Drive/Marsh Tap drainage system.
- Overtopping flooding from the lake was to be confined to an area west of the future Scarsdale Road alignment and south of the existing Little River alignment by the construction of barrier land forms and flood control weirs.

## 4.13 Woodlawn/Ypres/Memorial Storm Relief Study (CH2M Gore &amp; Storrie Limited, 2000)

## Scope:

Due to the 1997 storm and flooding, CH2M Gore & Storrie Limited was retained by the City of Windsor to complete this storm relief study, which provides the methodology employed for the flooding analysis, the development and assessment of alternatives for flooding mitigation and the preferred alternatives to be implemented within the Woodlawn Avenue/Ypres Avenue/Memorial Drive drainage area. Existing system improvements and new storm relief infrastructure have been identified to ensure that the hydraulic gradeline within the sewer system is below the basement elevations for the 1:5 year return storm event.

## Recommendations:

- Correct cross-connections between sanitary and storm sewers on Kildare Road.
- Remove process flows being contributed by the Chrysler plant.
- Implement a program for the removal of root intrusions.
- Disconnect catchbasins from combined sewers within Optimist Park.
- Disconnect catchbasins in field between Lens Avenue and Lillian Avenue.
- Disconnect 50% of the roof leaders connected in the study area with the first priority for areas with a separate sewer system.
- Area bounded by Ypres Avenue/Hall Avenue/Tecumseh Road/Gladstone Avenue:
  - Build a relief sanitary sewer on Tecumseh Road and alley way commencing from east of Gladstone Avenue and proceeding westerly to Parent Avenue connecting sewers from sanitary sewers in the alley ways between Gladstone Avenue, Moy Avenue, and Hall Avenue, also intercepting the sanitary sewers on Parkwood Road and Forest Avenue.
  - Convert the existing combined sewer on Tecumseh Road to a storm sewer.
  - Sanitary relief sewer and disconnect 50% of roof leaders.
  - 400 m<sup>3</sup> off-line storm sewer storage facility on the corner of Hall and Lens.
- Area bounded by Gladstone Avenue/Ypres Avenue/Lincoln Road/Tecumseh Road:
  - Relief sanitary sewer and disconnect of 50% of roof leaders.
- Area bounded by Memorial Avenue/Gladstone Avenue/Ypres Avenue/Kildare Road:
  - Replace the over/under sewer with a separated system including the private service laterals within the alley ways.
  - Upgrade the capacity of the sanitary sewer on Ypres Avenue from Gladstone Avenue to Ypres Avenue Pump Station.
- Area bounded by Memorial Drive/Kildare Road/Somme Avenue/Ida Road:
  - Rectify the sewer structural deficiencies identified in the Gail Road alley way up to Somme Avenue.
  - Reduce amount of inflow into the sanitary sewer by roof leader disconnect.
- Area bounded by Ypres Avenue/Byng Road/Walker Road/Tecumseh Road:
  - Replace existing 350 and 500 mm diameter pipes on Byng Road, between Lens Avenue and Tecumseh Road, with a 900 mm diameter pipe.

- Area bounded by Ypres Avenue/Elsmere Avenue/Woodlawn Avenue:
  - 400 m<sup>3</sup> off-line storm storage facility is required at Moy Avenue and Ypres Boulevard.
  - 1600 m<sup>3</sup> combined storage facility at Forest Avenue and Ypres Boulevard to relieve the flooding in this area and decrease the level of surcharge on Wellesley Avenue.
  - Extend the relief storm sewer on Parent Avenue between Lens Avenue and Vimy Avenue to relieve the conveyance capacity.
- Area bounded by Irvine/Lillian/Logan/Howard:
  - Construct a relief storm sewer on Irvine Avenue from Howard Avenue to Marentette Avenue, along Marentette Avenue and Tecumseh Road connecting to the existing relief storm sewer on Parent Avenue.
- Area bounded by Memorial/Louis/Howard:
  - Install a relief storm sewer in this area from Lillian Avenue and Vimy Avenue to the relief storm sewer at Parent Avenue and Terminal Street to eliminate the surcharge experienced in this area.

#### 4.14 Prince Road Sewer Study (Stantec, 2001)

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##### Scope:

Stantec Consulting Ltd. was retained by the City of Windsor to conduct a study of the Prince Road sewage system area. The Prince Road sewage system study area is primarily residential with significant areas of commercial and industrial development. This area has had a common occurrence of basement flooding following severe storms. The work that this study entails includes a review of previous studies, a review of flooding complaints, and development of a computer model of the existing storm and sanitary sewer systems.

##### Recommendations:

- Construction of the Prince Road trunk storm sewer from the McKee Creek to Huron Church Road.
- Construction of the Prince Road trunk sanitary sewer from Wells Street to Totten Street at Huron Church Road.
- Completion of the Algonquin Street trunk sanitary sewer along Betts Avenue from Algonquin Street to Totten Street, on Totten Street between Huron Church Road and Betts Avenue and onto Prince Road.
- Elimination of the cross-connections between the Prince Road sewage system and the Felix Avenue sewage system at Dorchester Road and Manchester Road.
- Storm sewer outletting to Prince Road will be required on Totten Street.

#### 4.15 Windsor Riverfront RTB Class EA (Stantec, 2008)

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##### Scope:

Following the 3 phases of the Windsor Riverfront Pollution Control Planning Study, Stantec Consulting Ltd. was retained by the City of Windsor to conduct this environmental assessment and develop solutions for

the identified problems. The City of Windsor initiated this Class EA and preparation of a functional design report as the next step in implementing the riverfront CSO control program.

Recommendations:

- A RTB, located on the riverfront between Aylmer Avenue and Glengarry Avenue, sized to treat a maximum CSO flow of 7.85 CMS at a surface overflow rate of 20 m/hr.
- A CSO collection sewer extending from Ouellette Avenue to Chamber U east of Devonshire Road.
- A CSO pumping station from the CSO collector sewer into the RTB.
- An underwater effluent outfall to the Detroit River.

#### 4.16 East Riverside Expropriation in the City of Windsor – SWM Opinion Report (Dillon, 2009)

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Scope:

The City of Windsor has initiated the expropriation and conveyance process of a parcel of land currently owned by 1027458 Ontario Ltd. (Coco Group), approximately 20.5 hectares in size, located within the North Neighbourhood Development. Dillon Consulting Limited has been retained by the Coco Group to provide engineering advice on alternative stormwater management solutions for the drainage area attributed to the North Neighbourhood pond.

Recommendations:

- Four stormwater management options for the North Neighbourhood:
  - Option #1: One regional pond stormwater management facility west of the subject lands, and east of the Little River Sewage Treatment Plant.
  - Option #2: Individual stormwater ponds for the lands owned by the Coco Group and other owners.
  - Option #3: A series of smaller ponds within the property.
  - Option #4: A combination of reduced sized ponds and oversized sewers for pipe storage.

#### 4.17 East Riverside Flood Risk Assessment (Landmark, 2019)

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Scope:

Landmark Engineering was retained to documenting and assessing the condition of the existing flood control measures along Riverside Drive East from St. Rose Beach, easterly to the City boundary with the Town of Tecumseh, quantifying the risk to the flood-prone areas, prepare a prioritized action plan to address and mitigate the risk of overland flooding, and to provide updated design recommendations and cost estimates for budgeting purposes.

## Recommendations:

- Carry out functional and detailed design and implementation of backflow prevention measures for each identified location.
- Carry out functional and detailed design and implementation of the proposed dike improvements for the area west of Little River should be carried out as soon as possible. Obtain property and/or easements should be acquired where needed for the construction of the proposed dike improvements. Construction of the recommended dike improvements west of Little River should then proceed as soon as possible. The preliminary construction estimate for these works
- Upon completion of the backflow prevention measures and the dike improvements west of Little River, functional and detailed design of the dike improvements east of Little River should proceed, followed by construction.
- Implement a policy requiring regular inspections of the diking system and any backflow prevention measures that are implemented as a result of this report.
- The City should also include an item in its operating budget for regular maintenance and repair of the diking system and any new backflow prevention measures.



## 5.0 City-Wide

### 5.1 Essex Region Conservation Authority – Technical Documentation of the 1981 Flood (Essex Region Conservation Authority, 1981)

#### Scope:

On October 1, 1981, extensive flooding was experienced throughout the City of Windsor and northwest Essex County. The flooding caused considerable damage, primarily due to basement flooding, caused by overflowing watercourses and ponding or sewer back-up in other areas. Essex Region Conservation Authority was retained by the City of Windsor to complete this report which presents the results of an investigation into the extent of the flood, the causes and effects.

#### Recommendations:

- Remedial measures such as channelization along unimproved portions of the Grand Marais Drain.
- Increase emphasis on the promotion of stormwater management planning in developing areas.

### 5.2 Water Pollution Assessment Plan for the City of Windsor (LaFontaine, 1986)

#### Scope:

LaFontaine, Cowie, Buratto & Associates Limited was retained by the City of Windsor and the Ministry of Transportation to conduct a study to document the City's pollution problems. This Water Pollution Assessment Plan outlines the scale and nature of the water pollution problems within the City and the efforts done prior to relieving these issues.

#### Recommendations:

- Construction of local sanitary sewers to reduce bacterial contamination.
- Expansion of the Little River Sewage Treatment Plant.
- Prepare 2 phase pollution control plan.

### 5.3 Study Plan for Windsor Area Subwatershed Planning (CH2M, 1996)

#### Scope:

This report by CH2M Gore & Storrie Limited arose by request by the Essex Region Conservation Authority and the City of Windsor to assess the applicability of the subwatershed planning process to the City's primary drainage areas: the Detroit River, Little River and Turkey Creek subwatersheds. The study included the examination and assessment of existing studies and background information, the examination of planning documents governing land use and current development related activities, and development of a recommended approach should the subwatershed planning be justified.

Recommendations:

- Little River land use and modelling assumptions used to estimate flows generated from upstream portions should be reviewed further.
- Turkey Creek has been recommended for subwatershed wide management schemes.

## 6.0 Lou Romano Water Reclamation Plant

### 6.1 The Grand Marais Sanitary Sewage System Functional Report (City of Windsor, 1969)

#### Scope:

The City of Windsor prepared this report to consider the design of the trunk sanitary sewers. This report established the parameters for each sewerage district used in the design of the trunk sanitary sewage collection system. The design criteria used in the Grand Marais Sanitary Sewerage System Functional Report for this area was discussed in further detail within the report.

#### Recommendations:

- Trunk sanitary sewer network from Lou Romano PCP through Roseland Drive.

### 6.2 Local Sanitary Sewers for South Windsor Area (City of Windsor, 1971)

#### Scope:

This report is subsequent to the “Grand Marais Sanitary Sewerage System Functional Report”. It anticipates the availability of the Grand Marais trunk sanitary sewer and presents a local sanitary system for servicing part of the South Windsor area, which at the time was serviced by septic tanks.

#### Recommendations:

- Collector sanitary sewers on Bruce Avenue and Dominion Boulevard in Sewerage Districts 6a and 7.
- Collector sanitary sewers on Woodland Avenue and Dominion Boulevard in Sewerage District 8.

### 6.3 Phase 1 Design Report: West Windsor Pollution Control Plant Expansion (LaFontaine, 1977)

#### Scope:

LaFontaine, Cowie, Buratto & Associates Limited was retained by the City of Windsor to submit a Design Report for Phase I of the West Windsor Pollution Control Plant expansion. This design report follows the functional study of February 10, 1976, and includes engineering details and recommendations concerning additional facilities and modifications to existing facilities in the main pumping station of the West Windsor Pollution Control Plant.

#### Recommendations:

- It is recommended that the provision of submersible pumps for dewatering the wet wells.
- Replace stepping switch for sequence control with relays and timers.
- Modify other controls for the pumps and other devices involved in the automatic pumping sequence.

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 6.4 Interim Report on Investigations of the Ojibway Sanitary Sewerage Area (MacLaren, 1978)
 

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## Scope:

In 1976, James F. MacLaren Limited was retained by the City of Windsor to undertake a study of the areas tributary to the proposed Ojibway Street trunk sanitary sewer, with the objective of selecting the optimal solution to the provision of a sanitary sewage outlet for the area, recommending its staging and timing and proposing alternative methods whereby the cost of the facility could be shared by the benefitting parties.

## Recommendations:

- An oversizing of the Township's proposed forcemain to provide additional capacity for the Corporation's flows.

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 6.5 Ojibway Parkway Sanitary Sewer Infrastructure Rehabilitation Needs Study (LaFontaine, 1992)
 

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## Scope:

LaFontaine, Cowie, Buratto & Associates Limited was authorized by the City of Windsor Council to carry out a functional engineering report on the conditions and cost-effective method of rehabilitation of the Ojibway Parkway sanitary sewer. The Ojibway Parkway sanitary sewer located in the west end of the City of Windsor served primarily industrial zoned properties at the time of the study. The existing trunk sewer system was approximately 70 years old and began to show signs of deterioration resulting from the industrial effluent discharged and natural aging process.

## Recommendations:

- The pipe between MH 5C606 and MH 8S1088B on Ojibway Parkway, from Linsell Avenue to Sandwich Street requires immediate rehabilitation. And the remaining portion of the trunk sewer requires rehabilitation in the near future.

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 6.6 Functional Design Report – Sanitary Sewerage and Stormwater Drainage – South Cameron Planning Area (Dillon, 1992)
 

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## Scope:

This study was completed by M.M. Dillon Limited following the City of Windsor's objectives to eliminate septic tank systems from existing developments, and to provide a comprehensive plan for servicing this primarily vacant area. The purpose of this study, was to develop a functional design for a sanitary sewerage and stormwater drainage system for the South Cameron Planning Area in the City of Windsor.

Recommendations:

- Sanitary sewer on Dominion Boulevard from Ojibway Street then crossing above the Centennial High School property to Huron Church Road.
- Sanitary sewer on Randolph Avenue from Cleary Street to Kenora Street.
- Sanitary sewer on Kenora Street from Betts Avenue to Everts Avenue.
- Storm sewers on Betts Avenue and California Avenue from Quebec Street to Ojibway Street.
- Storm sewer on St. Clair Avenue from Ojibway Street to the existing sewer near Northwood Street.
- Storm sewer on Cleary Street from St. Clair Avenue to just past Longfellow Avenue.

6.7 Functional Design Report – Sanitary Sewerage and Stormwater Drainage – Malden Road/Prairie Grass (Dillon, 1993)

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Scope:

This study was completed by M.M. Dillon Limited for the City of Windsor with the intent to develop a functional sanitary sewer design and provide stormwater drainage and detention guidelines for the Malden Road and Prairie Grass Planning Areas in the City of Windsor. The study was done to complete the City's objective, to eliminate septic tank systems from existing developments. The western main trunk sanitary sewer is available to serve this area.

Recommendations:

- Sanitary sewer on Chappus Street along its entirety to Matchette Road.
- Sanitary sewer along Malden Road from the E.C. Row Expressway to the Basin Drain.
- Sanitary sewer on Armanda Street and Spring Garden Road connecting to Malden Road trunk sewer.
- Future proposed sanitary sewer through the Basin Drain and Grand Marais Drain with a pumping station.
- Storm sewer from the E.C. Row Expressway southerly servicing lands along the Basin Drain.
- Storm sewer from the E.C. Row Expressway southerly servicing lands along the Titcombe Drain to just past Armanda Street.
- Storm sewer on Matchette Road from Broadway Boulevard to outlet at the storage pond.

## 7.0 Little River Pollution Control Plant

### 7.1 Little River Sewage Treatment Plant Expansion (LaFontaine, 1973)

#### Scope:

This report, completed by LaFontaine, Cowie, Buratto & Associates Limited for the City of Windsor, outlines design considerations such as projected population and sewage flows, ultimate plant size and future land requirements. Process design information relating to the individual components of sewage treatment is also included. A project schedule and cost estimates are provided. The proposed plan is to expand the Little River Sewage Treatment Plant to increase the treatment capacity from 4.0 MGD to 8.0 MGD.

#### Recommendations:

- Inclusion of additional sludge dewatering equipment and sludge disposal facilities.
- Adjustment of the overflow weirs in the storm overflow chamber to allow up to 16 MGD through treatment during storms.
- Extension of 12 inch sanitary sewer located at the south end of the existing tankage in the southerly direction to all for more drainage of future tankage.

### 7.2 Edgar Avenue Trunk & Lauzon Road Sub-Trunk Sanitary Sewer System (LaFontaine, 1977)

#### Scope:

LaFontaine, Cowie, Buratto & Associates Limited was retained by the City of Windsor to complete this report on a detailed engineering study of the Lauzon Road sub-trunk sanitary sewer and the Edgar Street trunk sanitary sewer to determine the most equitable distribution of the remaining sewer capacity, and review the feasibility of modifying the interception chambers to eliminate overloading of the Edgar Street sanitary sewer in times of storm.

#### Recommendations:

- A sanitary relief sewer will be required to supplement the 36 inch sewer on Little River Road, east of Lauzon Road, to the treatment plant. It is proposed to be on Lauzon Road to Jerome Street then to the plant.
- Install a fiberglass control gate or hydro-brake unit in the interceptor chamber at Ford Boulevard and South National Street.
- Install interceptor chambers on the combined sewers at Ferndale Avenue, Glendale Avenue, Balfour Boulevard and Jefferson Boulevard at South National Street to eliminate stagnating conditions in the storm drain.
- Install a fiberglass control gate in the interceptor chamber at Tecumseh Road and Jefferson Boulevard.

### 7.3 Rehabilitation Needs Study – Riverside Area Sanitary Sewer (Phase I) (Dillon, 1990)

#### Scope:

M.M. Dillon Limited was retained by the City of Windsor to complete a report on the Riverside area sanitary sewer rehabilitation needs study. The Phase I study area comprises a significant part of the former Town of Riverside and is bounded by Westminster Boulevard on the west. Three major problems that were identified in the study area include the frequent occurrence of flooding of basements, the occurrence of diluted wastewater overflows to the Detroit River and the by-passing of untreated sewerage to the Little River at the Little River Pollution Control Plant, and the structural deterioration of the sanitary sewer system.

#### Recommendations:

- Disconnect all roof downspouts.
- Install flow restrictors in all catchbasins.
- Provide in-system storage.
- Complete structural repairs on all sewers given a performance Grade 4 or 5, and regular inspection of sewers given a performance Grade of 3.

### 7.4 Rehabilitation Needs Study – Riverside Area Sanitary Sewer (Phase II) (Dillon, 1991)

#### Scope:

M.M. Dillon Limited was retained by the City of Windsor to complete a report on the Riverside Area Sanitary Sewer Rehabilitation Needs Study. The area is approximately 760 acres in size and is bounded by Homedale Boulevard on the west, Cedarview Street on the south, Little River on the east and the Detroit River on the north. The report summarizes the findings and recommends solutions required to alleviate: the frequency and severity of flooding of basements in the area, the occurrence of wastewater overflows into storm sewers and consequently to the Detroit River and Little River, the hydraulic surcharge of the Little River Pollution Control Plant through excessive discharge from surcharged sanitary sewers, and the structural deterioration of the sanitary sewer system.

#### Recommendations:

- Disconnect all roof downspouts.
- Install flow restrictors in all catchbasins.
- Provide in-system storage
- Deep inspection of sewer outlets and connections before and during new building construction.

### 7.5 Rehabilitation Needs Study – Riverside Area Sanitary Sewer (Phase III) (Dillon, 1992)

#### Scope:

M.M. Dillon Limited was retained by the City of Windsor to complete a report on the Riverside Area Sanitary Sewer Rehabilitation Needs Study. The subject area of the of Phase III is bounded by Isabelle

Place on the west, Edgar Street and Little River Road on the south, Little River on the east and a line along Cedarview Street on the north. The Riverside Area Sanitary Sewer Rehabilitation Needs Study was undertaken to investigate the causes of the sanitary sewer systems surcharging and to provide solutions to alleviate the problem.

Recommendations:

- Install flow restrictors in all catchbasins.
- Rehabilitate structurally deficient sewers and manholes.
- Provide in-system storage.
- Provide local sewer system modifications.
- Deep inspection of sewer outlets and connections before and during new building construction.

## 7.6 North Riverside Basement Flooding (CH2M, 2003)

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Scope:

The City of Windsor experienced numerous basements flooding during the November 29, 2001, storm event. An area in particular that experienced basement flooding, is the northeast section of Riverside. This area was known to experience basement flooding from previous storm events. CH2M HILL Canada Limited was commissioned to carry out an assessment of the area's sanitary sewer system to identify the causes of the flooding incidences and identify the preferred alternative to resolve them. The basement flooding cause was identified as backwater effects from the Little River PCP pumping station.

Recommendations:

- All roof leaders are to be disconnected and discharged to the ground surface. Roof leaders that cannot be disconnected are to be dye tested to ensure that they are not connected to the sanitary sewer system. If roof leaders are connected to the sanitary sewer, they are to be disconnected and connected to the storm sewer or issues with discharging to the surface must be resolved.
- The isolation of the study area's sanitary sewer hydraulics from those of the sewage plant (Little River PCP) and interceptor sewers. The isolated system can be achieved with the local sanitary sewers from Frank Avenue, Watson Avenue, Isack Drive, and Greendale Drive from north along Wyandotte Street and directing flow to a new local pumping station.

## 7.7 Sanitary Sewer Servicing Study - Lands Annexed from Tecumseh (Stantec, 2006)

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Scope:

In December of 2002, the Province of Ontario approved the transfer of approximately 2,600 hectares of land (Annexed Lands) from the Town of Tecumseh and Essex County to the City of Windsor. The dominant existing use of the land at that time was rural agricultural, with small areas of residential and industrial uses. The City of Windsor initiated a Master Planning Study to review potential land use and utility servicing. The Annexed Lands would require sanitary sewer services prior to any new development



occurring. In an attempt to accommodate the sanitary sewer servicing component of these development pressures, Stantec Consulting Ltd. was commissioned to review various alternatives. The City also provided a trunk sanitary sewer on Banwell Road to service adjacent Town of Tecumseh lands.

Recommendations:

- Expansion of the Little River Pollution Control Plant Sanitary Service Area, was the recommended alternative:
  - Sanitary sewage from the Annexed Lands, as well as the areas from the Town of Tecumseh and the Oldcastle Hamlet would be conveyed to the Little River Pollution Control Plant for treatment.
  - Expansion at the plant would have to take place, as well as construction of new trunk sanitary sewers, approximately 25.2 kilometres.

## 8.0 Conclusions

### 8.1 Overview

This literature review document was compiled in support of the Sewer and Coastal Flood Protection Master Plan to identify recommendations and findings from past studies and reports related to sewers and other drainage systems within the City of Windsor. This document is meant to supplement the understanding of the existing system operations and recommendations from past studies. Further, this information will assist in identifying alternative solutions to reduce the risks of surface and basement flooding within the City.

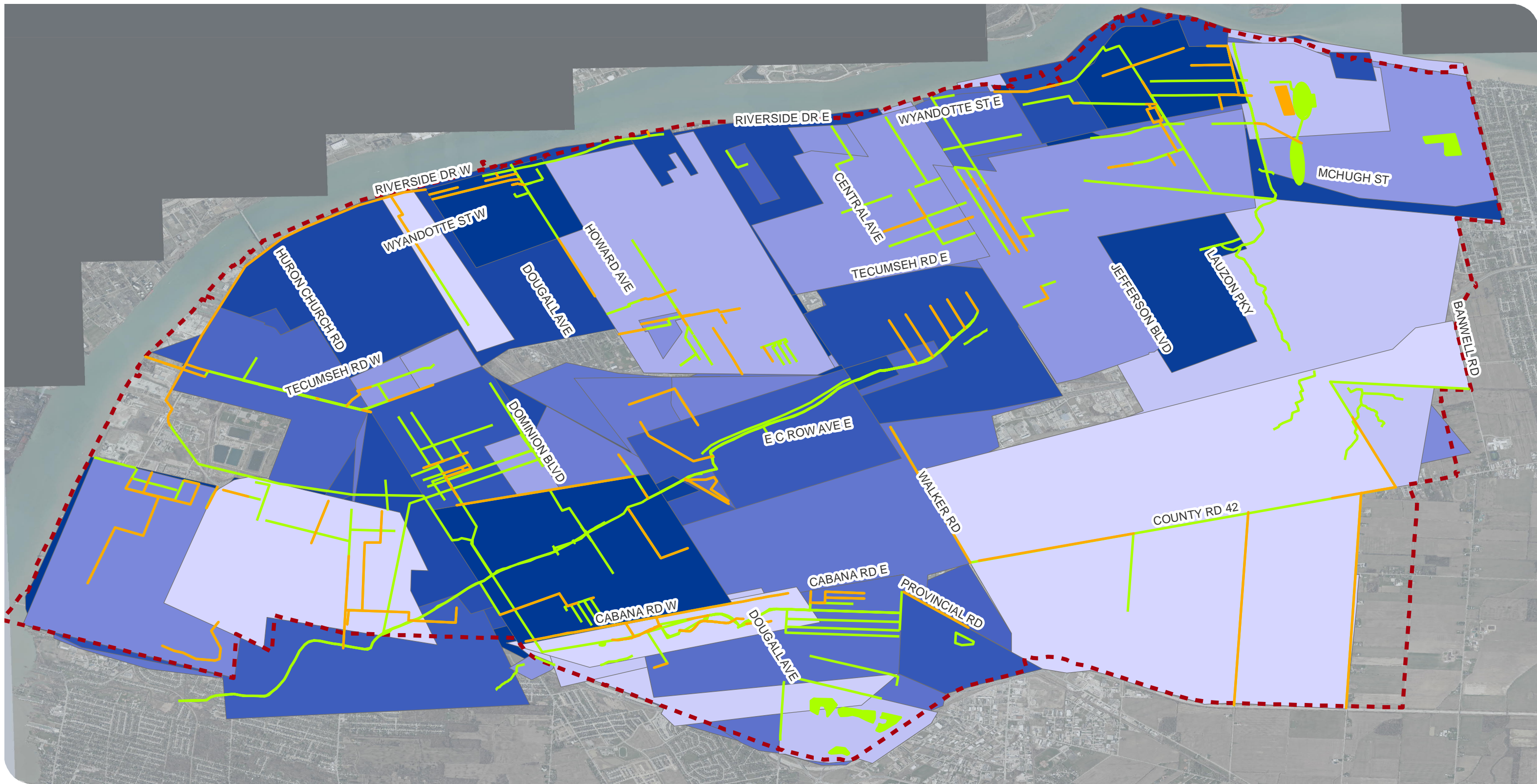
### 8.2 Geographic and Database Mapping - Summary

Based on the reports reviewed, two primary shapefiles were created: the area covered by the report and the linear infrastructure recommended within the report, each with a matching unique report ID. The reports area shape file has been organized by subwatershed and more specifically separated by corresponding report. The linear infrastructure shape file has been organized by corresponding report then split into either storm or sanitary recommendations. Finally, based on data received by the City of Windsor on the existing storm and sanitary sewers, a shape file was created to show the specific infrastructure that has not been completed of the linear infrastructure recommended works. Together these shape files are put together to map the extent of the areas studied in the reports across the City and the physical works that have been recommended.

# Appendix A-1

## Figure

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CITY OF WINDSOR  
SEWER AND COASTAL FLOOD  
PROTECTION MASTER PLAN  
BACKGROUND LITERATURE REVIEW

RECOMMENDED INFRASTRUCTURE  
IMPROVEMENTS (1960-2018)  
APPENDIX A-1  
FIGURE 1



- AREA OF STUDIES REVIEWED
- INFRASTRUCTURE CONSTRUCTED (PRIOR TO 2018)
- PROPOSED INFRASTRUCTURE NOT CONSTRUCTED AS OF 2018



MAP DRAWING INFORMATION:  
DATA PROVIDED BY CITY OF WINDSOR

MAP CREATED BY: IDW  
MAP CHECKED BY: LMH  
MAP PROJECTION: NAD 1983 UTM Zone 17N

SCALE 1:60,000

FILE LOCATION: \\G:\CAD\GIS\17-6638 SEWER AND OVERLAND DRAINAGE MP  
IGIS\TECHNICAL VOLUME 1 REPORT

PROJECT: 17-6638

STATUS: FINAL

DATE: OCT 2020